Service Manual

Our energy working for you.™

Power Generation

Generator Set

QSB7-G5 Engine with the PowerCommand® PC 1.2 and PC 3.3 Control

C150 D2R

C200 D2R

English
Original Instructions

11-2012

A042L436 (Issue 2)

Table of Contents

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1 Important Safety Instructions

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

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

1.1 Warning, Caution, and Note Styles Used In This Manual

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

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

WARNING: Warns of a hazard that may result in severe personal injury or death.

CAUTION: Warns of a hazard or an unsafe practice that can result in product or property damage.

NOTE: A short piece of text giving information that augments the current text.

1.2 General Information

This manual should form part of the documentation package supplied by Cummins Power Generation with specific generator sets. In the event that this manual has been supplied in isolation please contact your authorized distributor.

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

1.2.1 General Safety Precautions

WARNING: Coolants under pressure can cause severe scalding. Do not open a radiator or heat exchanger pressure cap while the engine is running. Let the engine cool down before removing the coolant pressure cap. Turn the cap slowly and do not open it fully until the pressure has been relieved.

WARNING: Moving parts can cause severe personal injury or death and hot exhaust parts can cause severe burns. Make sure all protective guards are properly in place before starting the generator set.

WARNING: Used engine oils have been identified by some state and federal agencies to cause cancer or reproductive toxicity. Do not ingest, breathe the fumes, or contact used oil when checking or changing engine oil.

WARNING: Operation of equipment is unsafe when mentally or physically fatigued. Do not operate equipment in this condition, or after consuming any alcohol or drug.

WARNING: Substances in exhaust gases have been identified by some state and federal agencies to cause cancer or reproductive toxicity. Do not breath in or come into contact with exhaust gases.

WARNING: Flammable liquids can cause fire or explosion. Do not store fuel, cleaners, oil, etc. near the generator set.

WARNING: Wear hearing protection when going near an operating generator set .

WARNING: Hot metal parts can cause severe burns. Avoid contact with the radiator, turbo charger, and exhaust system.

WARNING: Maintaining or installing a generator set can cause severe personal injury. Wear personal protective equipment such as safety glasses, protective gloves, hard hats, steel-toed boots, and protective clothing when working on equipment.

WARNING: Ethylene glycol, used as engine coolant, is toxic to humans and animals. Clean up coolant spills and dispose of used antifreeze in accordance with local environmental regulations.

WARNING: Starting fluids, such as ether, can cause explosion and generator set engine damage. Do not use.

CAUTION: Stepping on the generator set can cause parts to bend or break, leading to electrical shorts, or to fuel, coolant, or exhaust leaks. Do not step on the generator set when entering or leaving the generator room.

CAUTION: To prevent accidental or remote starting while working on the generator set, disconnect the negative (–) battery cable at the battery using an insulated wrench.

CAUTION: Make sure that rags are not left on or near the engine.

CAUTION: Make sure the generator set is mounted in a manner to prevent combustible materials from accumulating under the unit.

CAUTION: Accumulated grease and oil can cause overheating and engine damage presenting a potential fire hazard. Keep the generator set clean and repair any oil leaks promptly.

CAUTION: Before performing maintenance and service procedures on enclosed generator sets, make sure the service access doors are secured open.

CAUTION: 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.

NOTE: Keep multi-class ABC fire extinguishers handy. Class A fires involve ordinary combustible materials such as wood and cloth. Class B fires involve combustible and flammable liquid fuels and gaseous fuels. Class C fires involve live electrical equipment. (Refer to NFPA No. 10 in applicable region.)

1.3 Generator Set Safety Code

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

WARNING: Improper operation and maintenance can lead to severe personal injury, or loss of life and property, by fire, electrocution, mechanical breakdown, or exhaust gas asphyxiation. Read and follow all Safety Precautions, Warnings, and Cautions throughout this manual and the documentation supplied with your generator set.

WARNING: Lifting and repositioning of the generator set must only be carried out using suitable lifting equipment, shackles, and spreader bars, in accordance with local guidelines and legislation, by suitably trained and experienced personnel. Incorrect lifting can result in severe personal injury, death, and/or equipment damage. For more information, contact your authorized distributor.

1.3.1 Moving Parts Can Cause Severe Personal Injury Or Death

- Keep your hands, clothing, and jewelry away from moving parts.
- Before starting work on the generator set, disconnect the battery charger from its AC source, then disconnect the starting batteries using an insulated wrench, 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 any adjustments must be made while the unit is running, use extreme caution around hot manifolds, moving parts, etc.

1.3.2 Positioning of Generator Set

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

WARNING: On an enclosed generator set, the canopy doors must be locked before re-positioning, and they must remain locked during transportation and siting.

1.3.3 Moving the Generator Set

WARNING: Transportation and handling of generator sets must only be undertaken by suitably trained and experienced personnel.

It is essential that there are sufficient trained and experienced personnel in attendance to ensure the lifting and transportation of the generator set is undertaken in a safe and appropriate manner and in accordance to local guidelines and legislation.

WARNING: Do not lift the generator set by attaching to the engine or alternator lifting points. Improper handling of the generator set may cause serious damage to the generator set and its components and can result in severe personal injury or death.

Before lifting the generator set, lifting points, angle of slings, mass, access to intended site, and the distance of movement should all be taken into account when organizing a suitable crane/hoist. Consult the generator set information supplied with your generator set for details of dimensions and mass.

- Ensure that the crane operating area is able to support the mass of the crane and the generator set.

WARNING: ***Using the generator set as a means of access when attaching lifting shackles, chains, or other lifting aids, may damage the generator set, causing severe personal injury or death. Do not use the generator set as a means of access.***

WARNING: ***On an enclosed generator set, the canopy doors must be locked before re-positioning, and they must remain locked during transportation and siting.***

- Ensure the equipment used for lifting is adequate to support the weight of the generator set.
- Attach the lifting device to the lifting points only, using suitable shackles, chains and spreader bars.
- Slowly tighten the slings. Inspect the lifting attachments before commencing a full lift to ensure they are attached correctly.
- Hoist the generator set slowly using the indicated lifting points only.

WARNING: ***Contact with a lifted generator set can result in severe personal injury or death. Never stand underneath a lifted generator set.***

- Guide the generator set with ropes at a safe distance, to prevent uncontrolled rotation when positioning the generator set.
- Move the generator set to the desired location and place in position, bringing the set down slowly.
- Loosen the slings; unhook and remove the shackles.

1.3.3.1 Positioning a Generator Set Using a Forklift Truck

WARNING: ***Transportation and handling of generator sets by forklift trucks must only be undertaken by suitably trained and experienced personnel who are familiar with the transport of these items .***

If using a forklift truck to transport/position the generator set, the dimensions, mass, and route must be taken into account when selecting an appropriate lifting truck.

WARNING: ***Do not attempt to lift a generator set with an undersized forklift truck. Improper handling of the generator set may cause serious damage to the generator set and its components and can result in severe personal injury or death.***

It is essential that there are sufficient trained and experienced personnel in attendance to ensure the lifting and transportation of the generator set is undertaken in a safe and appropriate manner and in accordance to local guidelines and legislation.

WARNING: ***A generator set must not be moved with a forklift truck if it is attached to the trailer. Improper handling of the generator set may cause serious damage to the generator set and its components and can result in severe personal injury or death.***

WARNING: On an enclosed generator set, the canopy doors must be locked before re-positioning, and they must remain locked during transportation and siting.

- Fully insert the arms of the forklift into the forklift pockets, making sure the generator set completely rests on the forklift arms.
- Lift and handle the equipment slowly.
- Slowly set down the generator set in its final position.

1.4 Electrical Shocks and Arc Flashes Can Cause Severe Personal Injury or Death

WARNING: Any work with exposed energized circuits with potentials of 50 Volts AC or 75 Volts DC or higher poses a significant risk of electrical shock and electrical arc flash. These silent hazards can cause severe injuries or death. Refer to standard NFPA 70E or equivalent safety standards in corresponding regions for details of the dangers involved and for the safety requirements.

Guidelines to follow when working on de-energized electrical systems:

- Use proper PPE. Do not wear jewelry and make sure that any conductive items are removed from pockets as these items can fall into equipment and the resulting short circuit can cause shock or burning. Refer to standard NFPA 70E for PPE standards.
- De-energize and lockout/tagout electrical systems prior to working on them. Lockout/Tagout is intended to prevent injury due to unexpected start-up of equipment or the release of stored energy. Please refer to the lockout/tagout section for more information.
- De-energize and lockout/tagout all circuits and devices before removing any protective shields or making any measurements on electrical equipment.
- Follow all applicable regional electrical and safety codes.

Guidelines to follow when working on energized electrical systems:

NOTE: It is the policy of Cummins Inc. to perform all electrical work in a de-energized state. However, employees or suppliers may be permitted to occasionally perform work on energized electrical equipment only when qualified and authorized to do so and when troubleshooting, or if de-energizing the equipment would create a greater risk or make the task impossible and all other alternatives have been exhausted.

NOTE: Exposed energized electrical work is only allowed as per the relevant procedures and must be undertaken by a Cummins authorized person with any appropriate energized work permit for the work to be performed while using proper PPE, tools and equipment.

In summary:

- Do not tamper with or bypass interlocks unless you are authorized to do so.
- Understand and assess the risks - use proper PPE. Do not wear jewelry and make sure that any conductive items are removed from pockets as these items can fall into equipment and the resulting short circuit can cause shock or burning. Refer to standard NFPA 70E for PPE standards.
- Make sure that an accompanying person who can undertake a rescue is nearby.

1.4.1 AC Supply and Isolation

It is the sole responsibility of the customer to provide AC power conductors for connection to load devices and the means to isolate the AC input to the terminal box; these must comply to local electrical codes and regulations. Refer to the wiring diagram supplied with the generator set.

NOTE: Local electrical codes and regulations (for example BS EN 12601:2001) may require the installation of a disconnect means for the generator set, either on the generator set or where the generator set conductors enter a facility.

NOTE: The AC supply must have the correct over current and earth fault protection according to local electrical codes and regulations. This equipment must be earthed (grounded).

The disconnecting device is not provided as part of the generator set, and Cummins Power Generation accepts no responsibility for providing the means of isolation.

1.4.2 AC Disconnect Sources

WARNING: The equipment may have more than one source of electrical energy. Disconnecting one source without disconnecting the others presents a shock hazard that can result in severe personal injury or death. Before working on the equipment, disconnect and verify that all sources of electrical energy have been removed.

1.5 Fuel And Fumes Are Flammable

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

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

1.5.1 Spillage

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

1.5.2 Fluid Containment

If fluid containment is incorporated into the bedframe, it must be inspected at regular intervals. Any liquid present should be drained out and disposed of in line with local health and safety regulations. Failure to perform this action may result in spillage of liquids which could contaminate the surrounding area.

Any other fluid containment area must also be checked and emptied, as described above.

NOTE: Where spillage containment is not part of a Cummins supply, it is the responsibility of the installer to provide the necessary containment to prevent contamination of the environment, especially water courses and sources.

1.5.3 Do Not Operate in Flammable and Explosive Environments

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

1.6 Exhaust Gases Are Deadly

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

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

1.6.1 Exhaust Precautions

WARNING: Hot exhaust pipes and charge air pipes can cause severe personal injury or death from direct contact, or from fire hazard.

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

The exhaust outlet may be sited at the top or bottom of the generator set. Make sure that the exhaust outlet is not obstructed. Personnel using this equipment must be made aware of the exhaust position. Position the exhaust away from flammable materials - in the case of exhaust outlets at the bottom, make sure that vegetation is removed from the vicinity of the exhaust.

WARNING: Inhalation of exhaust gases can result in serious personal injury or death. Be sure deadly exhaust gas is piped outside and away from windows, doors, or other inlets to buildings. Do not allow to accumulate in habitable areas.

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

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

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

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

- Clean the exhaust pipe thoroughly.

1.7 Earth Ground Connection

The neutral of the generator set may be required to be bonded to earth ground at the generator location, or at a remote location depending on system design requirements. Consult the engineering drawings for the facility or a qualified electrical design engineer for proper installation.

NOTE: **The end user is responsible to ensure that the ground connection point surface area is clean and free of rust before making a connection.**

NOTE: **The end user is responsible for ensuring that an earthing arrangement that is compliant with local conditions is established and tested before the equipment is used.**

1.8 Distribution Panel Door

CAUTION: *Opening the distribution panel door while the generator set is running will trip the generator set circuit breaker and abruptly shut off power to all loads. Be sure that the generator set is not running and is in off mode before you open the distribution panel door .*

1.9 Beware of Traffic Hazards

- When the generator set is on or beside the road, be clear of traffic when starting, stopping, or checking the generator set.
- Be sure there are no oil or fuel leaks that can spill onto the road.
- Be sure that all fasteners and mounting brackets are tight. Be sure that fasteners and mounting brackets will not fall off during transit.

2 Introduction

WARNING: ***Improperly connected generator electrical output connections can cause equipment damage, severe personal injury, or death and therefore must be made by a trained and experienced electrician in accordance with the installation instructions and all applicable codes.***

WARNING: ***Improper installations can cause equipment damage, severe personal injury, or death and therefore all installations must be conducted by a trained and experienced person in accordance with the installation instructions and all applicable codes.***

2.1 About This Manual

This manual provides troubleshooting and repair information for the Generator Sets listed on the front cover. Engine and alternator service and maintenance instructions are contained within the applicable engine and alternator service manuals. Operating and basic maintenance instructions are in the applicable Generator Set Operator Manual.

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

This manual contains basic (generic) wiring diagrams and schematics that are included to help in troubleshooting. The wiring diagrams and schematics that are maintained with the unit should be updated when modifications are made to the unit.

Read Chapter 1 on page 1 and carefully observe all instructions and precautions in this manual.

2.2 Test Equipment

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

- True RMS meter for accurate measurement of small AC and DC voltages.
- Grounding wrist strap to prevent circuit board damage due to electrostatic discharge (ESD).
- Battery Hydrometer
- Jumper Leads
- Tachometer or Frequency Meter
- Wheatstone Bridge or Digital Ohmmeter
- Variac
- Load Test Panel
- Megger or Insulation Resistance Meter
- PCC Service Tool Kit (Harness Tool and Sensor Tool)
- InPower Service Tool (PC based Generator Set Service Tool)

2.3 Schedule of Abbreviations

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

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

ABBR.	DESCRIPTION	ABBR.	DESCRIPTION
AC	Alternating Current	LCT	Low Coolant Temperature
AMP	AMP, Inc., part of Tyco Electronics	LED	Light-emitting Diode
ANSI	American National Standards Institute	MFM	Multifunction Monitor
ASTM	American Society for Testing and Materials (ASTM International)	Mil Std	Military Standard
ATS	Automatic Transfer Switch	NC	Normally Closed
AVR	Automatic Voltage Regulator	NC	Not Connected
AWG	American Wire Gauge	NFPA	National Fire Protection Agency
CAN	Controlled Area Network	NO	Normally Open
CB	Circuit Breaker	NWF	Network Failure
CE	Conformité Européenne	OEM	Original Equipment Manufacturer
CFM	Cubic Feet per Minute	OOR	Out of Range
CGT	Cummins Generator Technologies	OORH / ORH	Out of Range High
CMM	Cubic Meters per Minute	OORL / ORL	Out of Range Low
CT	Current Transformer	PB	Push Button
DC	Direct Current	PCC	PowerCommand® Control
DPF	Diesel Particulate Filter	PGI	Power Generation Interface
ECM	Engine Control Module	PGN	Parameter Group Number
ECS	Engine Control System	PI	Proportional/Integral
EMI	Electromagnetic interference	PID	Proportional/Integral/Derivative
EN	European Standard	PLC	Programmable Logic Controller
EPS	Engine Protection System	PMG	Permanent Magnet Generator
E-Stop	Emergency Stop	PT	Potential Transformer
FAE	Full Authority Electronic	PTC	Power Transfer Control
FMI	Failure Mode Identifier	PWM	Pulse-width Modulation
FSO	Fuel Shutoff	RFI	Radio Frequency Interference
Genset	Generator Set	RH	Relative Humidity
GCP	Generator Control Panel	RMS	Root Mean Square
GND	Ground	RTU	Remote Terminal Unit
HMI	Human-machine Interface	SAE	Society of Automotive Engineers
IC	Integrated Circuit	SPN	Suspect Parameter Number
ISO	International Organization for Standardization	SW_B+	Switched B+

ABBR.	DESCRIPTION	ABBR.	DESCRIPTION
LBNG	Lean-burn Natural Gas	UL	Underwriters Laboratories
LCD	Liquid Crystal Display	UPS	Uninterruptible Power Supply
LCL	Low Coolant Level	USASI	United States of America Standards Institute former name of ANSI

2.4 Related Literature

Before any attempt is made to operate the generator set, the operator should take time to read all of the manuals supplied with the generator set, and to familiarize themselves with the warnings and operating procedures .

CAUTION: A generator set must be operated and maintained properly if you are to expect safe and reliable operation. The Operator manual includes a maintenance schedule and a troubleshooting guide.

The Health and Safety manual must be read in conjunction with this manual for the safe operation of the generator set:

- Health and Safety Manual (0908-0110)

The relevant manuals appropriate to your generator set are also available, the documents below are in English:

- Operator Manual for QSB7-G5 C150 D2R C200 D2R with PowerCommand 1.2 Control (A042L434)
- Operator Manual for QSB7-G5 C150 D2R C200 D2R with PowerCommand 3.3 Control (A041R636)
- Installation Manual for QSB7-G5 C150 D2R C200 D2R with PowerCommand 1.2 and 3.3 Control (A041R670)
- Service Manual for QSB7-G5 C150 D2R C200 D2R with PowerCommand 1.2 and 3.3 Control (A042L436)
- Controller Service Manual for PowerCommand 1.2 (A034L440)
- Controller Service Manual for PowerCommand 3.3 (0900-0670)
- Operation & Maintenance Manual for QSB7 Engine (4021531)
- Alternator Service Manual for HC Alternator (0900-9904, A040J849)
- Alternator Service Manual for UC Alternator (0900-9901, A040J848)
- Specification and Data Sheet (For engineering data specific to the generator set)
- Application Manual T-030, Liquid Cooled Generator Sets (For application information)
- Parts Manual for Rental Generator Set QSB7 with PowerCommand 1.2 and 3.3 Control (0906-0153)
- Parts Manual for HC Alternator (A040J849)
- Parts Manual for UC Alternator (A040J848)
- Standard Repair Times - SRT Family ZZ - PowerCommand 3.3 (PCC 3300 and HMI 320) (0900-0981)
- Standard Repair Times - 1.2 Control (A028Z371)

- Standard Repair Times - 3.3 Control (0900-0981)
- Recommended Spares List (RSL) for C150 D2R with PowerCommand 1.2 and 3.3 Control (A042W933)
- Recommended Spares List (RSL) for C200 D2R with PowerCommand 1.2 and 3.3 Control (A024W923)
- Warranty Manual (A040W374))
- Global Commercial Warranty Statement (A028U870)

2.5 After Sales Services

Cummins Power Generation offers a full range of maintenance and warranty services.

2.5.1 Maintenance

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

For customers who wish to have their generator sets expertly serviced at regular intervals your local distributor offers a complete maintenance contract package. This covers all items subject to routine maintenance and includes a detailed report on the condition of the generator set. In addition, this can be linked to a 24-hour call-out arrangement, providing year-round assistance if necessary. Specialist engineers are available to maintain optimum performance levels from customer's generator sets, and it is recommended that maintenance tasks are only undertaken by trained and experienced technicians provided by your authorized distributor.

2.5.2 Warranty

For details of the warranty coverage for your generator set, refer to the *Global Commercial Warranty Statement* listed in the Related Literature section.

Extended warranty coverage is also available. In the event of a breakdown, prompt assistance can normally be given by factory trained service technicians with facilities to undertake all minor and many major repairs to equipment on site.

For further warranty details, contact your authorized distributor.

NOTE: Damage caused by failure to follow the correct coolant recommendations will not be covered by the warranty. Please contact your authorized distributor.

2.5.2.1 Warranty Limitations

For details of the warranty limitations for your generator set, refer to the warranty statement applicable to the generator set.

3 Specifications

3.1 Generator Set Specifications

TABLE 1. C150 D2R AND C200 D2R SPECIFICATIONS

MODELS	C150 D2R, C200 D2R	
Engine Cummins Diesel Series	QSB7-G5	
Generator kW Rating	See generator set nameplate for rating information.	
Customer External Fuel Connection	Refer to customer connections drawing supplied (A043G195)	
Maximum Weight	4001 kg (8820 lb)	
Fuel Max. Fuel Inlet Restriction Max. Fuel Return Restriction Fuel Pump Flow Rate	127 mmHg (5 inHg) 152 mmHg (6 inHg) 106 L/hr (28 gal/hr)	
Exhaust	1500 RPM	1800 RPM
Outlet Size	4 in. NB	4 in. NB
Max. Allowable Back Pressure	76mm (3 in.) Hg	76mm (3 in.) Hg
Exhaust Flow at Rated Load	597 L/s (1265 cfm) at SBY	732L/s (1549 cfm) at SBY
Exhaust Temperature	561 °C (1041 °F)	532 °C (988 °F)
Electrical System Starting Voltage CCA (minimum) Cold Soak @ 0 °F (-18 °C)	12 Volts DC 1100 A at-18 °C to 0 °C (0 °F to 32 °F)	
Cooling System Capacity with Standard Radiator	For 50 °C radiator; 16.8 L (4.4 US gal)	
Lubricating System Oil Capacity with Filters	18.9 L (5 US gal)	

3.2 Engine Fuel Consumption

TABLE 2. FUEL CONSUMPTION (L/HR) AT 1500 RPM (50 HZ)

Model	CD150 D2R	CD200 D2R
Engine	**QSB7-G5**	**QSB7-G5**
Engine Performance Data at 50Hz[1]	**39.25**	**48.8**

1. Standby/Full Load
Refer to Data Sheets for other applications. In line with the CPG policy of continuous improvement, these figures are subject to change.

TABLE 3. FUEL CONSUMPTION (L/HR) AT 1800 RPM (60 HZ)

Model	CD150 D2R	CD200 D2R
Engine	**QSB7-G5**	**QSB7-G5**
Engine Performance Data at 60Hz[1]	**44.5**	**59**

1. Standby/Full Load
Refer to Data Sheets for other applications. In line with the CPG policy of continuous improvement, these figures are subject to change.

TABLE 4. FUEL CONSUMPTION (US GAL/HR) AT 1500 RPM (50 HZ)

Model	CD150 D2R	CD200 D2R
Engine	**QSB7-G5**	**QSB7-G5**
Engine Performance Data at 50Hz[1]	**10.36**	**12.8**

1. Standby/Full Load
Refer to Data Sheets for other applications. In line with the CPG policy of continuous improvement, these figures are subject to change.

TABLE 5. FUEL CONSUMPTION (US GAL/HR) AT 1800 RPM (60 HZ)

Model	CD150 D2R	CD200 D2R
Engine	**QSB7-G5**	**QSB7-G5**
Engine Performance Data at 60Hz[1]	**11.7**	**15.5**

1. Standby/Full Load
Refer to Data Sheets for other applications. In line with the CPG policy of continuous improvement, these figures are subject to change.

4 Periodic Maintenance

The periodic maintenance procedures should be performed at whichever interval occurs first. At each scheduled maintenance interval, perform all previous maintenance checks that are due for scheduled maintenance.

The tabular data that follows give the recommended service intervals for a generator set on Standby service. If the generator set will be subjected to Prime usage or extreme operating conditions, the service intervals should be reduced accordingly. Consult your authorized distributor.

Some of the factors that can affect the maintenance schedule are:

- Use for continuous duty (prime power)
- Extremes in ambient temperature
- Exposure to elements
- Exposure to salt water
- Exposure to windblown dust or sand.

Consult with an authorized distributor if the generator set will be subjected to any extreme operating conditions and determine a suitable schedule of maintenance. Use the running time meter to keep an accurate log of all service performed for warranty support. Perform all service at the time period indicated, or after the number of operating hours indicated, whichever comes first.

4.1 Periodic Maintenance Schedule

TABLE 6. PERIODIC MAINTENANCE SCHEDULE - ONE DAY TO TWO YEARS

MAINTENANCE ITEMS	Daily or after 8 Hours	Weekly or after 50 Hours [6]	3 Months or after 250 Hours[4,6]	12 Months or after 500 Hours[4,6]	1000 Hours[4,6]	12 Months or after 1500 Hours [4,6]	2000 Hours [4,6]	2 Years [4,6]
Perform maintenance tasks as specified using Daily or Hourly periods – whichever is the sooner								
Check fuel level in tank	■							
Check Fuel lines and hoses	■[1]							
Check fluid containment area	■[7]							
Check engine oil level	■[1]							
Check coolant level of radiator(s) (water jacket & LTA)	■[4]							
Check cooling fan blades	■							
Check all exhaust components, and hardware (fittings, clamps, fasteners, etc.)	■[1]							
Check drive belt, condition and tension	■[2]							
Check air cleaner restriction indicator (where fitted)	■							

MAINTENANCE ITEMS	Daily or after 8 Hours	Weekly or after 50 Hours [6]	3 Months or after 250 Hours[4,6]	12 Months or after 500 Hours[4,6]	1000 Hours[4,6]	12 Months or after 1500 Hours [4,6]	2000 Hours [4,6]	2 Years [4,6]
Check air intake system for leaks	■							
Check alternator	■[11]		■[12]				■	
Check operation of Emergency Stop Button		■						
Check coolant lines and radiator hoses for wear and cracks				■[8]				
Check electrical connections (battery, starter motor and alternator connections)				■[8,9]				
Check engine ground				■[9]				
Check engine valve lash					■[10]			
Check alternator stator winding insulation resistance						■[13]		
Check alternator Bearings						■[8]		
Check connections in alternator terminal box						■		
Check aftercooler core							■	
Check engine mounts							■	
Check starting motor							■	
Check turbocharger							■	
Check water pump							■	
Drain water from fuel system primary filter/water separator	■[3]							
Drain fuel tank water and sediment		■[3]						
Clean radiator matrix			■					
Clean air cleaner element				■[8]				
Replace engine oil and filter		■[5]		■				
Replace water separator element				■				
Replace fuel system secondary filter				■				
Replace cooling system coolant								■

MAINTENANCE ITEMS	Daily or after 8 Hours	Weekly or after 50 Hours [6]	3 Months or after 250 Hours[4,6]	12 Months or after 500 Hours[4,6]	1000 Hours[4,6]	12 Months or after 1500 Hours [4,6]	2000 Hours [4,6]	2 Years [4,6]

■[1] – Check for oil, fuel, coolant, and exhaust system leaks. Check exhaust system audibly and visually with the generator set running.
■[2] – Visually check belt for evidence of wear or slippage. Replace if hard or brittle (to be undertaken by a Service Engineer).
■[3] – Drain one cup, or more, of fuel to remove water and sediment.
■[4] – To be undertaken by a Service Technician.
■[5] – Engine oil and filter should be replaced after the initial running-in period of 50 hours. Contact your authorized distributor.
■[6] – All maintenance checks and inspections listed at lesser maintenance intervals must be carried out at this time.
■[7] – Visually check fluid containment area, drain as necessary/walk around inspection of generator set.
■[8] – Replace as necessary.
■[9] – Clean as necessary.
■[10] – Adjust as necessary.
■[11] – Visual inspection.
■[12] – Visual inspection and running audible check.
■[13] – Record resistance value.

TABLE 7. PERIODIC MAINTENANCE SCHEDULE - 3000 HOURS TO SIX YEARS

Maintenance Items	3000 Hours[3,4]	2 Years or 3000 Hours[3,4]	4000 Hours	3 Years or 4500 Hours[3,4]	3 Years or 6000 Hours[3,4]	6 Years or 12000 Hours[3,4]
Check fuel injectors	■[1]					
Check aftercooler core		■[2]				
Check alternator vibration levels					■[2]	
Check alternator bearing housings						■
Check alternator winding condition						■
Check alternator rotating diode assembly						■
Replace cooling system coolant (commercial heavy duty)			■			
Replace cooling system coolant (ELC)						■
Replace alternator bearings						■
Replace alternator NDE o-ring						■
Add cooling system coolant extender (ELC)					■	
Clean and regrease alternator bearings				■		

■[1] – Replace as necessary.
■[2] – Clean as necessary.
■[3] – To be undertaken by a Service Technician.
■[4] – All maintenance checks and inspections listed at lesser maintenance intervals must be carried out at this time.

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5 Troubleshooting - General

5.1 Control System

The generator set control system continuously monitors engine sensors for abnormal conditions, such as low oil pressure and high coolant temperature. If any of these conditions occur, the control will light a yellow Warning lamp or a red Shutdown lamp and will display a message on the graphical display panel. In the event of an engine shutdown fault (red Shutdown LED), the control will stop the engine immediately.

5.2 Safety Considerations

***WARNING:** Many troubleshooting procedures present hazards that can result in severe personal injury or death. Only trained and experienced service personnel with knowledge of fuels, electricity, and machinery hazards should perform service procedures. Review the safety precautions in Chapter 1 on page 1.*

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

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

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

Ventilate the battery area before working on or near a battery—Wear goggles—Stop the generator set and disconnect the charger before disconnecting the battery cables—Disconnect the negative (−) cable first and reconnect it last using an insulated wrench.

CAUTION: Disconnect the battery charger from the AC source before disconnecting the 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 with an insulated wrench.*

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

1. Make sure the generator set is in the Off mode.
2. Turn off or remove AC power from the battery charger.
3. Using an insulated wrench, remove the negative (−) battery cable from the generator set starting battery.

5.3 InPower Service Tool

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

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

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

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

⚠ *CAUTION: Using the wrong calibration file can result in equipment damage. Do not swap base boards from another generator set model.*

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

5.4 Network Applications and Customer Inputs

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

5.5 Test Equipment

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

- True RMS digital multi-meter for accurate measurement of resistance, AC voltage (0-1000 VAC), and DC voltage.
- Current probe(s).
- Battery hydrometer.
- Jumper leads.
- Tachometer.
- Megger or insulation resistance meter.
- InPower service tool (PC-based service tool)
- Newest InPower InCal files (calibration for control) from the InCal web site (**www.cumminspower.com** under “Services", “Software Updates", “InCal Quick Links").
- PC-based service tool connector (Cummins Power Generation Part number 0541-1199).
- Inline 4 / Inline 5 adapter or newer (Cummins Power Generation Part number 0491-8416).

- Inline 4 / Inline 5 drivers (available via kit or online at **http://inline.cummins.com/**).
- Basic electrical test lead set, with very small probe tips. Fluke test leads “TL80A" (part number 0541-1627) are recommended.

5.6 Voltage/Continuity Testing

Voltage and continuity tests are required in the following tables. In some cases, it is necessary to remove a plug to complete the test.

The following corrective actions will mention when it is necessary to remove a plug for testing. In other cases, the plug must not be removed for testing. When plug removal is not mentioned, testing must be performed by inserting a narrow meter probe into the back of the plug.

5.7 Troubleshooting Procedures

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

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

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

This section contains the following information:

- How to troubleshoot a local/remote failure to crank problem when the control panel does not indicate any fault condition.
- How to troubleshoot engine problems that are not within the detectable range of the PC control.
- How to troubleshoot a Check Engine lamp fault for generator sets that contain the low emissions option.
- Descriptions of each status, warning, and shutdown code; warning and shutdown limits where applicable; and basic corrective actions, such as checking fluid levels, control reset functions, battery connections, etc.
- Detailed troubleshooting procedures. In the following list of troubleshooting procedures, the fault codes are arranged in numeric order.

CAUTION: Always set the generator set to off mode before disconnecting or connecting harness connectors. Otherwise, disconnecting the harness connectors can result in voltage spikes high enough to damage the DC control circuits of the set.

CAUTION: Electrostatic discharge will damage circuit boards. Always wear a wrist strap when handling circuit boards or when disconnecting or connecting harness connectors. See the Circuit Board Removal/Replacement procedure in the controller Service Manual.

5.8 Reading Fault Codes

When a fault occurs, the graphical display on the HMI will display the fault code/message.

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.

5.9 Battle Short Mode

Battle Short mode is used to satisfy local code requirements. While Battle Short mode is active, the PCC ignores non-critical shutdown faults and non-critical shutdown with cooldown faults. It does not initiate a stop sequence and continues to run the genset until Battle Short Mode is inactive. Otherwise, genset operation remains the same.

WARNING: Use of Battle Short mode can cause a fire or electrical hazard, resulting in severe personal injury, death, and/or property and equipment damage. This mode must only be used during supervised, temporary operation of the genset.

Battle Short mode must be set up at the factory or by an authorized service representative. Contact your local distributor for assistance.

Battle Short mode is active only when all of these conditions are met:

- *Battle Short Enable* is set to Enable.
- The ECM is set to enable Battle Short mode (Core 2 ECMs only).
- The Battle Short Switch or *Battle Short Switch (Modbus)* is active. (*Battle Short Switch (Modbus*) is not available in the Operator Panel.)

The PCC generates warning fault 2942 (Shutdown Override Fail) if the Battle Short Switch is active but any of the other conditions are not met.

Battle Short mode is not a distinct mode of operation . The PCC is still in Off mode, Manual mode, or Auto mode while Battle Short mode is active. The PCC still follows the appropriate sequence of operation to start the genset and to stop the genset.

The PCC generates warning fault 1131 (Battle Short Active) as long as Battle Short mode is active.

While Battle Short mode is active, the PCC ignores most shutdown faults and only initiates a Shutdown Without Cooldown sequence if a critical shutdown fault occurs.

When the PCC overrides a shutdown fault, it generates warning fault 1416 (Fail To Shutdown) after *Fail To Shutdown Delay* as long as Battle Short mode remains active. It also turns on the Shutdown LED.

WARNING: The faults that are overridden in Battle Short mode can affect genset performance and might cause permanent engine, alternator, or connected equipment damage. All shutdown faults, including those overridden in Battle Short mode, must be acted upon immediately to ensure the safety and well-being of the operator and the genset.

NOTE: Any damage caused to the genset as a direct result of running in Battle Short mode is not covered by the warranty.

5.10 Battle Short Mode Procedures

All of the following procedures are required to activate Battle Short mode.

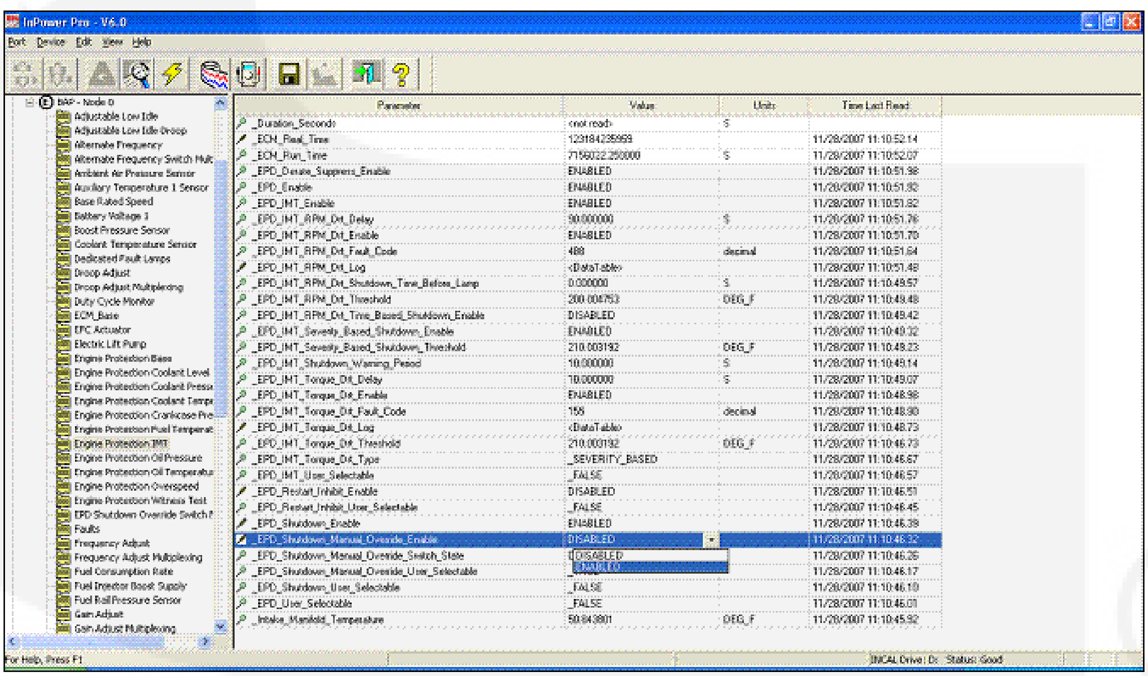
These procedures require the equipment identified in the table below.

TABLE 8. REQUIRED EQUIPMENT FOR BATTLE SHORT MODE PROCEDURES

Part Description	Part Number
InPower Pro service tool	0998-0077-02 (existing user) 0988-0077-04 (new user)
INLINE 4 product kit	4918190
INLINE 5 product kit	4918416
PC-based service tool harness	0541-1199

5.10.1 Enable Battle Short Mode in the ECM

1. Put the PCC in Off mode.
2. Connect the Inline 5 adapter to the engine control module (ECM), and connect the computer to the Inline 5 adapter.
3. Open InPower (make sure the security dongle is attached to the computer), and click on Core II ECS in the left side of the window.
4. Click on the Engine Protection IMT folder.
5. Set the EPD_Shutdown_Manual_Override_Enable parameter to Enable, as shown below.

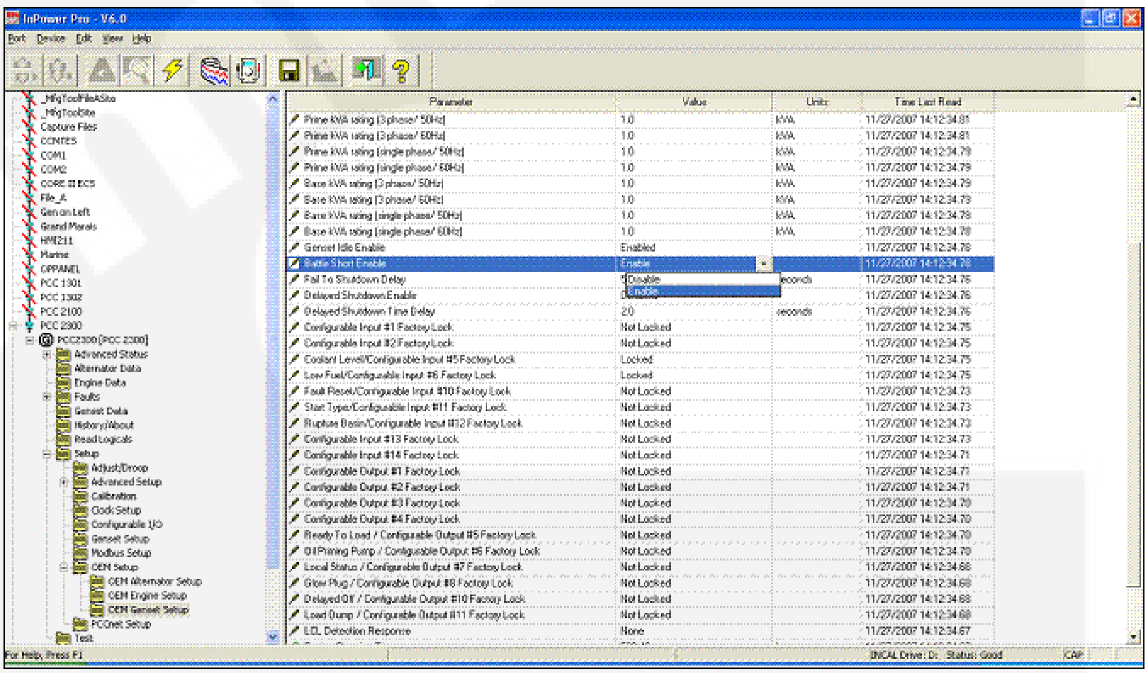


6. Click Save in order to save the changes.
7. Close InPower after the save is complete.
8. Engage/Activate the local emergency stop button, and wait 30-60 seconds for the ECM to complete the data save.

9. Remove power from the ECM, and wait 30-60 seconds.
10. Reapply power to the ECM, pull out/disengage the local emergency stop button, and press the Reset button on the Operator Panel.
11. Connect with InPower to verify that the EPD_Shutdown_Manual_Override_Enable parameter is set to Enable.

5.10.2 Enable Battle Short Mode in the PCC

1. Put the PCC in Off mode.
2. Use the PC-based service tool harness to connect the computer to TB15 on the PCC base board.
3. Open InPower (make sure that the security dongle is attached to the computer), and click on PCC 2300 in the left side of the window.
4. Click on the Setup >OEM Setup > OEM Genset Setup folders.
5. Set the Battle Short Enable parameter to Enable, as shown below.



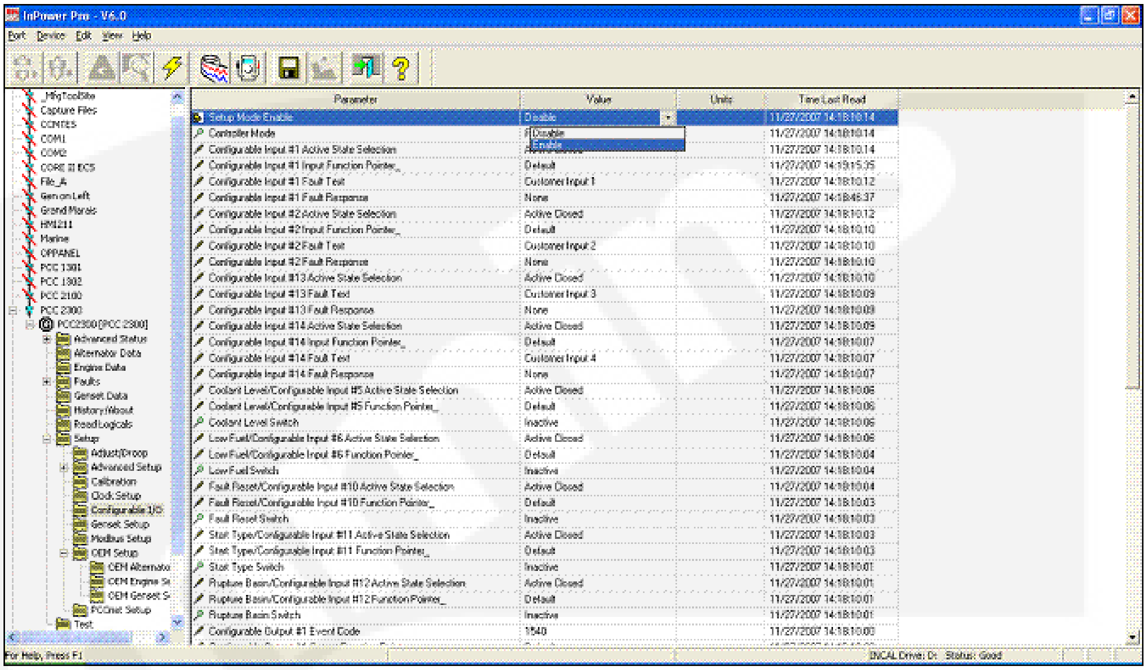
6. Click on Save in order to save the changes.

5.10.3 Map a Configurable Input to Battle Short Switch

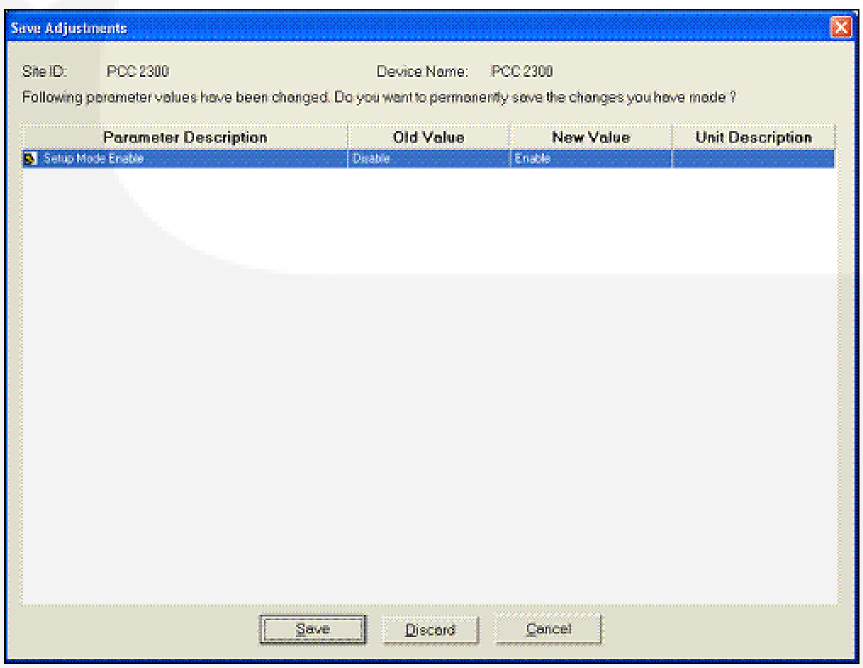
After Battle Short mode is enabled in the ECM and the PCC, you have to map a configurable input to the Battle Short Switch.

1. Put the PCC in Off mode.
2. Use the PC-based service tool harness to connect the computer to TB15 on the PCC base board.
3. Open InPower (make sure that the security dongle is attached to the computer) and click on PCC 2300 in the left side of the window.
4. Click on the Setup >Configurable I/O folders.

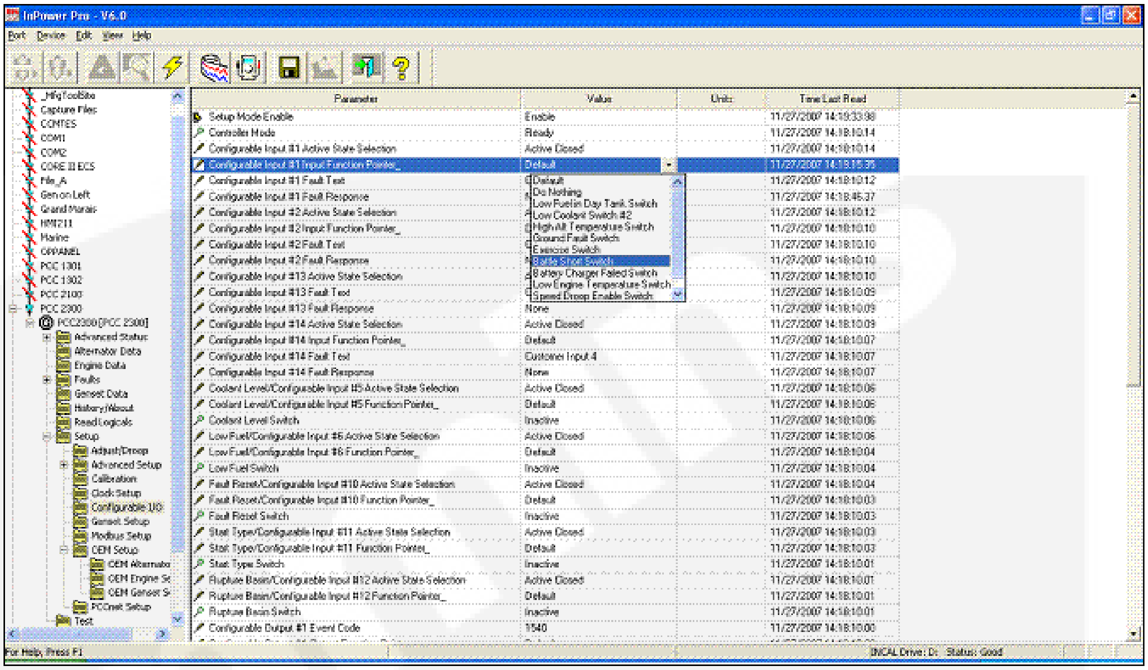
5. Set the Setup Mode Enable parameter to Enable in order to enter Setup mode, as shown below.



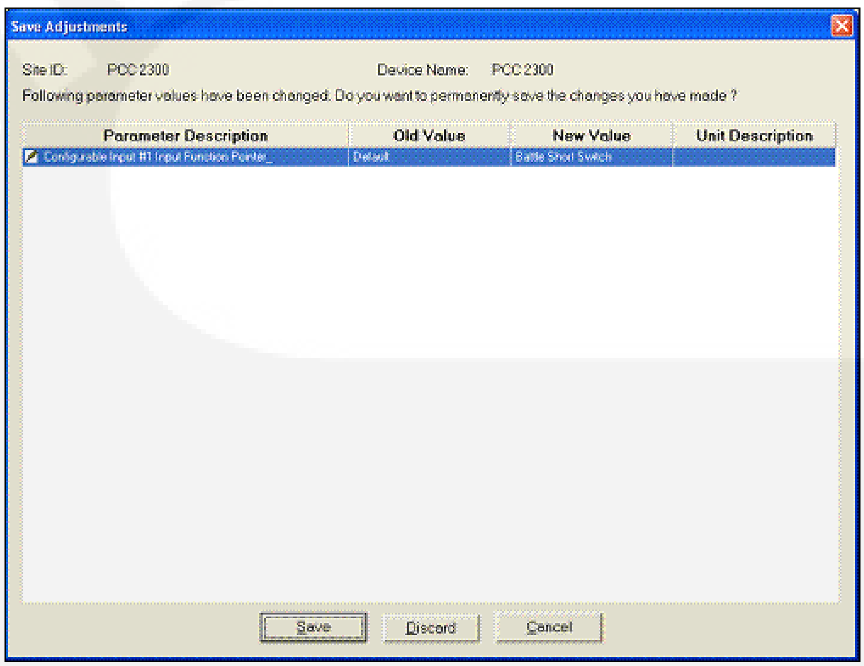
6. Click on Save, as shown below.



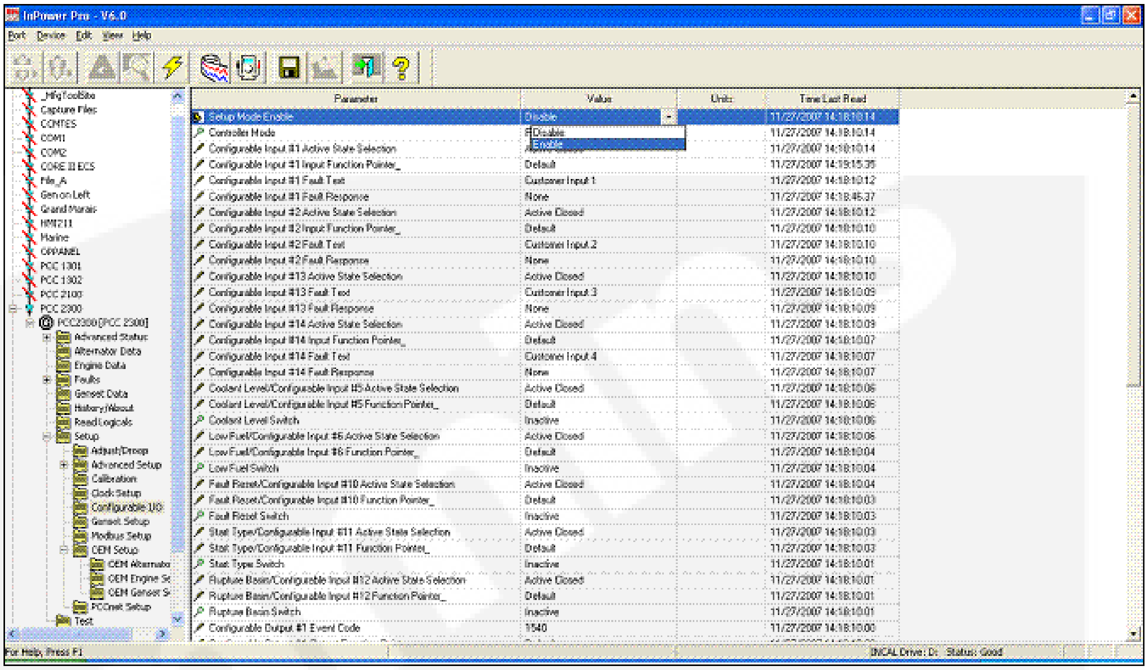
7. Any configurable input can be mapped to Battle Short Switch. Choose one of them. For example, set Configurable Input #1 Input Function Pointer parameter to Battle Short Switch, as shown below.



8. Click on Save, as shown below.



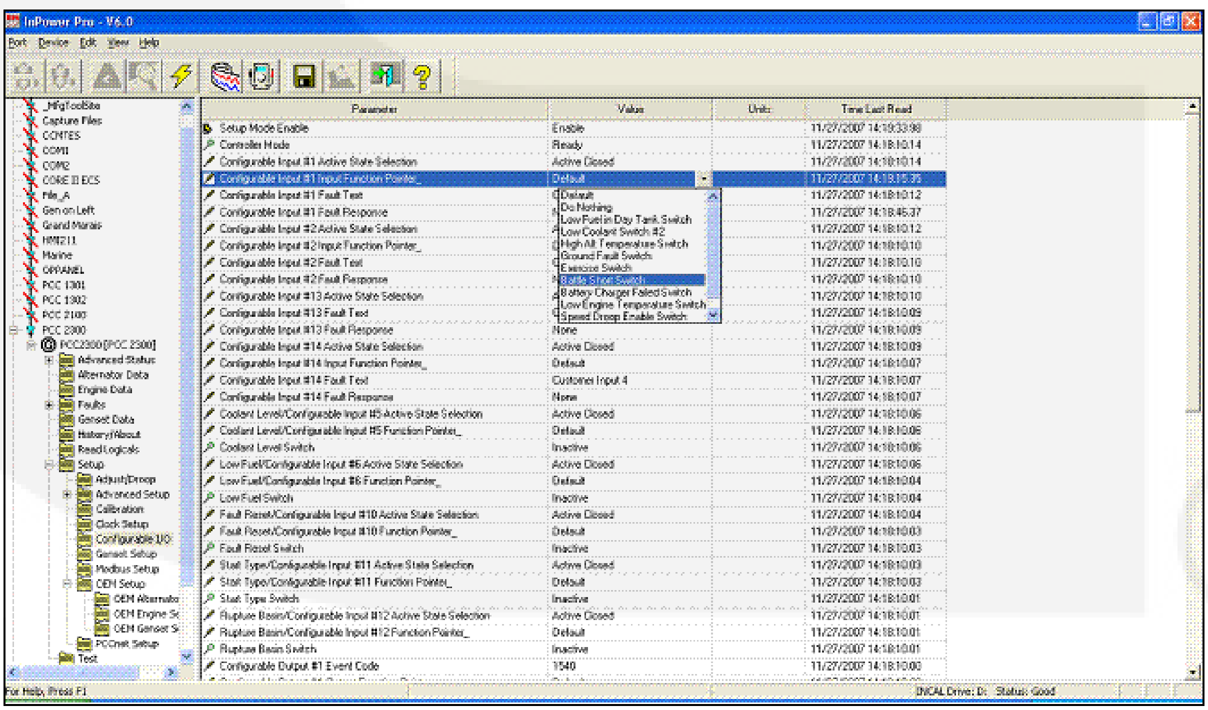
9. Set the Setup Mode Enable parameter to Disable, and click on Save in order to exit Setup mode.



5.10.4 Activate Battle Short Mode

Each configurable input can be Active Open or Active Closed. Check the value of the configurable input that was configured to Battle Short Switch, and activate the configurable input accordingly.

For example, Configurable Input #1 Active State Selection is set to Active Closed below. In order to activate Battle Short mode, Configurable Input #1 (TB-12 and TB13) has to be closed (connected together).



If Configurable Input #1 Active State Selection were set to Active Open, Configurable Input #1 (TB-12 and TB13) has to be an open contact (disconnected) to activate Battle Short mode.

5.11 Engine Does Not Crank in Manual Mode (No Fault Message)

Logic: The PCC has not received or recognized a manual start signal.

Possible causes:

1. No power is supplied to the control. (Control Alive indicator on the base board is not flashing).
2. The base board is not properly calibrated or the calibration is corrupt (the Control Alive indicator on the base board is flashing every 0.5 seconds).
3. The Emergency Stop switch or wiring is defective.
4. The Manual input is not getting from the Manual Select Switch (S12) to the base board.
5. The Manual Run/Stop button, harness, or the base board is defective.

5.11.1 Engine Does Not Crank in Manual Mode - Diagnosis and Repair

1. No power is supplied to the control. (The Control Alive indicator on the base board is not flashing).
   - Poor battery cable connections. Clean the battery cable terminals and tighten all connections using an insulated wrench.
   - Remove F4 and check continuity. If open, replace the fuse with one of the same type and amp rating (5 Amps).
     - If F4 is OK, remove connector P7 and check for B+ at P7-1 through P7-4 and GND at P7-5 through P7-8.
     - If B+ or ground missing, isolate to the harness and the TB BAT terminal mounted on the engine block.
     - If B+ and ground check OK, the base board may be defective. Cycle power to the base board by reconnecting P7.
2. The base board is not properly calibrated or the calibration is corrupt. (The Control Alive indicator flashes every ½ second.)
   - Confirm that the installed calibration part number matches the serial plate information. Re-enter a calibration file if necessary. (When properly installed, the Control Alive indicator flashes once every second.)
3. The Emergency Stop switch or wiring is defective.
   - With the Emergency Stop push button not activated, remove connector P1 and check for continuity between P1-1 (ESTOP-NC1) and P1-2 (ESTOP-NC2). (If the circuit is open, the control will detect a local E-Stop condition but will not display the E-Stop condition.) If the circuit is open, isolate to the Emergency Stop switch and wiring.
   - If there is continuity, go to the next step.

4. The Manual input is not getting from the Manual select switch (S12) to the base board indicating that S12, the base board, or the harness is defective.
    - With S12 in the Manual position, remove connector P1 from the base board and check for continuity from P1-6 (MAN) to P1-9 (GND). If there is no continuity, isolate the switch and wiring.
    - If there is continuity, go to the next step.
5. The Manual Run/Stop button, harness, or the base board is defective.
    - Remove connector P3 from the base board and check for continuity from P3-9 (MAN RUN/STOP) to P3-10 (GND). If there is no continuity when pressing the Manual Run/Stop button, replace the front membrane panel.

5.12 Engine Does Not Crank in Remote Mode (No Fault Message)

Logic:

PCC has not received or recognized a remote start signal.

Possible Cause:

1. The remote start switch or customer wiring is faulty.
2. The Auto mode input is not getting from the Auto select switch (S12) to the base board indicating that S12 or the harness is defective.

5.12.1 Engine Does Not Crank in Remote Mode - Diagnosis and Repair

1. The remote start switch or customer wiring is faulty.
    - Reset the control. Attempt to start and check for ground at TB1-1.
        - If ground is not present, isolate to the remote switch or customer wiring. Repair as necessary.
        - If ground is present, go to next step.
2. The Auto mode input is not getting from the Auto select switch (S12) to the base board, indicating that the S12 switch or the harness is defective.
    - With S12 in the Auto position, remove connector P1 from the base board and check for continuity from P1-5 (Auto) to P1-9 (GND).
        - If no continuity exists, isolate to the switch or the wiring harness.

5.13 Battery Charger Troubleshooting

5.13.1 Fault Code 379 - Over Current

Logic:

Charger output current is too high

Possible Causes:

1. Output current is excessive. Charger control may be failing.

5.13.1.1 Fault Code 379 - Diagnosis and Repair

1. Cycle through the Setup menus to try and clear the fault.

- If the fault returns, the charger control may have failed.

5.13.1.1.1 Clearing the Fault Code

NOTE: **Fault code can only be cleared by:**

- **Disconnect the charger harness plug,**
- **Cycle completely through the setup menus,**

Or

- **Recycling the power.**

5.13.2 Fault Code 441 - Low Battery Voltage

Logic:

Battery voltage is low

Possible Causes:

1. No battery connected.
2. Output breaker is in the “Off” (down) position.
3. A 12 V battery is connected but the charger is set for 24 V charging.
4. Battery can no longer maintain charge.
5. The wire between the charger and the battery is loose or broken

5.13.2.1 Fault Code 441 - Diagnosis and Repair

1. No battery connected.
   - Connect the battery.
2. Output breaker is in the “Off” (down) position.
   - Verify the output breaker is in “On” (up) position.
3. A 12V battery is connected but the charger is set for 24V charging.
   - Attach a 24V battery or set the charger for 12V charging.
4. Battery can no longer maintain charge.
   - Replace the battery.
5. The wire between the charger and the battery is loose or broken.
   - Check the wire.

5.13.3 Fault Code 442 - High Battery Voltage

Logic:

Battery voltage is high.

Possible Causes:

1. A 24 V battery is connected but the charger is set for 12 V charging.
2. Large load dump may have caused momentary voltage rise.

5.13.3.1 Fault Code 442 - Diagnosis and Repair

1. 24V battery is connected but the charger is set for 12 V charging.
   - Attach a 12 V battery or set the charger for 24 V charging.
2. Large load dump may have caused momentary voltage rise.
   - Cycle through the Setup menus to clear the fault and restart charging.

5.13.3.1.1 Clearing the Fault Code

NOTE: Fault code can only be cleared by:

- **Disconnect the charger harness plug,**
- **Cycle completely through the setup menus,**

Or

- **Recycling the power.**

5.13.4 Fault Code 2331 - Low AC Voltage

Logic:

AC input voltage is more than 10% below nominal rated voltage.

Possible Causes:

1. AC input voltage is more than 10% below nominal rated voltage.

5.13.4.1 Fault Code 2331 - Diagnosis and Repair

1. AC input voltage is more than 10% below nominal rated voltage.
   - Check level of input voltage.

     Charger will not operate with voltage 10% or more below nominal.

5.13.5 Fault Code 2358 - High AC Voltage

Logic:

AC input voltage is more than 10% above nominal rated voltage.

Possible Causes:

1. AC input voltage is more than 10% above nominal rated voltage.

5.13.5.1 Fault Code 2358 - Diagnosis and Repair

1. AC input voltage is more than 10% above nominal rated voltage.
   - Check level of input voltage.

     Charger will not operate with voltage 10% or more above nominal.

5.13.6 Fault Code 2263 - High Battery Temperature

(FOR INSTALLATIONS THAT INCLUDE THE OPTIONAL BATTERY TEMP SENSOR)

Logic:

Battery temperature is above 55 degrees C

Possible Causes:

1. Battery's ambient temperature is too high.
2. Possible shorted cells within the battery is causing an excessive battery temperature increase.

5.13.6.1 Fault Code 2263 - Diagnosis and Repair

1. Battery's ambient temperature is too high.
   - Move the battery into a cooler location.

     Charger will automatically begin charging again after the battery temp lowers.
2. Possible shorted cells within the battery is causing an excessive battery temperature increase.
   - Replace the battery.

5.13.7 Fault Code 2544 - Over Temperature

Logic:

Charger is overheating

Possible Causes:

1. Charger's ambient temperature is too high.
2. Charger's internal cooling fan is blocked, failed, or air inlets are covered.

5.13.7.1 Fault Code 2544 - Diagnosis and Repair

1. Charger's ambient temperature is too high.
   - Move the charger to a cooler location.

     The charger will automatically begin charging again after the internal temp lowers.
2. Charger's internal cooling fan is blocked, failed, or air inlets are covered.
   - Verify that the charger's air inlets on the side of the charger are not blocked and nothing is interfering with fan rotation.

5.13.8 Fault Code 9115 - Battery Fail

Logic:

Battery has failed.

Possible Causes:

1. The battery can no longer hold a charge or has been damaged excessively due to extremely deep discharge.

5.13.8.1 Fault Code 9115 - Diagnosis and Repair

1. Replace the battery and cycle through the Setup menus to clear the fault.

5.13.8.1.1 Clearing the Fault Code

NOTE: **Fault code can only be cleared by:**

- **Disconnect the charger harness plug,**
- **Cycle completely through the setup menus,**

Or

- **Recycling the power.**

5.13.9 No DC Output (No Fault Message)

Logic:

Charger cannot sense any DC output.

Possible Cause:

1. Tripped DC circuit breaker.
2. Blown AC fuse(s) (on 277, 380, 416 and 600 VAC battery chargers).
3. Tripped AC circuit breaker(s) (on 120, 208 and 240 VAC battery chargers).

5.13.9.1 No DC Output (No Fault Message) - Diagnosis and Repair

1. Tripped DC circuit breaker.
   - Correct the possible overload and reset the circuit breaker.
2. Blown AC fuse(s) (on 277, 380, 416 and 600 VAC battery chargers).
   - Correct the possible overload and replace the fuse(s).
3. Tripped AC circuit breaker(s) (on 120, 208 and 240 VAC battery chargers).
   - Correct the possible overload and reset the circuit breaker.

5.13.10 Low DC Output (No Fault Message)

Logic:

Charger senses low DC output.

Possible Cause:

1. Faulty battery.
2. Charger failure.

5.13.10.1 Low DC Output (No Fault Message) - Diagnosis and Repair

1. Faulty battery
   - Replace the battery.
2. Charger failure.
   - Arrange for a replacement charger.

5.13.11 High DC Output (No Fault Message)

Logic:

Charger senses high DC Output.

Possible Cause:

1. Charger failure.

5.13.11.1 High DC Output (No Fault Message) - Diagnosis and Repair

1. Arrange for a replacement charger.

5.14 CAN Datalink Troubleshooting

5.14.1 Fault Code 427 - CAN Datalink Lost Message

Logic:

Important data was lost between the Base Board and the ECM or keyswitch to ECM was removed during genset operation.

Possible Cause:

1. Power removed from ECM (keyswitch) during genset operation.
    - O pressed on control during genset operation.
2. Defective Datalink harness assembly.

5.14.1.1 Fault Code 427 - Diagnosis and Repair

1. Power removed from ECM (keyswitch) during genset operation.
    - O pressed on control during genset operation.

    Reset control by pressing Fault Reset buttion with O/Manual/Auto switch in O (off) position.
2. Defective Datalink harness assembly.
    - Inspect the Datalink harness between P10 and P41 connector pins.
        - Repair or Replace as necessary.
    - Check for resistive circuit in lead P10-1 to P41-N and P10-2 to P41-P (10ohms or less = ok).
    - Check terminating resistors. With connectors P10 and P41 removed, measure resistance between pins P10-1 and P10-2 (60 ohms = ok).

5.14.2 Fault Code 781 - CAN Datalink Lost Messages

Logic:

Important data was lost between the Base board and the ECM or keyswitch to ECM was removed during genset operation.

5.14.2.1 Fault Code 781 - Diagnosis and Repair

Refer to fault code **427**

5.14.3 Fault Code 1245 - CAN - Engine Shutdown

Logic:

The PCC received a shutdown message from the ECM

Possible Cause:

1. ECM/Engine fault

5.14.3.1 Fault Code 1245 - Diagnosis and Repair

1. ECM/Engine fault.
    - Refer to the E-Controls service tool and the engine service manual.

5.14.4 Fault Code 1246 - CAN - Unknown Engine Fault

Logic:

The PCC received an unknown message from the ECM

Possible Cause:

1. ECM/Engine fault

5.14.4.1 Fault Code 1246 - Diagnosis and Repair

1. ECM/Engine fault.
    - Refer to the E-Controls service tool and the engine service manual.

5.14.5 Fault Code 1247 - CAN - Engine Unannounced Fault

Logic:

The PCC received an unknown message from the ECM.

Possible Cause:

1. ECM/Engine fault

5.14.5.1 Fault Code 1247 - Diagnosis and Repair

1. ECM/Engine fault.
    - Refer to the E-Controls service tool and the engine service manual.

5.14.6 Fault Code 1248 - CAN - Engine Warning Fault

Logic:

The PCC received an unknown message from the ECM.

Possible Cause:

1. ECM/Engine fault

5.14.6.1 Fault Code 1248 - Diagnosis and Repair

1. ECM/Engine fault.
    - Refer to the E-Controls service tool and the engine service manual.

5.15 How to Obtain Service

At Cummins Power Generation, we want to deliver more than just good service. The process starts with an accurate description of generator set information, such as event/fault codes and troubleshooting procedures performed, without which no repair can possibly be performed accurately.

Before contacting your local distributor, locate the name plate on the side of the generator output box, and have the following information available.

Model of Controller: ____

Control Part Number and Serial Number:

____

Describe the control issue:

____

____

Are there any fault codes on the operator panel?

____

If so, list the fault codes on the operator panel:

____

To find the closest distributor,

1. Go to www.cumminspower.com.
2. Click on “Distributor Locator".

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Before contacting your local distributor, locate the name plate on the side of the generator output box, and have the following information available.

WARNING: Incorrect service or replacement of parts can result in severe personal injury, death, and/or equipment damage. Service personnel must be trained and experienced to perform electrical and mechanical service. Read Safety Precautions, and carefully observe all of the instructions and precautions in this manual.

6 Troubleshooting - PC1.2

6.1 Relay K4

The starter relay is used by the control board to energize the starter solenoid. K4 is part of the engine harness assembly.

6.2 Relay K5

The T26 relay, which is energized by the control board, controls the T26 (switched B+) output. K5 is part of the engine harness assembly.

6.3 Relay K15

The keyswitch pilot relay, which is energized by the control board, controls the keyswitch input to the ECM. K15 is part of the engine harness assembly.

6.4 Fuse F10A and F10B (Voltage Reference Signal)

The generator set will shut down and may display Fault code **1447** or **2335** if either fuse opens. The fuses protect the PCC control circuitry from damage due to an alternator field overload condition.

6.5 Dinrail Terminal Blocks

The six terminal blocks mounted to the dinrail are used for customer connections to T26 (switched B+), TB B+ (battery B+) and TB B- (battery ground). Refer to Relay Connections for wire recommendations. The terminal blocks are colored coded as follows:

ORANGE - T26 (20 amps, fused switched B+) RED - TB B+ (30 amps max, non-fused battery B+) BLACK - TB- (30 amps max, battery ground)

6.6 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. 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.

6.6.1 Code 118 − Fuel Pressure OOR High (Warning)

Logic:

Fuel pressure sensor signal is out of range – shorted high.

Possible Causes:

1. Faulty fuel pressure sensor connections

2. Faulty fuel pressure sensor
3. Faulty engine harness
4. Faulty extension harness
5. Verify the calibrations in the ECM and the PowerCommand controls

Diagnosis and Repair:

1. Faulty fuel pressure sensor connections
    a. Inspect the fuel pressure sensor and the engine harness connector pins.
        a. Disconnect the engine harness connector from the fuel pressure sensor.
        b. Inspect for corroded pins, bent or broken pins, pushed back or expanded pins.
        c. Inspect for evidence of moisture in or on the connector.
        d. Inspect for missing or damaged connector seals.
        e. Inspect for dirt or debris in or on the connector pins.
2. Faulty fuel pressure sensor
    a. Active Sensor.
        a. Check the fuel pressure sensor supply voltage.
            a. Disconnect the engine harness connector from the fuel pressure sensor.
            b. Install the pressure sensor breakout cable between the sensor and the sensor harness connector.
            c. Measure the supply voltage by connecting the breakout cable's supply and return connectors to the multimeter. If the reading is between 4.75 and 5.25 VDC, then the supply voltage is correct.
        b. Check the fuel pressure sensor signal (sense) voltage.
            a. Disconnect the engine harness connector from the fuel pressure sensor
            b. Install the pressure sensor breakout cable between the sensor and the sensor harness connector.
            c. Measure the signal voltage by connecting the breakout cable's signal and return connectors to the multimeter. If the reading is between 0.46 and 4.56 V, then the signal voltage is correct. If not, sensor is faulty.
3. Faulty engine harness
    a. Inspect the engine harness and the connector pins.
        a. Disconnect the engine harness connector from the extension harness.
        b. Inspect for corroded pins, bent or broken pins, pushed back or expanded pins.
        c. Inspect for evidence of moisture in or on the connector.
        d. Inspect for missing or damaged connector seals.
        e. Inspect for dirt or debris in or on the connector pin.
    b. Check for a short circuit from pin to pin.
        a. Disconnect the engine harness from the extension harness.

b. Disconnect the engine harness connector from the fuel pressure sensor.

c. Disconnect the engine harness from all sensors that have a shared supply or return with the fuel pressure sensor.

d. Measure the resistance from the fuel pressure 5 VDC supply pin on the engine harness inline connector to all other pins in the engine harness inline connector.

e. Measure the resistance from the fuel pressure return pin on the engine harness inline connector to all other pins in the engine harness inline connector.

f. Measure the resistance from the fuel pressure signal pin on the engine harness inline connector to all other pins in the engine harness inline connector.

g. If all measurements are greater than 100k ohms, then the resistance is correct.

c. Check for an open circuit.

a. Disconnect the engine harness from the extension harness.

b. Disconnect the engine harness connector from the fuel pressure sensor.

c. Measure the resistance from the fuel pressure return pin on the engine harness inline connector to the fuel pressure return pin on the engine harness sensor connector.

d. If the measurement is less than 10 ohms, then the resistance is correct.

4. Faulty extension harness

a. Inspect the extension harness and the control connector pins.

a. Disconnect the extension harness connector from the control.

b. Inspect for corroded pins, bent or broken pins, pushed back or expanded pins.

c. Inspect for evidence of moisture in or on the connector.

d. Inspect for missing or damaged connector seals.

e. Inspect for dirt or debris in or on the connector pins.

b. Check for an open circuit.

a. Disconnect the extension harness connector from the control.

b. Disconnect the extension harness from the engine harness.

c. Measure the resistance from the fuel pressure return pin on the extension harness connector to the fuel pressure return pin on the extension harness inline connection.

d. If the measurement is less than 10 ohms, then the resistance is correct.

c. Check for a short circuit from pin to pin.

a. Disconnect the extension harness connector from the control.

b. Disconnect the extension harness from the engine harness.

c. Measure the resistance from the fuel pressure 5 VDC supply pin on the extension harness connector to all other pins in the extension harness connector.

d. Measure the resistance from the fuel pressure return pin on the extension harness connector to all other pins in the extension harness connector.

   e. Measure the resistance from the fuel pressure signal pin on the extension harness connector to all other pins in the extension harness connector.
   f. If all measurements are greater than 100k ohms, then the resistance is correct.
5. Verify the calibrations in the ECM and the PowerCommand controls
   a. Using the display or the InPower Service tool, verify the calibration in the PCC.
      a. If the calibration in the PCC matches the latest calibration on the InCal website, then the calibration is correct. If it does not, update the calibration to the latest.
   b. Using the InSite Service tool, verify the calibration in the ECM.
      a. If the calibration in the ECM matches the latest calibration on QSOL, then the calibration is correct. If it does not, update the ECM to the latest calibration.

6.6.2 Code 119 - Fuel Pressure Sensor OOR Low (Warning)

Logic:

Fuel pressure sensor signal is out of range – shorted high.

Possible Causes:

1. Faulty fuel pressure sensor connections
2. Faulty fuel pressure sensor
3. Faulty engine harness
4. Faulty extension harness
5. Verify the calibrations in the ECM and the PowerCommand controls

Diagnosis and Repair:

1. Faulty fuel pressure sensor connections
   a. Inspect the fuel pressure sensor and the engine harness connector pins.
      a. Disconnect the engine harness connector from the fuel pressure sensor.
      b. Inspect for corroded pins, bent or broken pins, pushed back or expanded pins.
      c. Inspect for evidence of moisture in or on the connector.
      d. Inspect for missing or damaged connector seals.
      e. Inspect for dirt or debris in or on the connector pins.
2. Faulty fuel pressure sensor
   a. Active Sensor.
      a. Check the fuel pressure sensor supply voltage.
         a. Disconnect the engine harness connector from the fuel pressure sensor.
         b. Install the pressure sensor breakout cable between the sensor and the sensor harness connector.
         c. Measure the supply voltage by connecting the breakout cable's supply and return connectors to the multimeter. If the reading is between 4.75 and 5.25 VDC, then the supply voltage is correct.

   b. Check the fuel pressure sensor signal (sense) voltage.
      a. Disconnect the engine harness connector from the fuel pressure sensor
      b. Install the pressure sensor breakout cable between the sensor and the sensor harness connector.
      c. Measure the signal voltage by connecting the breakout cable's signal and return connectors to the multimeter. If the reading is between 0.46 and 4.56 V, then the signal voltage is correct. If not, sensor is faulty.

3. Faulty engine harness
   a. Inspect the engine harness and the connector pins.
      a. Disconnect the engine harness connector from the extension harness.
      b. Inspect for corroded pins, bent or broken pins, pushed back or expanded pins.
      c. Inspect for evidence of moisture in or on the connector.
      d. Inspect for missing or damaged connector seals.
      e. Inspect for dirt or debris in or on the connector pin.
   b. Check for a short circuit from pin to pin.
      a. Disconnect the engine harness from the extension harness.
      b. Disconnect the engine harness connector from the fuel pressure sensor.
      c. Disconnect the engine harness from all sensors that have a shared supply or return with the fuel pressure sensor.
      d. Measure the resistance from the fuel pressure 5 VDC supply pin on the engine harness inline connector to all other pins in the engine harness inline connector.
      e. Measure the resistance from the fuel pressure return pin on the engine harness inline connector to all other pins in the engine harness inline connector.
      f. Measure the resistance from the fuel pressure signal pin on the engine harness inline connector to all other pins in the engine harness inline connector.
      g. If all measurements are greater than 100k ohms, then the resistance is correct.
   c. Check for a short circuit to engine block ground.
      a. Disconnect the extension harness from the control.
      b. Disconnect the extension harness from the engine harness.
      c. Measure the resistance from the fuel pressure signal pin on the extension harness connector to the engine block ground.
      d. Measure the resistance from the fuel pressure 5 VDC pin on the extension harness connector to the engine block ground.
      e. If the measurement is more than 100k ohms, then the resistance is correct.
   d. Check for an open circuit.
      a. Disconnect the engine harness from the extension harness.
      b. Disconnect the engine harness connector from the fuel pressure sensor.

c. Measure the resistance from the fuel pressure return pin on the engine harness inline connector to the fuel pressure return pin on the engine harness sensor connector.

d. If the measurement is less than 10 ohms, then the resistance is correct.

4. Faulty extension harness
   a. Inspect the extension harness and the control connector pins.
      a. Disconnect the extension harness connector from the control.
      b. Inspect for corroded pins, bent or broken pins, pushed back or expanded pins.
      c. Inspect for evidence of moisture in or on the connector.
      d. Inspect for missing or damaged connector seals.
      e. Inspect for dirt or debris in or on the connector pins.
   b. Check for a short circuit from pin to pin.
      a. Disconnect the extension harness connector from the control.
      b. Disconnect the extension harness from the engine harness.
      c. Measure the resistance from the fuel pressure 5 VDC supply pin on the extension harness connector to all other pins in the extension harness connector.
      d. Measure the resistance from the fuel pressure return pin on the extension harness connector to all other pins in the extension harness connector.
      e. Measure the resistance from the fuel pressure signal pin on the extension harness connector to all other pins in the extension harness connector.
      f. If all measurements are greater than 100k ohms, then the resistance is correct.
   c. Check for a short circuit to engine block ground
      a. Disconnect the extension harness from the control.
      b. Disconnect the extension harness from the engine harness.
      c. Measure the resistance from the fuel pressure signal pin on the extension harness connector to the engine block ground.
      d. Measure the resistance from the fuel pressure 5 VDC pin on the extension harness connector to the engine block ground.
      e. If the measurement is more than 100K ohms, then the resistance is correct.
   d. Check for an open circuit.
      a. Disconnect the extension harness connector from the control.
      b. Disconnect the extension harness from the engine harness.
      c. Measure the resistance from the fuel pressure return pin on the extension harness connector to the fuel pressure return pin on the extension harness inline connection.
      d. If the measurement is less than 10 ohms, then the resistance is correct.

5. Verify the calibrations in the ECM and the PowerCommand controls
    a. Using the display or the InPower Service tool, verify the calibration in the PCC.
        a. If the calibration in the PCC matches the latest calibration on the InCal website, then the calibration is correct. If it does not, update the calibration to the latest.
    b. Using the InSite Service tool, verify the calibration in the ECM.
        a. If the calibration in the ECM matches the latest calibration on QSOL, then the calibration is correct. If it does not, update the ECM to the latest calibration.

6.6.3 Code 121 − Loss of Speed Sense (Shutdown)

Logic:

No engine speed signal detected from one of two signals: engine crankshaft speed or engine camshaft position.

Possible Causes:

1. Faulty crankshaft speed sensor connections
2. Faulty crankshaft speed sensor
3. Faulty camshaft position sensor connections
4. Faulty camshaft position sensor
5. Faulty engine harness
6. Faulty extension harness
7. Damaged crankshaft target wheel
8. Verify the calibrations in the ECM and the PowerCommand controls

Diagnosis and Repair:

1. Faulty crankshaft speed sensor connections
    a. Inspect the crankshaft speed sensor and the engine harness connector pins.
        a. Disconnect the engine harness connector from the crankshaft speed sensor.
        b. Inspect for corroded, bent broken, pushed back, expanded, or loose pins.
        c. Inspect for evidence of moisture in or on the connector.
        d. Inspect for missing or damaged connector seals.
        e. Inspect for dirt or debris in or on the connector pins.
2. Faulty crankshaft speed sensor
    a. Check the crankshaft speed sensor supply voltage.
        a. Disconnect the engine harness connector from the crankshaft speed sensor.
        b. Install the speed sensor breakout cable between the sensor and the sensor harness connector.
        c. Measure the supply voltage by connecting the breakout cable's supply and return connectors to the multimeter. If the reading is between 4.75 and 5.25 VDC, then the supply voltage is correct.

b. Check the crankshaft speed sensor signal (sense) voltage.

   a. Disconnect the engine harness connector from the camshaft position sensor.

   b. Install the pressure sensor breakout cable between the sensor and the sensor harness connector.

   c. Measure the signal voltage by connecting the breakout cable's signal and return connectors to the multimeter. If the reading is between 0.46 and 4.56 VDC, then the signal voltage is correct. If not, sensor is faulty.

3. Faulty camshaft position sensor connections

   a. Inspect the camshaft position sensor and the engine harness connector pins

      a. Disconnect the engine harness connector from the camshaft position sensor.

      b. Inspect for corroded, bent broken, pushed back, expanded, or loose pins.

      c. Inspect for evidence of moisture in or on the connector.

      d. Inspect for missing or damaged connector seals.

      e. Inspect for dirt or debris in or on the connector pins.

4. Faulty camshaft position sensor

   a. Check the camshaft position sensor supply voltage.

      a. Disconnect the engine harness connector from the camshaft position sensor.

      b. Install the speed sensor breakout cable between the sensor and the sensor harness connector.

      c. Measure the supply voltage by connecting the breakout cable's supply and return connectors to the multimeter. If the reading is between 4.75 and 5.25 VDC, then the supply voltage is correct.

   b. Check the camshaft position sensor signal (sense) voltage.

      a. Disconnect the engine harness connector from the camshaft position sensor.

      b. Install the pressure sensor breakout cable between the sensor and the sensor harness connector.

      c. Measure the signal voltage by connecting the breakout cable's signal and return connectors to the multimeter. If the reading is between 0.46 and 4.56 VDC, then the signal voltage is correct. If not, sensor is faulty.

5. Faulty engine harness

   a. Inspect the engine harness and the connector pins.

      a. Disconnect the engine harness connector from the extension harness.

      b. Inspect for corroded pins, bent or broken pins, pushed back or expanded pins.

      c. Inspect for evidence of moisture in or on the connector.

      d. Inspect for missing or damaged connector seal.

      e. Inspect for dirt or debris in or on the connector pin.

   b. Check for a short circuit from pin to pin on the crankshaft speed sensor conductors.

      a. Disconnect the engine harness from the extension harness.

  b. Disconnect the engine harness connector from the crankshaft speed sensor.
  c. Disconnect the engine harness from all sensors that have a shared supply or return with the crankshaft speed sensor.
  d. Measure the resistance from the crankshaft speed 5 VDC supply pin on the engine harness inline connector to all other pins in the engine harness inline connector.
  e. Measure the resistance from the crankshaft speed return pin on the engine harness inline connector to all other pins in the engine harness inline connector.
  f. Measure the resistance from the crank shaft speed signal pin on the engine harness inline connector to all other pins in the engine harness inline connector.
  g. If all measurements are greater than 100k ohms, then the resistance is correct.

c. Check for a short circuit to engine block ground on the crankshaft speed sensor conductors.
  a. Disconnect the extension harness from the control.
  b. Disconnect the extension harness from the engine harness.
  c. Measure the resistance from the crankshaft speed signal pin on the extension harness connector to the engine block ground.
  d. Measure the resistance from the crankshaft speed 5 VDC pin on the extension harness connector to the engine block ground.
  e. If the measurement is more than 100k ohms, then the resistance is correct.

d. Check for an open circuit on the crankshaft speed sensor conductors.
  a. Disconnect the engine harness connector from the extension harness.
  b. Disconnect the engine harness from the crankshaft speed sensor.
  c. Measure the resistance from the crankshaft speed return pin on the engine harness inline connector to the crankshaft speed return pin on the engine harness sensor connector.
  d. If the measurement is less than 10 ohms, then the resistance is correct.

e. Check for a short circuit from pin to pin on the camshaft position sensor conductors.
  a. Disconnect the engine harness from the extension harness.
  b. Disconnect the engine harness connector from the camshaft position sensor.
  c. Disconnect the engine harness from all sensors that have a shared supply or return with the camshaft position sensor.
  d. Measure the resistance from the camshaft position 5 VDC supply pin on the engine harness inline connector to all other pins in the engine harness inline connector.
  e. Measure the resistance from the camshaft position return pin on the engine harness inline connector to all other pins in the engine harness inline connector.
  f. Measure the resistance from the camshaft position signal pin on the engine harness inline connector to all other pins in the engine harness inline connector.
  g. If all measurements are greater than 100k ohms, then the resistance is correct.

f. Check for a short circuit to engine block ground on the camshaft position sensor conductors.

   a. Disconnect the extension harness from the control.

   b. Disconnect the extension harness from the engine harness.

   c. Measure the resistance from the camshaft position signal pin on the extension harness connector to the engine block ground.

   d. Measure the resistance from the camshaft position 5 VDC pin on the extension harness connector to the engine block ground.

   e. If the measurement is more than 100k ohms, then the resistance is correct.

g. Check for an open circuit on the camshaft position sensor conductors.

   a. Disconnect the engine harness connector from the extension harness.

   b. Disconnect the engine harness from the camshaft position sensor.

   c. Measure the resistance from the camshaft position return pin on the engine harness inline connector to the camshaft position return pin on the engine harness sensor connector.

   d. If the measurement is less than 10 ohms, then the resistance is correct.

6. Faulty extension harness

   a. Inspect the extension harness and control pins.

      a. Disconnect the extension harness connector from the control.

      b. Inspect for corroded, bent broken, pushed back, expanded, or loose pins.

      c. Inspect for evidence of moisture in or on the connector.

      d. Inspect for missing or damaged connector seals.

      e. Inspect for dirt or debris in or on the connector pins.

   b. Check for a short circuit from pin to pin on the crankshaft speed sensor conductors.

      a. Disconnect the extension harness connector from the control.

      b. Disconnect the extension harness from the engine harness.

      c. Measure the resistance from the crankshaft speed sensor 5 VDC supply pin on the extension harness connector to all other pins in the extension harness connector.

      d. Measure the resistance from the crankshaft speed return pin on the extension harness connector to all other pins in the extension harness connector.

      e. Measure the resistance from the crankshaft speed signal pin on the extension harness connector to all other pins in the extension harness connector.

      f. If all measurements are greater than 100k ohms, then the resistance is correct.

   c. Check for a short circuit to engine block ground on the crankshaft speed sensor conductors.

      a. Disconnect the extension harness from the control.

      b. Disconnect the extension harness from the engine harness.

c. Measure the resistance from the crankshaft speed signal pin on the extension harness connector to the engine block ground.

d. Measure the resistance from the crankshaft speed 5 VDC pin on the extension harness connector to the engine block ground.

e. If the measurement is more than 100k ohms, then the resistance is correct.

d. Check for an open circuit on the crankshaft speed sensor conductors.

a. Disconnect the extension harness from the control.

b. Disconnect the extension harness from the engine harness.

c. Measure the resistance from the crankshaft speed return pin on the engine harness inline connector to the crankshaft speed return pin on the engine harness sensor connector.

d. If the measurement is less than 10 ohms, then the resistance is correct.

e. Check for a short circuit from pin to pin on the camshaft position sensor conductors.

a. Disconnect the extension harness connector from the control.

b. Disconnect the extension harness from the engine harness.

c. Measure the resistance from the camshaft position sensor 5 VDC supply pin on the extension harness connector to all other pins in the extension harness connector.

d. Measure the resistance from the camshaft position return pin on the extension harness connector to all other pins in the extension harness connector.

e. Measure the resistance from the camshaft position signal pin on the extension harness connector to all other pins in the extension harness connector.

f. If all measurements are greater than 100k ohms, then the resistance is correct.

f. Check for a short circuit to engine block ground on the camshaft position sensor conductors.

a. Disconnect the extension harness from the control.

b. Disconnect the extension harness from the engine harness.

c. Measure the resistance from the camshaft position signal pin on the extension harness connector to the engine block ground.

d. Measure the resistance from the camshaft position 5 VDC pin on the extension harness connector to the engine block ground.

e. If the measurement is more than 100k ohms, then the resistance is correct.

g. Check for an open circuit on the camshaft position sensor conductors.

a. Disconnect the extension harness from the control.

b. Disconnect the extension harness from the engine harness.

c. Measure the resistance from the camshaft position return pin on the engine harness inline connector to the camshaft position return pin on the engine harness sensor connector.

d. If the measurement is less than 10 ohms, then the resistance is correct.

7. Damaged crankshaft target wheel
    a. Visually inspect the crankshaft target wheel.
        a. Inspect for damaged, malformed, missing or broken target wheel teeth.
        b. Inspect for evidence of corrosion or other materials on or around the target wheel teeth.
        c. Inspect for dirt or debris on the target wheel teeth.
8. Verify the calibrations in the ECM and the PowerCommand controls.
    a. Using the display or the InPower Service tool, verify the calibration in the PCC.
        a. If the calibration in the PCC matches the latest calibration on the InCal website, then the calibration is correct. If it does not, update the calibration to the latest.
    b. Using the InSite Service tool, verify the calibration in the ECM.
        a. If the calibration in the ECM matches the latest calibration on QSOL, then the calibration is correct. If it does not, update the ECM to the latest calibration.

6.6.4 Code 135 - Oil Pressure Sensor OOR - High (Warning)

Logic:

Engine oil pressure sensor is out of range – shorted high. An “OIL PRESSURE SENSOR OOR” warning is displayed after the fault condition is sensed for 10 seconds.

Possible Causes:

1. Failed oil pressure sensor connections
2. Failed oil pressure sensor
3. Failed engine harness
4. Failed extension harness
5. Verify the calibrations in the ECM and the PowerCommand controls

Diagnosis and Repair:

1. Failed oil pressure sensor connections
    a. Visually inspect the oil pressure sensor and harness connector pins.
        a. Disconnect the engine harness connector from the crankshaft speed sensor.
        b. Inspect for corroded, bent broken, pushed back, expanded, or loose pins.
        c. Inspect for evidence of moisture in or on the connector.
        d. Inspect for missing or damaged connector seals.
        e. Inspect for dirt or debris in or on the connector pins.
2. Failed oil pressure sensor
    a. Check the oil pressure sensor supply voltage.
        a. Disconnect the engine harness connector from the oil pressure sensor.
        b. Install the pressure sensor breakout cable between the sensor and the sensor harness connector.

c. Measure the supply voltage by connecting the breakout cable's supply and return connectors to the multimeter. If the reading is between 4.75 and 5.25 VDC, then the supply voltage is correct.

b. Check the oil pressure sensor signal (sense) voltage.

   a. Disconnect the engine harness connector from the oil pressure sensor.

   b. Install the pressure sensor breakout cable between the sensor and the sensor harness connector.

   c. Measure the signal voltage by connecting the breakout cable's signal and return connectors to the multimeter. If the reading is between 0.46 and 4.56 V, then the signal voltage is correct. If not, sensor is faulty.

3. Faulty engine harness

   a. Inspect the engine harness and the connector pins.

      a. Disconnect the engine harness connector from the extension harness.

      b. Inspect for corroded pins, bent or broken pins, pushed back or expanded pins.

      c. Inspect for evidence of moisture in or on the connector.

      d. Inspect for missing or damaged connector seals.

      e. Inspect for dirt or debris in or on the connector pin.

   b. Check for a short circuit from pin to pin.

      a. Disconnect the engine harness from the extension harness.

      b. Disconnect the engine harness connector from the oil pressure sensor.

      c. Disconnect the engine harness from all sensors that have a shared supply or return with the oil pressure sensor.

      d. Measure the resistance from the oil pressure 5 VDC supply pin on the engine harness inline connector to all other pins in the engine harness inline connector.

      e. Measure the resistance from the oil pressure return pin on the engine harness inline connector to all other pins in the engine harness inline connector.

      f. Measure the resistance from the oil pressure signal pin on the engine harness inline connector to all other pins in the engine harness inline connector.

      g. If all measurements are greater than 100k ohms, then the resistance is correct.

   c. Check for an open circuit.

      a. Disconnect the engine harness from the extension harness.

      b. Disconnect the engine harness connector from oil pressure sensor.

      c. Measure the resistance from the oil pressure return pin on the engine harness inline connector to the oil pressure return pin on the engine harness sensor connector.

      d. If the measurement is less than 10 ohms the resistance is correct.

4. Faulty extension harness

   a. Inspect the extension harness and the generator set control connector pins.

      a. Disconnect the extension harness connector from the control.

b. Inspect for corroded, bent broken, pushed back, expanded, or loose pins.

c. Inspect for evidence of moisture in or on the connector.

d. Inspect for missing or damaged connector seals.

e. Inspect for dirt or debris in or on the connector pins.

b. Check for an open circuit on the crankshaft speed sensor conductors.

a. Disconnect the extension harness from the control.

b. Disconnect the extension harness from the engine harness.

c. Measure the resistance from the crankshaft speed return pin on the engine harness inline connector to the crankshaft speed return pin on the engine harness sensor connector.

d. If the measurement is less than 10 ohms, then the resistance is correct.

c. Check for a short circuit from pin to pin.

a. Disconnect the extension harness connector from the control.

b. Disconnect the extension harness from the engine harness.

c. Measure the resistance from the crankshaft speed sensor 5 VDC supply pin on the extension harness connector to all other pins in the extension harness connector.

d. Measure the resistance from the crankshaft speed return pin on the extension harness connector to all other pins in the extension harness connector.

e. Measure the resistance from the crankshaft speed signal pin on the extension harness connector to all other pins in the extension harness connector.

f. If all measurements are greater than 100k ohms, then the resistance is correct.

5. Verify the calibrations in the ECM and the PowerCommand controls

a. Using the display or the InPower Service tool, verify the calibration in the PCC.

a. If the calibration in the PCC matches the latest calibration on the InCal website, then the calibration is correct. If it does not, update the calibration to the latest.

b. Using the InSite Service tool, verify the calibration in the ECM.

a. If the calibration in the ECM matches the latest calibration on QSOL, then the calibration is correct. If it does not, update the ECM to the latest calibration.

6.6.5 Code 141 - Oil Pressure Sensor OOR - Low (Warning)

Logic:

Engine oil pressure sensor is out of range – shorted low. An “OIL PRESSURE SENSOR OOR” warning is displayed after the fault condition is sensed for 10 seconds.

Possible Causes:

1. Failed oil pressure sensor connections
2. Failed oil pressure sensor
3. Failed engine harness
4. Failed extension harness

5. Verify the calibrations in the ECM and the PowerCommand controls

Diagnosis and Repair:

1. Failed oil pressure sensor connections
    a. Visually inspect the oil pressure sensor and harness connector pins.
        a. Disconnect the engine harness connector from the crankshaft speed sensor.
        b. Inspect for corroded, bent broken, pushed back, expanded, or loose pins.
        c. Inspect for evidence of moisture in or on the connector.
        d. Inspect for missing or damaged connector seals.
        e. Inspect for dirt or debris in or on the connector pins.
2. Failed oil pressure sensor
    a. Check the oil pressure sensor supply voltage.
        a. Disconnect the engine harness connector from the oil pressure sensor.
        b. Install the pressure sensor breakout cable between the sensor and the sensor harness connector.
        c. Measure the supply voltage by connecting the breakout cable's supply and return connectors to the multimeter. If the reading is between 4.75 and 5.25 VDC, then the supply voltage is correct.
    b. Check the oil pressure sensor signal (sense) voltage.
        a. Disconnect the engine harness connector from the oil pressure sensor.
        b. Install the pressure sensor breakout cable between the sensor and the sensor harness connector.
        c. Measure the signal voltage by connecting the breakout cable's signal and return connectors to the multimeter. If the reading is between 0.46 and 4.56 V, then the signal voltage is correct. If not, sensor is faulty.
3. Faulty engine harness
    a. Inspect the engine harness and the connector pins.
        a. Disconnect the engine harness connector from the extension harness.
        b. Inspect for corroded pins, bent or broken pins, pushed back or expanded pins.
        c. Inspect for evidence of moisture in or on the connector.
        d. Inspect for missing or damaged connector seals.
        e. Inspect for dirt or debris in or on the connector pin.
    b. Check for a short circuit from pin to pin.
        a. Disconnect the engine harness from the extension harness.
        b. Disconnect the engine harness connector from the oil pressure sensor.
        c. Disconnect the engine harness from all sensors that have a shared supply or return with the oil pressure sensor.
        d. Measure the resistance from the oil pressure 5 VDC supply pin on the engine harness inline connector to all other pins in the engine harness inline connector.

e. Measure the resistance from the oil pressure return pin on the engine harness inline connector to all other pins in the engine harness inline connector.

f. Measure the resistance from the oil pressure signal pin on the engine harness inline connector to all other pins in the engine harness inline connector.

g. If all measurements are greater than 100k ohms, then the resistance is correct.

c. Check for a short circuit to engine block ground.

a. Disconnect the extension harness from the control.

b. Disconnect the extension harness from the engine harness.

c. Measure the resistance from the oil pressure signal pin on the extension harness connector to the engine block ground.

d. Measure the resistance from the oil pressure 5 VDC pin on the extension harness connector to the engine block ground.

e. If the measurement is more than 100k ohms, then the resistance is correct.

4. Faulty extension harness

a. Inspect the extension harness and the generator set control connector pins.

a. Disconnect the extension harness connector from the control.

b. Inspect for corroded, bent broken, pushed back, expanded, or loose pins.

c. Inspect for evidence of moisture in or on the connector.

d. Inspect for missing or damaged connector seals.

e. Inspect for dirt or debris in or on the connector pins.

b. Check for a short circuit from pin to pin.

a. Disconnect the extension harness connector from the control.

b. Disconnect the extension harness from the engine harness.

c. Measure the resistance from the crankshaft speed sensor 5 VDC supply pin on the extension harness connector to all other pins in the extension harness connector.

d. Measure the resistance from the crankshaft speed return pin on the extension harness connector to all other pins in the extension harness connector.

e. Measure the resistance from the crankshaft speed signal pin on the extension harness connector to all other pins in the extension harness connector.

f. If all measurements are greater than 100k ohms, then the resistance is correct.

c. Check for a short circuit to engine block ground.

a. Disconnect the extension harness from the control.

b. Disconnect the extension harness from the engine harness.

c. Measure the resistance from the oil pressure signal pin on the extension harness connector to the engine block ground.

d. Measure the resistance from the oil pressure 5 VDC pin on the extension harness connector to the engine block ground.

e. If the measurement is more than 100k ohms, then the resistance is correct.

d. Check for an open circuit.

a. Disconnect the extension harness from the control.

b. Disconnect the extension harness from the engine harness.

c. Measure the resistance from the engine oil temperature return pin on the extension harness connector to the engine oil temperature return pin at the extension harness inline connector.

d. Measure the resistance from the engine oil temperature signal pin on the extension harness connector to the engine oil temperature signal pin at the extension harness inline connector.

e. If the measurement is less than 10 ohms, then the resistance is correct.

5. Verify the calibrations in the ECM and the PowerCommand controls

a. Using the display or the InPower Service tool, verify the calibration in the PCC.

a. If the calibration in the PCC matches the latest calibration on the InCal website, then the calibration is correct. If it does not, update the calibration to the latest.

b. Using the InSite Service tool, verify the calibration in the ECM.

a. If the calibration in the ECM matches the latest calibration on QSOL, then the calibration is correct. If it does not, update the ECM to the latest calibration.

6.6.6 Code 143 - Engine Oil Pressure Low (Warning)

Logic:

Engine oil pressure is below the low oil pressure warning threshold.

Possible Cause:

1. Lubricating oil level is low
2. External leak
3. Lubricating oil does not meet specifications
4. Lubricating oil is contaminated with coolant or fuel
5. Engine angularity during operation exceeds specification
6. Coolant temperature is above specification
7. Lubricating oil filter plumbing is not routed correctly
8. Main oil pressure regulator is faulty
9. Lubricating oil suction or transfer tube is loose or broken
10. Lubricating oil pump is faulty
11. Incorrect lubricating oil cooler is installed
12. Lubricating oil cooler is plugged
13. Lubricating oil temperature is above specification
14. Piston cooling nozzles are damaged or are not installed correctly
15. Oil pressure sensor is inaccurate or blocked
16. Fault simulation is enabled or the threshold is set too high

Diagnosis and Repair:

1. Lubricating oil level is low
   a. Check the oil level. Add or drain oil, if necessary.
2. External leak
   a. Inspect the engine and surrounding area for external oil leaks.
   b. Tighten the capscrews, pipe plugs, and fittings.
   c. Replace gaskets, if necessary.
3. Lubricating oil does not meet specifications
   a. Verify lubricating oil meets the specifications as required per the engine manual.
   b. Verify alternative oil and additives were not added during the oil life.
   c. Verify the age of the lubricating oil.
   d. If necessary, take an oil sample. Refer to oil analysis technique bulletins for instructions on how to take an oil sample.
4. Lubricating oil is contaminated with coolant or fuel
   a. Refer to Lubricating Oil Contaminated symptom tree for proper troubleshooting.
5. Engine angularity during operation exceeds specification
   a. Verify rental container is level or near level.
   b. See engine specification to determine suitable amount of angularity.
6. Coolant temperature is above specification
   a. On the display or using the InPower service tool, read the engine coolant temperature.
   b. Compare the coolant temperature against the expected coolant temperature for that engine model. This data can be found in the engine manual.
   c. If the coolant temperature is outside of the expected range, refer to FC146 troubleshooting for above normal coolant temperature troubleshooting.
7. Lubricating oil filter plumbing is not routed correctly
   a. Inspect the lubricating oil filter plumbing.
   b. If the routing is an issue, refer to the lubricating filter plumbing procedure in the engine manual.
8. Main oil pressure regulator is faulty
   a. Inspect the plunger and plunger bore for nicks or scratches.
   b. Verify the plunger moves freely in the bore.
   c. Measure the pressure regulator spring at the following heights:
      a. At 41.25 mm (1.624 in) the pressure should be at least 127 N (29 lb).
      b. At 44.50 mm (1.752 in) the pressure should be at least 109 N (25 lb).
   d. If the regulator meets the above specifications, the regulator is not faulty.

9. Lubricating oil suction or transfer tube is loose or broken
    a. Inspect lubricating oil suction tube or transfer tube for leaks. Visually inspect for cracks, kinks, or tears.
    b. Inspect the capscrews for signs of leaks.
    c. Inspect the gaskets and o-rings for signs of damage, excessive wear or pinching.
10. Lubricating oil pump is faulty
    a. Check the oil pump for backlash.
    b. If the backlash is not within 0.170 mm (0.007 in) min and 0.300 mm (0.012 in) max, then the pump needs to be replaced.
    c. Inspect the lubricating oil pump gears for chips, cracks, or excessive wear.
    d. If debris is suspected of having gone through the pump, the rear cover plate may be removed to inspect for internal damage.
    e. Inspect the rear cover plate for scoring and grooves.
    f. Inspect the pump housing and generator drive for damage and excessive wear.
11. Incorrect lubricating oil cooler is installed
    a. Check if the correct lubricating oil cooler part number is installed. Verify against the appropriate parts manual.
12. Lubricating oil cooler is plugged
    a. Visually inspect the oil cooler for cleanliness.
    b. Refer to engine manual for instructions on how to clean the oil cooler housing.
13. Lubricating oil temperature is above specification
    a. On the display or using the InPower service tool, read the engine oil temperature.
    b. Compare the oil temperature against the expected oil temperature. Refer to engine manual for operating oil temperatures. Refer to the coolant or block heater specification for a non-running engine.
    c. If the oil temperature is outside of the expected range, refer to FC421 troubleshooting for above normal coolant temperature troubleshooting.
14. Piston cooling nozzles are damaged or are not installed correctly
    a. Inspect capscrew and piston cooling nozzle for damage.
    b. Check for leaks and improper seating.
15. Oil pressure sensor is inaccurate or blocked
    a. Connect the a mechanical oil pressure gauge of known quality and calibration to the engine at one of the plugs on top of the oil filter head.
    b. Connect InPower.
    c. While engine is stopped, compare the oil pressure reading on the service tool to the reading on the mechanical oil pressure gauge.
    d. Only proceed if engine troubleshooting has been completed. Do not attempt to start the engine if there is doubt about oil pressure.
    e. Start the generator set.

f. Compare the oil pressure reading on the service tool to the reading on the mechanical oil pressure gauge.

g. Refer to the troubleshooting and repair manual for the specific engine platform for oil pressure ranges.

16. Fault simulation is enabled or the threshold is set too high

    a. Connect to the control with InPower and ensure that the fault simulation for LOP is not enabled.

    b. Using the electronic service tool, verify that the fault threshold is NOT within the normal operating range for the oil pressure sensor. Refer to the appropriate base engine manual for normal operating range.

6.6.7 Code 145 – Engine Coolant Temperature OOR High (Warning)

Logic:

Engine coolant temperature signal voltage is out of range – shorted high.

Possible Cause:

1. Fault simulation feature is enabled
2. Faulty coolant temperature sensor connections
3. Faulty coolant temperature sensor
4. Faulty engine harness
5. Faulty extension harness
6. Verify controller calibrations

Diagnosis and Repair:

1. Fault simulation feature is enabled
    a. Connect InPower.
    b. Verify that the fault simulation is not enabled for the intake manifold temperature sensor by connecting to the PCC via InPower. If the fault simulation is disabled, there is no problem.
2. Faulty coolant temperature sensor connections
    a. Inspect the coolant temperature sensor and the harness connector pins.
        a. Disconnect the engine harness connector from the coolant temperature sensor.
        b. Inspect for corroded pins, bent or broken pins, pushed back or expanded pins.
        c. Inspect for evidence of moisture in or on the connector.
        d. Inspect for missing or damaged connector seals.
        e. Inspect for dirt or debris in or on the connector pins.
3. Faulty coolant temperature sensor
    a. Check the resistance of the sensor.
        a. Disconnect the engine harness connector from the coolant temperature sensor.

b. Measure the resistance between the coolant temperature signal pin and the coolant temperature return pin.

c. Refer to the troubleshooting and repair manual for the specific engine platform for coolant temperature ranges.

4. Faulty engine harness

   a. Inspect the engine harness and the connector pins.

      a. Disconnect the engine harness connector from the extension harness.

      b. Inspect for corroded pins, bent or broken pins, pushed back or expanded pins.

      c. Inspect for evidence of moisture in or on the connector.

      d. Inspect for missing or damaged connector seals.

      e. Inspect for dirt or debris in or on the connector pin.

   b. Check for a short circuit from pin to pin.

      a. Disconnect the engine harness connector from the extension harness.

      b. Disconnect the engine harness from the coolant temperature sensor.

      c. Disconnect the engine harness from all sensors that have a shared return with the coolant temperature sensor.

      d. Measure the resistance from the coolant temperature return pin on the engine harness inline connector to all other pins in the engine harness inline connector.

      e. Measure the resistance from the coolant temperature signal pin on the engine harness inline connector to all other pins in the engine harness inline connector.

      f. If all measurements are greater than 100k Ohms, then the resistance is correct.

   c. Check for a short circuit to engine block ground.

      a. Disconnect the extension harness from the engine harness.

      b. Measure the resistance from the coolant temperature signal pin on the extension harness connector to the engine block ground.

      c. If the measurement is more than 100k ohms, then the resistance is correct.

   d. Check for an open circuit.

      a. Disconnect the engine harness connector from the extension harness.

      b. Disconnect the engine harness from the coolant temperature sensor.

      c. Measure the resistance from the coolant temperature return pin on the engine harness inline connector to the coolant temperature return pin at the engine harness sensor connector.

      d. Measure the resistance from the coolant temperature signal pin on the engine harness inline connector to the coolant temperature signal pin at then engine harness sensor connector.

      e. If the measurement is less than 10 ohms, then the resistance is correct.

5. Faulty extension harness

   a. Inspect the extension harness connector pins.

      a. Inspect for corroded pins, bent or broken pins, pushed back or expanded pins.

        b. Inspect for evidence of moisture in or on the connector.
        c. Inspect for missing or damaged connector seals.
        d. Inspect for dirt or debris in or on the connector pins.
    b. Check for an open circuit.
        a. Disconnect the extension harness from the engine harness.
        b. Measure the resistance from the coolant temperature return pin on the extension harness connector to the coolant temperature return pin at the extension harness inline connector.
        c. Measure the resistance from the coolant temperature signal pin on the extension harness to the coolant temperature signal pin at the extension harness inline connector.
        d. If all measurements are greater than 10 Ohms, then the resistance is correct.
    c. Check for a short circuit from pin to pin.
        a. Disconnect the extension harness from the engine harness.
        b. Measure the resistance from the coolant temperature return pin on the extension harness connector to all other pins in the extension harness connector.
        c. Measure the resistance from the coolant temperature signal pin on the extension harness connector to all other pins in the extension harness connector.
        d. If all measurements are greater than 100k ohms, then the resistance is correct.
6. Verify controller calibrations
    a. Using the display or the InPower Service tool, verify the calibration in the PCC.
        a. If the calibration in the PCC matches the latest calibration on the InCal website, then the calibration is correct. If it does not, update the calibration to the latest.
    b. Using the InSite Service tool, verify the calibration in the ECM.
        a. If the calibration in the ECM matches the latest calibration on QSOL, then the calibration is correct. If it does not, update the ECM to the latest calibration.

6.6.8 Code 146 - Engine Coolant Temperature Above Normal (Warning)

Logic:

Engine coolant temperature has exceeded 225° F (107.2° C) for greater than 5 seconds.

Possible Cause:

1. High ambient temperature
2. Radiator blocked
3. Louvers are closed or damaged
4. Charge air cooler fins or radiator fins are damaged or obstructed
5. Coolant level is below specification
6. Antifreeze and water mixture is not correct
7. Fan shroud is damaged or air recirculation baffles are damaged

8. Fan belt is broken or loose
9. Fan drive or fan controls are malfunctioning
10. Radiator cap is not faulty
11. Thermostat is faulty
12. Cooling system hose is collapsed, restricted or leaking
13. Intake manifold air temperature is above specification
14. Cooling system is contaminated with dirt, scale, or sludge
15. Water pump is malfunctioning
16. Air or combustion gases are entering the cooling system
17. Inaccurate coolant temperature sensor
18. Fault simulation feature is enabled
19. Incorrect threshold setting

Diagnosis and Repair:

1. High ambient temperature
   a. Using thermocouple verify air temperature entering intake louver of generator.
   b. Reduce loads or recirculation of discharge air to generator in elevated ambient.
2. Radiator blocked
   a. Inspect for dirt, debris or obstructions.
   b. Remove blockage or winterfront as applicable.
3. Louvers are closed or damaged
   a. Inspect louvers for proper operation.
   b. Repair or replace if damaged.
   c. Check louver motor for proper operation.
   d. If louver motor is operational, verify louver shutterstat is operational.
4. Charge air cooler fins or radiator fins are damaged or obstructed
   a. Inspect for dirt, debris or obstructions.
   b. Clean if necessary.
5. Coolant level is below specification
   a. Inspect the engine, cooling system, and surrounding area for external coolant leaks.
   b. Repair as required.
   c. Inspect the coolant level is correct via the sight glass.
   d. Add coolant as necessary.
6. Antifreeze and water mixture is not correct
   a. Verify the concentration of antifreeze in the coolant. Add coolant as necessary.
7. Fan shroud is damaged or air recirculation baffles are damaged
   a. Inspect shroud and baffles for damage and clearance.

   b. Repair or replace if damaged.

8. Fan belt is broken or loose
   a. Inspect belt(s) for damage, wear, and proper tension
   b. Repair or replace if damaged or worn.
9. Fan drive or fan controls are malfunctioning
   a. Inspect pullies and belt tensioner for damage or wear.
   b. Repair or replace if damaged or worn.
10. Radiator cap is not faulty
    a. Inspect radiator cap and gasket for damage and proper pressure operation.
    b. Replace if damaged or worn.
11. Thermostat is faulty
    a. Remove thermostat and inspect/test for proper operation.
    b. Replace if damaged or malfunctioning.
12. Cooling system hose is collapsed, restricted or leaking
    a. Inspect upper and lower radiator hoses for collapse, distortion, or fluid leaks.
    b. Replace if damaged or worn.
13. Intake manifold air temperature is above specification
    a. Use a thermocouple to verify manifold air temperature.
    b. Repair or replace faulty after cooler components.
14. Cooling system is contaminated with dirt, scale, or sludge
    a. Inspect cooling system components for external contaminates and clean as required.
    b. Open radiator cap and inspect for contaminated coolant and scale.
    c. Flush cooling system per engine service manual.
15. Water pump is malfunctioning
    a. Inspect water pump for proper operation.
    b. Replace if damaged or worn.
16. Air or combustion gases are entering the cooling system
    a. Inspect engine for head gasket leak.
    b. Repair or replace faulty components.
17. Inaccurate coolant temperature sensor
    a. Using a thermocouple or similar device, measure coolant temperature near sender and compare to coolant temperature displayed.
    b. Verify the temperature sender resistance and compare to specifications called out in the engine manual.
    c. Verify continuity from temperature sender wire pin to engine ECM pin. Harness resistance should be less than 5 Ohms.

   d. Repair or replace faulty components or wiring

18. Fault simulation feature is enabled
   a. Use the service tool to connect to the engine ECM and verify fault override toggle is disabled.
   b. Reconfigure generator and disable fault overrides.
19. Incorrect threshold setting
   a. Use the service tool to connect to the engine ECM and verify fault threshold settings and compare to the specifications called out in the engine manual.
   b. Verify ECM and PCC calibration number and revision is correct.
   c. Recalibrate the engine ECM to reset the threshold settings.

6.6.9 Code 151 – Engine Coolant Temperature High (Shutdown)

Logic:

Engine coolant temperature has exceeded the alarm (shutdown) threshold for high coolant temperature.

Possible Causes:

1. High ambient temperature
2. Radiator blocked
3. Louvers are closed or damaged
4. Charge air cooler fins or radiator fins are damaged or obstructed
5. Coolant level is below specification
6. Antifreeze and water mixture is not correct
7. Fan shroud is damaged or air recirculation baffles are damaged
8. Fan belt is broken or loose
9. Fan drive or fan controls are malfunctioning
10. Radiator cap is not faulty
11. Thermostat is faulty
12. Cooling system hose is collapsed, restricted or leaking
13. Intake manifold air temperature is above specification
14. Cooling system is contaminated with dirt, scale, or sludge
15. Water pump is malfunctioning
16. Air or combustion gases are entering the cooling system
17. Inaccurate coolant temperature sensor
18. Fault simulation feature is enabled
19. Incorrect threshold setting

Diagnosis and Repair:

1. High ambient temperature
   a. Using thermocouple verify air temperature entering intake louver of generator.
   b. Reduce loads or recirculation of discharge air to generator in elevated ambient.
2. Radiator blocked
   a. Inspect for dirt, debris or obstructions.
   b. Remove blockage or winterfront as applicable.
3. Louvers are closed or damaged
   a. Inspect louvers for proper operation.
   b. Repair or replace if damaged.
   c. Check louver motor for proper operation.
   d. If louver motor is operational, verify louver shutterstat is operational.
4. Charge air cooler fins or radiator fins are damaged or obstructed
   a. Inspect for dirt, debris or obstructions.
   b. Clean if necessary.
5. Coolant level is below specification
   a. Inspect the engine, cooling system, and surrounding area for external coolant leaks.
   b. Repair as required.
   c. Inspect the coolant level is correct via the sight glass.
   d. Add coolant as necessary.
6. Antifreeze and water mixture is not correct
   a. Verify the concentration of antifreeze in the coolant. Add coolant as necessary.
7. Fan shroud is damaged or air recirculation baffles are damaged
   a. Inspect shroud and baffles for damage and clearance.
   b. Repair or replace if damaged.
8. Fan belt is broken or loose
   a. Inspect belt(s) for damage, wear, and proper tension
   b. Repair or replace if damaged or worn.
9. Fan drive or fan controls are malfunctioning
   a. Inspect pullies and belt tensioner for damage or wear.
   b. Repair or replace if damaged or worn.
10. Radiator cap is not faulty
    a. Inspect radiator cap and gasket for damage and proper pressure operation.
    b. Replace if damaged or worn.
11. Thermostat is faulty
    a. Remove thermostat and inspect/test for proper operation.

    b. Replace if damaged or malfunctioning.

12. Cooling system hose is collapsed, restricted or leaking
    a. Inspect upper and lower radiator hoses for collapse, distortion, or fluid leaks.
    b. Replace if damaged or worn.
13. Intake manifold air temperature is above specification
    a. Use a thermocouple to verify manifold air temperature.
    b. Repair or replace faulty after cooler components.
14. Cooling system is contaminated with dirt, scale, or sludge
    a. Inspect cooling system components for external contaminates and clean as required.
    b. Open radiator cap and inspect for contaminated coolant and scale.
    c. Flush cooling system per engine service manual.
15. Water pump is malfunctioning
    a. Inspect water pump for proper operation.
    b. Replace if damaged or worn.
16. Air or combustion gases are entering the cooling system
    a. Inspect engine for head gasket leak.
    b. Repair or replace faulty components.
17. Inaccurate coolant temperature sensor
    a. Using a thermocouple or similar device, measure coolant temperature near sender and compare to coolant temperature displayed.
    b. Verify the temperature sender resistance and compare to specifications called out in the engine manual.
    c. Verify continuity from temperature sender wire pin to engine ECM pin. Harness resistance should be less than 5 Ohms.
    d. Repair or replace faulty components or wiring
18. Fault simulation feature is enabled
    a. Use the service tool to connect to the engine ECM and verify fault override toggle is disabled.
    b. Reconfigure generator and disable fault overrides.
19. Incorrect threshold setting
    a. Use the service tool to connect to the engine ECM and verify fault threshold settings and compare to the specifications called out in the engine manual.
    b. Verify ECM and PCC calibration number and revision is correct.
    c. Recalibrate the engine ECM to reset the threshold settings.

6.6.10 Code 153 – Intake Manifold Temperature OOR High (Warning)

Logic:

Engine intake manifold temperature sensor signal is out of range – shorted high.

Possible Causes:

1. Faulty intake manifold temperature sensor connections
2. Faulty intake manifold temperature sensor
3. Faulty engine harness
4. Faulty extension harness

NOTE: Part Number 3822758 - Male Deutsch/AMP/Metri-Pack test lead
Part Number 3822917 - Female Deutsch/AMP/Metri-Pack test lead

Diagnosis and Repair:

1. Faulty intake manifold temperature sensor connections
   a. Inspect the intake manifold temperature sensor and the harness connector pins.
      a. Disconnect the engine harness connector from the intake manifold temperature sensor.
      b. Inspect for corroded pins, bent or broken pins, pushed back or expanded pins.
      c. Inspect for evidence of moisture in or on the connector.
      d. Inspect for missing or damaged connector seals.
      e. Inspect for dirt or debris in or on the connector pins.
2. Faulty intake manifold temperature sensor
   a. Check the resistance of the sensor
      a. Disconnect the engine harness connector from the intake manifold temperature sensor.
      b. Measure the resistance between the intake manifold temperature signal pin and the intake manifold temperature return pin.
      c. Refer to the troubleshooting and repair manual for the specific engine platform for intake manifold temperature ranges.
3. Faulty engine harness
   a. Inspect the engine harness and the extension harness connector pins.
      a. Disconnect the engine harness from the extension harness.
      b. Inspect for corroded pins, bent or broken pins, pushed back or expanded pins.
      c. Inspect for evidence of moisture in or on the connector.
      d. Inspect for missing or damaged connector seals.
      e. Inspect for dirt or debris in or on the connector pins.
   b. Check for a short circuit from pin to pin.
      a. Disconnect the engine harness connector from the extension harness.
      b. Disconnect the engine harness from the intake manifold temperature sensor.
      c. Disconnect the engine harness from all sensors that have a shared return with the intake manifold temperature sensor.

        d. Measure the resistance from the intake manifold temperature return pin on the engine harness inline connector to all other pins in the engine harness inline connector.

        e. Measure the resistance from the intake manifold temperature signal pin on the engine harness inline connector to all other pins in the engine harness inline connector.

        f. If all measurements are greater than 100k Ohms, then the resistance is correct.

    c. Check for an open circuit.

        a. Disconnect the engine harness connector from the extension harness.

        b. Disconnect the engine harness from the intake manifold

        c. Measure the resistance from the intake manifold temperature return pin on the engine harness inline connector to the intake manifold temperature return pin at the engine harness sensor connector.

        d. Measure the resistance from the intake manifold temperature signal pin on the engine harness inline connector to the intake manifold temperature signal pin at then engine harness sensor connector.

        e. If the measurement is less than 10 ohms, then the resistance is correct.

4. Faulty extension harness

    a. Inspect the extension harness.

        a. Inspect for corroded pins, bent or broken pins, pushed back or expanded pins.

        b. Inspect for evidence of moisture in or on the connector.

        c. Inspect for missing or damaged connector seals.

        d. Inspect for dirt or debris in or on the connector pins.

    b. Check for an open circuit.

        a. Disconnect the extension harness from the engine harness.

        b. Measure the resistance from the intake manifold temperature return pin on the extension harness connector to the intake manifold temperature return pin at the extension harness inline connector.

        c. Measure the resistance from the intake manifold temperature signal pin on the extension harness connector to the intake manifold temperature signal pin at then engine harness inline connector.

        d. If the measurement is less than 10 ohms, then the resistance is correct.

    c. Check for a short circuit from pin to pin.

        a. Disconnect the extension harness from the engine harness.

        b. Measure the resistance from the intake manifold temperature return pin on the extension harness connector to all other pins in the extension harness connector.

        c. Measure the resistance from the intake manifold temperature signal pin on the extension harness connector to all other pins in the extension harness connector.

        d. If all measurements are greater than 100k ohms, then the resistance is correct.

6.6.11 Code 154 – Intake Manifold Temperature OOR Low (Warning)

Logic:

Engine intake manifold temperature sensor signal is out of range – shorted low.

Possible Causes:

1. Faulty intake manifold temperature sensor connections
2. Faulty intake manifold temperature sensor
3. Faulty engine harness
4. Faulty extension harness

NOTE: Part Number 3822758 - Male Deutsch/AMP/Metri-Pack test lead
Part Number 3822917 - Female Deutsch/AMP/Metri-Pack test lead

Diagnosis and Repair:

1. Faulty intake manifold temperature sensor connections
    a. Inspect the intake manifold temperature sensor and the harness connector pins.
        a. Disconnect the engine harness connector from the intake manifold temperature sensor.
        b. Inspect for corroded pins, bent or broken pins, pushed back or expanded pins.
        c. Inspect for evidence of moisture in or on the connector.
        d. Inspect for missing or damaged connector seals.
        e. Inspect for dirt or debris in or on the connector pins.
2. Faulty intake manifold temperature sensor
    a. Check the resistance of the sensor
        a. Disconnect the engine harness connector from the intake manifold temperature sensor.
        b. Measure the resistance between the intake manifold temperature signal pin and the intake manifold temperature return pin.
        c. Refer to the troubleshooting and repair manual for the specific engine platform for intake manifold temperature ranges.
    b. Check for a short circuit to engine block ground.
        a. Disconnect the engine harness connector from the intake manifold temperature sensor.
        b. Measure the resistance from one of the pins of the intake manifold temperature sensor connector to engine block ground. If the resistance is more than 100k ohms, the sensor is operating correctly.
3. Faulty engine harness
    a. Inspect the engine harness and the extension harness connector pins.
        a. Disconnect the engine harness from the extension harness.

   b. Inspect for corroded pins, bent or broken pins, pushed back or expanded pins.
   c. Inspect for evidence of moisture in or on the connector.
   d. Inspect for missing or damaged connector seals.
   e. Inspect for dirt or debris in or on the connector pins.

b. Check for a short circuit from pin to pin.
   a. Disconnect the engine harness connector from the extension harness.
   b. Disconnect the engine harness from the intake manifold temperature sensor.
   c. Disconnect the engine harness from all sensors that have a shared return with the intake manifold temperature sensor.
   d. Measure the resistance from the intake manifold temperature return pin on the engine harness inline connector to all other pins in the engine harness inline connector.
   e. Measure the resistance from the intake manifold temperature signal pin on the engine harness inline connector to all other pins in the engine harness inline connector.
   f. If all measurements are greater than 100k Ohms, then the resistance is correct.

c. Check for a short circuit to engine block ground.
   a. Disconnect the extension harness from the engine harness.
   b. Measure the resistance from the intake manifold temperature signal pin on the extension harness connector to the engine block ground.
   c. If the measurement is more than 100k ohms, then the resistance is correct.

d. Check for an open circuit.
   a. Disconnect the engine harness connector from the extension harness.
   b. Disconnect the engine harness from the intake manifold
   c. Measure the resistance from the intake manifold temperature return pin on the engine harness inline connector to the intake manifold temperature return pin at the engine harness sensor connector.
   d. Measure the resistance from the intake manifold temperature signal pin on the engine harness inline connector to the intake manifold temperature signal pin at then engine harness sensor connector.
   e. If the measurement is less than 10 ohms, then the resistance is correct.

4. Faulty extension harness
   a. Inspect the extension harness.
      a. Inspect for corroded pins, bent or broken pins, pushed back or expanded pins.
      b. Inspect for evidence of moisture in or on the connector.
      c. Inspect for missing or damaged connector seals.
      d. Inspect for dirt or debris in or on the connector pins.
   b. Check for a short circuit to engine block ground.
      a. Disconnect the extension harness from the engine harness.

   b. Measure the resistance from the intake manifold temperature signal pin on the extension harness connector to engine block ground.

   c. Measure the resistance from the intake manifold temperature return pin on the extension harness connector to engine block ground.

   d. If all measurements are greater than 100k ohms, then the resistance is correct.

c. Check for a short circuit from pin to pin AUX 105.

   a. Disconnect the extension harness from the engine harness.

   b. Measure the resistance from the intake manifold temperature return pin on the extension harness connector to all other pins in the extension harness connector.

   c. Measure the resistance from the intake manifold temperature signal pin on the extension harness connector to all other pins in the extension harness connector.

   d. If all measurements are greater than 100k ohms, then the resistance is correct.

d. Check for an open circuit.

   a. Disconnect the extension harness from the engine harness.

   b. Measure the resistance from the engine oil temperature return pin on the extension harness connector to the engine oil temperature return pin at the extension harness inline connector.

   c. Measure the resistance from the engine oil temperature signal pin on the extension harness connector to the engine oil temperature signal pin at the extension harness inline connector.

   d. If the measurement is less than 10 ohms, then the resistance is correct.

6.6.12 Code 155 – Intake Manifold Temperature High (Shutdown)

Logic:

Engine intake manifold temperature has exceeded 203° F (95° C) for greater than 10 seconds.

Possible Causes:

1. High ambient temperature
2. Radiator blocked
3. Louvers are closed or damaged
4. Charge air cooler fins or radiator fins are damaged or obstructed
5. Fan belt is broken or loose
6. Fan drive or fan controls are malfunctioning
7. Inaccurate coolant temperature sensor
8. Fault simulation feature is enabled
9. Incorrect threshold setting

Diagnosis and Repair:

1. High ambient temperature
   a. Using thermocouple verify air temperature entering intake louver of generator.
   b. Reduce loads or recirculation of discharge air to generator in elevated ambient.
2. Radiator blocked
   a. Inspect radiator for debris or blockages.
   b. Remove blockage or winterfront as applicable.
3. Louvers are closed or damaged
   a. Inspect louvers for proper operation.
   b. Repair or replace if damaged.
   c. Check louver motor for proper operation.
   d. If louver motor is operational, verify louver shutter thermostat is operational.
4. Charge air cooler fins or radiator fins are damaged or obstructed
   a. Inspect for dirt, debris or obstructions.
   b. Clean if necessary.
5. Fan belt is broken or loose
   a. Inspect for dirt, debris or obstructions.
   b. Clean if necessary.
6. Fan drive or fan controls are malfunctioning
   a. Inspect for dirt, debris or obstructions
   b. Clean if necessary.
7. Inaccurate coolant temperature sensor
   a. Use a thermocouple or similar device to measure coolant temperature near sender and compare to coolant temperature displayed.
   b. Verify the temperature sender resistance and compare to specifications called out in the engine manual.
   c. Verify continuity from temperature sender wire to engine ECM. Harness resistance should be less than 5 Ohms.
   d. Repair or replace faulty components or wiring.
8. Fault simulation feature is enabled
   a. Use the service tool to connect to the engine ECM and verify fault override toggle is disabled.
   b. Reconfigure generator and disable fault overrides.
9. Incorrect threshold setting
   a. Use the service tool to connect to the engine ECM and verify fault threshold settings and compare to the specifications called out in the engine manual.
   b. Verify ECM and PCC calibration number and revision is correct.

c. Recalibrate the engine ECM to reset the threshold settings.

6.6.13 Code 195 – Coolant Level Sensor OOR High (Warning)

Logic:

Coolant level sensor signal is out of range – shorted high.

Possible Causes:

1. Faulty coolant level sensor connections
2. Faulty coolant level sensor
3. Faulty engine harness
4. Faulty extension harness

NOTE: **Part Number 3822758 - Male Deutsch/AMP/Metri-Pack test lead**
Part Number 3822917 - Female Deutsch/AMP/Metri-Pack test lead

Diagnosis and Repair:

1. Faulty coolant level sensor connections
   a. Inspect the coolant level sensor and the harness connector pins.
      a. Disconnect the engine harness connector from the coolant level sensor.
      b. Inspect for corroded pins, bent or broken pins, pushed back or expanded pins.
      c. Inspect for evidence of moisture in or on the connector.
      d. Inspect for missing or damaged connector seals.
      e. Inspect for dirt or debris in or on the connector pins.
2. Faulty coolant level sensor
   a. Check the resistance of the sensor
      a. Disconnect the engine harness connector from the coolant level sensor.
      b. Measure the resistance between the coolant level sensor signal pin and the coolant level sensor return pin.
3. Faulty engine harness
   a. Inspect the engine harness and the extension harness connector pins.
      a. Disconnect the engine harness from the extension harness.
      b. Inspect for corroded pins, bent or broken pins, pushed back or expanded pins.
      c. Inspect for evidence of moisture in or on the connector.
      d. Inspect for missing or damaged connector seals.
      e. Inspect for dirt or debris in or on the connector pins.
   b. Check for a short circuit from pin to pin.
      a. Disconnect the engine harness connector from the extension harness.
      b. Disconnect the engine harness from the coolant level sensor.

   c. Disconnect the engine harness from all sensors that have a shared return with the coolant level sensor. Measure the resistance from the intake manifold temperature return pin on the engine harness inline connector to all other pins in the engine harness inline connector.
   d. Measure the resistance from the coolant level sensor signal pin on the engine harness inline connector to all other pins in the engine harness inline connector.
   e. If all measurements are greater than 100k Ohms, then the resistance is correct.
c. Check for an open circuit.
   a. Disconnect the engine harness connector from the extension harness.
   b. Disconnect the engine harness from the coolant level sensor.
   c. Measure the resistance from the coolant level sensor return pin on the engine harness inline connector to the coolant level sensor return pin at the engine harness sensor connector.
   d. Measure the resistance from the coolant level sensor signal pin on the engine harness inline connector to coolant level sensor signal pin at then engine harness sensor connector.
   e. If the measurement is less than 10 ohms, then the resistance is correct.

4. Faulty extension harness
   a. Inspect the extension harness pins.
      a. Disconnect the extension harness.
      b. Inspect for corroded pins, bent or broken pins, pushed back or expanded pins.
      c. Inspect for evidence of moisture in or on the connector.
      d. Inspect for missing or damaged connector seals.
      e. Inspect for dirt or debris in or on the connector pins.
   b. Check for an open circuit.
      a. Disconnect the extension harness from the engine harness.
      b. Measure the resistance from the intake manifold temperature return pin on the extension harness connector to the intake manifold temperature return pin at the extension harness inline connector.
      c. Measure the resistance from the coolant level sensor signal pin on the extension harness connector to the coolant level sensor signal pin at then engine harness inline connector.
   c. Check for a short circuit from pin to pin.
      a. Disconnect the extension harness from the engine harness.
      b. Measure the resistance from coolant level sensor return pin on the extension harness connector to all other pins in the extension harness connector.
      c. Measure the resistance from the coolant level sensor signal pin on the extension harness connector to all other pins in the extension harness connector.
      d. If all measurements are greater than 100k ohms, then the resistance is correct.

6.6.14 Code 196 – Coolant Level Sensor OOR Low (Warning)

Logic:

Coolant level sensor signal is out of range – shorted high.

Possible Causes:

1. Faulty coolant level sensor connections
2. Faulty coolant level sensor
3. Faulty engine harness
4. Faulty extension harness

NOTE: Part Number 3822758 - Male Deutsch/AMP/Metri-Pack test lead
Part Number 3822917 - Female Deutsch/AMP/Metri-Pack test lead

Diagnosis and Repair:

1. Faulty coolant level sensor connections
   a. Inspect the coolant level sensor and the harness connector pins.
      a. Disconnect the engine harness connector from the coolant level sensor.
      b. Inspect for corroded pins, bent or broken pins, pushed back or expanded pins.
      c. Inspect for evidence of moisture in or on the connector.
      d. Inspect for missing or damaged connector seals.
      e. Inspect for dirt or debris in or on the connector pins.
2. Faulty coolant level sensor
   a. Check the resistance of the sensor
      a. Disconnect the engine harness connector from the coolant level sensor.
      b. Measure the resistance between the coolant level sensor signal pin and the coolant level sensor return pin.
   b. Check for a short circuit to engine block ground.
      a. Disconnect the engine harness connector from the coolant level sensor.
      b. Measure the resistance from one of the pins of the coolant level sensor connector to engine block ground. If the resistance is more than 100k ohms, the sensor is operating correctly.
3. Faulty engine harness
   a. Inspect the engine harness and the connector pins.
      a. Disconnect the engine harness from the extension harness.
      b. Inspect for corroded pins, bent or broken pins, pushed back or expanded pins.
      c. Inspect for evidence of moisture in or on the connector.
      d. Inspect for missing or damaged connector seals.
      e. Inspect for dirt or debris in or on the connector pins.

b. Check for a short circuit from pin to pin.
    a. Disconnect the engine harness connector from the extension harness.
    b. Disconnect the engine harness from the coolant level sensor.
    c. Disconnect the engine harness from all sensors that have a shared return with the coolant level sensor. Measure the resistance from the intake manifold temperature return pin on the engine harness inline connector to all other pins in the engine harness inline connector.
    d. Measure the resistance from the coolant level sensor signal pin on the engine harness inline connector to all other pins in the engine harness inline connector.
    e. If all measurements are greater than 100k Ohms, then the resistance is correct.
c. Check for a short circuit to engine block ground.
    a. Disconnect the extension harness.
    b. Disconnect the extension harness from the engine harness.
    c. Measure the resistance from coolant level sensor signal pin on the extension harness connector to the engine block ground.
    d. If the measurement is more than 100k ohms, then the resistance is correct.
d. Check for an open circuit.
    a. Disconnect the engine harness connector from the extension harness.
    b. Disconnect the engine harness from the coolant level sensor.
    c. Measure the resistance from the coolant level sensor return pin on the engine harness inline connector to the coolant level sensor return pin at the engine harness sensor connector.
    d. Measure the resistance from the coolant level sensor signal pin on the engine harness inline connector to coolant level sensor signal pin at then engine harness sensor connector.
    e. If the measurement is less than 10 ohms, then the resistance is correct.

4. Faulty extension harness
    a. Inspect the extension harness pins.
        a. Disconnect the extension harness.
        b. Inspect for corroded pins, bent or broken pins, pushed back or expanded pins.
        c. Inspect for evidence of moisture in or on the connector.
        d. Inspect for missing or damaged connector seals.
        e. Inspect for dirt or debris in or on the connector pins.
    b. Check for a short circuit to engine block ground.
        a. Disconnect the extension harness from the engine harness.
        b. Measure the resistance from coolant level sensor signal pin on the extension harness connector to engine block ground.
        c. Measure the resistance from the coolant level sensor return pin on the extension harness connector to engine block ground.

d. If all measurements are greater than 100k ohms, then the resistance is correct.

c. Check for a short circuit from pin to pin.

a. Disconnect the extension harness from the engine harness.

b. Measure the resistance from coolant level sensor return pin on the extension harness connector to all other pins in the extension harness connector.

c. Measure the resistance from the coolant level sensor signal pin on the extension harness connector to all other pins in the extension harness connector.

d. If all measurements are greater than 100k ohms, then the resistance is correct.

6.6.15 Code 197 – Coolant Level Low (Warning)

Logic:

Coolant level sensor signal is showing a low coolant level for greater 10 seconds.

Possible Causes:

1. Low coolant
2. Faulty coolant level sensor

Diagnosis and Repair:

1. Low coolant
    a. Visually inspect that engine coolant is at the appropriate level.
    b. Remove radiator cap and check that coolant is up to the required level.
    c. If coolant is below 1 in. (2.54 cm) from the top of the radiator add manufacture's prescribed coolant.
2. Faulty coolant level sensor
    a. Disconnect the engine harness connector from the sensor.
    b. Reconnect the sensor and measure the voltage between the coolant level sensor signal pin and the coolant level sensor return pin.Voltage should be lower than 2.00 VDC.
    c. If voltage is higher that above specification, replace sensor.

6.6.16 Code 234 – Engine Speed High (Shutdown)

Logic:

Engine speed signals indicate an engine speed greater than shutdown threshold.

Possible Causes:

1. Fault simulation feature is enabled
2. Incorrect threshold setting
3. Incorrect fuel type setting
4. Faulty engine speed sensor connections
5. Faulty engine harness
6. Faulty extension harness

7. Faulty engine speed/position sensor

Diagnosis and Repair:

1. Fault simulation feature is enabled
   a. Connect InPower
   b. Verify that the fault simulation is not enabled for the engine speed sensor by connecting to the PCC via InPower. If the fault simulation is disabled, there is no problem.
2. Incorrect threshold setting
   a. Connect InPower
   b. Verify that fault threshold is within the normal operating range for the engine overspeed sensor. Refer to the engine manual for correct threshold values and make the appropriate changes using InPower.
3. Incorrect fuel type setting
   a. Connect InPower
   b. Verify the fuel source set with InPower is the same fuel used by the generator.
4. Faulty engine speed sensor connections
   a. Inspect the engine speed sensor and the harness connector pins.
   b. Disconnect the engine harness connector from the engine speed sensor.
   c. Inspect for corroded pins, bent or broken pins, pushed back or expanded pins.
   d. Inspect for evidence of moisture in or on the connector.
   e. Inspect for missing or damaged connector seals.
   f. Inspect for dirt or debris in or on the connector pins.
5. Faulty engine harness
   a. Inspect the engine harness and the connector pins.
   b. Disconnect the engine harness connector from the extension harness.
   c. Inspect for corroded pins, bent or broken pins, pushed back or expanded pins.
   d. Inspect for evidence of moisture in or on the connector.
   e. Inspect for missing or damaged connector seals.
   f. Inspect for dirt or debris in or on the connector pin.
   g. Disconnect harness from ECM and sensor.
   h. Measure the resistance in each pin from ECM to sensor. Resistance should be 5 ohms or less.
   i. Repair or replace harness as necessary.
6. Faulty engine speed/position sensor
   a. Inspect the engine speed sensor.
   b. Disconnect the engine speed/position sensor from the engine and engine harness.
   c. Inspect sensor for bent, corroded or loose pins.

d. Inspect the sensor for structural deficiencies.

e. Check the crankshaft speed sensor supply voltage.

f. Disconnect the engine harness connector from the crankshaft speed sensor.

g. Install the speed sensor breakout cable between the sensor and the sensor harness connector.

h. Measure the supply voltage by connecting the breakout cable's supply and return connectors to the multimeter. If the reading is between 4.75 and 5.25 VDC, then the supply voltage is correct.

i. Check the crankshaft speed sensor signal (sense) voltage.

j. Disconnect the engine harness connector from the camshaft position sensor.

k. Install the speed/position sensor breakout cable between the sensor and the sensor harness connector.

l. Measure the signal voltage by connecting the breakout cable's signal and return connectors to the multimeter. If the reading is between 0.46 and 4.56 VDC, then the signal voltage is correct. If not, sensor is faulty.

6.6.17 Code 415 – Engine Oil Pressure Low (Shutdown)

Logic:

Engine oil pressure is below 26 psig (180 kpa) for greater than 10 seconds.

Possible Causes:

1. Lubricating oil level is low
2. External leak
3. Lubricating oil does not meet specifications
4. Lubricating oil is contaminated with coolant or fuel
5. Engine angularity during operation exceeds specification
6. Coolant temperature is above specification
7. Lubricating oil filter plumbing is not routed correctly
8. Main oil pressure regulator is faulty
9. Lubricating oil suction or transfer tube is loose or broken
10. Lubricating oil pump is faulty
11. Incorrect lubricating oil cooler is installed
12. Lubricating oil cooler is plugged
13. Lubricating oil temperature is above specification
14. Piston cooling nozzles are damaged or are not installed correctly
15. Oil pressure sensor is inaccurate or blocked
16. Fault simulation is enabled or the threshold is set too high

Diagnosis and Repair:

1. Lubricating oil level is low
   a. Check the oil level. Add or drain oil, if necessary.
2. External leak
   a. Inspect the engine and surrounding area for external oil leaks.
   b. Tighten the capscrews, pipe plugs, and fittings.
   c. Replace gaskets, if necessary.
3. Lubricating oil does not meet specifications
   a. Verify lubricating oil meets the specifications as required per the engine manual.
   b. Verify alternative oil and additives were not added during the oil life.
   c. Verify the age of the lubricating oil.
   d. If necessary, take an oil sample. Refer to oil analysis technique bulletins for instructions on how to take an oil sample.
4. Lubricating oil is contaminated with coolant or fuel
   a. Refer to Lubricating Oil Contaminated symptom tree for proper troubleshooting.
5. Engine angularity during operation exceeds specification
   a. Verify rental container is level or near level.
   b. See engine specification to determine suitable amount of angularity.
6. Coolant temperature is above specification
   a. On the display or using the InPower service tool, read the engine coolant temperature.
   b. Compare the coolant temperature against the expected coolant temperature for that engine model. This data can be found in the engine manual.
   c. If the coolant temperature is outside of the expected range, refer to FC 146 troubleshooting for above normal coolant temperature troubleshooting.
7. Lubricating oil filter plumbing is not routed correctly
   a. Inspect the lubricating oil filter plumbing.
   b. If the routing is an issue, refer to the lubricating filter plumbing procedure in the engine manual.
8. Main oil pressure regulator is faulty
   a. Inspect the plunger and plunger bore for nicks or scratches.
   b. Verify the plunger moves freely in the bore.
   c. Measure the pressure regulator spring at the following heights:
      a. At 41.25 mm (1.624 in), the pressure should be at least 127 N (29 lb).
      b. At 44.50 mm (1.752 in), the pressure should be at least 109 N (25 lb).
   d. If the regulator meets the above specifications, the regulator is not faulty.

9. Lubricating oil suction or transfer tube is loose or broken
    a. Inspect lubricating oil suction tube or transfer tube for leaks. Visually inspect for cracks, kinks, or tears.
    b. Inspect the capscrews for signs of leaks.
    c. Inspect the gaskets and o-rings for signs of damage, excessive wear or pinching.
10. Lubricating oil pump is faulty
    a. Check the oil pump for backlash.
    b. If the backlash is not within 0.170 mm (0.007 in) min and 0.300 mm (0.012 in) max, then the pump needs to be replaced.
    c. Inspect the lubricating oil pump gears for chips, cracks, or excessive wear.
    d. If debris is suspected of having gone through the pump, the rear cover plate may be removed to inspect for internal damage.
    e. Inspect the rear cover plate for scoring and grooves.
    f. Inspect the pump housing and generator drive for damage and excessive wear.
11. Incorrect lubricating oil cooler is installed
    a. Check if the correct lubricating oil cooler part number is installed. Verify against the appropriate parts manual.
12. Lubricating oil cooler is plugged
    a. Visually inspect the oil cooler for cleanliness.
    b. Refer to engine manual for instructions on how to clean the oil cooler housing.
13. Lubricating oil temperature is above specification
    a. On the display or using the InPower service tool, read the engine oil temperature.
    b. Compare the oil temperature against the expected oil temperature. Refer to engine manual for operating oil temperatures and refer to the coolant or block heater specification for a non-running engine.
    c. If the oil temperature is outside of the expected range, refer to FC 421 troubleshooting for above normal coolant temperature troubleshooting.
14. Piston cooling nozzles are damaged or are not installed correctly
    a. Inspect capscrew and piston cooling nozzle for damage.
    b. Check for leaks and improper seating.
15. Oil pressure sensor is inaccurate or blocked
    a. Connect the a mechanical oil pressure gauge of known quality and calibration to the engine at one of the plugs on top of the oil filter head.
    b. Connect InPower.
    c. While engine is stopped, compare the oil pressure reading on the service tool to the reading on the mechanical oil pressure gauge.
    d. Only proceed if engine troubleshooting has been completed. Do not attempt to start the engine if there is doubt about oil pressure.
    e. Start the generator.

f. Compare the oil pressure reading on the service tool to the reading on the mechanical oil pressure gauge.

g. Refer to the troubleshooting and repair manual for the specific engine platform for oil pressure ranges.

16. Fault simulation is enabled or the threshold is set too high

a. Connect to the control with InPower and ensure that the fault simulation for LOP is not enabled.

b. Use the electronic service tool to verify that the fault threshold is not within the normal operating range for the oil pressure sensor. Refer to the appropriate base engine manual for normal operating range.

6.6.18 Code 421 – Engine Oil Temperature High (Warning)

Logic:

The control has detected the engine oil temperature has exceeded the warning threshold.

Possible Causes:

1. High ambient temperature
2. Radiator blocked
3. Louvers are closed or damaged
4. Charge air cooler fins or radiator fins are damaged or obstructed
5. Coolant level is below specification
6. Fan shroud is damaged or air recirculation baffles are damaged
7. Fan belt is broken or loose
8. Fan drive or fan controls are malfunctioning
9. Thermostat is faulty
10. Cooling system hose is collapsed, restricted or leaking
11. Intake manifold air temperature is above specification
12. Water pump is malfunctioning
13. Oil temperature sensor is inaccurate or faulty
14. Fault simulation is enabled
15. Threshold is set too high

Diagnosis and Repair:

1. High ambient temperature

a. Using thermocouple verify air temperature entering intake louver of generator.

b. Reduce loads or recirculation of discharge air to generator in elevated ambient.

2. Radiator blocked

a. Inspect radiator for debris or blockages.

b. Remove blockage or winter front as applicable.

3. Louvers are closed or damaged
    a. Inspect louvers for proper operation.
    b. Repair or replace if damaged.
    c. Check louver motor for proper operation.
    d. If louver motor is operational, verify louver shutter thermostat is operational.
4. Charge air cooler fins or radiator fins are damaged or obstructed
    a. Inspect for dirt, debris or obstructions.
    b. Clean if necessary.
5. Coolant level is below specification
    a. Inspect the engine, cooling system, and surrounding area for external coolant leaks.
    b. Repair as required.
    c. Inspect the coolant level is correct via the sight glass.
    d. Add coolant as necessary .
6. Fan shroud is damaged or air recirculation baffles are damaged
    a. Inspect shroud and baffles for damage and clearance.
    b. Repair or replace if damaged.
7. Fan belt is broken or loose
    a. Inspect belt(s) for damage, wear, and proper tension.
    b. Repair or replace if damaged or worn.
8. Fan drive or fan controls are malfunctioning
    a. Inspect pullies and belt tensioner for damage or wear.
    b. Repair or replace if damaged or worn.
9. Thermostat is faulty
    a. Remove thermostat and inspect/test for proper operation.
    b. Replace if damaged or malfunctioning.
10. Cooling system hose is collapsed, restricted or leaking
    a. Inspect upper and lower radiator hoses for collapse, distortion, or fluid leaks.
    b. Replace if damaged or worn.
11. Intake manifold air temperature is above specification
    a. Use the thermocouple to verify manifold air temperature.
    b. Repair or replace faulty after cooler components.
12. Water pump is malfunctioning
    a. Inspect water pump for proper operation.
    b. Replace if damaged or worn.

13. Oil temperature sensor is inaccurate or faulty
    a. Use a thermocouple or similar device to measure oil temperature near sender and compare to oil temperature displayed.
    b. Verify the temperature sender resistance and compare to specifications called out in the engine manual.
    c. Verify continuity from temperature sender wire pin to engine ECM pin. Harness resistance should be less than 5 Ohms.
    d. Repair or replace faulty components or wiring.
14. Fault simulation is enabled
    a. Use the service tool to connect to the engine ECM and verify fault override toggle is disabled.
    b. Reconfigure generator and disable fault overrides.
15. Threshold is set too high
    a. Use the service tool to connect to the engine ECM and verify fault threshold settings and compare to the specifications called out in the engine manual.
    b. Verify ECM and PCC calibration number and revision is correct.
    c. Recalibrate the engine ECM to reset the threshold settings.

6.6.19 Code 426 – J1939 Data Link Cannot Transmit

Logic:

Communication between the ECM and another device on the SAE J1939 data link has been lost.

Possible Causes:

1. Communication error
2. Faulty engine harness

Diagnosis and Repair:

1. Communication error
    a. Check for ECM communication with InSite.
        a. Connect the INLINE data link adapter to SAE J1939 data link diagnostic connector.
        b. Attempt to communicate with the ECM using InSite.
2. Faulty engine harness
    a. Inspect the engine harness and the connector pins.
        a. Disconnect the engine harness connector from the extension harness.
        b. Inspect for corroded pins, bent or broken pins, pushed back or expanded pins.
        c. Inspect for evidence of moisture in or on the connector.
        d. Inspect for missing or damaged connector seals.
        e. Inspect for dirt or debris in or on the connector pin.

6.6.20 Code 427 - CAN Data Link Degraded

Logic:

Communication between the engine control (ECM) and the generator set control is severed.

Possible Causes:

1. The Engine ECM has lost power or failed
2. The CAN datalink has failed

Diagnosis and Repair:

1. The Engine ECM has lost power or failed
   a. Emergency (E-Stop) button is a closed relay when it is pulled out (not active), and open relay when depressed (active). The E-Stop button on the Operator Panel disables power to the engine ECM when it is depressed (active); CAN-LINK communication will cease when power to the ECM is lost. Ensure that the E-Stop is not active on the control. Follow the procedure below:

      Reset the Local/Remote Emergency Stop

      a. Pull-out (not active) the Local/Remote Emergency Stop button.
      b. Press the Off button on the Operator Panel.
      c. Press the Reset button.
      d. Select Manual or Auto as required.

   b. Ensure that the emergency stop button is functioning correctly, measure the outputs of the E-Stop (Normally Open and Normally Closed contacts) and ensure that the outputs switch state correctly when engaged and disengaged, replace the switch if faulty.
   c. Check the wiring from the base board.
   d. Keyswitch control relay is a normally open relay. Ensure that B+ is available at the relay input, then measure the voltage output. If there is a B+ at both the input and output of the Keyswitch control relay, the relay is not faulty. If B+ is noted at the input but not at the output of the Keyswitch control relay, replace the relay.
   e. Connect to the engine ECM with InPower and/or Insite, to verify that the ECM is functioning properly and is communicating with the CAN-LINK network. Refer to the engine service manual for ECM troubleshooting procedures, if the ECM is faulty, then replace.
2. The CAN datalink has failed
   a. There is a defective datalink harness connection, or open circuit; inspect the Datalink harness and connector pins from J11-20 to J1939+ and from J11-19 to J1039-; also check the shield ground connection at J11-17.
   b. Check the terminating resistors. With connector J11 disconnected from the base board and the engine datalink connection disconnected from the ECM control, measure resistance between pins J11-19 and J11-20 (60 ohms is satisfactory). If the resistance is not 60 ohms, check the terminating resistors. Each of the two terminating resistors should be 120 ohms, replace if not 120 ohms.

6.6.21 Code 436 – AUX 101 Intake Manifold Temperature ORR (Warning)

Logic:

Intake manifold temperature sensor voltage is out of range.

Possible Causes:

1. Faulty intake manifold temperature sensor connections
2. Faulty intake manifold temperature sensor
3. Faulty engine harness
4. Faulty extension harness
5. Verify controller calibrations

Diagnosis and Repair:

1. Faulty intake manifold temperature sensor connections
    a. Inspect the intake manifold temperature sensor and the engine harness connector pins.
        a. Disconnect the engine harness connector from the intake manifold temperature sensor.
        b. Inspect for corroded pins, bent or broken pins, pushed back or expanded pins.
        c. Inspect for evidence of moisture in or on the connector.
        d. Inspect for missing or damaged connector seals.
        e. Inspect for dirt or debris in or on the connector pins.
2. Faulty intake manifold temperature sensor
    a. Check the resistance of the sensor.
        a. Disconnect the engine harness connector from the intake manifold temperature sensor.
        b. Measure the resistance between the intake manifold temperature sensor signal pin and the intake manifold temperature sensor return pin.
3. Faulty engine harness
    a. Inspect the engine harness and the connector pins.
        a. Disconnect the engine harness connector from the extension harness.
        b. Inspect for corroded pins, bent or broken pins, pushed back or expanded pins.
        c. Inspect for evidence of moisture in or on the connector.
        d. Inspect for missing or damaged connector seals.
        e. Inspect for dirt or debris in or on the connector pin.
    b. Check for a short circuit from pin to pin.
        a. Disconnect the engine harness connector from the extension harness.
        b. Disconnect the engine harness from the intake manifold temperature sensor.

c. Disconnect the engine harness from all sensors that have a shared return with the intake manifold temperature sensor.

d. Measure the resistance from the intake manifold temperature sensor return pin on the engine harness inline connector to all other pins in the engine harness inline connector.

e. Measure the resistance from the intake manifold temperature sensor signal pin on the engine harness inline connector to all other pins in the engine harness inline connector.

f. If all measurements are greater than 100k Ohms, then the resistance is correct.

c. Check for a short circuit to engine block ground.

a. Disconnect the extension harness from the engine harness.

b. Measure the resistance from the intake manifold temperature sensor signal pin on the extension harness connector to the engine block ground.

c. If the measurement is more than 100k ohms, then the resistance is correct.

d. Check for an open circuit.

a. Disconnect the engine harness connector from the extension harness.

b. Disconnect the engine harness from the intake manifold temperature sensor.

c. Measure the resistance from the intake manifold temperature sensor return pin on the engine harness inline connector to the intake manifold temperature sensor return pin at the engine harness sensor connector.

d. Measure the resistance from the intake manifold temperature sensor signal pin on the engine harness inline connector to the intake manifold temperature sensor signal pin at then engine harness sensor connector.

e. If the measurement is less than 10 ohms, then the resistance is correct

4. Faulty extension harness

a. Inspect the extension harness connector pins.

a. Disconnect the extension harness connector.

b. Inspect for corroded pins, bent or broken pins, pushed back or expanded pins.

c. Inspect for evidence of moisture in or on the connector.

d. Inspect for missing or damaged connector seals.

e. Inspect for dirt or debris in or on the connector pins.

b. Check for a short circuit to engine block ground.

a. Disconnect the extension harness from the engine harness.

b. Measure the resistance from the intake manifold temperature sensor signal pin on the extension harness connector to engine block ground.

c. Measure the resistance from the intake manifold temperature sensor return pin on the engine harness connector to engine block ground.

d. If all measurements are greater than 100k ohms, then the resistance is correct.

c. Check for a short circuit from pin to pin.

   a. Disconnect the extension harness from the engine harness.

   b. Measure the resistance from the intake manifold temperature sensor return pin on the extension harness connector to all other pins in the extension harness connector.

   c. Measure the resistance from the intake manifold temperature sensor signal pin on the extension harness connector to all other pins in the extension harness connector.

   d. If all measurements are greater than 100k ohms, then the resistance is correct.

d. Check for an open circuit.

   a. Disconnect the extension harness from the engine harness.

   b. Measure the resistance from the intake manifold temperature sensor return pin on the extension harness connector to the intake manifold temperature sensor return pin at the extension harness inline connector.

   c. Measure the resistance from the intake manifold temperature sensor signal pin on the extension harness connector to the intake manifold temperature sensor signal pin at the extension harness inline connector.

   d. If the measurement is less than 10 ohms, then the resistance is correct.

5. Verify controller calibrations

   a. Using the display or the InPower Service tool, verify the calibration in the PCC.

      a. If the calibration in the PCC matches the latest calibration on the InCal website, then the calibration is correct. If it does not, update the calibration to the latest.

   b. Using the InSite Service tool, verify the calibration in the ECM.

      a. If the calibration in the ECM matches the latest calibration on QSOL, then the calibration is correct. If it does not, update the ECM to the latest calibration.

6.6.22 Code 441 - Battery Voltage Low (Warning)

Logic:

Battery voltage low.

Possible Causes:

1. Damaged battery cable connections
2. Low battery voltage
3. Bad battery ground connection
4. Damaged accessory wiring at B+
5. Damaged OEM battery harness
6. Damaged engine harness
7. Discharged or defective battery
8. Alternator not functioning properly
9. Incorrect battery setting

NOTE: Part Number 3822758 - Male Deutsch/AMP/Metri-Pack test lead
Part Number 3822917 - Female Deutsch/AMP/Metri-Pack test lead

Diagnosis and Repair:

1. Damaged battery cable connections
    a. Inspect the battery cable connections.
        a. Inspect connections for corrosion.
        b. Inspect connections for loose connections.
2. Low battery voltage
    a. Measure the battery voltage.
        a. Measure the battery voltage from the positive (+) terminal to the negative (-) terminal. If the voltage is between 11.0 to 14.2 V on a 12 VDC system and 17.3 and 34.7 V on a 24 VDC system, then the voltage is within normal range.
3. Bad battery ground connection
    a. Inspect the battery ground connection.
        a. Disconnect the engine harness.
        b. Measure the resistance from the negative (-) battery terminal to the engine block ground. If the resistance is less than 10 ohms, then there exists proper grounding. If the resistance is greater than 10 ohms, then the battery ground connection is in need of repair.
4. Damaged accessory wiring at B+
    a. Check for add-on or accessory wiring at the positive (+) terminal of the battery.
        a. Starting at the positive (+) terminal, follow any add-on or accessory wiring and examine the wire(s) for damaged insulation or installation error that can cause supply wire to be shorted to the engine block.
5. Damaged OEM battery harness
    a. Inspect the OEM battery harness and the Inline E connector pins.
        a. Disconnect the OEM battery harness from the Inline E connector.
        b. Inspect for corroded pins, bent or broken pins, pushed back or expanded pins.
        c. Inspect for evidence of moisture in or on the connector.
        d. Inspect for missing or damaged connector seals.
        e. Inspect for dirt and debris in or on the connector pins.
    b. Check for an open circuit.
        a. Disconnect the OEM battery harness from the engine.
        b. Disconnect the positive (+) battery terminal.
        c. Measure the resistance from all pins being supplied by unswitched battery on the OEM battery harness at the Inline E connector to the positive (+) battery terminal connector. If the resistance is less than 10 ohms, then there is not an open circuit. If the resistance is greater than 10 ohms, then there is an open circuit that is in need of repair.

c. Check for a short circuit from pin to pin.

   a. Disconnect the engine harness.

   b. Disconnect the positive (+) battery terminal.

   c. Measure the resistance from all unswitched battery pins on the Inline E connector to all other pins on the Inline E connector. If the resistance is more than 100k ohms, then there is not a short circuit. If the resistance is less than 100k ohms, then there is a short circuit that is in need of repair.

6. Damaged engine harness

   a. Inspect the engine harness fuse connection. Inspect for correct installation.

   b. Check the engine harness fuse.

      a. Disconnect the 20 amp fuse from the OEM harness.

      b. Inspect that the 20 amp to verify the fuse is not blown.

   c. Inspect the engine harness and the extension harness inline connector pins.

      a. Disconnect the engine harness.

      b. Inspect for corroded pins, bent or broken pins, pushed back or expanded pins.

      c. Inspect for evidence of moisture in or on the connector.

      d. Inspect for missing or damaged connector seals.

      e. Inspect for dirt and debris in or on the connector pins.

   d. Check for an open circuit.

      a. Disconnect the OEM battery harness from the engine connector.

      b. Disconnect the positive (+) battery terminal.

      c. Measure the resistance from all pins being supplied by unswitched battery on the OEM battery harness at the Inline E connector to the positive (+) battery terminal connector. If the resistance is less than 10 ohms, then there is not an open circuit. If the resistance is greater than 10 ohms, then there is an open circuit that is in need of repair.

   e. Check for a short circuit from pin to pin.

      a. Disconnect the engine harness.

      b. Disconnect the positive (+) battery terminal.

      c. Measure the resistance from all unswitched battery pins on the Inline E connector to all other pins on the Inline E connector. If the resistance is more than 100k ohms, then there is not a short circuit. If the resistance is less than 100k ohms, then there is a short circuit that is in need of repair.

7. Discharged or defective battery

   a. Measure the voltage of the battery with a voltmeter. Battery voltage should be 12 VDC or greater in a 12 V system and 24 VDC or greater in a 24 V system. If the battery voltage is low, check the electrolyte level. Replenish the electrolyte level if low and recharge the battery; the specific gravity of a fully charged lead acid battery is approximately 1.260 at 80 °F (27 °C).

   b. If the battery cannot hold adequate voltage, then replace the battery.

8. Alternator not functioning properly
    a. Check the engine DC alternator. If charging voltage is not 12-14 VDC for a 12 V system, or 24-26 VDC in a 24 V system, replace the alternator.
9. Incorrect battery setting
    a. Verify that the battery voltage (12V or 24V) matches calibration.

6.6.23 Code 442 - Battery Voltage High (Warning)

Logic:

Battery voltage high.

Possible Causes:

1. Incorrect battery voltage setup
2. The voltage of the battery is above the high battery voltage threshold
3. Battery charger is overcharging the battery
4. Faulty engine DC alternator

NOTE: Part Number 3822758 - Male Deutsch/AMP/Metri-Pack test lead
Part Number 3822917 - Female Deutsch/AMP/Metri-Pack test lead

Diagnosis and Repair:

1. Incorrect battery voltage setup
    a. Measure the voltage of the battery with a voltmeter. Battery voltage of lead acid batteres should be between 12-14 VDC in a 12 VDC system or 24-28 VDC in a 24 VDC system. Verify that the battery voltage matches the voltage that the control is calibrated for. If the generator set has a 24 V battery, but the control is calibrated to 12 V, the high battery voltage alarm will activate. In these cases, change the voltage on the control to 24 V using InPower.
2. The voltage of the battery is above the high battery voltage threshold
    a. Voltage of the battery is above the “High Battery” threshold for the time set in the “High Battery Time Set” parameter. Using InPower, change the battery voltage setup of the control accordingly.
3. Battery charger is overcharging the battery
    a. Ensure that the battery charger is charging the battery at an acceptable rate and not overcharging the battery. Adjust the charge rate of the battery if the charge rate is above the recommendation of the manufacturer.
    b. Refer to the battery charger OEM manual.
4. Faulty engine DC alternator
    a. Check the engine DC alternator for overcharging conditions. If charging voltage is not 12-14 VDC in a 12 VDC systems or 24-28 VDC in a 24 VDC system, replace the DC alternator.

6.6.24 Code 488 – Intake Manifold Temperature High (Warning)

Logic:

Engine intake manifold temperature has exceeded 185° F (85° C) for more than 90 seconds.

Possible Causes:

1. High ambient temperature
2. Radiator blocked
3. Louvers are closed or damaged
4. Charge air cooler fins or radiator fins are damaged or obstructed
5. Fan belt is broken or loose
6. Fan drive or fan controls are malfunctioning
7. Inaccurate coolant temperature sensor
8. Fault simulation feature is enabled
9. Incorrect threshold setting

Diagnosis and Repair:

1. High ambient temperature
   a. Use a thermocouple to verify air temperature entering intake louver of generator.
   b. Reduce loads or recirculation of discharge air to generator in elevated ambient.
2. Radiator blocked
   a. Inspect radiator for debris or blockages.
   b. Remove blockage or winterfront as applicable.
3. Louvers are closed or damaged
   a. Inspect louvers for proper operation.
   b. Repair or replace if damaged.
   c. Check louver motor for proper operation.
   d. If louver motor is operational, verify louver shutter thermostat is operational.
4. Charge air cooler fins or radiator fins are damaged or obstructed
   a. Inspect for dirt, debris or obstructions.
   b. Clean if necessary.
5. Fan belt is broken or loose
   a. Inspect belt(s) for damage, wear, and proper tension.
   b. Repair or replace if damaged or worn.
6. Fan drive or fan controls are malfunctioning
   a. Inspect pullies and belt tensioner for damage or wear.
   b. Repair or replace if damaged or worn.
7. Inaccurate coolant temperature sensor
   a. Use a thermocouple or similar device to measure coolant temperature near sender and compare to coolant temperature displayed.

   b. Verify the temperature sender resistance and compare to specifications called out in the engine manual.

   c. Verify continuity from temperature sender wire to engine ECM. Harness resistance should be less than 5 Ohms.

   d. Repair or replace faulty components or wiring.

8. Fault simulation feature is enabled

   a. Use the service tool to connect to the engine ECM and verify fault override toggle is disabled.

   b. Reconfigure generator and disable fault overrides.

9. Incorrect threshold setting

   a. Use the service tool to connect to the engine ECM and verify fault threshold settings and compare to the specifications called out in the engine manual.

   b. Verify ECM and PCC calibration number and revision is correct.

   c. Recalibrate the engine ECM to reset the threshold settings.

6.6.25 Code 781 - ECM CAN Datalink Has Failed

Logic:

Communication between the engine control module (ECM) and the generator set control is severed.

Possible Causes:

1. The Engine ECM has lost power or failed
2. The CAN datalink has failed

Diagnosis and Repair:

1. The Engine ECM has lost power or failed

   a. Check the wiring from the base board.

   b. Keyswitch control relay is a normally open relay. Ensure that B+ is available at the relay input, then measure the voltage output. If there is a B+ at both the input and output of the Keyswitch control relay, the relay is not faulty. If B+ is noted at the input but not at the output of the Keyswitch control relay, replace the relay.

   c. Connect to the engine ECM with InPower and/or Insite, to verify that the ECM is functioning properly and is communicating with the CAN-LINK network. Refer to the engine service manual for ECM troubleshooting procedures, if the ECM is faulty, replace.

2. The CAN datalink has failed

   a. There is a defective datalink harness connection, or open circuit; inspect the datalink harness and connector pins. Also check the shield ground connection.

   b. Check the terminating resistors. With connector disconnected from the base board and the engine datalink connection disconnected from the ECM control, measure resistance between pins (60 ohms is satisfactory). If the resistance is not 60 ohms, check the terminating resistors. Each of the two terminating resistors should be 120 ohms, replace if not 120 ohms.

6.6.26 Code 1117 − ECM Power Lost (Warning)

Logic:

Indicates that "Keyswitch" to the ECM was NOT removed for 30 seconds before removing battery power to the ECM (removing connectors or battery cable).

Diagnosis and Repair:

1. To reset, press the Off button, press E-Stop, wait 30 seconds; then remove E-Stop and select the desired operating mode (manual or remote).

6.6.27 Code 1244 − Engine Normal Shutdown

Logic:

A normal shutdown request has been received by the engine and no active shutdown with cooldown fault exists on the PCC (LBNG).

Possible Causes:

The generator set is going through a normal shutdown.

Diagnosis and Repair:

1. The generator set is going through a normal shutdown.
    a. The generator set is going through a normal shutdown and there are no active shutdown fault(s) in the ECM for at least 2 seconds.

6.6.28 Code 1245 − Engine Shutdown Fault

Logic:

Engine shutdown fault has occurred in the engine ECM, and no other active shutdown faults exist on the PCC.

Possible Cause:

1. Engine shutdown fault

Diagnosis and Repair:

1. Engine shutdown fault
    a. Event/fault code 1245 is activated by another active shutdown fault in the ECM. Connect to the Engine ECM with InPower or Insite to determine the actual shutdown fault that is generating event/ fault code 1245; then troubleshoot the shutdown fault(s) (Reference the Engine Service Manual).

6.6.29 Code 1248 − Engine Warning

Logic:

An engine warning fault has occurred in the engine ECM, and there are no active warning faults on the PCC.

Possible Cause:

1. An engine warning fault is active.

Diagnosis and Repair:

1. An engine warning fault is active.
   a. Event/fault code 1248 is activated by another active warning fault in the ECM. Connect to the Engine ECM with InPower or Insite to determine the actual warning fault that is generating event/fault code 1248; then troubleshoot the warning fault(s) (Reference the Engine Service Manual).

6.6.30 Codes 1317 − Low Coolant Level (Warning or Shutdown)

Logic:

This fault is used when an optional coolant level sensor is installed. The nature of the fault is an optional customer selection.

The fault function can be programmed (using the InPower service tool), as follows:

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

Possible Cause:

1. Low coolant
2. No actual fault, external wiring problem

Diagnosis and Repair:

1. Low coolant
   a. If the generator set is powering critical loads and cannot be shut down, wait until next shutdown period, then do the steps that follow.
   b. Allow engine to completely.
   c. Check coolant level and replenish if low.
2. No actual fault, external wiring problem
   a. Disconnect the signal lead from TB1 and reset the control.
      a. CONFIG INPUT 1 - TB1-13
   b. If the message goes away, the external wiring has a short circuit. Grounding of either input activates fault.

6.6.31 Codes 1318 − Low Fuel (Warning or Shutdown)

Logic:

This fault is used when an optional low fuel level sensor is installed. The nature of the fault is an optional customer selection.

The fault function can be programmed (using the InPower service tool), as follows:

- Enable/disable input (Default: enable)
- Status, Warning, or Shutdown (Default: #1-None, #2 and #3-Warning)

- Active closed or open (Default: closed [ground])
- Change the display name using up to 19 characters (Default: #1- Customer Fault 1, #2-Ground Fault, #3-Low Fuel)

Possible Cause:

1. Low fuel level
2. No actual fault, external wiring problem
3. The base board is faulty

Diagnosis and Repair:

1. Low fuel level.
   a. Add fuel.
2. No actual fault, external wiring problem.
   a. Disconnect the signal lead from TB1 and reset the control.
      a. CONFIG INPUT 1 - TB1-14
   b. If the message goes away, the external wiring has a short circuit. Grounding of either input activates fault.
3. The base board is faulty.
   a. If the previous steps do not reveal any problems but event/fault code 1318 is still active, replace the base board.

6.6.32 Code 1417 − Power Down Failure

Logic:

The PCC has failed to go to sleep.

Possible Cause:

1. Faulty base board

Diagnosis and Repair:

1. Faulty base board
   a. Remove power (B+) from the PCC for 5−10 seconds and reconnect B+ to the PCC. If the PCC fails to go to sleep after power is cycled from the PCC and the PCC shows event/fault code 1417 again, replace the base board.

6.6.33 Code 1433 − Local E−Stop

Logic:

The Local Emergency Stop has been activated.

Possible Causes:

1. The Local Emergency Stop button has been activated
2. Faulty connection or faulty Emergency Stop switch
3. The base board is faulty

Diagnosis and Repair:

1. The Local Emergency Stop button has been activated
   a. Reset the Local Emergency Stop:
      a. Pull the Local Emergency stop button out.
      b. Press the Off button.
      c. Press the Reset button.
      d. Select Manual or Auto as required.
2. Faulty connection or faulty Emergency Stop switch
   a. Check the Emergency Stop button, and verify that it is working properly. The Emergency Stop button is a closed relay when it is pulled out (not active), and open relay when depressed (active).
   b. Verify that the connection/wiring from the Local Emergency Stop switch to the PCC for an open circuit condition. A ground connection to the Local E−Stop control input (J25 – 2 Input; J25 – 6 Ground) disables the emergency stop alarm. An open circuit should activate the Emergency stop alarm.

      J25 – 2 Input

      J25 – 6 Ground
3. Check to see if the base board is faulty.
   a. Replace the base board.

6.6.34 Code 1434 - Remote E-Stop

Logic:

The Remote Emergency Stop has been activated.

Possible Causes:

1. The Remote Emergency stop button has been activated.
2. Faulty connection or faulty Emergency Stop switch.
3. The base board is faulty.

Diagnosis and Repair:

1. The Remote Emergency stop button has been activated.
   a. Reset the Remote Emergency Stop:
      1. Pull the Remote Emergency stop button out.
      2. Press the Off button.
      3. Press the Reset button.
      4. Select Manual or Auto as required.
   b. If the Remote Emergency Stop is not used, then install a jumper between:

      TB1 – 16 Input

      TB1 – 15 Ground

And repeat step 1a.

2. Faulty connection or faulty Emergency Stop switch.
   a. Check the Emergency Stop button, and verify that it is working properly. The Emergency Stop button is a closed relay when it is pulled out (not active), and open relay when depressed (active).
   b. Verify that the connection/wiring from the Remote Emergency Stop switch to the control for an open circuit condition. A ground connection to the Remote E-Stop control input (TB1 – 16 Input; TB1 – 15 Ground) disables the emergency stop alarm. An open circuit should activate the Emergency stop alarm.

      TB1 – 16 Input

      TB1 – 15 Ground.
3. Check to see if the base board is faulty.
   a. If the base board is faulty, replace it.

6.6.35 Code 1438 − Fail to Crank (Shutdown)

Logic:

The engine failed to crank after the generator control received a start signal.

Possible Cause:

1. Dead or weak battery
2. Blown 20 Amp supply fuse
3. Failed starter
4. Failed starter solenoid
5. Failed starter relay
6. Engine or rotor is locked or binding
7. Failed emergency Stop switch or wiring

Diagnosis and Repair:

1. Dead or weak battery
   a. Verify battery voltage is at least 12 VDC (24 VDC where applicable).
   b. Charge or replace the battery as necessary.
2. Blown 20 Amp supply fuse
   a. Verify the switched B+ supply fuse is in place and functional.
   b. Replace fuse as necessary.
3. Failed starter
   a. Press the Reset/Fault Acknowledge button on the display.
   b. Attempt to start the generator and test for B+ at the starter supply lug.
   c. If B+ is present at the starter supply lug, the starter could be defective.
4. Failed starter solenoid
   a. Press the Reset/Fault Acknowledge button on the display.

b. Check wiring for continuity between terminal 87 on the starter relay and start solenoid SW terminal. Resistance should be less than 5 Ohms.

c. Attempt to start the generator and test for B+ at SW terminal of the starter solenoid.

d. Check wiring for continuity between the solenoid COM terminal and B+ lug of the battery. Resistance should be less than 5 Ohms.

e. Attempt to start the generator and test for B+ at the solenoid output lug.

f. If B+ is not present, the starter solenoid is defective.

5. Failed starter relay

   a. Check wiring for continuity between terminal 86 on the starter relay and J20-13 control board terminal. Resistance should be less than 5 Ohms.

   b. Check wiring for continuity between terminal 85 on the starter relay and J20-15 control board terminal. Resistance should be less than 5 Ohms.

   c. Check for B+ at terminal 30 on the starter relay. If voltage is not present, verify 20 Amp fuse is in place and functional.

   d. Attempt to start the generator and test for B+ at terminal 86 of the starter relay.

   e. Check wiring for continuity between terminal 85 of the starter relay and ground. Resistance should be less than 5 Ohms.

   f. Attempt to start the generator and test for B+ at terminal 87 of starter relay.

   g. If B+ is not present, the starter relay is defective.

6. Engine or rotor is locked or binding

   a. Verify that the generator can rotate freely by barring the engine over by hand. If generator cannot be turned over, identify the source of bind and repair as necessary.

7. Failed emergency stop switch or wiring

   a. Push emergency stop button in, remove the configurable leads from TB1–15 and TB1–16 and check for continuity between these two leads.

   b. If the circuit is open, isolate to the emergency stop switch and wiring.

   c. Push emergency stop button in and remove P25 from the base board. Check for continuity between J25–2 and J25–6.

   d. Repair or replace the emergency stop switch or the wiring as necessary.

6.6.36 Code 1447 − Low AC Voltage (Shutdown)

Logic:

One or more of the phase voltages has dropped to 85% of nominal for more than 10 seconds.

Possible Causes:

1. Fault simulation feature is enabled
2. Incorrect threshold setting or AVR settings
3. Overload
4. Improper connections at generator output terminals
5. The voltage sense or setup wiring connection could be incorrect

6. Damaged voltage regulator
7. The rotating rectifier assembly (diodes CR1 through CR6) is faulty

Diagnosis and Repair:

1. Fault simulation feature is enabled
   a. Connect InPower.
   b. Verify that the fault simulation is NOT enabled for the engine speed sensor by connecting to the PCC via InPower. If the fault simulation is disabled, there is no problem.
2. Incorrect threshold setting or AVR settings
   a. Check threshold settings.
   b. Connect InPower.
   c. Verify that fault threshold is within the normal operating range for low AC voltage.
   d. Verify AVR settings. Compare gains, settings, and calibration factors against default calibrations.
   e. Adjust or recalibrate as necessary
3. Overload
   a. Check for overload.
   b. Check that load is within proper operating range.
   c. Check inrush current.
   d. Check for current spikes.
   e. Check for motor starts.
   f. Check operation by disconnecting the load and restarting the unit.
   g. Correct any overload.
4. Improper connections at generator output terminals
   a. Check connections.
   b. Compare connections in generator to wiring schematic.
   c. Correct according to the appropriate schematic as needed.
5. The voltage sense or setup wiring connection could be incorrect
   a. Verify that the voltage sensing inputs J22-1, J22-2, J22-3, and J22-4 are connected to L1, L2, L3, and L4 respectively.
   b. Verify that excitation inputs J18–1 and J18–2 are connected to the correct generator PMG terminals.
6. Damaged voltage regulator
   a. Bring the generator to idle.
   b. Connect InPower.
   c. Using InPower, verify that the AC voltage output is greater than residual.
   d. If the AC voltage output is residual, than the regulator is operating correctly.

e. Inspect the voltage regulator and the generator control harness connector pins.
f. Turn off the generator.
g. Disconnect the generator control harness from the voltage regulator.
h. Visually inspect for corroded pins, bent or broken pins, pushed back or expanded pins.

7. The rotating rectifier assembly (diodes CR1 through CR6) is faulty
   a. Check each diode. See the alternator service manual.

6.6.37 Code 1471 - High AC Current (Warning)

Logic:

The generator output current has exceeded at least 110% of rated current for greater than 60 seconds.

Possible Causes:

1. Short or overload
2. Incorrect CTs, CT connections, or CT setup
3. CT harness connections
4. Incorrect rating setup
5. The base board is faulty
6. Refer to Generator Troublshooting

Diagnosis and Repair:

1. Short or overload
   a. Inspect the load cables and the AC harness connections.
   b. Disconnect the AC harness from the load cables.
   c. Inspect the AC harness and board connector pins.
   d. Visually inspect for corroded pins, bent or broken pins, pushed back or expanded pins.
   e. Check for a short circuit to engine block ground.
2. Incorrect CTs, CT connections, or CT setup
   a. Check CTs.
      a. Check that correct CT’s have been installed.
      b. Check that CT connections are secure by zip ties to corresponding wires.
      c. Check that CTs are installed in the correct order.
      d. Connect InPower.
      e. Verify the correct CT ratio has been entered in the generator setup.
      f. Adjust the setting(s) as necessary.
3. CT harness connections
   a. Measure the resistance of the CT harness on each pin.

b. Disconnect connector P12 from the control board and CTs.

c. Verify the resistance from board connector to CT connections. Resistance should be 5 ohms or less.

d. Measure the resistance of each pin on the CT harness connector to engine block ground. Resistance should be open or infinite.

e. Verify the CT connections are correct from P12 to the CT terminals.

P12–1 (CT1) to P12–4 (CT1–COM)

P12–2 (CT2) to P12–5 (CT2–COM)

P12–3 (CT3) to P12–6 (CT3–COM)

f. Re-terminate connections as necessary.

4. Incorrect rating setup
    a. Connect InPower.
    b. Verify the generator rating in the control is set correctly.
    c. Verify CT ratings in the control are set correctly.
    d. Adjust settings as necessary.
5. The base board is faulty.
    a. If the previous steps did not identify any problems, replace the control board.

6.6.38 Code 1472 - High AC Current (Shutdown)

Logic:

The generator output current has exceeded at least 150% of rated current.

Possible Causes:

1. Short or overload
2. Incorrect CTs, CT connections, or CT setup
3. CT harness connections
4. Incorrect rating setup

Diagnosis and Repair:

1. Short or overload
    a. Inspect the load cables and the AC harness connections.
    b. Disconnect the AC harness from the load cables.
    c. Inspect the AC harness and board connector pins.
    d. Visually inspect for corroded pins, bent or broken pins, pushed back or expanded pins.
    e. Check for a short circuit to engine block ground.
2. Incorrect CTs, CT connections, or CT setup
    a. Check CTs.
        a. Check that correct CT’s have been installed.

b. Check that CT connections are secure by zip ties to corresponding wires.

c. Check that CTs are installed in the correct order.

d. Connect InPower.

e. Verify the correct CT ratio has been entered in the generator setup.

f. Adjust the setting(s) as necessary.

3. CT harness connections

   a. Measure the resistance of the CT harness on each pin.

   b. Disconnect connector P12 from the control board and CTs.

   c. Verify the resistance from board connector to CT connections. Resistance should be 5 ohms or less.

   d. Measure the resistance of each pin on the CT harness connector to engine block ground. Resistance should be open or infinite.

   e. Verify the CT connections are correct from P12 to the CT terminals.

      P12–1 (CT1) to P12–4 (CT1–COM)

      P12–2 (CT2) to P12–5 (CT2–COM)

      P12–3 (CT3) to P12–6 (CT3–COM)

   f. Re-terminate connections as necessary.

4. Incorrect rating setup

   a. Connect InPower.

   b. Verify the generator rating in the control is set correctly.

   c. Verify CT ratings in the control are set correctly.

   d. Adjust settings as necessary.

6.6.39 Code 1667 – AUX 101 Exhaust Temperature OOR (Warning)

Logic:

Exhaust gas temperature sensor signal is out of range – shorted high.

Possible Causes:

1. Faulty exhaust gas temperature sensor connections
2. Faulty exhaust gas temperature sensor
3. Faulty engine harness
4. Faulty extension harness
5. Verify the calibrations in the ECM and the PCC control

Diagnosis and Repair:

1. Faulty exhaust gas temperature sensor connections
    a. Inspect the exhaust gas temperature sensor and the engine harness connector pins.
        a. Disconnect the engine harness connector from the exhaust gas temperature sensor.
        b. Inspect for corroded pins, bent or broken pins, pushed back or expanded pins.
        c. Inspect for evidence of moisture in or on the connector.
        d. Inspect for missing or damaged connector seals.
        e. Inspect for dirt or debris in or on the connector pins.
2. Faulty exhaust gas temperature sensor
    a. Active Sensor.
        a. Check the exhaust gas temperature sensor supply voltage.
            a. Disconnect the engine harness connector from the exhaust gas temperature sensor.
            b. Install the pressure sensor breakout cable between the sensor and the sensor harness connector.
            c. Measure the supply voltage by connecting the breakout cable's supply and return connectors to the multimeter. If the reading is between 4.75 and 5.25 VDC, then the supply voltage is correct.
        b. Check exhaust gas temperature sensor signal (sense) voltage.
            a. Disconnect the engine harness connector from the exhaust gas temperature sensor.
            b. Install the pressure sensor breakout cable between the sensor and the sensor harness connector.
            c. Measure the signal voltage by connecting the breakout cable's signal and return connectors to the multimeter. If the reading is between 0.46 and 4.56 V, then the signal voltage is correct. If not, sensor is faulty.
3. Faulty engine harness
    a. Inspect the engine harness and the connector pins.
        a. Disconnect the engine harness connector from the extension harness.
        b. Inspect for corroded pins, bent or broken pins, pushed back or expanded pins.
        c. Inspect for evidence of moisture in or on the connector.
        d. Inspect for missing or damaged connector seals.
        e. Inspect for dirt or debris in or on the connector pin.
    b. Check for a short circuit from pin to pin.
        a. Disconnect the engine harness from the extension harness.
        b. Disconnect the engine harness connector from the exhaust gas temperature sensor.

   c. Disconnect the engine harness from all sensors that have a shared supply or return with the fuel pressure sensor.
   d. Measure the resistance from the exhaust gas temperature 5 VDC supply pin on the engine harness inline connector to all other pins in the engine harness inline connector.
   e. Measure the resistance from the exhaust gas temperature sensor pin on the engine harness inline connector to all other pins in the engine harness inline connector.
   f. Measure the resistance from the exhaust gas temperature signal pin on the engine harness inline connector to all other pins in the engine harness inline connector.
   g. If all measurements are greater than 100k ohms, then the resistance is correct.
  c. Check for an open circuit.
   a. Disconnect the engine harness from the extension harness.
   b. Disconnect the engine harness connector from the exhaust gas temperature sensor.
   c. Measure the resistance from the exhaust gas temperature return pin on the engine harness inline connector to the exhaust gas temperature return pin on the engine harness sensor connector.
   d. If the measurement is less than 10 ohms, then the resistance is correct.

4. Faulty extension harness
  a. Inspect the extension harness and the control connector pins.
   a. Disconnect the extension harness connector from the control.
   b. Inspect for corroded pins, bent or broken pins, pushed back or expanded pins.
   c. Inspect for evidence of moisture in or on the connector.
   d. Inspect for missing or damaged connector seals.
   e. Inspect for dirt or debris in or on the connector pins.
  b. Check for an open circuit.
   a. Disconnect the extension harness connector from the control.
   b. Disconnect the extension harness from the engine harness.
   c. Measure the resistance from the exhaust gas temperature return pin on the extension harness connector to the exhaust gas temperature return pin on the extension harness inline connection.
   d. If the measurement is less than 10 ohms, then the resistance is correct.
  c. Check for a short circuit from pin to pin.
   a. Disconnect the extension harness connector from the control.
   b. Disconnect the extension harness from the engine harness.
   c. Measure the resistance from the exhaust gas temperature 5 VDC supply pin on the extension harness connector to all other pins in the extension harness connector.

d. Measure the resistance from the exhaust gas temperature return pin on the extension harness connector to all other pins in the extension harness connector.

e. Measure the resistance from the exhaust gas temperature signal pin on the extension harness connector to all other pins in the extension harness connector.

f. If all measurements are greater than 100k ohms, then the resistance is correct.

5. Verify the calibrations in the ECM and the PCC control
   a. Using the display or the InPower Service tool, verify the calibration in the PCC control.
      a. If the calibration in the PCC control matches the latest calibration on the InCal website, then the calibration is correct. If it does not, update the calibration to the latest.
   b. Using the InSite Service tool, verify the calibration in the ECM.
      a. If the calibration in the ECM matches the latest calibration on QSOL, then the calibration is correct. If it does not, update the ECM to the latest calibration.

6.6.40 Code 1847 – Engine Coolant Temperature High (Shutdown with Cooldown)

Logic:

Exhaust gas temperature sensor signal is out of range – shorted high.

Possible Causes:

1. Inaccurate engine temperature sensor
2. Fault simulation feature is enabled
3. Threshold setting too low

Diagnosis and Repair:

1. Inaccurate engine temperature sensor
   a. Verify the sensor accuracy with a thermocouple or similar temperature probe.
      a. Connect the temperature probe to the engine near the coolant temperature sensor.
      b. Connect InPower.
      c. Compare the coolant temperature reading on the service tool monitor screen to the reading from the temperature probe. If the two readings are reasonably close, then the sensor is reading correctly.
2. Fault simulation feature is enabled
   a. Verify that the fault simulation feature for the sensor is not enabled.
      a. Connect InPower.
      b. Verify that the fault simulation is not enabled for the coolant temperature sensor by connecting to the PCC via InPower. If the fault simulation is disabled, there is no problem.

3. Threshold setting too low
    a. Check threshold settings.
        a. Connect InPower.
        b. Verify that fault threshold is within the normal operating range for the coolant temperature sensor. Refer to the engine manual for correct threshold values and make the appropriate changes using InPower.

6.6.41 Code 1853 - Annunciator Fault 1

Logic:

Customer annunciator fault #1.

Possible Cause:

1. Condition for which "Annunciator Input #1" is configured for is active
2. Incorrectly configured or wiring issue
3. Faulty annunciator

Diagnosis and Repair:

1. Condition for which "Annunciator Input #1" is configured for is active
    a. Check the condition for which "Annunciator Input #1" has been configured for; ex. if "Annunciator Input #1" was configured to become active when the fuel level is low, check the fuel level and add fuel if needed. After the issue is resolved, press the Reset button on the Operator Panel in order to clear the fault, if the fault does not clear go to the next step.
2. Incorrectly configured or wiring issue
    a. With InPower, verify that the annunciator fault #1 is configured correctly.
    b. Check the wiring at TB1-1 and ensure that customer input 1 is not wired incorrectly. Depending on the configuration of the annunciator, ensure that there is not a short or open circuit at the TB1-2 connection.
    c. Check the sender, relay, or device that is activating Input 1 on the Universal Annunciator, replace if faulty.
3. Faulty Annunciator
    a. If the wiring and configuration is satisfactory, replace the Universal Annunciator.

6.6.42 Code 1854 - Annunciator Fault 2

Logic:

Customer annunciator fault #2.

Possible Cause:

1. Condition for which "Annunciator Input #2" is configured for is active
2. Incorrectly configured or wiring issue
3. Faulty annunciator

Diagnosis and Repair:

1. Condition for which "Annunciator Input #2" is configured for is active
   a. Check the condition for which "Annunciator Input #2" has been configured for; ex. if "Annunciator Input #2" was configured to become active when the fuel level is low, check the fuel level and add fuel if needed. After the issue is resolved, press the Reset button on the Operator Panel in order to clear the fault, if the fault does not clear go to the next step.
2. Incorrectly configured or wiring issue
   a. With InPower, verify that the annunciator fault #2 is configured correctly.
   b. Check the wiring at TB1-2 and ensure that customer input 2 is not wired incorrectly. Depending on the configuration of the annunciator, ensure that there is not a short or open circuit at the TB1-2 connection.
   c. Check the sender, relay, or device that is activating Input 2 on the Universal Annunciator, replace if faulty.
3. Faulty Annunciator
   a. If the wiring and configuration is satisfactory, replace the Universal Annunciator.

6.6.43 Code 1855 - Annunciator Fault 3

Logic:

Customer annunciator fault #3.

Possible Cause:

1. Condition for which "Annunciator Input #3" is configured for is active
2. Incorrectly configured or wiring issue
3. Faulty annunciator

Diagnosis and Repair:

1. Condition for which "Annunciator Input #3" is configured for is active
   a. Check the condition for which "Annunciator Input #3" has been configured for; ex. if "Annunciator Input #3" was configured to become active when the fuel level is low, check the fuel level and add fuel if needed. After the issue is resolved, press the Reset button on the Operator Panel in order to clear the fault, if the fault does not clear go to the next step.
2. Incorrectly configured or wiring issue
   a. With InPower, verify that the annunciator fault #3 is configured correctly.
   b. Check the wiring at TB1-3 and ensure that customer input 3 is not wired incorrectly. Depending on the configuration of the annunciator, ensure that there is not a short or open circuit at the TB1-3 connection.
   c. Check the sender, relay, or device that is activating Input 3 on the Universal Annunciator, replace if faulty.
3. Faulty Annunciator
   a. If the wiring and configuration is satisfactory, replace the Universal Annunciator.

6.6.44 Code 1992 - Engine Crankshaft Speed Above Rated Speed (Warning)

Logic:

Engine speed signals indicate an engine speed 15% greater than rated.

Possible Cause:

1. Fault simulation feature is enabled
2. Incorrect threshold setting
3. Incorrect fuel type setting
4. Faulty engine speed sensor connections
5. Faulty engine harness
6. Faulty engine speed/position sensor

Diagnosis and Repair:

1. Fault simulation feature is enabled
    a. Verify that the fault simulation feature for the sensor is not enabled.
        a. Connect InPower.
        b. Verify that the fault simulation is not enabled for the engine speed sensor by connecting to the PCC via InPower. If the fault simulation is disabled, there is no problem.
2. Incorrect threshold setting
    a. Connect InPower.
    b. Verify that fault threshold is within the normal operating range for the engine overspeed sensor. Refer to the engine manual for correct threshold values and make the appropriate changes using InPower.
3. Incorrect fuel type setting
    a. Connect InPower.
    b. Verify the fuel source set with InPower is the same fuel used by the generator set.
4. Faulty engine speed sensor connections
    a. Inspect the engine speed sensor and the harness connector pins.
        a. Disconnect the engine harness connector from the engine speed sensor.
        b. Inspect for corroded pins, bent or broken pins, pushed back or expanded pins.
        c. Inspect for evidence of moisture in or on the connector.
        d. Inspect for missing or damaged connector seals.
        e. Inspect for dirt or debris in or on the connector pins.
5. Faulty engine harness
    a. Inspect the engine harness and the connector pins.
    b. Disconnect the engine harness connector from the extension harness.
    c. Inspect for corroded pins, bent or broken pins, pushed back or expanded pins.

   d. Inspect for evidence of moisture in or on the connector.
   e. Inspect for missing or damaged connector seals.
   f. Inspect for dirt or debris in or on the connector pin.
   g. Disconnect harness from ECM and sensor.
   h. Measure the resistance in each pin from ECM to sensor. Resistance should be 5 ohms or less.
   i. Repair or replace harness as necessary.
6. Faulty engine speed/position sensor
   a. Inspect the engine speed sensor.
   b. Disconnect the engine speed/position sensor from the engine and engine harness.
   c. Inspect sensor for bent, corroded or loose pins.
   d. Inspect the sensor for structural deficiencies.
   e. Check the crankshaft speed sensor supply voltage.
   f. Disconnect the engine harness connector from the crankshaft speed sensor.
   g. Install the speed sensor breakout cable between the sensor and the sensor harness connector.
   h. Measure the supply voltage by connecting the breakout cable's supply and return connectors to the multimeter. If the reading is between 4.75 and 5.25 VDC, then the supply voltage is correct.
   i. Check the crankshaft speed sensor signal (sense) voltage.
   j. Disconnect the engine harness connector from the camshaft position sensor.
   k. Install the speed/position sensor breakout cable between the sensor and the sensor harness connector.
   l. Measure the signal voltage by connecting the breakout cable's signal and return connectors to the multimeter. If the reading is between 0.46 and 4.56 VDC, then the signal voltage is correct. If not, sensor is faulty.

6.6.45 Code 1994 - Annunciator Output Configuration Error (Warning)

Logic:

Annunciator output relay(s) are being activated by more than one source.

Possible Cause:

1. Annunciator output relay(s) activated by more than one source at the same time
2. Faulty annunciator

Diagnosis and Repair:

1. Annunciator output relay(s) activated by more than one source at the same time
   a. Ensure that the annunciator(s) are only connected to one genset control.

2. Faulty annunciator
    a. Replace the annunciator.

6.6.46 Code 2112 – AUX 101 Coolant Inlet Temperature ORR (Warning)

Logic:

Coolant temperature sensor voltage is out of range.

Possible Causes:

1. Faulty coolant temperature sensor connections
2. Faulty coolant temperature sensor
3. Improper wiring
4. Verify controller calibrations

Diagnosis and Repair:

1. Faulty coolant temperature sensor connections
    a. Inspect the coolant temperature sensor and the engine harness connector pins.
        a. Disconnect the engine harness connector from the coolant temperature sensor.
        b. Inspect for corroded pins, bent or broken pins, pushed back or expanded pins.
        c. Inspect for evidence of moisture in or on the connector.
        d. Inspect for missing or damaged connector seals.
        e. Inspect for dirt or debris in or on the connector pins.
2. Faulty coolant temperature sensor
    a. Check the resistance of the sensor
        a. Disconnect the engine harness connector from the coolant temperature sensor.
        b. Measure the resistance between the coolant temperature sensor signal pin and the coolant temperature sensor return pin.
3. Improper wiring
    a. Check wiring. Ensure wiring from the coolant temperature sensor is connected to the correct Aux 101 input.
    b. Check wires for breaks or abrasions.
    c. Check wires for moisture and debris at connection points.
4. Verify controller calibrations
    a. Using the display or the InPower Service tool, verify the calibration in the PCC control.
        a. If the calibration in the PCC control matches the latest calibration on the InCal website, then the calibration is correct. If it does not, update the calibration to the latest.
    b. Using the InSite Service tool, verify the calibration in the ECM.
        a. If the calibration in the ECM matches the latest calibration on QSOL, then the calibration is correct. If it does not, update the ECM to the latest calibration.

6.6.47 Code 2224 – AUX 101 Fuel Level ORR (Warning)

Logic:

Fuel level sensor voltage is out of range.

Possible Causes:

1. Faulty fuel level sensor connections
2. Faulty fuel level sensor
3. Improper wiring
4. Verify controller calibrations

Diagnosis and Repair:

1. Faulty fuel level sensor connections
    a. Inspect the fuel level sensor and the engine harness connector pins.
        a. Disconnect the engine harness connector from the fuel level sensor.
        b. Inspect for corroded pins, bent or broken pins, pushed back or expanded pins.
        c. Inspect for evidence of moisture in or on the connector.
        d. Inspect for missing or damaged connector seals.
        e. Inspect for dirt or debris in or on the connector pins.
2. Faulty fuel level sensor
    a. Check the resistance of the sensor
        a. Disconnect the engine harness connector from the fuel level sensor.
        b. Measure the resistance between the fuel level sensor signal pin and the fuel level sensor return pin.
3. Improper wiring
    a. Check wiring. Ensure wiring from the coolant temperature sensor is connected to the correct Aux 101 input.
    b. Check wires for breaks or abrasions.
    c. Check wires for moisture and debris at connection points.
4. Verify controller calibrations
    a. Using the display or the InPower Service tool, verify the calibration in the PCC control.
        a. If the calibration in the PCC control matches the latest calibration on the InCal website, then the calibration is correct. If it does not, update the calibration to the latest.
    b. Using the InSite Service tool, verify the calibration in the ECM.
        a. If the calibration in the ECM matches the latest calibration on QSOL, then the calibration is correct. If it does not, update the ECM to the latest calibration.

6.6.48 Code 2398 – AUX 101 Ambient Temperature ORR (Warning)

Logic:

Ambient temperature sensor voltage is out of range.

Possible Causes:

1. Faulty ambient temperature sensor connections
2. Faulty ambient temperature sensor
3. Improper wiring
4. Verify controller calibrations

Diagnosis and Repair:

1. Faulty ambient temperature sensor connections
   a. Inspect the ambient temperature sensor and the engine harness connector pins.
      a. Disconnect the engine harness connector from the ambient temperature sensor.
      b. Inspect for corroded pins, bent or broken pins, pushed back or expanded pins.
      c. Inspect for evidence of moisture in or on the connector.
      d. Inspect for missing or damaged connector seals.
      e. Inspect for dirt or debris in or on the connector pins.
2. Faulty ambient temperature sensor
   a. Check the resistance of the sensor.
      a. Disconnect the engine harness connector from the ambient temperature sensor.
      b. Measure the resistance between the ambient temperature sensor signal pin and the ambient temperature sensor return pin.
3. Improper wiring
   a. Check wiring. Ensure wiring from the coolant temperature sensor is connected to the correct Aux 101 input.
   b. Check wires for breaks or abrasions.
   c. Check wires for moisture and debris at connection points.
4. Verify controller calibrations
   a. Using the display or the InPower Service tool, verify the calibration in the PCC control.
      a. If the calibration in the PCC control matches the latest calibration on the InCal website, then the calibration is correct. If it does not, update the calibration to the latest.
   b. Using the InSite Service tool, verify the calibration in the ECM.
      a. If the calibration in the ECM matches the latest calibration on QSOL, then the calibration is correct. If it does not, update the ECM to the latest calibration.

6.6.49 Code 2542 – AUX 101 Voltage Bias ORR (Warning)

Logic:

Fuel level sensor voltage is out of range.

Possible Causes:

1. Faulty fuel level sensor connections
2. Faulty fuel level sensor
3. Improper wiring
4. Verify controller calibrations

Diagnosis and Repair:

1. Faulty fuel level sensor connections
    a. Inspect the fuel level sensor and the engine harness connector pins.
        a. Disconnect the engine harness connector from the fuel level sensor.
        b. Inspect for corroded pins, bent or broken pins, pushed back or expanded pins.
        c. Inspect for evidence of moisture in or on the connector.
        d. Inspect for missing or damaged connector seals.
        e. Inspect for dirt or debris in or on the connector pins.
2. Faulty fuel level sensor
    a. Check the resistance of the sensor.
        a. Disconnect the engine harness connector from the fuel level sensor.
        b. Measure the resistance between the fuel level sensor signal pin and the fuel level sensor return pin.
3. Improper wiring
    a. Check wiring. Ensure wiring from the coolant temperature sensor is connected to the correct Aux 101 input.
    b. Check wires for breaks or abrasions.
    c. Check wires for moisture and debris at connection points.
4. Verify controller calibrations
    a. Using the display or the InPower Service tool, verify the calibration in the PCC control.
        a. If the calibration in the PCC control matches the latest calibration on the InCal website, then the calibration is correct. If it does not, update the PCC to the latest calibration.
    b. Using the InSite Service tool, verify the calibration in the ECM.
        a. If the calibration in the ECM matches the latest calibration on QSOL, then the calibration is correct. If it does not, update the ECM to the latest calibration.

6.6.50 Code 2545 – Keyswitch Reset Required (Warning)

Logic:

CAN datalink communication has been lost between the generator set control and ECM, therefore event/fault code 2545 becomes active if event/fault code 781 “CAN Data Link Failure" is also active at the ECM.

Possible Causes:

1. CAN datalink failure
2. Faulty ECM

Diagnosis and Repair:

1. CAN datalink failure
    a. Reset the Keyswitch manually.
        a. Put the generator set control in the OFF position and press the Reset button on the operator panel. This action will clear any shutdown faults and resets the Keyswitch.
        b. Enable the Keyswitch through the operator panel. Go to **Test > Output > Engine > Keyswitch Driver Override Enable**, set to Enable.
    b. Reset the ECM and PCC controls.
        a. Push the Emergency Stop button in.
        b. Wait 30 seconds.
        c. Disconnect the battery terminals from the battery.
        d. Wait 10-15 seconds.
        e. Reconnect the battery cables to the battery terminals correctly.
        f. Pull the Emergency Stop button out.
        g. Press the Fault Reset button.
    c. Check the relay that is proving power to the Keyswitch. This relay is normally open, and if faulty, replace.
    d. Check the terminating resistors. With connectors J11 and J26 removed, measure resistance between pins J11-19 and J11-20 (60 ohms, is satisfactory).
    e. Reference the troubleshooting procedure for event/fault code 781 in the engine service manual.
2. Faulty ECM
    a. After ensuring that the ECM has an adequate B+ supply, connect to the ECM with InPower or Insite in order to determine if it is functioning correctly and can communicate with the PCC controller. Replace the controller if communication to it with InPower is not possible.

6.6.51 Code 2619 – AUX 101 Input #1 Fault

Logic:

Analog input #1 fault is active.

Possible Causes:

1. Condition for which "Analog Input #1" is configured is active

2. "Analog Input #1 Active State Selection" parameter is configured incorrectly
3. Incorrectly wired; or open circuit or short circuit in the wiring

Diagnosis and Repair:

1. Condition for which "Analog Input #1" is configured is active
   a. Check the condition for which "Analog Input #1" has been configured for. After the issue is resolved, press the Reset button on the Operator Panel in order to clear the fault, if the fault does not clear go to next step.
2. "Analog Input #1 Active State Selection" parameter is configured incorrectly
   a. With InPower or through the Operator Panel check the switch input setting (active closed or active open) for Analog Input #1. Ensure that the switch input setting is correctly set. If “Analog Input #1 Sensor Type" parameter is set to active low, an active high will invert the logic, causing this fault code to go active.
3. Incorrectly wired; or open circuit or short circuit in the wiring
   a. Check the wiring at J11-1 (reference input 1) and J11-2 (switch input) for an open circuit, short circuit, or a miswired condition.

6.6.52 Code 2621 – AUX 101 Input #2 Fault

Logic:

Analog input #2 fault is active.

Possible Causes:

1. Condition for which "Analog Input #2" is configured is active
2. "Analog Input #2 Active State Selection" parameter is configured incorrectly
3. Incorrectly wired; or open circuit or short circuit in the wiring

Diagnosis and Repair:

1. Condition for which "Analog Input #2" is configured is active
   a. Check the condition for which "Analog Input #2" has been configured for. After the issue is resolved, press the Reset button on the Operator Panel in order to clear the fault, if the fault does not clear go to next step.
2. "Analog Input #2 Active State Selection" parameter is configured incorrectly
   a. With InPower or through the Operator Panel check the switch input setting (active closed or active open) for Analog Input #2. Ensure that the switch input setting is correctly set. If “Analog Input #2 Sensor Type" parameter is set to active low, an active high will invert the logic, causing this fault code to go active.
3. Incorrectly wired; or open circuit or short circuit in the wiring
   a. Check the wiring at J11-3 (reference input 1) and J11-4 (switch input) for an open circuit, short circuit, or a miswired condition.

6.6.53 Code 2622 – AUX 101 Input #3 Fault

Logic:

Analog input #3 fault is active.

Possible Causes:

1. Condition for which "Analog Input #3" is configured is active
2. "Analog Input #3 Active State Selection" parameter is configured incorrectly
3. Incorrectly wired; or open circuit or short circuit in the wiring

Diagnosis and Repair:

1. Condition for which "Analog Input #3" is configured is active
   a. Check the condition for which "Analog Input #3" has been configured for. After the issue is resolved, press the Reset button on the Operator Panel in order to clear the fault, if the fault does not clear go to next step.
2. "Analog Input #3 Active State Selection" parameter is configured incorrectly
   a. With InPower or through the Operator Panel check the switch input setting (active closed or active open) for Analog Input #3. Ensure that the switch input setting is correctly set. If “Analog Input #3 Sensor Type" parameter is set to active low, an active high will invert the logic, causing this fault code to go active.
3. Incorrectly wired; or open circuit or short circuit in the wiring
   a. Check the wiring at J11-5 (reference input 1) and J11-6 (switch input) for an open circuit, short circuit, or a miswired condition.

6.6.54 Code 2623 – AUX 101 Input #4 Fault

Logic:

Analog input #4 fault is active.

Possible Causes:

1. Condition for which "Analog Input #4" is configured is active
2. "Analog Input #4 Active State Selection" parameter is configured incorrectly
3. Incorrectly wired; or open circuit or short circuit in the wiring

Diagnosis and Repair:

1. Condition for which "Analog Input #4" is configured is active
   a. Check the condition for which "Analog Input #4" has been configured for. After the issue is resolved, press the Reset button on the Operator Panel in order to clear the fault, if the fault does not clear go to next step.
2. "Analog Input #4 Active State Selection" parameter is configured incorrectly
   a. With InPower or through the Operator Panel check the switch input setting (active closed or active open) for Analog Input #4. Ensure that the switch input setting is correctly set. If “Analog Input #4 Sensor Type" parameter is set to active low, an active high will invert the logic, causing this fault code to go active.
3. Incorrectly wired; or open circuit or short circuit in the wiring
   a. Check the wiring at J11-7 (reference input 1) and J11-8 (switch input) for an open circuit, short circuit, or a miswired condition.

6.6.55 Code 2624 – AUX 101 Input #5 Fault

Logic:

Analog input #5 fault is active.

Possible Causes:

1. Condition for which "Analog Input #5" is configured is active
2. "Analog Input #5 Active State Selection" parameter is configured incorrectly
3. Incorrectly wired; or open circuit or short circuit in the wiring

Diagnosis and Repair:

1. Condition for which "Analog Input #5" is configured is active
    a. Check the condition for which "Analog Input #5" has been configured for. After the issue is resolved, press the Reset button on the Operator Panel in order to clear the fault, if the fault does not clear go to next step.
2. "Analog Input #5 Active State Selection" parameter is configured incorrectly
    a. With InPower or through the Operator Panel check the switch input setting (active closed or active open) for Analog Input #5. Ensure that the switch input setting is correctly set. If “Analog Input #5 Sensor Type" parameter is set to active low, an active high will invert the logic, causing this fault code to go active.
3. Incorrectly wired; or open circuit or short circuit in the wiring
    a. Check the wiring at J11-9 (reference input 1) and J11-10 (switch input) for an open circuit, short circuit, or a miswired condition.

6.6.56 Code 2625 – AUX 101 Input #6 Fault

Logic:

Analog input #6 fault is active.

Possible Causes:

1. Condition for which "Analog Input #6" is configured is active
2. "Analog Input #6 Active State Selection" parameter is configured incorrectly
3. Incorrectly wired; or open circuit or short circuit in the wiring

Diagnosis and Repair:

1. Condition for which "Analog Input #6" is configured is active
    a. Check the condition for which "Analog Input #6" has been configured for. After the issue is resolved, press the Reset button on the Operator Panel in order to clear the fault, if the fault does not clear go to next step.
2. "Analog Input #6 Active State Selection" parameter is configured incorrectly
    a. With InPower or through the Operator Panel check the switch input setting (active closed or active open) for Analog Input #6. Ensure that the switch input setting is correctly set. If “Analog Input #6 Sensor Type" parameter is set to active low, an active high will invert the logic, causing this fault code to go active.

3. Incorrectly wired; or open circuit or short circuit in the wiring
    a. Check the wiring at J11-11 (reference input 1) and J11-12 (switch input) for an open circuit, short circuit, or a miswired condition.

6.6.57 Code 2626 – AUX 101 Input #7 Fault

Logic:

Analog input #7 fault is active.

Possible Causes:

1. Condition for which "Analog Input #7" is configured is active
2. "Analog Input #7 Active State Selection" parameter is configured incorrectly
3. Incorrectly wired; or open circuit or short circuit in the wiring

Diagnosis and Repair:

1. Condition for which "Analog Input #7" is configured is active
    a. Check the condition for which "Analog Input #7" has been configured for. After the issue is resolved, press the Reset button on the Operator Panel in order to clear the fault, if the fault does not clear go to next step.
2. "Analog Input #7 Active State Selection" parameter is configured incorrectly
    a. With InPower or through the Operator Panel check the switch input setting (active closed or active open) for Analog Input #7. Ensure that the switch input setting is correctly set. If “Analog Input #7 Sensor Type" parameter is set to active low, an active high will invert the logic, causing this fault code to go active.
3. Incorrectly wired; or open circuit or short circuit in the wiring
    a. Check the wiring at J11-13 (reference input 1) and J11-14 (switch input) for an open circuit, short circuit, or a miswired condition.

6.6.58 Code 2627 – AUX 101 Input #8 Fault

Logic:

Analog input #8 fault is active.

Possible Causes:

1. Condition for which "Analog Input #8" is configured is active
2. "Analog Input #8 Active State Selection" parameter is configured incorrectly
3. Incorrectly wired; or open circuit or short circuit in the wiring

Diagnosis and Repair:

1. Condition for which "Analog Input #8" is configured is active
    a. Check the condition for which "Analog Input #8" has been configured for. After the issue is resolved, press the Reset button on the Operator Panel in order to clear the fault, if the fault does not clear go to next step.

2. "Analog Input #8 Active State Selection" parameter is configured incorrectly
   a. With InPower or through the Operator Panel check the switch input setting (active closed or active open) for Analog Input #8. Ensure that the switch input setting is correctly set. If “Analog Input #8 Sensor Type" parameter is set to active low, an active high will invert the logic, causing this fault code to go active.
3. Incorrectly wired; or open circuit or short circuit in the wiring
   a. Check the wiring at J11-15 (reference input 1) and J11-16 (switch input) for an open circuit, short circuit, or a miswired condition.

6.6.59 Code 2628 – AUX 102 Input #1 Fault

Logic:

Discrete input #1 fault is active.

Possible Causes:

1. Condition for which "Discrete Input #1" is configured is active
2. "Discrete Input #1 Active State Selection" parameter is configured incorrectly
3. Incorrectly wired; or open circuit or short circuit in the wiring

Diagnosis and Repair:

1. Condition for which "Discrete Input #1" is configured is active
   a. Check the condition for which "Discrete Input #1" has been configured for. After the issue is resolved, press the Reset button on the Operator Panel in order to clear the fault, if the fault does not clear go to next step.
2. "Discrete Input #1 Active State Selection" parameter is configured incorrectly
   a. With InPower or through the Operator Panel check the switch input setting (active closed or active open) for Discrete Input #1. Ensure that the switch input setting is correctly set. If “Discrete Input #1 Sensor Type" parameter is set to active low, an active high will invert the logic, causing this fault code to go active.
3. Incorrectly wired; or open circuit or short circuit in the wiring
   a. Check the wiring at J4-1 (switch input 1) and J4-2 (reference input) for an open circuit, short circuit, or a miswired condition.

6.6.60 Code 2629 – AUX 102 Input #2 Fault

Logic:

Discrete input #2 fault is active.

Possible Causes:

1. Condition for which "Discrete Input #2" is configured is active
2. "Discrete Input #2 Active State Selection" parameter is configured incorrectly
3. Incorrectly wired; or open circuit or short circuit in the wiring

Diagnosis and Repair:

1. Condition for which "Discrete Input #2" is configured is active
   a. Check the condition for which "Discrete Input #2" has been configured for. After the issue is resolved, press the Reset button on the Operator Panel in order to clear the fault, if the fault does not clear go to next step.
2. "Discrete Input #2 Active State Selection" parameter is configured incorrectly
   a. With InPower or through the Operator Panel check the switch input setting (active closed or active open) for Discrete Input #2. Ensure that the switch input setting is correctly set. If “Discrete Input #2 Sensor Type" parameter is set to active low, an active high will invert the logic, causing this fault code to go active.
3. Incorrectly wired; or open circuit or short circuit in the wiring
   a. Check the wiring at J4-3 (switch input 1) and J4-4 (reference input) for an open circuit, short circuit, or a miswired condition.

6.6.61 Code 2631 – AUX 102 Input #3 Fault

Logic:

Discrete input #3 fault is active.

Possible Causes:

1. Condition for which "Discrete Input #3" is configured is active
2. "Discrete Input #3 Active State Selection" parameter is configured incorrectly
3. Incorrectly wired; or open circuit or short circuit in the wiring

Diagnosis and Repair:

1. Condition for which "Discrete Input #3" is configured is active
   a. Check the condition for which "Discrete Input #3" has been configured for. After the issue is resolved, press the Reset button on the Operator Panel in order to clear the fault, if the fault does not clear go to next step.
2. "Discrete Input #3 Active State Selection" parameter is configured incorrectly
   a. With InPower or through the Operator Panel check the switch input setting (active closed or active open) for Discrete Input #3. Ensure that the switch input setting is correctly set. If “Discrete Input #3 Sensor Type" parameter is set to active low, an active high will invert the logic, causing this fault code to go active.
3. Incorrectly wired; or open circuit or short circuit in the wiring
   a. Check the wiring at J4-5 (switch input 1) and J4-6 (reference input) for an open circuit, short circuit, or a miswired condition.

6.6.62 Code 2632 – AUX 102 Input #4 Fault

Logic:

Discrete input #4 fault is active.

Possible Causes:

1. Condition for which "Discrete Input #4" is configured is active

2. "Discrete Input #4 Active State Selection" parameter is configured incorrectly
3. Incorrectly wired; or open circuit or short circuit in the wiring

Diagnosis and Repair:

1. Condition for which "Discrete Input #4" is configured is active
   a. Check the condition for which "Discrete Input #4" has been configured for. After the issue is resolved, press the Reset button on the Operator Panel in order to clear the fault, if the fault does not clear go to next step.
2. "Discrete Input #4 Active State Selection" parameter is configured incorrectly
   a. With InPower or through the Operator Panel check the switch input setting (active closed or active open) for Discrete Input #4. Ensure that the switch input setting is correctly set. If “Discrete Input #4 Sensor Type" parameter is set to active low, an active high will invert the logic, causing this fault code to go active.
3. Incorrectly wired; or open circuit or short circuit in the wiring
   a. Check the wiring at J4-7 (switch input 1) and J4-8 (reference input) for an open circuit, short circuit, or a miswired condition.

6.6.63 Code 2693 - Speed Bias OOR (Warning)

Logic:

Indicates the speed bias circuit output is out of range (OOR), high or low.

Possible Cause:

1. Sensor/wiring is defective

Diagnosis and Repair:

1. Sensor/wiring is defective
   a. Check wiring. Ensure speed bias OOR wiring is connected to the correct Aux 101 input.
   b. Check wires for breaks or abrasions.
   c. Check wires for moisture and debris at connection points.

6.6.64 Code 2694 - Alternator RTD OOR (Warning)

Logic:

Indicates the RTD circuit output is out of range (OOR), high or low.

Possible Cause:

1. Sensor/wiring is defective

Diagnosis and Repair:

1. Sensor/wiring is defective
   a. Check wiring. Ensure alternator RDT OOR wiring is connected to the correct Aux 101 input.
   b. Check wires for breaks or abrasions.
   c. Check wires for moisture and debris at connection points.

6.6.65 Code 2696 - Alternator RTD Temperature High (Warning)

Logic:

Indicates that the alternator temperature is above normal and has reached the shutdown trip point.

Possible Cause:

1. Sensor/wiring is defective

Diagnosis and Repair:

1. Sensor/wiring is defective
    a. Check wiring. Ensure alternator RDT temperature wiring is connected to the correct Aux 101 input.
    b. Check wires for breaks or abrasions.
    c. Check wires for moisture and debris at connection points.

6.6.66 Code 2729 – IO Module Lost (Warning)

Logic:

Indicates an intermittent data link between the I/O module and the PCC control (Aux 101 I/O Module option) and no input fault levels were set to Shutdown.

Possible Causes:

1. Incorrect Wiring
2. I/O settings misconfigured

Diagnosis and Repair:

1. Incorrect Wiring
    a. Connection between AUX 101 and PCC 1302 is incorrect. Ensure proper wiring.
        a. PCC 1302 TB1-1 – PCC Net A (+) to AUX 101 J1-3
        b. PCC 1302 TB1-2 – PCC Net B (-) to AUX 101 J1-4
        c. PCC 1302 TB1-3 – B+ Return to AUX 101 J14-2
        d. PCC 1302 TB1-5 – Customer Fused B+ to AUX 101 J14-1
        e. PCC 1302 TB15-5 – System Wake-up to AUX 101 J1-5
2. I/O settings misconfigured
    a. If no AUX 101 is connected to PCC 1302, connect to InPower. Under Adjustments > System I/O Adjustment > Output Relays ensure System IO Board Enable is disabled.
    b. If no AUX 101 is connected to PCC 1302, connect to InPower. Under Adjustments > System I/O Adjustment > ensure no inputs or outputs are configured as enabled.

6.6.67 Code 2731 – IO Module Lost (Shutdown)

Logic:

Indicates an intermittent data link between the I/O module and the PCC control (Aux 101 I/O Module option) and at least one input fault level was set to Shutdown.

Possible Causes:

1. Incorrect Wiring
2. I/O settings misconfigured

Diagnosis and Repair:

1. Incorrect Wiring
    a. Connection between AUX 101 and PCC 1302 is incorrect. Ensure proper wiring.
        a. PCC 1302 TB1-1 – PCC Net A (+) to AUX 101 J1-3
        b. PCC 1302 TB1-2 – PCC Net B (-) to AUX 101 J1-4
        c. PCC 1302 TB1-3 – B+ Return to AUX 101 J14-2
        d. PCC 1302 TB1-5 – Customer Fused B+ to AUX 101 J14-1
        e. PCC 1302 TB15-5 – System Wake-up to AUX 101 J1-5
2. I/O settings misconfigured
    a. If no AUX 101 is connected to PCC 1302, connect to InPower. Under Adjustments > System I/O Adjustment > Output Relays ensure System IO Board Enable is disabled.
    b. If no AUX 101 is connected to PCC 1302, connect to InPower. Under Adjustments > System I/O Adjustment > ensure no inputs or outputs are configured as enabled.

6.6.68 Code 2897 – Factory Memory Block Corrupt

Logic:

Control has detected a corrupted memory block.

Possible Cause:

Defective memory block

Diagnosis and Repair:

Contact factory for support.

6.6.69 Code 2898 – Periodic or Fault Memory Block Corrupt

Logic:

Control has detected a corrupted memory block.

Possible Cause:

Defective memory block

Diagnosis and Repair:

Contact factory for support.

6.6.70 Code 2899 – User Memory Block Corrupt

Logic:

Control has detected a corrupted memory block.

Possible Cause:

Defective memory block

Diagnosis and Repair:

Contact factory for support.

6.6.71 Code 2911 – Trim Memory Block Corrupt

Logic:

Control has detected a corrupted memory block.

Possible Cause:

Defective memory block

Diagnosis and Repair:

Contact factory for support.

6.6.72 Code 2972 - Field Overload

Logic:

If the time that the Field AVR Duty Cycle is operating at maximum output is longer than the time in the “Max Field Time" parameter, event/fault code 2972 will become active.

Possible Causes:

WARNING: Excessive voltage is possible during testing. Make sure your meter can handle alternator full voltage.

1. Max Field Time Delay is set too low.
2. Voltage sensing into the base board is too low, or there is an open/short circuit.
3. Application issue.
4. The base board is faulty.

Diagnosis and Repair:

1. Max Field Time Delay is set too low.
   a. Through the operator panel, check the “Max Field Time" parameter setting. Verify that the “Max Field Time" is not set to zero. The “Max Field Time" parameter may require adjustment to a value more appropriate for the application. To access the Max Field Time configuration menu on the operator panel go to **Setup > OEM Setup > OEM Alt Setup > Max Field Time** and set the “Max Field Time" parameter appropriately for the application. Refer to the parameter list to see the default value for “Max Field Time".
2. Voltage sensing into the base board is too low, or there is an open/short circuit.
   a. Measure the voltage going into the base board at L1 = J22-1, L2 = J22-2, L3 = J22-3, and LN = J22-4 (for single phase applications use L1, L2 and LN). If the genset control is not sensing voltage, it will try to overcompensate by maxing out the AVR output. If the voltage going into the control board is zero, or less than the voltage that the control was calibrated for (Nominal Voltage), then check the wiring from the alternator to the base board for an open circuit or short circuit.

b. If the genset is over 600 VAC, check connections from the alternator to the PT, and from the PT to the base board. If there is voltage going into the PT, but not coming out of the PT, replace the PT.

c. Measure the output of the AVR at J17 -1 and J17-2 while turning the genset on. The output should be at least 300 VDC when the genset is starting, but the voltage should decrease significantly when the genset builds up voltage. If the output of J17-1 and J17-2 is constantly high or is locked in, then the AVR portion of the PCC is faulty. Replace the base board if the AVR is faulty.

d. Using a True RMS meter, measure the PWM at J19-2 (AVR PWM +) and J19-9 (AVR PWM -) while turning the genset “ON". This is a 2.5 VDC max output from the base board to the AUX 103 AVR; if the voltage at J19-2 and J19-9 is continuously 2.0-2.5 VDC, without any change, then replace the base board.

e. Measure the output of the AUX 103 AVR at J17-1 and J17-2, the output should be at 9-12 VDC when the genset is operating at “No Load", if the voltage output of J17-1 & J17-2 is constantly high, then the AUX 103 AVR is faulty replace the AUX 103 AVR.

3. Application issue.

   a. If the genset runs adequately with no load or some load but as soon as additional load is applied, the genset shuts down on “Field Overload"; then this might be an application issue (load issue, genset undersized, etc.).

4. The base board is faulty.

   a. If the previous steps do not reveal any problems, replace the base board.

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7 Troubleshooting - PC3.3

7.1 Types of Events/Faults

The PCC generates these types of events/faults.

7.1.1 Shutdown Faults

The PCC generates shutdown faults to prevent damage to the genset. The PCC shuts down the genset immediately.

When the PCC generates a shutdown fault, the shutdown fault becomes active. The PCC initiates a Shutdown Without Cooldown sequence.

Active shutdown faults appear in the Shutdown Faults screen. In addition, the PCC provides these indications as long as there is an active shutdown fault:

- The Shutdown LED on the Operator Panel is on.
- Event 1541 (Common Shutdown) is active.
- Event 1483 (Common Alarm) is active.

You cannot start the genset until you clear the shutdown fault. Follow these steps to clear a shutdown fault.

1. Correct the condition(s) that caused the fault.
2. Make sure the emergency stop buttons are inactive, and change the PCC to Off mode.

NOTE: If Remote Fault Reset Enabled is set to Enable, you can also clear shutdown faults in Auto mode. In this case, change the PCC to Auto mode , and make sure the exercise signal and the remote start signal are inactive. The PCC generates event 2941 (Remote Shutdown Fault Reset Occurrence) when shutdown faults are reset in Auto mode.

3. Activate the fault reset signal.

Faults that have been cleared appear in the Fault History screen.

7.1.1.1 Shutdown with Cooldown Faults

Shutdown with cooldown faults are shutdown faults in which the PCC has time to cool down the genset.

When the PCC generates a shutdown with cooldown fault, the shutdown with cooldown fault becomes active. If the PCC is running in Load Govern paralleling state, it initiates a Manual Stop sequence and starts running the load govern kW ramp unload process. If the PCC is not running in Load Govern paralleling state, it initiates a Controlled Shutdown sequence. When the stop sequence has finished, the PCC generates shutdown fault 1336 (Cooldown Complete).

If a shutdown with cooldown fault is active and the engine speed is greater than zero, warning fault 1132 (Controlled Shutdown) is active. You can assign this event/fault to a configurable output, so that the PCC notifies an external device that is going to shut down the genset.

In other ways, shutdown with cooldown faults are the same as shutdown faults.

7.1.1.2 Critical Shutdown Faults vs. Non-critical Shutdown Faults

The PCC always shuts down the genset when a critical shutdown fault is generated. Non-critical shutdown faults do not prevent the PCC from starting or running the genset when Battle Short mode is active. The PCC also responds to critical shutdown faults and non-critical shutdown faults differently if Delayed Shutdown is set up.

NOTE: This discussion applies to shutdown with cooldown faults as well as shutdown faults.

The table below identifies the critical shutdown faults.

TABLE 9. CRITICAL SHUTDOWN FAULTS

Event/Fault Code	Description
115	Eng Crank Sensor Error
234	Crankshaft Speed High
236	Both Engine Speed Signals Lost
359	Fail To Start
781	CAN Data Link Failure
1245	Engine Shutdown Fault
1247	Unannounced Engine Shutdown
1336	Cooldown Complete
1433	Local Emergency Stop
1434	Remote Emergency Stop
1438	Fail To Crank
1992	Crankshaft Sensor High
2335	AC Voltage Sensing Lost (Excitation Fault)
2914	Genset AC Meter Failed

All other shutdown faults are non-critical shutdown faults. The PCC still provides the usual indications that a shutdown fault has occurred, even if it overrides a non-critical shutdown fault.

7.1.2 Warning Faults

The PCC generates warning faults to warn the operator when unsafe conditions are occurring.

When the PCC generates a warning fault, the warning fault becomes active. However, active warning faults have no effect on genset operation. The genset can start, continue running, and stop as usual.

Active warning faults appear in the Warning Faults screen. In addition, the PCC provides these indications as long as there is an active warning fault:

- The Warning LED on the Operator Panel is on.
- Event 1540 (Common Warning) is active.
- Event 1483 (Common Alarm) is active.

Follow these steps to clear a warning fault.

1. Correct the condition(s) that caused the fault.
2. Activate the fault reset signal.

Faults that have been cleared appear in the Fault History screen.

7.1.2.1 Derate Events

Derate events are warning faults in which the PCC also requests a reduction in the kW output level of the genset.

If a derate event is active, *Derate Request* (This Parameter is not available in the Operator Panel, refer to parameters table) is the percentage of the current kW output level the PCC would like to have removed. Each derate event has this percentage associated with it. If two or more derate events are active at the same time, the PCC considers only the maximum percentage requested by each derate event. The PCC does not add the percentages together. For example, if one derate event requests a 10% reduction and a second derate event requests a 20% reduction, *Derate Request (This Parameter is not available in the Operator Panel, refer to parameters table)* is 20%, not 30%.

The PCC is running in Load Govern paralleling state, the PCC requests that *Genset % Standby Total kW* be no more than 100% - *Derate Request (This Parameter is not available in the Operator Panel, refer to parameters table)*. This becomes a limitation for *Load Govern kW Target*.

If the PCC is not running in Load Govern paralleling state, the PCC generates warning fault 1464 (Load Dump Fault). If *Load Dump/Configurable Output #11 Output Function Pointer* is set to Default, the Load Dump connection is active. The PCC does not do anything else to reduce the kW output level. It is up to external devices to reduce the load.

If *LBNG Genset Enable* is set to Enable, the PCC recognizes derate requests from the engine control module (ECM) only if all of these conditions are met.

- *LBNG Derate Enable* is set to Enable.
- The AUX 101's Derate Authorization connection is active.

7.1.3 Events

The PCC generates events to notify external devices when certain conditions are met. The PCC may send notifications any of these ways:

- Configurable outputs.
- PCCNet devices (For example, events might control a LED or a configurable output on a PCCNet device.)

It is up to the external devices to respond to an event when they are notified about one. Events do not appear in any screen in the Operator Panel.

7.2 Fault Reset Signal

This signal may come from any of these sources:

- PCC Fault Reset connection (typically, the Reset button on the Operator Panel)
- Reset button on the Operator Panel

- Modbus networks
- PC-based service tool, such as InPower

This signal becomes active for one second when any of these sources changes from inactive to active. Then, the signal remains inactive until any of these sources changes from inactive to active again.

7.3 Delayed Shutdown

The PCC provides advance warning of an impending shutdown if all of these conditions are met:

- *Delayed Shutdown Enable* is set to Enable.
- The ECM is set to enable Battle Short mode (Core 2 ECMs only).
- A non-critical shutdown fault occurs, and there are no critical shutdown faults.

When these conditions are met, the PCC generates warning fault 1124 (Delayed Shutdown) and waits *Delayed Shutdown Time Delay* before it initiates the stop sequence.

7.4 Event/Fault List

This table identifies the faults and events the PCC can generate.

NOTE: PCC generator set may not be able to generate some faults or events.

InPower can be used to raise the response/severity of an event or fault. For example, an event can be changed to a warning fault or a warning fault to a shutdown fault. The response/severity of an event or fault (except event/fault 1452 (Genset Breaker Fail to Close)) cannot be set lower than its default value, and the severity cannot be changed of any fault or event with an asterisk (*).

TABLE 10. EVENT/FAULT LIST

Event/Fault Code	Description	Severity
111	Engine Control Module Critical Internal Failure	Shutdown
115	Eng Crank Sensor Error	Shutdown
121	EPS Main Channel Lost Error	Warning
122	Manifold 1 Press High	Warning
123	Manifold 1 Press Low	Warning
124	Manifold 1 Press High	Warning
135	High Oil Rifle 1 Pressure	Warning
136	Oil Inlet Pressure High Error	Warning
137	Oil Inlet Pressure Low Error	Warning
141	Low Oil Rifle 1 Pressure	Warning
142	Oil Overpressure Error	Warning
143	Low Oil Rifle Pressure	Warning
144	High Coolant 1 Temp	Warning

Event/Fault Code	Description	Severity
145	Low Coolant 1 Temp	Warning
146	Pre-High Engine Coolant Temperature	Derate
151	High Coolant Temp	Shutdown
152	Intake Manifold 1 Temp:Vtg Above Normal	Warning
153	High Intake Manf 1 Temp	Warning
154	Low Intake Manf 1 Temp	Warning
155	High Intake Manf 1 Temp	Shutdown
156	Intake Manifold Temp 2 OORH	Warning
157	Intake Manifold Temp 2 OORL	Warning
158	Intake Manifold Temp 2 High	Shutdown
159	Intake Manifold 3 Temp OORH	Warning
161	Intake Manifold 3 Temp OORL	Warning
162	Intake Manifold 3 Temp High	Shutdown
163	Intake Manifold 4 Temp OORH	Warning
164	Intake Manifold 4 Temp OORL	Warning
165	Intake Manifold 4 Temp High	Shutdown
175	Throttle_Driver_Feedback_High_Error	Shutdown w/Cooldown
176	Throttle_Driver_Feedback_Low_Error	Shutdown w/Cooldown
177	Throttle_Actuator_Error	Shutdown w/Cooldown
187	Sensor Supply 2 Low	Warning
189	HT Coolant Temperature Root Cause Unknown	Shutdown w/Cooldown
195	High Coolant 1 Level	Warning
196	Low Coolant 1 Level	Warning
197	Low Coolant Level	Warning
212	High Oil 1 Temperature	Warning
213	Low Oil 1 Temperature	Warning
214	High Oil 1 Temp	Shutdown
219	Eng Oil Level Remote Reservoir: Least Severe Level	Warning
221	Air Pressure Sensor High	Warning
222	Air Pressure Sensor Low	Warning
223	Oil Burn Valve Sol Low	Warning
224	Oil Burn Valve Sol High	Warning
227	Sensor Supply 2 Low	Warning
228	Low Coolant Pressure	Shutdown
229	HT Coolant Pressure Incorrect	Warning
231	High Coolant Pressure	Warning

Event/Fault Code	Description	Severity
232	Low Coolant Pressure	Warning
233	HT Coolant Pressure Moderate Low	Warning
234	Crankshaft Speed High	Shutdown
235	Low Coolant Level	Shutdown
236	Both Engine Speed Signals Lost	Shutdown
238	Sensor Supply 3 Low	Warning
239	Main Supply High	Warning
244	Red Stop Lamp Driver OORL	Warning
245	Fan Control Low	Warning
246	Exhaust Gas Temp Sensor 1 OORH	Warning
247	Exhaust Gas Temp Sensor 1 OORL	Warning
248	Exhaust Gas Temp Sensor 1 High	Warning
253	Oil Level Low Error	Shutdown w/Cooldown
254	FSO_PWM_HIGH_CONTROL_ERROR	Shutdown
255	FSO_PWM_LOW_CONTROL_ERROR	Warning
259	Engine Fuel Shutoff Valve stuck open	Warning
261	High Fuel Temperature	Warning
263	High Fuel 1 Temperature	Warning
265	Low Fuel 1 Temperature	Warning
266	High Fuel Temperature	Shutdown
271	Low Fuel Pump Press	Warning
272	High Fuel Pump Press	Warning
277	Fuel Control Valve Out of Adj	Warning
281	Cylinder Press Imbalance	Warning
284	Eng Speed/Position Sensor :Voltage Below Normal	Warning
285	CAN Mux PGN Rate Err	Warning
286	CAN Mux Calibration Err	Warning
287	CAN Mux Accel Data Err	Warning
295	Key On Air Press Error	Warning
311	ACT1_FF_SHORTED_HS_TO_LS_ERROR	Warning
312	ACT5_SHORTED_HS_TO_LS_ERROR	Warning
313	ACT3_RF_SHORTED_HS_TO_LS_ERROR	Warning
314	ACT6_SHORTED_HS_TO_LS_ERROR	Warning
315	ACT2_FT_SHORTED_HS_TO_LS_ERROR	Warning
319	RTC PWR Intr:Data Erratic Intermittent or Wrong	Warning
321	ACT4_RT_SHORTED_HS_TO_LS_ERROR	Warning
322	Inj 1 Solenoid Low Curr	Warning

Event/Fault Code	Description	Severity
323	Inj 5 Solenoid Low Curr	Warning
324	Inj 3 Solenoid Low Curr	Warning
325	Inj 6 Solenoid Low Curr	Warning
331	Inj 2 Solenoid Low Curr	Warning
332	Inj 4 Solenoid Low Curr	Warning
334	HT Coolant Temperature Incorrect	Warning
341	Engine Control Module data lost	Warning
342	Calibration Code Fail	Shutdown
343	ECM Hardware Failure	Warning
346	Powerdown Data Lost Error	Warning
351	Injector Supply Failure	Warning
352	Sensor Supply 1 Low	Warning
354	Manifold_Absolute_Pressure_1_High_Error	Warning
355	Manifold_Absolute_Pressure_1_Low_Error	Warning
359	Fail To Start	Shutdown
378	Elect Fuel Inj Cntrl Calve Ckt : Curr Below Normal	Warning
379	Elect Fuel Inj Cntrl Valve Ckt : Curr Above Normal	Warning
386	Sensor Supply 1 High	Warning
394	Eng Timing Actuator Driver Ckt: Curr Below Normal	Warning
395	Eng Timing Actuator Driver Ckt : Curr Above Normal	Warning
396	Fuel Cntl Valve Solenoid Driver 2 Sensor Ckt :OC	Warning
397	Fuel Cntl Valve Solenoid Driver 2 - Grounded Ckt	Warning
398	Engine Timing Actuator Driver 2 Circuit : OC	Warning
399	Engine Timing Actuator Driver 2 :Grounded Ckt	Warning
412	J1708 Link Cannot Transmit Error	Event
414	J1708 Link Not Fast Enough Error	Event
415	Low Oil Rifle Press	Shutdown
418	High H2O In Fuel	Warning
419	Intake Manifold Pres Bank Imbalance : Data Erratic	Warning
421	High Oil Temperature	Derate
422	Coolant Level Data Error	Warning
425	Oil Temperature Error	Warning
426	J1939 Datalink: Data Erratic/Intermittent/Wrong	Event
427	CAN Data Link Degraded	Warning
433	Intake Manfld Press Sensor Ckt : Data Erratic	Warning
435	Oil Press Switch Error	Warning
441	Low Battery 1 Voltage	Warning
442	High Battery 1 Voltage	Warning

Event/Fault Code	Description	Severity
449	Inj Metering 1 Press High	Shutdown
451	Inj Metering 1 Press High	Warning
452	Inj Metering 1 Press Low	Warning
453	Gas_Mass_Flow_High_Error	Warning
454	Gas_Mass_Flow_Low_Error	Warning
458	Spark_Timing_B_Error	Shutdown w/Cooldown
459	Spark_Timing_A_Error	Shutdown w/Cooldown
461	Spark_Reference_B_Error	Shutdown w/Cooldown
462	Spark_Reference_A_Error	Shutdown w/Cooldown
463	Exhaust_Gas_Oxygen_High_Error	Warning
464	Exhaust_Gas_Oxygen_Low_Error	Warning
471	Sump Oil Level Warning Error	Warning
477	Isolated Battery Voltage Low Error	Warning
478	Isolated Battery Voltage High Error	Warning
482	Fuel Press Low: Valid But Below Normal: Mod Severe	Warning
488	High Intake Manf 1 Temp	Derate
496	Eng Speed Sensor2 Supply Volt: Rootcause Unknown	Warning
512	Throttle Pos 1 Feedback OOR High	Warning
513	Throttle Pos 1 Feedback OOR Low	Warning
514	FCV_Actuator_Error	Shutdown w/Cooldown
546	Fuel Delivery Press High	Warning
547	Fuel Delivery Press Low	Warning
553	APC Pressure High	Warning
554	APC Pressure Error	Warning
556	Crankcase Press High	Shutdown
557	Fuel Control Valve 2 OORH	Shutdown w/Cooldown
558	Fuel Control Valve 2 OORL	Warning
559	Inj Metering 1 Press Low	Warning
561	Heavy_Knock_Error_1_(A1)	Shutdown w/Cooldown
562	Heavy_Knock_Error_2_(B1)	Shutdown w/Cooldown
563	Heavy_Knock_Error_3_(A2)	Shutdown w/Cooldown
564	Heavy_Knock_Error_4_(B2)	Shutdown w/Cooldown

Event/Fault Code	Description	Severity
565	Heavy_Knock_Error_5_(A3)	Shutdown w/Cooldown
566	Heavy_Knock_Error_6_(B3)	Shutdown w/Cooldown
567	Heavy_Knock_Error_7_(A4)	Shutdown w/Cooldown
568	Heavy_Knock_Error_8_(B4)	Shutdown w/Cooldown
569	Heavy_Knock_Error_9_(A5)	Shutdown w/Cooldown
571	Knock Cyl 1 (A1) OORL	Warning
572	Knock Cyl 2 (B1) OORL	Warning
573	Knock Cyl 3 (A2) OORL	Warning
574	Knock Cyl 4 (B2) OORL	Warning
575	Knock Cyl 5 (A3) OORL	Warning
576	Knock Cyl 6 (B3) OORL	Warning
577	Knock Cyl 7 (A4) OORL	Warning
578	Knock Cyl 8 (B4) OORL	Warning
579	Knock Cyl 9 (A5) OORL	Warning
584	High Side DRV3 High Control Error	Warning
585	High Side DRV3 Low Control Error	Warning
591	Exhaust_Backpressure_High_Error	Warning
592	Exhaust_Backpressure_Low_Error	Warning
595	Turbo 1 Overspeed Warning Error	Warning
611	Engine Hot Shut Down	Warning
618	Turbo 1 Inlet Pressure High	Warning
619	Turbo 2 Inlet Press High	Warning
641	Exhaust Temp 1 (A1) High Serious Error	Shutdown w/Cooldown
642	Exhaust Temp 3 (A2) High Serious Error	Shutdown w/Cooldown
643	Exhaust Temp 5 (A3) High Serious Error	Shutdown w/Cooldown
644	Exhaust Temp 7 (A4) High Serious Error	Shutdown w/Cooldown
645	Exhaust Temp 9 (A5) High Serious Error	Shutdown w/Cooldown
646	Exhaust Temp 11 (A6) High Serious Error	Shutdown w/Cooldown
647	Exhaust Temp 13 (A7) High Serious Error	Shutdown w/Cooldown
648	Exhaust Temp 15 (A8) High Serious Error	Shutdown w/Cooldown

Event/Fault Code	Description	Severity
651	Exhaust Temp 17 (A9) High Serious Error	Shutdown w/Cooldown
652	Exhaust Temp 2 (B1) High Serious Error	Shutdown w/Cooldown
653	Exhaust Temp 4 (B2) High Serious Error	Shutdown w/Cooldown
654	Exhaust Temp 6 (B3) High Serious Error	Shutdown w/Cooldown
655	Exhaust Temp 8 (B4) High Serious Error	Shutdown w/Cooldown
656	Exhaust Temp 10 (B5) High Serious Error	Shutdown w/Cooldown
657	Exhaust Temp 12 (B6) High Serious Error	Shutdown w/Cooldown
658	Exhaust Temp 14 (B7) High Serious Error	Shutdown w/Cooldown
671	Exhaust Gas Temp Cyl 1 (A1) OORL	Warning
672	Exhaust Gas Temp Cyl 3 (A2) OORL	Warning
673	Exhaust Gas Temp Cyl 5 (A3) OORL	Warning
674	Exhaust Gas Temp Cyl 7 (A4) OORL	Warning
675	Exhaust Gas Temp Cyl 9 (A5) OORL	Warning
676	Exhaust Gas Temp Cyl 11 (A6) OORL	Warning
677	Exhaust Gas Temp Cyl 13 (A7) OORL	Warning
678	Exhaust Gas Temp Cyl 15 (A8) OORL	Warning
683	Turbo 2 Speed Moderate High	Warning
684	Turbo 2 Speed Moderate Low	Warning
685	Turbo 2 Speed Incorrect	Warning
686	Turbo 1 Speed Incorrect	Warning
687	Turbo 1 Speed Low	Warning
689	Crankshaft Speed Error	Warning
697	ECM Temperature High	Warning
698	ECM Temperature Low	Warning
721	Exhaust Gas Temp 2 (B1) OORL	Warning
722	Exhaust Gas Temp 4 (B2) OORL	Warning
723	Exhaust Gas Temp 6 (B3) OORL	Warning
724	Exhaust Gas Temp 8 (B4) OORL	Warning
725	Exhaust Gas Temp 10 (B5) OORL	Warning
726	Exhaust Gas Temp 12 (B6) OORL	Warning
727	Exhaust Gas Temp 14 (B7) OORL	Warning
728	Exhaust Gas Temp 16 (B8) OORL	Warning
731	Crankshaft Mech Misalign	Warning

Event/Fault Code	Description	Severity
736	Starter Air Pressure OORL	Warning
737	Starter Air Pressure OORH	Warning
738	Starter Air Press Underpressure Error	Warning
741	Air Filter Restriction Pressure High Error	Warning
742	Air Filter Restriction Pressure Low Error	Warning
751	Gas_Mass_Flow_In_Range_Error	Warning
752	Exhaust_Gas_Oxygen_In_Range_Error	Warning
757	ALL_PERSISTANT_DATA_LOST_ERROR	Warning
778	EPS_Backup_Lost_Sync_Error	Warning
781	CAN Data Link Failure	Shutdown
782	SAE J1939 Data Link 2 Engine Network No Data Received - Condition Exists	Warning
783	Intake Manf 1 Rate Error	Shutdown
831	Spark Plug 1 (A1) OORL	Warning
832	Spark Plug 2 (B1) OORL	Warning
833	Spark Plug 3 (A2) OORL	Warning
834	Spark Plug 4 (B2) OORL	Warning
835	Spark Plug 5 (A3) OORL	Warning
836	Spark Plug 6 (B3) OORL	Warning
837	Spark Plug 7 (A4) OORL	Warning
838	Spark Plug 8 (B4) OORL	Warning
839	Spark Plug 9 (A5) OORL	Warning
841	Spark Plug 10 (B5) OORL	Warning
842	Spark Plug 11 (A6) OORL	Warning
843	Spark Plug 12 (B6) OORL	Warning
844	Spark Plug 13 (A7) OORL	Warning
845	Spark Plug 14 (B7) OORL	Warning
846	Spark Plug 15 (A8) OORL	Warning
847	Spark Plug 16 (B8) OORL	Warning
848	Spark Plug 17 (A9) OORL	Warning
849	Spark Plug 18 (B9) OORL	Warning
891	Spark Plug 1 (A1) Root Cause Unknown	Warning
892	Spark Plug 2 (B1) Root Cause Unknown	Warning
893	Spark Plug 3 (A2) Root Cause Unknown	Warning
894	Spark Plug 4 (B2) Root Cause Unknown	Warning
895	Spark Plug 5 (A3) Root Cause Unknown	Warning
896	Spark Plug 6 (B3) Root Cause Unknown	Warning
897	Spark Plug 7 (A4) Root Cause Unknown	Warning

Event/Fault Code	Description	Severity
898	Spark Plug 8 (B4) Root Cause Unknown	Warning
899	Spark Plug 9 (A5) Root Cause Unknown	Warning
911	Spark Plug 10 (B5) Root Cause Unknown	Warning
912	Spark Plug 11 (A6) Root Cause Unknown	Warning
913	Spark Plug 12 (B6) Root Cause Unknown	Warning
914	Spark Plug 13 (A7) Root Cause Unknown	Warning
915	Spark Plug 14 (B7) Root Cause Unknown	Warning
916	Spark Plug 15 (A8) Root Cause Unknown	Warning
917	Spark Plug 16 (B8) Root Cause Unknown	Warning
918	Spark Plug 17 (A9) Root Cause Unknown	Warning
919	Spark Plug 18 (B9) Root Cause Unknown	Warning
1117	Power Lost With Ignition On	Warning
1121	Fail To Disconnect	Warning
1122	Rated to Idle Delay	Event
1124	Delayed Shutdown	Warning
1131	Battle Short Active	Warning
1132	Controlled Shutdown	Warning
1139	UFD_INJECTOR_1_ERROR	Warning
1141	UFD_INJECTOR_2_ERROR	Warning
1142	UFD_INJECTOR_3_ERROR	Warning
1143	UFD_INJECTOR_4_ERROR	Warning
1144	UFD_INJECTOR_5_ERROR	Warning
1145	UFD_INJECTOR_6_ERROR	Warning
1213	COP_Overboost_Error	Shutdown w/Cooldown
1219	Utility Breaker Tripped	Warning
1223	Utility Frequency	Warning
1224	Genset Overvoltage	Warning
1225	Genset Undervoltage	Warning
1226	Genset Frequency	Warning
1242	DUAL_ACCEL_CONFORMANCE_ERROR	Shutdown
1243	Engine Derated	Derate
1244	Engine Normal Shutdown	Shutdown
1245	Engine Shutdown Fault	Shutdown
1246	Unknown Engine Fault	Warning
1247	Engine Quiet Shutdown	Shutdown
1248	Engine Warning	Warning
1256	Ctrl Mod ID In State Error	Warning

Event/Fault Code	Description	Severity
1257	Ctrl Mod ID In State Fail	Shutdown
1274	Heavy_Knock_Error_10_(B5)	Shutdown w/Cooldown
1275	Knock Cyl 10 (B5) OORL	Warning
1276	Knock Cyl 10 (B5) OORH	Warning
1277	Knock Cyl 11 (A6) OORL	Warning
1278	Knock Cyl 11 (A6) OORH	Warning
1279	Knock 12 (B6) High Warning	Warning
1281	Heavy_Knock_Error_12_(B6)	Shutdown w/Cooldown
1282	Knock Cyl 12 (B6) OORL	Warning
1283	Knock Cyl 12 (B6) OORH	Warning
1284	Knock 13 (A7) High Warning	Warning
1285	Continuous_Light_Knock_Error_13_(A7)	Shutdown w/Cooldown
1286	Heavy_Knock_Error_13_(A7)	Shutdown w/Cooldown
1287	Knock Cyl 13 (A7) OORL	Warning
1288	Knock Cyl 13 (A7) OORH	Warning
1289	Knock 14 (B7) High Warning	Warning
1291	Heavy_Knock_Error_14_(B7)	Shutdown w/Cooldown
1292	Knock Cyl 14 (B7) OORL	Warning
1293	Knock Cyl 14 (B7) OORH	Warning
1294	Knock 15 (A8) High Warning	Warning
1295	Continuous_Light_Knock_Error_15_(A8)	Shutdown w/Cooldown
1296	Heavy_Knock_Error_15_(A8)	Shutdown w/Cooldown
1297	Knock Cyl 15 (A8) OORL	Warning
1298	Knock Cyl 15 (A8) OORH	Warning
1299	Knock 16 (B8) High Warning	Warning
1311	Heavy_Knock_Error_18_(B9)	Shutdown w/Cooldown
1312	Configurable Input #2	Event
1317	Configurable Input #13	Event
1318	Configurable Input #14	Event
1322	kW Load Setpoint OOR High	Warning
1323	kW Load Setpoint OOR Low	Warning
1324	kVAR Load Setpoint OOR High	Warning
1325	kVAR Load Setpoint OOR Low	Warning

Event/Fault Code	Description	Severity
1328	Genset Breaker Tripped	Warning
1336	Cooldown Complete	Shutdown
1338	Knock Cyl 18 (B9) OORL	Warning
1339	Knock Cyl 18 (B9) OORH	Warning
1352	Knock 20 (B10) High Warning	Warning
1353	Continuous_Light_Knock_Error_20_(B10)	Shutdown w/Cooldown
1354	Heavy_Knock_Error_20_(B10)	Shutdown w/Cooldown
1355	Knock Cyl 20 (B10) OORL	Warning
1356	Knock Cyl 20 (B10) OORH	Warning
1357	Oil Remote Level Low	Warning
1362	Oil Filter Restriction Error	Warning
1363	Intake Manf 1 Press Low	Warning
1367	High Prefilter Oil Press	Warning
1368	Low Prefilter Oil Press	Warning
1376	Camshaft Speed Error	Warning
1387	J1939 Eng Commanded Shutdown: Condition Exists	Event
1411	High Out Freq Adjust Pot	Warning
1412	High Droop Adjust Pot	Warning
1416	Fail To Shutdown	Warning
1417	Power Down Failure	Warning
1418	High Gain Adjust Pot	Warning
1427	Overspeed Relay Error	Warning
1428	LOP Relay Error	Warning
1429	HET Relay Error	Warning
1431	Pre-LOP Relay Error	Warning
1432	Pre-HET Relay Error	Warning
1433	Local Emergency Stop	Shutdown
1434	Remote Emergency Stop	Shutdown
1435	Low Coolant Temperature	Warning
1438	Fail To Crank	Shutdown
1439	Low Day Tank Fuel Sw	Warning
1441	Low Fuel Level	Warning
1442	Weak Battery	Warning
1443	Dead Battery	Shutdown
1444	Overload	Warning
1445	Short Circuit	Shutdown
1446	High AC Voltage	Shutdown

Event/Fault Code	Description	Severity
1447	Low AC Voltage	Shutdown
1448	Underfrequency	Shutdown
1449	Overfrequency	Warning
1451	Gen/Bus Voltages Out of Calibration	Warning
1452	Genset Breaker Fail To Close	Warning
1453	Genset Breaker Fail To Open	Warning
1454	Genset Breaker Position Contact	Warning
1455	Utility Breaker Position Contact	Warning
1456	Bus Out Of Synchronizer Range	Warning
1457	Fail To Synchronize	Warning
1458	Sync Phase Rotation Mismatch Overfrequency	Warning
1459	Reverse Power	Shutdown
1461	Loss Of Field (Reverse kVAR)	Shutdown
1463*	Not In Auto	Event
1464*	Load Dump Fault	Warning
1465*	Ready To Load	Event
1469	Speed/Hz Mismatch	Shutdown
1471	Over Current	Warning
1472	Over Current	Shutdown
1474	ECM Software mismatch	Shutdown w/Cooldown
1475	First Start Backup	Warning
1483*	Common Alarm	Event
1517	Failed Module Shutdown	Shutdown
1518	Failed Module Warning	Warning
1519	At Least One Module Has: Least Severe Fault	Warning
1521	Exhaust Gas Temp 3 (A2) OORH	Warning
1522	Exhaust Gas Temp 5 (A3) OORH	Warning
1523	Exhaust Gas Temp 7 (A4) OORH	Warning
1524	Exhaust Gas Temp 9 (A5) OORH	Warning
1525	Exhaust Gas Temp 11 (A6) OORH	Warning
1526	Exhaust Gas Temp 13 (A7) OORH	Warning
1527	Exhaust Gas Temp 15 (A8) OORH	Warning
1528	Exhaust Gas Temp 17 (A9) OORH	Warning
1529	Exhaust Gas Temp 2 (B1) OORH	Warning
1531	Exhaust Gas Temp 6 (B3) OORH	Warning
1532	Exhaust Gas Temp 8 (B4) OORH	Warning
1533	Exhaust Gas Temp 10 (B5) OORH	Warning

Event/Fault Code	Description	Severity
1534	Exhaust Gas Temp 12 (B6) OORH	Warning
1535	Exhaust Gas Temp 14 (B7) OORH	Warning
1536	Exhaust Gas Temp 16 (B8) OORH	Warning
1537	Exhaust Gas Temp 18 (B9) OORH	Warning
1540	Common Warning	Event
1541	Common Shutdown	Event
1545	EPS Backup Channel Lost	Warning
1546	EPS Main Channel Lost	Warning
1548	Inj 7 Solenoid Low Curr	Warning
1549	Inj 8 Solenoid Low Curr	Warning
1551	Inj 10 Solenoid Low Curr	Warning
1552	Inj 11 Solenoid Low Curr	Warning
1553	Inj 12 Solenoid Low Curr	Warning
1554	Inj 13 Solenoid Low Curr	Warning
1555	Inj 14 Solenoid Low Curr	Warning
1556	Inj 15 Solenoid Low Curr	Warning
1557	Inj 16 Solenoid Low Curr	Warning
1572	Continuous_Light_Knock_Error_19_(A10)	Shutdown w/Cooldown
1573	Configurable Input #1	Event
1574	Heavy_Knock_Error_19_(A10)	Shutdown w/Cooldown
1575	Knock Cyl 19 (A10) OORL	Warning
1576	Knock Cyl 19 (A10) OORH	Warning
1579	Continuous_Light_Knock_Error_12_(B6)	Shutdown w/Cooldown
1581	Continuous_Light_Knock_Error_14_(B7)	Shutdown w/Cooldown
1582	Continuous_Light_Knock_Error_16_(B8)	Shutdown w/Cooldown
1583	Heavy_Knock_Error_16_(B8)	Shutdown w/Cooldown
1584	Knock Cyl 16 (B8) OORL	Warning
1585	Knock Cyl 16 (B8) OORH	Warning
1586	Knock 17 (A9) High Warning	Warning
1587	Continuous_Light_Knock_Error_17_(A9)	Shutdown w/Cooldown
1588	Heavy_Knock_Error_17_(A9)	Shutdown w/Cooldown
1589	Knock Cyl 17 (A9) OORL	Warning
1591	Knock Cyl 17 (A9) OORH	Warning

Event/Fault Code	Description	Severity
1592	Knock 18 (B9) High Warning	Warning
1593	Continuous_Light_Knock_Error_18_(B9)	Shutdown w/Cooldown
1594	Knock 19 (A10) High Warning	Warning
1597	ECM Device/Component	Warning
1618	Exhaust Gas Temp, Cyl 1 (A1) OORH	Warning
1619	Exhaust Gas Temp, Cyl 4 (B2) OORH	Warning
1622	Inj 9 Solenoid Low Curr	Warning
1636	Intake Manif Press 2 OORH	Warning
1637	Intake Manif Press 2 OORL	Warning
1689	Real Time Clock Power	Warning
1695	Sensor Supply 5 High	Warning
1696	Sensor Supply 5 Low	Warning
1737	CAN_Throttle_Internal_Failure_Error	Shutdown w/Cooldown
1738	CAN_Throttle_Internal_Fault_Error	Warning
1739	Engine Throttle Control Condition Exists	Warning
1741	CAN_Throttle_High_Temp_Warning_Error	Warning
1742	CAN_Throttle_Temp_Limiting_Error	Warning
1743	Throttle Ctrl 2 OOR High	Shutdown w/Cooldown
1744	Throttle Ctrl 2 OOR Low	Shutdown w/Cooldown
1745	Throttle Ctrl 2 Incorrect	Shutdown w/Cooldown
1746	Throttle Ctrl 2 Out of Adjustment	Shutdown w/Cooldown
1747	Throttle Ctrl 2 Bad Device	Shutdown w/Cooldown
1748	Throttle Ctrl 2 Root Unknown	Warning
1749	Throttle Ctrl 2 Condition Exists	Warning
1751	Throttle Ctrl 2 Warning High	Warning
1752	Throttle Ctrl 2 Moderate High	Warning
1753	Fuel Shutoff 2 OOR High	Warning
1754	Fuel Tmp 2 OOR High	Warning
1755	Fuel Tmp 2 OOR Low	Warning
1756	Gas Flow 2 OOR High	Warning
1757	Gas Flow 2 OOR Low	Warning
1758	Gas Flow 2 Incorrect Data	Warning
1759	FCV 2 Pos Feedback Incorrect	Shutdown w/Cooldown

Event/Fault Code	Description	Severity
1761	FCV_Actuator_Error_1761	Shutdown w/Cooldown
1765	FCV 2 In Pr OOR High	Warning
1766	FCV 2 In Pr OOR Low	Warning
1767	FCV 2 Out Pr OOR High	Warning
1768	FCV 2 Out Pr OOR Low	Warning
1769	E_Shutd Indication OORH	Warning
1771	E_Shutd Indication OORL	Warning
1772	Eng Derate Request OORH	Warning
1773	Eng Derate Request OORL	Warning
1774	Oil Priming Pump OORH	Warning
1775	Oil Priming Pump OORL	Warning
1778	Engine_Heater_Control_Driver_High_Error	Warning
1779	Engine_Heater_Control_Driver_Low_Error	Warning
1781	Shutd Request OOR High	Warning
1782	Shutd Request OOR Low	Warning
1783	Coolant_Pump_Control_Driver_High_Error	Warning
1784	Coolant_Pump_Control_Driver_Low_Error	Warning
1785	Oil_Priming_Pump_Manual_Override_Input_On	Warning
1786	Oil_Priming_Pump_Stuck_On_Error	Warning
1787	Post_Lube_Oil_Priming_Error	Warning
1788	Maintenance_Lube_Oil_Priming_Error	Warning
1789	Pre_Start_Lube_Oil_Priming_Error	Shutdown w/Cooldown
1791	Failure_To_Meet_Load_Speed_Error	Shutdown w/Cooldown
1792	Idle when CB Closed	Warning
1793	Speed/Posit sensor out of Adj	Warning
1794	Fire Detected	Shutdown with Cooldown
1795	Compressor_Bypass_Position_High_Error	Warning
1796	Compressor_Bypass_Position_Low_Error	Warning
1797	Compressor Bypass ctrl OORH	Warning
1798	Compressor Bypass ctrl OORL	Warning
1799	CB_Position_Err_Status	Warning
1811	HIGH_SIDE_DRV2_High_Control_Error (VPS)	Warning
1812	HIGH_SIDE_DRV2_Low_Control_Error (VPS)	Warning
1813	Valve_Proving_System_Test_Failed_Warning_Error	Warning
1814	Valve_Proving_System_Test_Failed_Shutdown_Error	Shutdown w/Cooldown

Event/Fault Code	Description	Severity
1815	RLY14_High_Control_Error	Warning
1816	Oil PreHtr Ctrl OOR Low	Warning
1817	Oil_Pre-Heater_Tripped_Error	Warning
1818	Oil_Pre-Heater_Not_Warming_Error	Warning
1819	Common AC Aux CB tripped	Warning
1821	Min_FSO_Speed_Error	Shutdown w/Cooldown
1822	LT Coolant Level Low Shutdown Error	Shutdown w/Cooldown
1823	LT Coolant Level Low Warning Error	Warning
1824	Idle_Rated_Trans_Oil_Temp_Low_Error	Warning
1825	Dirty_Oil_Level_Error	Warning
1826	ECM Software incompatible	Shutdown w/Cooldown
1827	Fuel_Inlet_Pressure_High_Error	Warning
1828	Fuel_Inlet_Pressure_Low_Error	Warning
1829	Vent_Gas_Valve_Error	Shutdown w/Cooldown
1831	Upstream_FSO_Valve_Error	Shutdown w/Cooldown
1832	Downstream_FSO_Valve_Error	Shutdown w/Cooldown
1833	Engine_Heater_Trip_Error	Warning
1834	Coolant_Pump_Trip_Error	Warning
1835	Oil_Priming_Pump_Tripped_Error	Warning
1836	LCP_(LT)_Low_Serious_Error	Shutdown w/Cooldown
1837	Permanent_FS_Cam_Sync_Lost_Error	Shutdown w/Cooldown
1838	Partial_Engine_Overload_Shutdown_Error	Shutdown w/Cooldown
1839	Fuel_Supply_Pressure_High_Error	Warning
1841	Fuel_Supply_Pressure_Low_Error	Warning
1842	Radiator_Fan_Trip_Error	Warning
1843	Crankcase Press High	Warning
1844	Crankcase Press Low	Warning
1845	H2O In Fuel Sens High	Warning
1846	H2O In Fuel Sens Low	Warning
1847	Eng Coolant Temp - Shutdown w/Cool	Shutdown w/Cooldown
1852	Pre-High H2O In Fuel	Warning
1853	Annunciator Input 1 Fault	Warning

Event/Fault Code	Description	Severity
1854	Annunciator Input 2 Fault	Warning
1855	Annunciator Input 3 Fault	Warning
1858	Exhaust Aft Inlet O2 OOR High	Warning
1859	Exhaust Aft Inlet O2 OOR Low	Warning
1861	Exhaust Aft Inlet O2 Incorrect	Warning
1862	Exhaust Aft Out O2 OOR High	Warning
1863	Exhaust Aft Outlet O2 OOR Low	Warning
1864	Exhaust Aft Outlet O2 Incorrect	Warning
1866	EGR_DP_AUTOZERO_ERROR	Warning
1891	Change Oil	Warning
1893	CAN EGR Valve Comm	Warning
1894	CAN VGT Comm Error	Warning
1895	EGA_DL_MISMATCH_ERROR	Warning
1896	EGR DL Valve Stuck	Warning
1899	Low EGR Dif Pressure	Warning
1911	Inj Metering 1 Press High	Warning
1912	Utility Loss Of Phase	Warning
1913	Genset Loss Of Phase	Warning
1914	Utility Phase Rotation	Warning
1915	Genset Phase Rotation	Warning
1916	Sync Check OK	Event
1917	Fuel Level High	Warning
1918	Fuel Level Low	Shutdown
1933	High EGR Data Link Volt	Warning
1934	Low EGR Data Link Volt	Warning
1935	EGR DL Cmd Source Err	Warning
1942	THD AZ Error	Warning
1943	CBR_DENSITY_DERATE_ERROR_ID	Event
1944	HMI 113 Out Config Error	Warning
1961	High EGR DL EDU Temp	Warning
1974	Crankcase Press High	Warning
1978	Speed Bias OOR High	Warning
1979	Speed Bias OOR Low	Warning
1984	Int Man 2 Tmp Moderate High	Warning
1985	Int Man 3 Tmp Moderate High	Warning
1986	Int Man 4 Tmp Moderate High	Warning
1992	Crankshaft Sensor High	Shutdown
1999	Maximum Parallel Time	Warning

Event/Fault Code	Description	Severity
2111	Coolant_Inlet_Temperature_(LT)_High_Error	Warning
2112	Coolant_Inlet_Temperature_(LT)_Low_Error	Warning
2113	CIT_(LT)_High_Warning_Error	Warning
2114	CIT_(LT)_High_Serious_Error	Shutdown w/Cooldown
2115	LT_Coolant_Pressure_High_Error	Warning
2116	LT_Coolant_Pressure_Low_Error	Warning
2117	LCP_(LT)_Low_Warning_Error	Warning
2121	Exhaust_Temp_1_(A1)_High_Warning_Error	Warning
2122	Exhaust_Temp_3_(A2)_High_Warning_Error	Warning
2123	Exhaust_Temp_5_(A3)_High_Warning_Error	Warning
2124	Exhaust_Temp_7_(A4)_High_Warning_Error	Warning
2125	Exhaust_Temp_9_(A5)_High_Warning_Error	Warning
2126	Exhaust_Temp_11_(A6)_High_Warning_Error	Warning
2127	Exhaust_Temp_13_(A7)_High_Warning_Error	Warning
2128	Exhaust_Temp_15_(A8)_High_Warning_Error	Warning
2129	Exhaust_Temp_17_(A9)_High_Warning_Error	Warning
2131	Exhaust_Temp_2_(B1)_High_Warning_Error	Warning
2132	Exhaust_Temp_4_(B2)_High_Warning_Error	Warning
2133	Exhaust_Temp_6_(B3)_High_Warning_Error	Warning
2134	Exhaust_Temp_8_(B4)_High_Warning_Error	Warning
2135	Exhaust_Temp_10_(B5)_High_Warning_Error	Warning
2136	Exhaust_Temp_12_(B6)_High_Warning_Error	Warning
2137	Exhaust_Temp_14_(B7)_High_Warning_Error	Warning
2138	Exhaust_Temp_16_(B8)_High_Warning_Error	Warning
2139	Exhaust_Temp_18_(B9)_High_Warning_Error	Warning
2141	Start_Air_Pressure_High_Error	Warning
2142	Start_Air_Pressure_Low_Error	Warning
2143	SAP_Overpressure_Error	Warning
2144	Exhaust Temp 16 (B8) High Serious Error	Shutdown w/Cooldown
2145	Exhaust Temp 18 (B9) High Serious Error	Shutdown w/Cooldown
2146	EGT 17 (A9) OOR Low	Warning
2147	EGT 18 (B9) OOR Low	Warning
2154	Oil_Filter_Outlet_Pressure_High_Error	Warning
2155	Oil_Filter_Outlet_Pressure_Low_Error	Warning
2157	Int Man 2 Tmp Abnormal Rate	Shutdown w/Cooldown

Event/Fault Code	Description	Severity
2158	Int Man 3 Tmp Abnormal Rate	Shutdown w/Cooldown
2159	Int Man 4 Tmp Abnormal Rate	Shutdown w/Cooldown
2185	Sensor Supply 4 High	Warning
2186	Sensor Supply 4 Low	Warning
2188	Exhaust O2 OOR High	Warning
2191	ST_Throttle_Press_Err_Status	Warning
2192	Exhaust O2 OOR Low	Warning
2193	HT Coolant Level Moderate High	Warning
2215	Fuel Pump Press Low	Warning
2217	RAM_Image_Word_Error	Warning
2219	Exhaust O2 Moderate High	Warning
2221	Exhaust O2 Moderate Low	Warning
2231	Knock Cyl 1 (A1) OORH	Warning
2232	Knock Cyl 2 (B1) OORH	Warning
2233	Knock Cyl 3 (A2) OORH	Warning
2234	Knock Cyl 4 (B2) OORH	Warning
2235	Knock Cyl 5 (A3) OORH	Warning
2236	Knock Cyl 6 (B3) OORH	Warning
2237	Knock Cyl 7 (A4) OORH	Warning
2238	Knock Cyl 8 (B4) OORH	Warning
2239	Knock Cyl 9 (A5) OORH	Warning
2249	APC 2 Press Low	Warning
2261	Fuel Pump Press High	Warning
2262	Fuel Pump Press Low	Warning
2265	High Fuel Lift Pump Volt	Warning
2266	Low Fuel Lift Pump Volt	Warning
2272	EGR_DL_POS_SENSOR_ERROR	Warning
2273	EGR_DELTA_P_OOR_HIGH_ERROR	Warning
2274	EGR_DELTA_P_OOR_LOW_ERROR	Warning
2279	Knock 11 (A6) High Warning	Warning
2281	Knock 11 (A6) Moderate High	Shutdown w/Cooldown
2282	Knock 11 (A6) Critical High	Shutdown w/Cooldown
2292	APC Flow High	Warning
2293	APC Flow Low	Warning
2298	Fuel Shutoff 2 OOR Low	Warning
2311	EFI Control Valve Fail	Warning

Event/Fault Code	Description	Severity
2313	Fuel Control Valve Error	Warning
2315	Red Lamp OOR High	Warning
2316	Amber Lamp OOR High	Warning
2317	Amber Lamp OOR Low	Warning
2322	Engine Camshaft Speed/Pos None Fault	Event
2328	Utility Available	Event
2331	Utility Undervoltage	Warning
2332	Utility Connected	Event
2333	Genset Connected	Event
2335	AC Voltage Sensing Lost (Excitation Fault)	Shutdown
2336	Bad Checksum	Shutdown
2342	Too Long In Idle	Warning
2346	CBR_TFC_DERATE_ERROR_ID	Event
2349	EGR_DL_MOTOR_OPEN_ERROR	Warning
2351	EGR_DL_MOTOR_SHORT_ERROR	Warning
2357	EGR_DL_MOTOR_LOCK_ERROR	Warning
2358	Utility Overvoltage	Warning
2359	EGR_DELTA_P_IR_HIGH_ERROR	Warning
2375	EGR_ORIFICE_TMPTR_OOR_HIGH_ERROR	Warning
2376	EGR_ORIFICE_TMPTR_OOR_LOW_ERROR	Warning
2377	High Fan Control Voltage	Warning
2396	Utility Breaker Fail To Close	Warning
2397	Utility Breaker Fail To Open	Warning
2427	Fuel_Outlet_Pressure_High_Error	Warning
2428	Fuel_Outlet_Pressure_Low_Error	Warning
2431	Knock 1 (A1) High Warning	Warning
2432	Knock 2 (B1) High Warning	Warning
2433	Knock 3 (A2) High Warning	Warning
2434	Knock 4 (B2) High Warning	Warning
2435	Knock 5 (A3) High Warning	Warning
2436	Knock 6 (B3) High Warning	Warning
2437	Knock 7 (A4) High Warning	Warning
2438	Knock 8 (B4) High Warning	Warning
2439	Knock 9 (A5) High Warning	Warning
2441	Knock 10 (B5) High Warning	Warning
2448	COOLANT_LEVEL_MODERATELY_LOW	Warning
2453	Total Real Power Circuit OORH	Warning
2454	Total Real Power Circuit OORL	Warning

Event/Fault Code	Description	Severity
2455	Speed_Bias_Low_Error	Warning
2456	Speed_Bias_High_Error	Warning
2457	Max_Total_Misfire_Error	Shutdown w/Cooldown
2458	Cylinder_2_(B1)_Total_Misfire_Error	Warning
2459	Cylinder_4_(B2)_Total_Misfire_Error	Warning
2461	Cylinder_6_(B3)_Total_Misfire_Error	Warning
2462	Cylinder_8_(B4)_Total_Misfire_Error	Warning
2463	Cylinder_10_(B5)_Total_Misfire_Error	Warning
2464	Cylinder_12_(B6)_Total_Misfire_Error	Warning
2465	Cylinder_14_(B7)_Total_Misfire_Error	Warning
2466	Cylinder_16_(B8)_Total_Misfire_Error	Warning
2467	Cylinder_18_(B9)_Total_Misfire_Error	Warning
2469	Cylinder_1_(A1)_Total_Misfire_Error	Warning
2471	Cylinder_3_(A2)_Total_Misfire_Error	Warning
2472	Cylinder_5_(A3)_Total_Misfire_Error	Warning
2473	Cylinder_7_(A4)_Total_Misfire_Error	Warning
2475	Cylinder_9_(A5)_Total_Misfire_Error	Warning
2476	Cylinder_11_(A6)_Total_Misfire_Error	Warning
2477	Cylinder_13_(A7)_Total_Misfire_Error	Warning
2478	Cylinder_15_(A8)_Total_Misfire_Error	Warning
2479	Cylinder_17_(A9)_Total_Misfire_Error	Warning
2482	Start_Before_Ready_Error	Shutdown w/Cooldown
2483	Continuous_Starter_Failure_Error	Shutdown w/Cooldown
2484	Exhaust Temperature 1 (A1) Abnormal Rate	Shutdown w/Cooldown
2485	Exhaust Temperature 3 (A2) Abnormal Rate	Shutdown w/Cooldown
2486	Exhaust Temperature 5 (A3) Abnormal Rate	Shutdown w/Cooldown
2487	Exhaust Temperature 7 (A4) Abnormal Rate	Shutdown w/Cooldown
2488	Exhaust Temperature 9 (A5) Abnormal Rate	Shutdown w/Cooldown
2489	Exhaust Temperature 11 (A6) Abnormal Rate	Shutdown w/Cooldown
2491	Exhaust Temperature 13 (A7) Abnormal Rate	Shutdown w/Cooldown
2492	Exhaust Temperature 15 (A8) Abnormal Rate	Shutdown w/Cooldown

Event/Fault Code	Description	Severity
2493	Exhaust Temperature 17 (A9) Abnormal Rate	Shutdown w/Cooldown
2494	Exhaust Temperature 2 (B1) Abnormal Rate	Shutdown w/Cooldown
2495	Exhaust Temperature 4 (B2) Abnormal Rate	Shutdown w/Cooldown
2496	Exhaust Temperature 6 (B3) Abnormal Rate	Shutdown w/Cooldown
2497	Exhaust Temperature 8 (B4) Abnormal Rate	Shutdown w/Cooldown
2498	Exhaust Temperature 10 (B5) Abnormal Rate	Shutdown w/Cooldown
2499	Exhaust Temperature 12 (B6) Abnormal Rate	Shutdown w/Cooldown
2511	Exhaust Temperature 14 (B7) Abnormal Rate	Shutdown w/Cooldown
2512	Exhaust Temperature 16 (B8) Abnormal Rate	Shutdown w/Cooldown
2513	Exhaust Temperature 18 (B9) Abnormal Rate	Shutdown w/Cooldown
2514	Exhaust Temperature 19 (A10) Abnormal Rate	Shutdown w/Cooldown
2515	Exhaust Temperature 20 (B10) Abnormal Rate	Shutdown w/Cooldown
2517	Compressor_Outlet_Pressure_High_Error	Warning
2518	Compressor_Outlet_Pressure_Low_Error	Warning
2521	Bank_Id_Error	Shutdown w/Cooldown
2522	Continuous_Light_Knock_Error_1_(A1)	Shutdown w/Cooldown
2523	Continuous_Light_Knock_Error_2_(B1)	Shutdown w/Cooldown
2524	Continuous_Light_Knock_Error_3_(A2)	Shutdown w/Cooldown
2525	Continuous_Light_Knock_Error_4_(B2)	Shutdown w/Cooldown
2526	Continuous_Light_Knock_Error_5_(A3)	Shutdown w/Cooldown
2527	Continuous_Light_Knock_Error_6_(B3)	Shutdown w/Cooldown
2528	Continuous_Light_Knock_Error_7_(A4)	Shutdown w/Cooldown
2529	Continuous_Light_Knock_Error_8_(B4)	Shutdown w/Cooldown
2531	Continuous_Light_Knock_Error_9_(A5)	Shutdown w/Cooldown
2532	Continuous_Light_Knock_Error_10_(B5)	Shutdown w/Cooldown

Event/Fault Code	Description	Severity
2539	High Voltage Bias	Warning
2541	Low Voltage Bias	Warning
2544	ECM_Overtemp_Error	Shutdown w/Cooldown
2545	Keysw Reset Required	Warning
2553	Engine Oil Level Low Warning Error	Warning
2555	Low GHC 1 Voltage	Warning
2556	High GHC 1 Voltage	Warning
2567	DG_Air_Compressor_Trip_Error	Warning
2568	Gas Supply Pressure Critical High	Shutdown w/Cooldown
2569	Gas Supply Pressure Critical Low	Shutdown w/Cooldown
2586	Spark Plug 1 (A1) High Warning	Event
2587	Spark Plug 2 (B1) High Warning	Event
2588	Spark Plug 3 (A2) High Warning	Event
2589	Spark Plug 4 (B2) High Warning	Event
2591	Spark Plug 5 (A3) High Warning	Event
2592	Spark Plug 6 (B3) High Warning	Event
2593	Spark Plug 1 (A1) Low Warning	Event
2594	Spark Plug 2 (B1) Low Warning	Event
2595	Spark Plug 3 (A2) Low Warning	Event
2596	Spark Plug 4 (B2) Low Warning	Event
2597	Spark Plug 5 (A3) Low Warning	Event
2598	Spark Plug 6 (B3) Low Warning	Event
2619	Aux101 0 Input 1 Fault	Warning
2621	Aux101 0 Input 2 Fault	Warning
2622	Aux101 0 Input 3 Fault	Warning
2623	Aux101 0 Input 4 Fault	Warning
2624	Aux101 0 Input 5 Fault	Warning
2625	Aux101 0 Input 6 Fault	Warning
2626	Aux101 0 Input 7 Fault	Warning
2627	Aux101 0 Input 8 Fault	Warning
2628	Aux102 0 Expansion Input 9 Fault	Warning
2629	Aux102 0 Expansion Input 10 Fault	Warning
2631	Aux102 0 Expansion Input 11 Fault	Warning
2632	Aux102 0 Expansion Input 12 Fault	Warning
2643	Throttle Pos 2 Feedback OOR High	Warning
2644	Throttle Pos 2 Feedback OOR Low	Warning

Event/Fault Code	Description	Severity
2646	HT Coolant Temperature Condition Exists	Warning
2653	Exhaust St 2 Temp High	Warning
2657	Exhaust St 1 Temp High	Warning
2661	At Least One Unacknowledged Most Severe Fault - Condition Exists	Shutdown
2662	At Least One Ack : Most severe Fault	Warning
2678	Charging Alternator Fail	Warning
2724	Gas Supply Pr Moderate High	Warning
2725	Gas Supply Pr Moderate Low	Warning
2727	CRITICAL_CEN_NOT_ACCESSIBLE_ERROR	Warning
2737	Exh Gas Tmp Critical High	Shutdown w/Cooldown
2738	ETHER_INJ_LOW_CTRL_ERROR	Warning
2739	ETHER_INJ_HIGH_CTRL_ERROR	Warning
2752	Throttle Actuator - Shorted High	Shutdown w/Cooldown
2766	Bank_A_CCD_Failed_Error	Shutdown w/Cooldown
2767	Bank_B_CCD_Failed_Error	Shutdown w/Cooldown
2768	CAN Parent Communication Incorrect	Shutdown w/Cooldown
2769	CAN Child Com Incorrect	Shutdown w/Cooldown
2774	EGR_DP_CLOGGED_TUBES_ERROR	Warning
2779	Utility Unloaded Event	Event
2789	COT_Low_Error	Warning
2793	COT_Low_Serious_Error	Shutdown w/Cooldown
2794	Ign Shutd Relay OOR High	Warning
2795	Ign Shutd Relay OOR Low	Warning
2796	Partial_Engine_Overload_Warning_Error	Warning
2797	Inlet Gas Diff Pressure OOR High	Warning
2798	Inlet Gas Diff Pressure OOR Low	Warning
2799	IMOP_Compressor_Outlet_Presure_Delta_Error	Shutdown w/Cooldown
2811	IMOP_Compressor_Outlet_Pressure_Maximum_Error	Shutdown w/Cooldown
2812	Throttle Control Actuator Error	Shutdown w/Cooldown
2814	Genset CT Ratio Low	Shutdown
2815	Genset CT Ratio High	Warning
2816	Genset PT Ratio Low	Shutdown

Event/Fault Code	Description	Severity
2817	Genset PT Ratio High	Warning
2818	Genset Bus PT Ratio Too Small	Shutdown
2819	Genset Bus PT Ratio Too Large	Warning
2821	Utility PT Ratio Too Small	Shutdown
2822	Utility PT Ratio Too Large	Warning
2837	Exhaust_Temp_1_(A1)_Deviation_Error	Warning
2838	Exhaust_Temp_3_(A2)_Deviation_Error	Warning
2839	Exhaust_Temp_5_(A3)_Deviation_Error	Warning
2841	Exhaust_Temp_7_(A4)_Deviation_Error	Warning
2842	Exhaust_Temp_9_(A5)_Deviation_Error	Warning
2843	Exhaust_Temp_11_(A6)_Deviation_Error	Warning
2844	Exhaust_Temp_13_(A7)_Deviation_Error	Warning
2845	Exhaust_Temp_15_(A8)_Deviation_Error	Warning
2846	Exhaust_Temp_17_(A9)_Deviation_Error	Warning
2847	Exhaust_Temp_2_(B1)_Deviation_Error	Warning
2848	Exhaust_Temp_4_(B2)_Deviation_Error	Warning
2849	Exhaust_Temp_6_(B3)_Deviation_Error	Warning
2851	Exhaust_Temp_8_(B4)_Deviation_Error	Warning
2852	Exhaust_Temp_10_(B5)_Deviation_Error	Warning
2853	Exhaust_Temp_12_(B6)_Deviation_Error	Warning
2854	Exhaust_Temp_14_(B7)_Deviation_Error	Warning
2855	Exhaust_Temp_16_(B8)_Deviation_Error	Warning
2856	Exhaust_Temp_18_(B9)_Deviation_Error	Warning
2857	Turbo_1_Overspeed_Critical_Error	Shutdown w/Cooldown
2858	Turbo_2_Overspeed_Critical_Error	Shutdown w/Cooldown
2859	Alt Heater Ctrl OOR High	Warning
2861	Alt Heater Ctrl OOR Low	Warning
2862	Gen Alternator 1st Start Cond Exists	Warning
2863	Genset to Engine Com Incorrect	Shutdown w/Cooldown
2864	FSO_NON_High_Control_Error	Shutdown w/Cooldown
2866	FCV_Position_High_Error	Warning
2867	FCV_Position_Low_Error	Warning
2868	Engine_Heater_Over-Temperature_Alarm_Error	Warning
2869	HT Cool Temp Driver OOR High	Warning
2871	HT Cool Temp Driver OOR Low	Warning
2872	HT Cool Temp Driver Cond Exists	Warning

Event/Fault Code	Description	Severity
2873	LT Cool Temp Driver OOR High	Warning
2874	LT Cool Temp Driver OOR Low	Warning
2875	LT Cool Temp Driver Cond Exists	Warning
2876	WarninjgComp_Surge_Shutdown_Error	Shutdown w/Cooldown
2877	Comp_Surge_Derate_Error	Warning
2882	Aux101 1 Input 1 Fault	Warning
2883	Aux101 1 Input 2 Fault	Warning
2884	Aux101 1 Input 3 Fault	Warning
2885	Aux101 1 Input 4 Fault	Warning
2886	Aux101 1 Input 5 Fault	Warning
2887	Aux101 1 Input 6 Fault	Warning
2888	Aux101 1 Input 7 Fault	Warning
2889	Aux101 1 Input 8 Fault	Warning
2891	Aux102 1 Expansion Input 9 Fault	Warning
2892	Aux102 1 Expansion Input 10 Fault	Warning
2893	Aux102 1 Expansion Input 11 Fault	Warning
2894	Aux102 1 Expansion Input 12 Fault	Warning
2895	PCCnet Device Failed	Warning
2896	Critical PCCnet Dev Fail	Shutdown
2914	Genset AC Meter Failed	Shutdown
2915	Genset Bus AC Meter Failed	Warning
2916	Utility AC Meter Failed	Warning
2917	High Genset Bus Voltage	Warning
2918	Utility Voltage OOR Warning	Warning
2919	Utility Current OOR Warning	Warning
2921	High Genset Bus Current	Warning
2922	High Genset Neutral Curr	Warning
2923	High Genset Bus kW	Warning
2924	High Genset Bus kVAR	Warning
2925	High Genset Bus kVA	Warning
2926	Utility kW OOR Warning	Warning
2927	Utility kVAR OOR Warning	Warning
2928	Utility kVA OOR Warning	Warning
2931	AUX101 Device ID Fault	Shutdown
2932	AUX101 Oil Temp OOR High	Warning
2933	AUX101 Oil Temp OOR Low	Warning
2934	High Ambient Temp	Warning

Event/Fault Code	Description	Severity
2935	Low Ambient Temp	Warning
2936	Fuel Level High	Warning
2937	Fuel Level Low	Warning
2938	Earth/Ground Fault	Warning
2939	MODBUS Failure	Warning
2941	Remote Shutdown Fault Reset Occurrence	Event
2942	Shutdown Override Fail	Warning
2943	Manual Sw Config Fail	Warning
2944	Auto Switch Config Fail	Warning
2945	Rupture Basin Switch	Warning
2946	Exhaust St 2 Temp Low	Warning
2947	Exhaust St 1 Temp Low	Warning
2948	Exhaust St 2 Temp High	Warning
2949	Exhaust St 1 Temp High	Warning
2951	Alternator 1 Temp High	Warning
2952	Alternator 1 Temp Low	Warning
2953	Alternator 1 Temp High	Warning
2954	Alternator 2 Temp High	Warning
2955	Alternator 2 Temp Low	Warning
2956	Alternator 2 Temp High	Warning
2957	Alternator 3 Temp High	Warning
2958	Alternator 3 Temp Low	Warning
2959	Alternator 3 Temp High	Warning
2961	EGR_TORQUE_DERATE_ERROR	Event
2962	EGR_RPM_DERATE_ERROR	Warning
2963	HT Coolant Temperature Warning High	Event
2965	Genset Available	Event
2971	Test/Exercise Fault	Warning
2972	Field Overload	Shutdown
2973	Charge Press IR Error	Warning
2977	Low Coolant Level 2 Sw	Warning
2978	Low Intake Manf 1 Temp	Warning
2979	High Alternator Temp Sw	Warning
2981	High Drive Bearing Temp	Warning
2982	Low Drive Bearing Temp	Warning
2983	High Drive Bearing Temp	Warning
2984	High Free Bearing Temp	Warning
2985	Low Free Bearing Temp	Warning

Event/Fault Code	Description	Severity
2986	High Free Bearing Temp	Warning
2992	High Intake Manf 1 Temp	Warning
2993	Battery Charger Sw Fail	Warning
2994	MC68302_Error	Warning
2995	Int Man Pressure 1 Critical High	Shutdown w/Cooldown
2996	Int Man Pressure 1 Moderate High	Warning
2997	Exhaust O2 Critical Low	Shutdown w/Cooldown
3111	Excessive_Mech_Vibration_1_(A1)	Shutdown w/Cooldown
3112	Excessive_Mech_Vibration_2_(B1)	Shutdown w/Cooldown
3113	Excessive_Mech_Vibration_3_(A2)	Shutdown w/Cooldown
3114	Excessive_Mech_Vibration_4_(B2)	Shutdown w/Cooldown
3115	Excessive_Mech_Vibration_5_(A3)	Shutdown w/Cooldown
3116	Excessive_Mech_Vibration_6_(B3)	Shutdown w/Cooldown
3117	Excessive_Mech_Vibration_7_(A4)	Shutdown w/Cooldown
3118	Excessive_Mech_Vibration_8_(B4)	Shutdown w/Cooldown
3119	Excessive_Mech_Vibration_9_(A5)	Shutdown w/Cooldown
3121	Excessive_Mech_Vibration_10_(B5)	Shutdown w/Cooldown
3122	Excessive_Mech_Vibration_11_(A6)	Shutdown w/Cooldown
3123	Excessive_Mech_Vibration_12_(B6)	Shutdown w/Cooldown
3124	Excessive_Mech_Vibration_13_(A7)	Shutdown w/Cooldown
3125	Excessive_Mech_Vibration_14_(B7)	Shutdown w/Cooldown
3126	Excessive_Mech_Vibration_15_(A8)	Shutdown w/Cooldown
3127	Excessive_Mech_Vibration_16_(B8)	Shutdown w/Cooldown
3128	Excessive_Mech_Vibration_17_(A9)	Shutdown w/Cooldown
3129	Excessive_Mech_Vibration_18_(B9)	Shutdown w/Cooldown
3131	Secondary Engine Overspeed	Shutdown

Event/Fault Code	Description	Severity
3226	Base Load	Event
3227	Peak Shave	Event
3262	Spark Plug 7 (A4) High Warning	Event
3263	Spark Plug 7 (A4) Low Warning	Event
3264	Spark Plug 8 (B4) High Warning	Event
3265	Spark Plug 8 (B4) Low Warning	Event
3266	Spark Plug 9 (A5) High Warning	Event
3267	Spark Plug 9 (A5) Low Warning	Event
3268	Spark Plug 10 (B5) High Warning	Event
3269	Spark Plug 10 (B5) Low Warning	Event
3271	Spark Plug 11 (A6) High Warning	Event
3272	Spark Plug 11 (A6) Low Warning	Event
3273	Spark Plug 12 (B6) High Warning	Event
3274	Spark Plug 12 (B6) Low Warning	Event
3275	Spark Plug 13 (A7) High Warning	Event
3276	Spark Plug 13 (A7) Low Warning	Event
3277	Spark Plug 14 (B7) High Warning	Event
3278	Spark Plug 14 (B7) Low Warning	Event
3279	Spark Plug 15 (A8) High Warning	Event
3281	Spark Plug 15 (A8) Low Warning	Event
3282	Spark Plug 16 (B8) High Warning	Event
3283	Spark Plug 16 (B8) Low Warning	Event
3284	Spark Plug 17 (A9) High Warning	Event
3285	Spark Plug 17 (A9) Low Warning	Event
3286	Spark Plug 18 (B9) High Warning	Event
3287	Spark Plug 18 (B9) Low Warning	Event
3288	Exhaust Aft Outlet Oxygen Relay OORH	Warning
3289	Exhaust Aft Outlet Oxygen Relay OORL	Warning
3291	Exhaust Aft Inlet Oxygen Relay OORH	Warning
3292	Exhaust Aft Inlet Oxygen Relay OORL	Warning
3293	Exhaust Oxygen Relay OORH	Warning
3294	Exhaust Oxygen Relay OORL	Warning
3362	Power Conservation Control OORH	Warning
3363	Power Conservation Control OORL	Warning
3364	Power Conservation Control Cond Exists	Warning
3365	External Air Pressure Low Warning Error	Warning
3384	Manifold_Absolute_Pressure_2_High_Error	Warning
3391	Manifold_Absolute_Pressure_2_Low_Error	Warning

Event/Fault Code	Description	Severity
3392	Int Man Pressure 2 Critical High	Shutdown w/Cooldown
3393	Int Man Pressure 2 Moderate High	Warning
3397	Low Gearbox Oil Pressure - Condition Exists	Shutdown
3398	High Gearbox Oil Pressure - Condition Exists	Shutdown
3399	Differential Fault - Condition Exists	Shutdown
3411	DC Power Supply Fault - Condition Exists	Warning
3412	GIB Isolator Open Fault - Condition Exists	Warning
3413	Radiator Fan Trip Fault - Condition Exists	Warning
3414	Ventilator Fan Trip Fault - Condition Exists	Warning
3415	Louvres Closed Fault - Condition Exists	Warning
3416	Start System Fault - Condition Exists	Warning
3417	Alternator Heater Trip Fault - Condition Exists	Warning
3457	Loss of Bus Voltage Sensing	Warning
3458	Knock Engine Derate	Warning
3475	Engine Electronic Fuel Valve #2 OORH	Warning
3476	Engine Electronic Fuel Valve #2 OORL	Warning
3479	Start - Inhibit Warning Fault Event	Warning
3481	Start - Inhibit Warning Fault Event	Warning
3482	Off Load Running Fault	Shutdown
3483	High Alternator Temperature 1 Shutdown Fault	Shutdown
3484	High Alternator Temperature 2 Shutdown Fault	Shutdown
3485	High Alternator Temperature 3 Shutdown Fault	Shutdown
3486	High Drive End Bearing Temperature Shutdown Fault	Shutdown
3487	High Non-Drive End Bearing Temp Shutdown Fault	Shutdown
3489	Compressor Bypass Actuator Error	Warning
3491	Oil Filter Restriction High	Shutdown w/Cooldown
3499	Throttle Actuator 2 - Special Instruction	Shutdown w/Cooldown
3511	Throttle Actuator 2 - Shorted High	Shutdown w/Cooldown
3512	Throttle Actuator 2 - Shorted Low	Shutdown w/Cooldown
3513	Negative Sequence Overcurrent	Warning
3514	Throttle Actuator - Shorted Low	Shutdown w/Cooldown
3515	Throttle Actuator - Special Instruction	Shutdown w/Cooldown
3521	Throttle Actuator - Temperature Low	Warning
3522	Throttle Actuator 2 - Temp Low	Warning

Event/Fault Code	Description	Severity
3599	Ground Current OOR Warning	Warning
3611	Custom Overcurrent Fault	Warning
3629	Device Calibration Update Recommended	Warning
3631	Device Calibration Update Required	Shutdown
4872	System Network Failure	Warning
4873	Genset Failed to Come Online	Warning
4874	Load Demand SW Version Incompatibility	Warning
4875	Genset Ineligible for Load Demand	Warning
4876	Genset Lost on System Network	Warning
4877	System Settings not Synchronized	Warning
4878	Check System Network Installation	Warning
4879	Load Demand Setup Error	Warning
4881	System Genset ID Conflict	Warning
4882	Genset Bus Overload	Warning
5145	Load Demand Genset Bus Failure	Warning
9945	Injector_6_Circuit_2_Error	Warning
9946	Injector_5_Circuit_2_Error	Warning
9947	Injector_4_Circuit_2_Error	Warning
9948	Injector_3_Circuit_2_Error	Warning
9949	Injector_2_Circuit_2_Error	Warning
9951	Injector_1_Circuit_2_Error	Warning
9971	ECM Derate Fault	Event
9973	Watchdog Reset Occurence	Event

7.5 CT Ratio Calculator

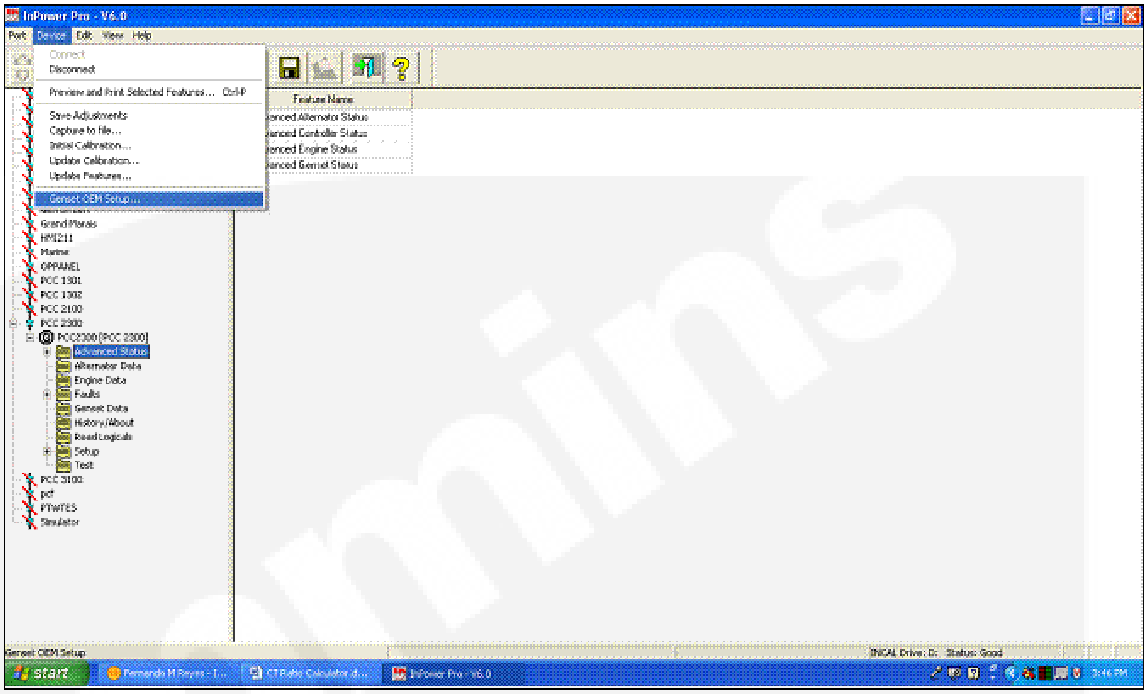
InPower has a built-in CT ratio calculator which allow you to determine the required CT size and CT ratio.

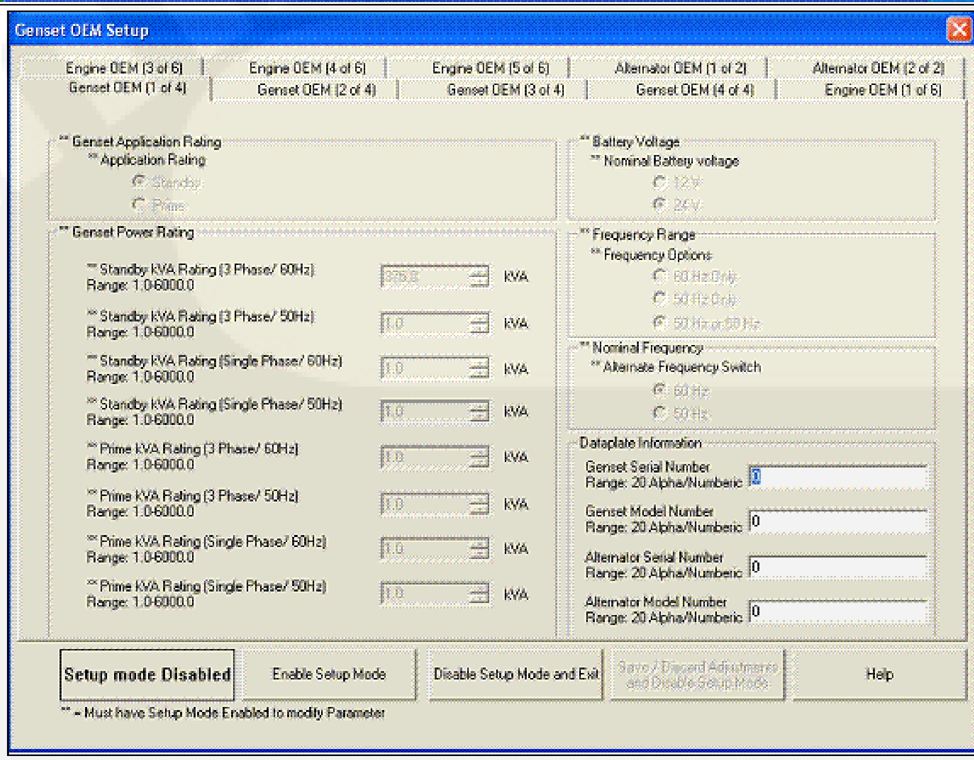
The following genset information is required to calculate the CT ratio:

- Genset power ratings
- Frequency range
- Nominal frequency
- Nominal voltage Limits
- Secondary CT ratio value

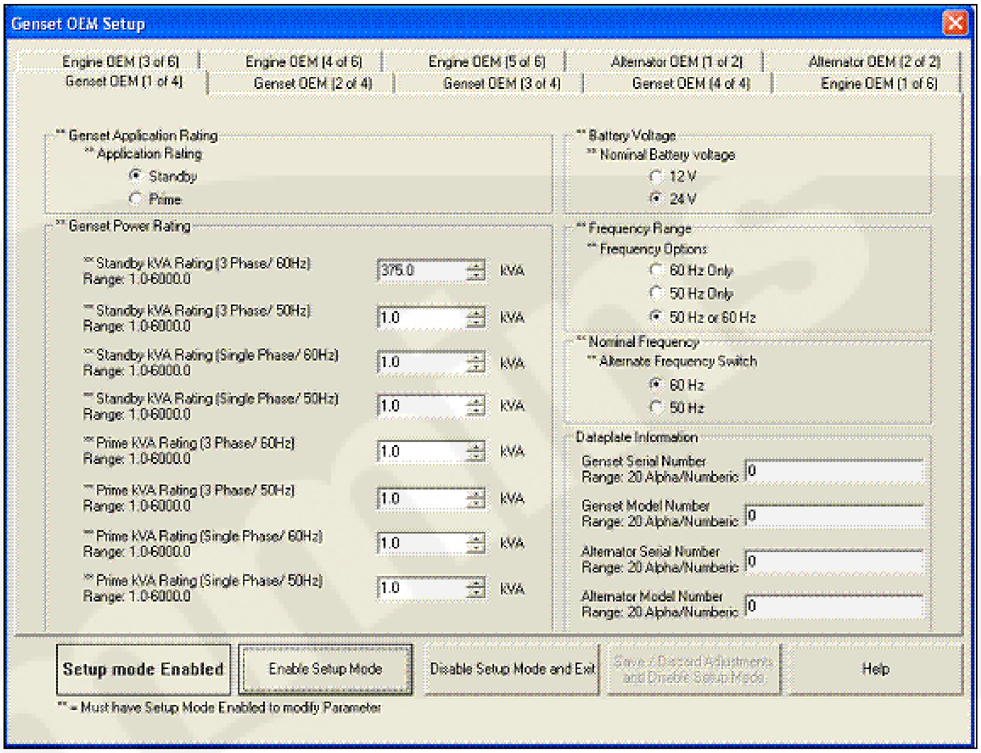
Follow these steps to use the CT ratio calculator in InPower.

1. Connect to the PCC and highlight any of the folders under the PCC connection (such as Advanced Status). Right click on the folder, and click on Genset OEM Setup...

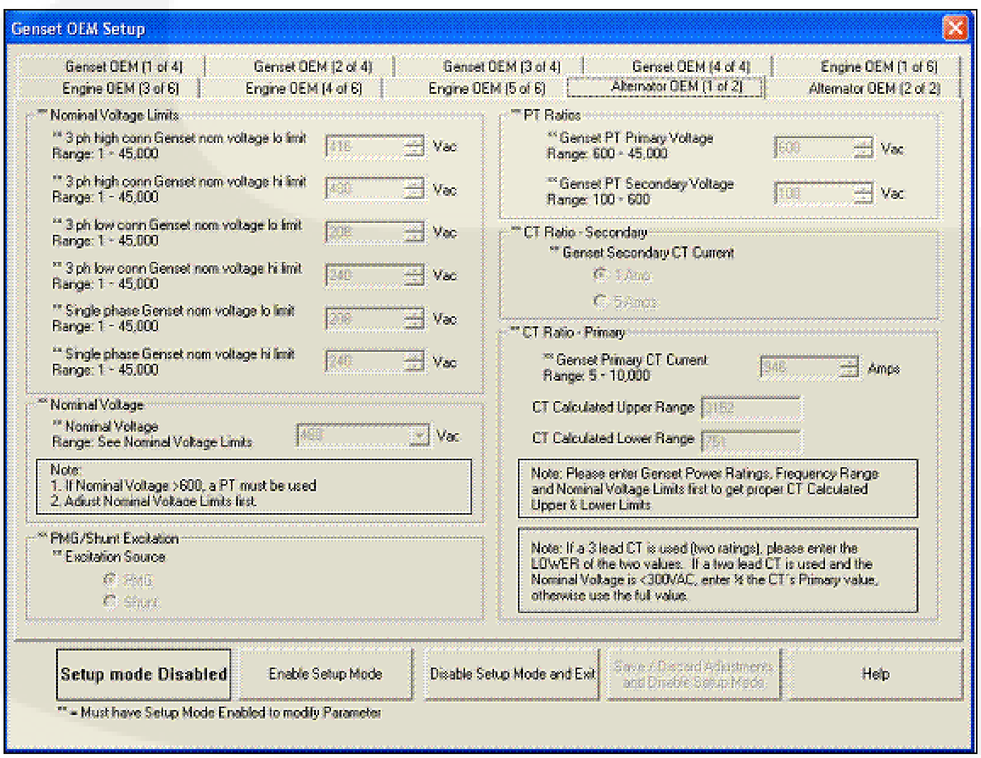




2. Click on Enable Setup Mode in order to enable the menu.
3. Enter the genset information under Genset Power Ratings, Frequency Range, and Nominal Frequency.
4. Click on Save/Discard Adjustments and Disable Setup Mode in order to save the genset settings. This step is required.



5. Open the Genset OEM Setup again.
6. Click on the Alternator OEM (1 of 2) tab to display the settings below.

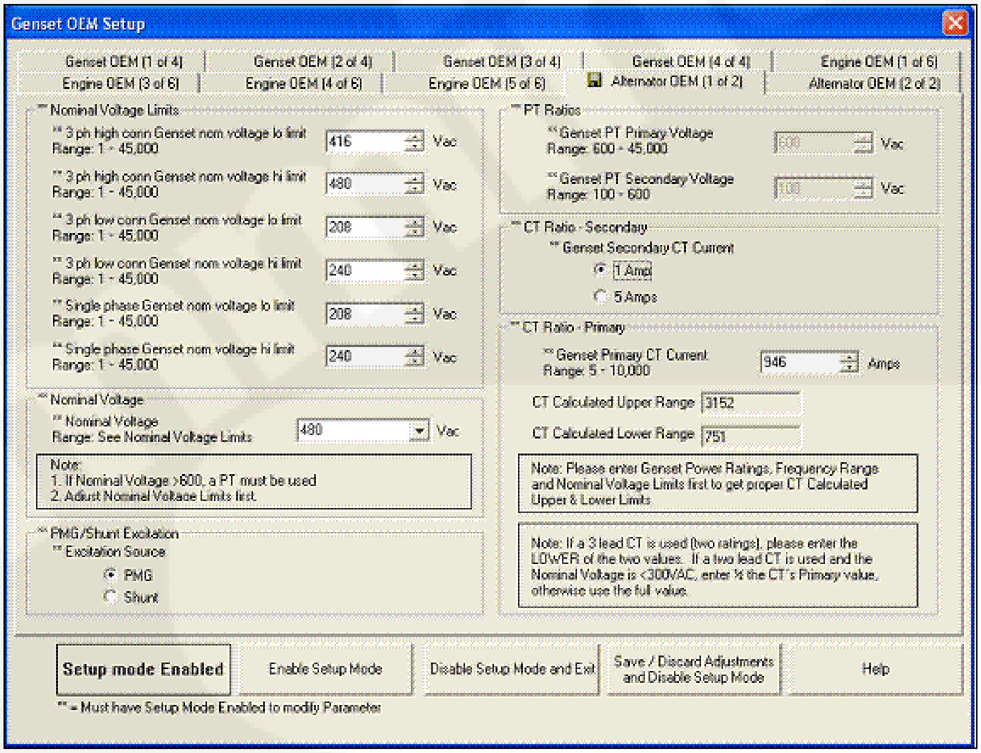


7. Click on Enable Setup Mode in order to enable the menu.

8. Enter the genset information under Nominal Voltage Limits and CT Ratio –Secondary. After all the information is entered, InPower will calculate the required Genset Primary CT Ratio limits. The primary CT Ratio needs to be between the CT Calculated Upper Range and the CT Calculated Lower Range.

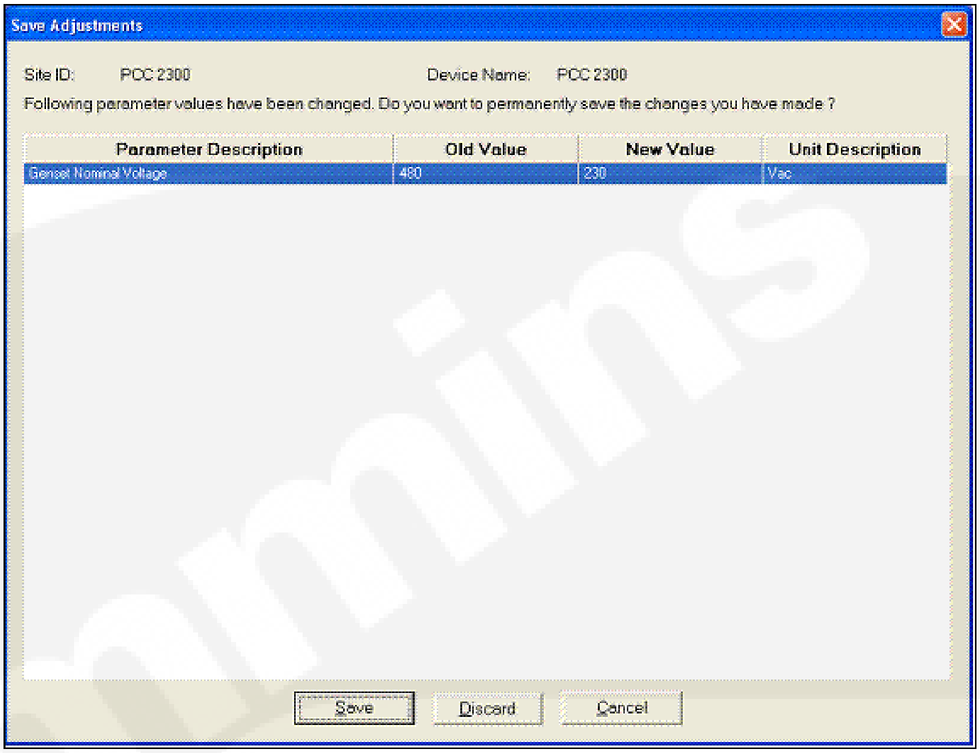
   The CTs and the CT ratio setting in the PCC require a primary CT ratio between the CT Calculated Upper Range and the CT Calculated Lower Range.

   The alternator CT ratio is required to have a secondary CT Ratio equal to the setting under the CT Ratio – Secondary.



9. To exit the setup mode and save changes, click on Save / Discard Adjustments and Disable Setup Mode.

   To exit the setup mode without saving changes, click on Disable Setup Mode and Exit. Then, click on Discard when the Save Adjustments Screen pops up.



7.6 Troubleshooting Procedures

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

If you are troubleshooting the fault that appears in the graphical display, the source of the fault is displayed to the right of the event/fault code. If this area is blank, the source is the PCC.

NOTE: The troubleshooting procedures for ECM-related faults and engine-related faults are in the engine service manual.

If you are troubleshooting a fault that does not appear in the graphical display, look at the SA field in the Faults screens to identify the source of the fault. If this field is blank, the PCC is the source of this fault.

7.6.1 No Code - The Operator Panel Is Unavailable After Changing the PCCNet Network

Logic:

The Operator Panel was working until a PCCNet device was added or removed from the PCCNet network.

Possible Causes:

1. Bad installation of PCCNet device.

Diagnosis and Repair:

1. Bad installation of PCCNet device.
   a. Check the installation of the PCCNet device, in particular the connection at TB1. J25 and TB1 share the same electrical connection. If the PCCNet device is installed incorrectly, the Operator Panel on J25 stops working. Make sure the PCCNet device is connected correctly and is functioning properly.

7.6.2 Code 135 - Oil Pressure Sensor OOR High

Logic:

Engine oil pressure sensor signal is out of range – shorted high.

NOTE: This warning will only occur if the genset is equipped with an oil pressure sensor.

Possible Causes:

1. Faulty oil pressure sensor connections.
2. Faulty oil pressure sensor.
3. Faulty engine harness.
4. Faulty extension harness.

NOTE: Part Number 316289800 - Pressure/Temperature sensor breakout cable

Part Number 382477400 - Pressure sensor breakout cable

Part Number 382477600 - Pressure sensor breakout cable

Part Number 316475200 - Danfoss™ pressure sensor breakout cable

Part Number 382275800 - Male Deutsch/AMP/Metri-Pack test lead

Part Number 382291700 - Female Deutsch/AMP/Metri-Pack test lead

Part Number 382481200 - Deutsch socket pin test lead

Part Number 382481100 - Deutsch pin test lead

Diagnosis and Repair:

1. Oil pressure sensor connections.

   Inspect the oil pressure sensor and the engine harness connector pins.
   a. Disconnect the engine harness connector from the oil pressure sensor.
   b. Inspect for corroded pins, bent or broken pins, and pushed back or expanded pins.
   c. Inspect for evidence of moisture in or on the connector.
   d. Inspect for missing or damaged connector seals.
   e. Inspect for dirt or debris in or on the connector pins.
2. Faulty sensor/switch.

   Active Sensor
   a. Check the oil pressure sensor supply voltage.
      a. Disconnect the engine harness connector from the oil pressure sensor.

b. Install the pressure sensor breakout cable between the sensor and the sensor harness connector.

c. Measure the supply voltage by connecting the breakout cable's supply and return connectors to the multimeter. If the reading is between 4.75 and 5.25 VDC, then the supply voltage is correct.

b. Check the oil pressure sensor signal (sense) voltage.

a. Disconnect the engine harness connector from the oil pressure sensor.

b. Install the pressure sensor breakout cable between the sensor and the sensor harness connector.

c. Measure the signal voltage by connecting the breakout cable's signal and return connectors to the multimeter. If the reading is between 0.46 and 4.56 V, then the signal voltage is correct. If not, the sensor is faulty.

Passive Sensor

Check the resistance of the sensor.

a. Disconnect the engine harness connector from the oil pressure sensor.

b. Measure the resistance between the oil pressure signal pin and the oil pressure return pin.

c. Refer to the troubleshooting and repair manual for the specific engine platform for oil pressure ranges.

Switch

a. Check genset manual to determine if switch should be normally open or normally closed.

b. Ensure physical switch is of same type.

3. Faulty engine harness.

a. Inspect the engine harness and the connector pins.

a. Disconnect the engine harness connector from the extension harness.

b. Inspect for corroded pins, bent or broken pins, and pushed back or expanded pins.

c. Inspect for evidence of moisture in or on the connector.

d. Inspect for missing or damaged connector seals.

e. Inspect for dirt or debris in or on the connector pin.

b. Check for a short circuit from pin to pin.

a. Disconnect the engine harness from the extension harness.

b. Disconnect the engine harness connector from the oil pressure sensor.

c. Disconnect the engine harness from all sensors that have a shared supply or return with the oil pressure sensor.

d. Measure the resistance from the oil pressure 5 VDC supply pin on the engine harness inline connector to all other pins in the engine harness inline connector.

e. Measure the resistance from the oil pressure return pin on the engine harness inline connector to all other pins in the engine harness inline connector.

f. Measure the resistance from the oil pressure signal pin on the engine harness inline connector to all other pins in the engine harness inline connector.

g. If all measurements are greater than 100k ohms, then the resistance is correct.

c. Check for an open circuit.

a. Disconnect the engine harness from the extension harness.

b. Disconnect the engine harness connector from the oil pressure sensor.

c. Measure the resistance from the oil pressure return pin on the engine harness inline connector to the oil pressure return pin on the engine harness sensor connector.

d. If the measurement is less than 10 ohms, then the resistance is correct.

4. Faulty extension harness.

a. Inspect the extension harness and the AUX 105 connector pins.

a. Disconnect the extension harness connector from the AUX 105.

b. Inspect for corroded pins, bent or broken pins, and pushed back or expanded pins.

c. Inspect for evidence of moisture in or on the connector.

d. Inspect for missing or damaged connector seals.

e. Inspect for dirt or debris in or on the connector pins.

b. Check for an open circuit.

a. Disconnect the extension harness connector from the AUX 105.

b. Disconnect the extension harness from the engine harness.

c. Measure the resistance from the oil pressure return pin on the extension harness connector to the oil pressure return pin on the extension harness inline connection.

d. If the measurement is less than 10 ohms, then the resistance is correct.

c. Check for a short circuit from pin to pin.

a. Disconnect the extension harness connector from the AUX 105.

b. Disconnect the extension harness from the engine harness.

c. Measure the resistance from the oil pressure 5 VDC supply pin on the extension harness connector to all other pins in the extension harness connector.

d. Measure the resistance from the oil pressure return pin on the extension harness connector to all other pins in the extension harness connector.

e. Measure the resistance from the oil pressure signal pin on the extension harness connector to all other pins in the extension harness connector.

f. If all measurements are greater than 100k ohms, then the resistance is correct.

7.6.3 Code 141 - Oil Pressure Sensor OOR Low

Logic:

Engine oil pressure sensor signal is out of range – shorted low.

NOTE: This warning will only occur if the genset is equipped with an oil pressure sensor.

Possible Causes:

1. Fault simulation feature is enabled.
2. Faulty oil pressure sensor connections.
3. Faulty oil pressure sensor.
4. Faulty engine harness.
5. Faulty extension harness.

NOTE: Part Number 316289800 - Pressure/Temperature sensor breakout cable

Part Number 382477400 - Pressure sensor breakout cable

Part Number 382477600 - Pressure sensor breakout cable

Part Number 316475200 - Danfoss™ pressure sensor breakout cable (Danfoss is a trademark of Danfoss A/S.)

Part Number 382275800 - Male Deutsch/AMP/Metri-Pack test lead

Part Number 382291700 - Female Deutsch/AMP/Metri-Pack test lead

Part Number 382481200 - Deutsch socket pin test lead

Part Number 382481100 - Deutsch pin test lead

Diagnosis and Repair:

1. Verify that the fault simulation feature for the sensor is not enabled.
   a. Connect InPower.
   b. Verify that the fault simulation is NOT enabled for the intake manifold temperature sensor by connecting to the PCC via InPower. If the fault simulation is disabled, there is no problem.
2. Oil pressure sensor connections.

   Inspect the oil pressure sensor and the engine harness connector pins.

   a. Disconnect the engine harness connector from the oil pressure sensor.
   b. Inspect for corroded, bent, broken, pushed back, expanded, or loose pins
   c. Inspect for evidence of moisture in or on the connector.
   d. Inspect for missing or damaged connector seals.
   e. Inspect for dirt or debris in or on the connector pins.
3. Faulty sensor/switch.

   Active Sensor

   a. Check the oil pressure sensor supply voltage.
      a. Disconnect the engine harness connector from the oil pressure sensor.
      b. Install the pressure sensor breakout cable between the sensor and the sensor harness connector.

c. Measure the supply voltage by connecting the breakout cable's supply and return connectors to the multimeter. If the reading is between 4.75 and 5.25 VDC, then the supply voltage is correct.

b. Check the oil pressure sensor signal (sense) voltage.

a. Disconnect the engine harness connector from the oil pressure sensor.

b. Install the pressure sensor breakout cable between the sensor and the sensor harness connector.

c. Measure the signal voltage by connecting the breakout cable's signal and return connectors to the multimeter. If the reading is between 0.46 and 4.56 V, then the signal voltage is correct. If not, the sensor is faulty.

Passive Sensor

Check the resistance of the sensor.

a. Disconnect the engine harness connector from the oil pressure sensor.

b. Measure the resistance between the oil pressure signal pin and the oil pressure return pin.

c. Refer to the troubleshooting and repair manual for the specific engine platform for oil pressure ranges.

Switch

a. Check genset manual to determine if switch should be normally open or normally closed.

b. Ensure physical switch is of same type.

4. Faulty engine harness.

a. Inspect the engine harness and the connector pins.

a. Disconnect the engine harness connector from the extension harness.

b. Inspect for corroded pins, bent or broken pins, and pushed back or expanded pins.

c. Inspect for evidence of moisture in or on the connector.

d. Inspect for missing or damaged connector seals.

e. Inspect for dirt or debris in or on the connector pin.

b. Check for a short circuit from pin to pin.

a. Disconnect the engine harness from the extension harness.

b. Disconnect the engine harness connector from the oil pressure sensor.

c. Disconnect the engine harness from all sensors that have a shared supply or return with the oil pressure sensor.

d. Measure the resistance from the oil pressure 5 VDC supply pin on the engine harness inline connector to all other pins in the engine harness inline connector.

e. Measure the resistance from the oil pressure return pin on the engine harness inline connector to all other pins in the engine harness inline connector.

f. Measure the resistance from the oil pressure signal pin on the engine harness inline connector to all other pins in the engine harness inline connector.

g. If all measurements are greater than 100k ohms, then the resistance is correct.

c. Check for a short circuit to engine block ground.

a. Disconnect the extension harness from the AUX 105.

b. Disconnect the extension harness from the engine harness.

c. Measure the resistance from the oil pressure signal pin on the extension harness connector to the engine block ground.

d. Measure the resistance from the oil pressure 5 VDC pin on the extension harness connector to the engine block ground.

e. If the measurement is more than 100k ohms, then the resistance is correct.

d. Check for an open circuit.

a. Disconnect the engine harness connector from the extension harness.

b. Disconnect the engine harness from the oil pressure sensor.

c. Measure the resistance from the oil pressure return pin on the engine harness inline connector to the oil pressure return pin on the engine harness sensor connector.

d. If the measurement is less than 10 ohms, then the resistance is correct.

5. Faulty extension harness.

a. Inspect the extension harness and the AUX 105 connector pins.

a. Disconnect the extension harness connector from the AUX 105.

b. Inspect for corroded pins, bent or broken pins, and pushed back or expanded pins.

c. Inspect for evidence of moisture in or on the connector.

d. Inspect for missing or damaged connector seals.

e. Inspect for dirt or debris in or on the connector pins.

b. Check for a short circuit from pin to pin.

a. Disconnect the extension harness connector from the AUX 105.

b. Disconnect the extension harness from the engine harness.

c. Measure the resistance from the oil pressure 5 VDC supply pin on the extension harness connector to all other pins in the extension harness connector.

d. Measure the resistance from the oil pressure return pin on the extension harness connector to all other pins in the extension harness connector.

e. Measure the resistance from the oil pressure signal pin on the extension harness connector to all other pins in the extension harness connector.

f. If all measurements are greater than 100k ohms, then the resistance is correct.

c. Check for a short circuit to engine block ground.

a. Disconnect the extension harness from the AUX 105.

b. Disconnect the extension harness from the engine harness.

c. Measure the resistance from the oil pressure signal pin on the extension harness connector to the engine block ground.

d. Measure the resistance from the oil pressure 5 VDC pin on the extension harness connector to the engine block ground.

e. If the measurement is more than 100k ohms, then the resistance is correct.

d. Check for an open circuit.

a. Disconnect the extension harness connector from the AUX 105.

b. Disconnect the extension harness from the engine harness.

c. Measure the resistance from the engine oil temperature return pin on the extension harness connector to the engine oil temperature return pin at the extension harness inline connector.

d. Measure the resistance from the engine oil temperature signal pin on the extension harness connector to the engine oil temperature signal pin at the extension harness inline connector.

e. If the measurement is less than 10 ohms, then the resistance is correct.

7.6.4 Code 143 - Low Oil Rifle Pressure

Logic:

Engine oil pressure is below the low oil pressure warning threshold.

NOTE: This warning will only occur if the genset is equipped with an oil rifle pressure sensor.

Possible Causes:

1. Oil pressure sensor is inaccurate.
2. Fault simulation is enabled.
3. Threshold is set too high.
4. Check the oil lines to make sure they are not leaking.
5. Check the oil filters and replace if defective or dirty.
6. Check the oil level and replenish if low.
7. Reset the control and restart. Verify that there are no oil leaks.

Diagnosis and Repair:

1. Check the oil pressure sensor accuracy with a mechanical oil pressure gauge.

   a. Connect a mechanical oil pressure gauge of known quality and calibration to the engine at one of the plugs on top of the oil filter head.

   b. Connect InPower.

   c. While the engine is stopped, compare the oil pressure reading on the service tool to the reading on the mechanical oil pressure gauge.

   d. Only proceed if engine troubleshooting has been completed. Do not attempt to start the engine if there is doubt about the oil pressure.

CAUTION: *Do not attempt to start the engine if there is any doubt about the oil pressure, or the generator set may be damaged.*

e. Start the generator set.

f. Compare the oil pressure reading on the service tool to the reading on the mechanical oil pressure gauge.

g. Refer to the troubleshooting and repair manual for the specific engine platform for oil pressure ranges.

2. Fault simulation is enabled.

   Connect to the control with InPower, and make sure that fault simulation for LOP is not enabled.

3. Threshold is set too high.

   Using the electronic service tool, verify that the fault threshold is NOT within the normal operating range for the oil pressure sensor. Refer to the appropriate base engine manual for normal operating range.

7.6.5 Code 144 - Engine Coolant Temperature OOR High

Logic:

Engine coolant temperature signal voltage is out of range - shorted high

Possible Causes:

1. Fault simulation feature is enabled.
2. Faulty coolant temperature sensor connections.
3. Faulty coolant temperature sensor.
4. Faulty engine harness.
5. Faulty extension harness.

NOTE: Part number 382275800 - Male Deutsch/AMP/Metri-Pack test lead

Part number 382291700 - Female Deutsch/AMP/Metri-Pack test lead

Diagnosis and Repair:

1. Verify that the fault simulation feature is not enabled.

   a. Connect InPower.

   b. Verify that the fault simulation is NOT enabled for the intake manifold temperature sensor by connecting to the PCC via InPower. If fault simulation is disabled, there is no problem.

2. Coolant temperature sensor connections.

   Inspect the coolant temperature sensor and the harness connector pins.

   a. Disconnect the engine harness connector from the coolant temperature sensor.

   b. Inspect for corroded pins, bent pins, broken pins, pushed-back pins or expanded pins.

   c. Inspect for evidence of moisture in or on the connector.

   d. Inspect for missing or damaged connector seals.

e. Inspect for dirt or debris in or on the connector pins.

3. Faulty sensor.

   Check the resistance of the sensor.

   a. Disconnect the engine harness connector from the coolant temperature sensor.
   b. Measure the resistance between the coolant temperature signal pin and the coolant temperature return pin.
   c. Refer to the troubleshooting and repair manual for the specific engine platform for coolant temperature ranges.

4. Faulty engine harness.

   Inspect the engine harness and the extension harness connector pins.

   a. Disconnect the engine harness connector from the extension harness.
   b. Inspect for corroded pins, bent pins, broken pins, pushed-back pins or expanded pins.
   c. Inspect for evidence of moisture in or on the connector.
   d. Inspect for missing or damaged connector seals.
   e. Inspect for dirt or debris in or on the connector pins.

   Check for a short circuit from pin-to-pin.

   a. Disconnect the engine harness connector from the extension harness.
   b. Disconnect the engine harness from the coolant temperature sensor.
   c. Disconnect the engine harness from all sensors that have a shared return with the coolant temperature sensor.
   d. Measure the resistance from the coolant temperature return pin on the engine harness inline connector to all other pins in the engine harness inline connector.
   e. Measure the resistance from the coolant temperature signal pin on the engine harness inline connector to all other pins in the engine harness inline connector.
   f. If all measurements are greater than 100K ohms, then the resistance is correct.

   Check for an open circuit.

   a. Disconnect the engine harness connector from the extension harness.
   b. Disconnect the engine harness from the coolant temperature sensor.
   c. Measure the resistance from the coolant temperature return pin on the engine harness inline connector to the coolant temperature return pin on the engine harness sensor connector.
   d. Measure the resistance from the coolant temperature signal pin on the engine harness inline connector to the coolant temperature signal pin on the engine harness sensor connector.
   e. If the measurements are less than 10 ohms, then the resistance is correct.

5. Faulty extension harness.

   Inspect the extension harness and the AUX 105 connector pins.

   a. Disconnect the engine harness connector from the AUX 105.

b. Inspect for corroded pins, bent pins, broken pins, pushed-back pins or expanded pins.
c. Inspect for evidence of moisture in or on the connector.
d. Inspect for missing or damaged connector seals.
e. Inspect for dirt or debris in or on the connector pins.

Check for an open circuit.

a. Disconnect the extension harness from the AUX 105.
b. Disconnect the extension harness from the engine harness.
c. Measure the resistance from the coolant temperature return pin on the extension harness connector to the coolant temperature return pin on the extension harness inline connector.
d. Measure the resistance from the coolant temperature signal pin on the extension harness to the coolant temperature signal pin on the extension harness inline connector.
e. If the measurements are less than 10 ohms, then the resistance is correct.

Check for a short circuit from pin-to-pin.

a. Disconnect the extension harness from the AUX 105.
b. Disconnect the extension harness from the engine harness.
c. Measure the resistance from the coolant temperature return pin on the extension harness connector to all other pins in the extension harness connector.
d. Measure the resistance from the coolant temperature signal pin on the extension harness connector to all other pins in the engine harness connector.
e. If all measurements are greater than 100K ohms, then the resistance is correct.

7.6.6 Code 145 - Engine Coolant Temperature OOR Low

Logic:

Engine coolant temperature signal voltage is out of range - shorted low

Possible Causes:

1. Faulty coolant temperature sensor connections.
2. Faulty coolant temperature sensor.
3. Faulty engine harness.
4. Faulty extension harness.

NOTE: **Part number 382275800 - Male Deutsch/AMP/Metri-Pack test lead**
Part number 382291700 - Female Deutsch/AMP/Metri-Pack test lead

Diagnosis and Repair:

1. Coolant temperature sensor connections.

   Inspect the coolant temperature sensor and the harness connector pins.

   a. Disconnect the engine harness connector from the coolant temperature sensor.
   b. Inspect for corroded pins, bent pins, broken pins, pushed-back pins or expanded pins.

c. Inspect for evidence of moisture in or on the connector.

d. Inspect for missing or damaged connector seals.

e. Inspect for dirt or debris in or on the connector pins.

2. Faulty sensor.

   Check the resistance of the sensor.

   a. Disconnect the engine harness connector from the coolant temperature sensor.

   b. Measure the resistance between the coolant temperature signal pin and the coolant temperature return pin.

   c. Refer to the troubleshooting and repair manual for the specific engine platform for coolant temperature ranges.

3. Faulty engine harness.

   Inspect the engine harness and the extension harness connector pins.

   a. Disconnect the engine harness connector from the extension harness.

   b. Inspect for corroded pins, bent pins, broken pins, pushed-back pins or expanded pins.

   c. Inspect for evidence of moisture in or on the connector.

   d. Inspect for missing or damaged connector seals.

   e. Inspect for dirt or debris in or on the connector pins.

   Check for a short circuit from pin-to-pin.

   a. Disconnect the engine harness connector from the extension harness.

   b. Disconnect the engine harness from the coolant temperature sensor.

   c. Disconnect the engine harness from all sensors that have a shared return with the coolant temperature sensor.

   d. Measure the resistance from the coolant temperature return pin on the engine harness inline connector to all other pins in the engine harness inline connector.

   e. Measure the resistance from the coolant temperature signal pin on the engine harness inline connector to all other pins in the engine harness inline connector.

   f. If all measurements are greater than 100K ohms, then the resistance is correct.

   Check for a short circuit to engine block ground.

   a. Disconnect the extension harness from the AUX 105.

   b. Disconnect the extension harness from the engine harness.

   c. Measure the resistance from the coolant temperature signal pin on the extension harness connector to the engine block ground.

   d. If the measurement is greater than 100K ohms, then the resistance is correct.

   Check for an open circuit.

   a. Disconnect the engine harness connector from the extension harness.

   b. Disconnect the engine harness from the coolant temperature sensor.

c. Measure the resistance from the coolant temperature return pin on the engine harness inline connector to the coolant temperature return pin on the engine harness sensor connector.

d. Measure the resistance from the coolant temperature signal pin on the engine harness inline connector to the coolant temperature signal pin on the engine harness sensor connector.

e. If the measurements are less than 10 ohms, then the resistance is correct.

4. Faulty extension harness.

Inspect the extension harness and the AUX 105 connector pins.

a. Disconnect the extension harness connector from the AUX 105.

b. Inspect for corroded pins, bent pins, broken pins, pushed-back pins or expanded pins.

c. Inspect for evidence of moisture in or on the connector.

d. Inspect for missing or damaged connector seals.

e. Inspect for dirt or debris in or on the connector pins.

Check for a short circuit to engine block ground.

a. Disconnect the extension harness from the AUX 105.

b. Disconnect the extension harness from the engine harness.

c. Measure the resistance from the coolant temperature signal pin on the extension harness connector to the engine block ground.

d. Measure the resistance from the coolant temperature return pin on the extension harness connector to the engine block ground.

e. If all measurements are greater than 100K ohms, then the resistance is correct.

Check for a short circuit from pin-to-pin.

a. Disconnect the extension harness from the AUX 105.

b. Disconnect the extension harness from the engine harness.

c. Measure the resistance from the coolant temperature return pin on the extension harness connector to all other pins in the extension harness connector.

d. Measure the resistance from the coolant temperature signal pin on the extension harness connector to all other pins in the engine harness connector.

e. If all measurements are greater than 100K ohms, then the resistance is correct.

Check for an open circuit.

a. Disconnect the extension harness from the AUX 105.

b. Disconnect the extension harness from the engine harness.

c. Measure the resistance from the coolant temperature return pin on the extension harness connector to the coolant temperature return pin on the extension harness inline connector.

d. Measure the resistance from the coolant temperature signal pin on the extension harness to the coolant temperature signal pin on the extension harness inline connector.

e. If the measurements are less than 10 ohms, then the resistance is correct.

7.6.7 Code 146 - Engine Coolant Temperature Moderately Above Normal

Logic:

Engine coolant temperature has exceeded the warning threshold for high coolant temperature.

Possible Causes:

1. Inaccurate coolant temperature sensor.
2. Fault simulation feature is enabled.
3. Incorrect threshold setting.

Diagnosis and Repair:

1. Verify the sensor accuracy with a thermocouple or similar temperature probe.
   a. Connect the temperature probe to the engine near the coolant temperature sensor.
   b. Connect InPower.
   c. Compare the coolant temperature reading from the service tool to the reading from the temperature sensor. If the two readings are reasonably close, then the sensor is reading correctly.
2. Verify that the fault simulation feature is not enabled.
   a. Connect InPower.
   b. Verify that the fault simulation is NOT enabled for the coolant temperature sensor by connecting to the PCC via InPower. If fault simulation is disabled, there is no problem.
3. Check threshold settings.
   a. Connect InPower.
   b. Verify that the fault threshold is within the normal operating range for the coolant temperature sensor. Refer to the engine manual for correct threshold values, and make the appropriate changes using InPower.

7.6.8 Code 151 - Engine Coolant Temperature High - Critical

Logic:

Engine coolant temperature has exceeded the alarm (shutdown) threshold for high coolant temperature.

Possible Causes:

1. Inaccurate engine temperature sensor.
2. Fault simulation feature is enabled.
3. Incorrect threshold setting.
4. Look for possible coolant leakage points and repair as necessary.
5. Check the coolant level and replenish if low.
6. Check for obstructions to cooling airflow and correct as necessary.

7. Check the fan belt and repair or tighten if necessary.
8. Check the blower fan and circulation pumps on remote radiator installations.
9. Reset the control and restart.

Diagnosis and Repair:

1. Verify the sensor accuracy with a thermocouple or similar temperature probe.
    a. Connect the temperature probe to the engine near the coolant temperature sensor.
    b. Connect InPower.
    c. Compare the coolant temperature reading from the service tool to the reading from the temperature sensor. If the two readings are reasonably close, then the sensor is reading correctly.
2. Verify that the fault simulation feature is not enabled.
    a. Connect InPower.
    b. Verify that the fault simulation is NOT enabled for the coolant temperature sensor by connecting to the PCC via InPower. If fault simulation is disabled, there is no problem.
3. Check threshold settings.
    a. Connect InPower.
    b. Verify that the fault threshold is within the normal operating range for the coolant temperature sensor. Refer to the engine manual for correct threshold values, and make the appropriate changes using InPower.

7.6.9 Code 153 - Intake Manifold Temperature OOR - High

Logic:

Engine intake manifold temperature sensor signal is out of range - shorted high.

Possible Causes:

1. Faulty intake manifold temperature sensor connections.
2. Faulty intake manifold temperature sensor.
3. Faulty engine harness.
4. Faulty extension harness.

NOTE: Part number 382275800 - Male Deutsch/AMP/Metri-Pack test lead
Part number 382291700 - Female Deutsch/AMP/Metri-Pack test lead

Diagnosis and Repair:

1. Intake manifold temperature sensor connections

    Inspect the intake manifold temperature sensor and the harness connector pins.
    a. Disconnect the engine harness connector from the intake manifold temperature sensor.
    b. Inspect for corroded pins, bent pins, broken pins, pushed-back pins, or expanded pins.
    c. Inspect for evidence of moisture in or on the connector.

   d. Inspect for missing or damaged connector seals.
   e. Inspect for dirt or debris in or on the connector pins.

2. Faulty sensor.

   Check the resistance of the sensor.

   a. Disconnect the engine harness connector from the intake manifold temperature sensor.
   b. Measure the resistance between the intake manifold temperature signal pin and the intake manifold temperature return pin.
   c. Refer to the troubleshooting and repair manual for the specific engine platform for intake manifold temperature ranges.

3. Faulty engine harness.

   Inspect the engine harness and the extension harness connector pins.

   a. Disconnect the engine harness connector from the extension harness.
   b. Inspect for corroded pins, bent pins, broken pins, pushed-back pins, or expanded pins.
   c. Inspect for evidence of moisture in or on the connector.
   d. Inspect for missing or damaged connector seals.
   e. Inspect for dirt or debris in or on the connector pins.

   Check for a short circuit from pin-to-pin.

   a. Disconnect the engine harness connector from the extension harness.
   b. Disconnect the engine harness from the intake manifold temperature sensor.
   c. Disconnect the engine harness from all sensors that have a shared return with the intake manifold temperature sensor.
   d. Measure the resistance from the intake manifold temperature return pin on the engine harness inline connector to all other pins in the engine harness inline connector.
   e. Measure the resistance from the intake manifold temperature signal pin on the engine harness inline connector to all other pins in the engine harness inline connector.
   f. If all measurements are greater than 100K ohms, then the resistance is correct.

   Check for an open circuit.

   a. Disconnect the engine harness connector from the extension harness.
   b. Disconnect the engine harness from the intake manifold temperature sensor.
   c. Measure the resistance from the intake manifold temperature return pin on the engine harness inline connector to the intake manifold temperature return pin at the engine harness sensor connector.
   d. Measure the resistance from the intake manifold temperature signal pin on the engine harness inline connector to the intake manifold temperature signal pin at the engine harness sensor connector.
   e. If all measurements are less than 10 ohms, then the resistance is correct.

4. Faulty extension harness.

Inspect the extension harness and the AUX 105 connector pins.

a. Disconnect the extension harness connector from the AUX 105.

b. Inspect for corroded pins, bent pins, broken pins, pushed-back pins, or expanded pins.

c. Inspect for evidence of moisture in or on the connector.

d. Inspect for missing or damaged connector seals.

e. Inspect for dirt or debris in or on the connector pins.

Check for an open circuit.

a. Disconnect the extension harness connector from the AUX 105.

b. Disconnect the extension harness from the engine harness.

c. Measure the resistance from the intake manifold temperature return pin on the extension harness connector to the intake manifold temperature return pin at the extension harness inline connector.

d. Measure the resistance from the intake manifold temperature signal pin on the extension harness connector to the intake manifold temperature signal pin at the extension harness inline connector.

e. If all measurements are less than 10 ohms, then the resistance is correct.

Check for a short circuit from pin-to-pin.

a. Disconnect the extension harness from the AUX 105.

b. Disconnect the extension harness from the engine harness.

c. Measure the resistance from the intake manifold temperature return pin on the extension harness connector to all other pins in the extension harness connector.

d. Measure the resistance from the intake manifold temperature signal pin on the extension harness connector to all other pins in the extension harness connector.

e. If all measurements are greater than 100K ohms, then the resistance is correct.

7.6.10 Code 154 - Intake Manifold Temperature OOR - Low

Logic:

Engine intake manifold temperature sensor signal is out of range - shorted low.

Possible Causes:

1. Faulty intake manifold temperature sensor connections.
2. Faulty intake manifold temperature sensor.
3. Faulty engine harness.
4. Faulty extension harness.

NOTE: **Part number 382275800 - Male Deutsch/AMP/Metri-Pack test lead**
Part number 382291700 - Female Deutsch/AMP/Metri-Pack test lead

Diagnosis and Repair:

1. Intake manifold temperature sensor connections

Inspect the intake manifold temperature sensor and the harness connector pins.

a. Disconnect the engine harness connector from the intake manifold temperature sensor.
b. Inspect for corroded pins, bent pins, broken pins, pushed-back pins, or expanded pins.
c. Inspect for evidence of moisture in or on the connector.
d. Inspect for missing or damaged connector seals.
e. Inspect for dirt or debris in or on the connector pins.

2. Faulty sensor.

Check the resistance of the sensor.

a. Disconnect the engine harness connector from the intake manifold temperature sensor.
b. Measure the resistance between the intake manifold temperature signal pin and the intake manifold temperature return pin.
c. Refer to the troubleshooting and repair manual for the specific engine platform for intake manifold temperature ranges.

Check for a short circuit to engine block ground.

a. Disconnect the engine harness connector from the intake manifold temperature sensor.
b. Measure the resistance from one of the pins of the intake manifold temperature sensor connector to engine block ground. If the resistance is more than 100K ohms, the sensor is operating correctly.

3. Faulty engine harness.

Inspect the engine harness and the connector pins.

a. Disconnect the engine harness connector from the extension harness.
b. Inspect for corroded pins, bent pins, broken pins, pushed-back pins, or expanded pins.
c. Inspect for evidence of moisture in or on the connector.
d. Inspect for missing or damaged connector seals.
e. Inspect for dirt or debris in or on the connector pins.

Check for a short circuit from pin-to-pin.

a. Disconnect the engine harness connector from the extension harness.
b. Disconnect the engine harness from the intake manifold temperature sensor.
c. Disconnect the engine harness from all sensors that have a shared return with the intake manifold temperature sensor.
d. Measure the resistance from the intake manifold temperature return pin on the engine harness inline connector to all other pins in the engine harness inline connector.
e. Measure the resistance from the intake manifold temperature signal pin on the engine harness inline connector to all other pins in the engine harness inline connector.

f. If all measurements are greater than 100K ohms, then the resistance is correct.

Check for a short circuit to engine block ground.

a. Disconnect the extension harness from the AUX 105.
b. Disconnect the extension harness from the engine harness.
c. Measure the resistance from the intake manifold temperature signal pin on the extension harness connector to engine block ground.
d. If the resistance is more than 100K ohms, the sensor is operating correctly.

Check for an open circuit.

a. Disconnect the engine harness connector from the extension harness.
b. Disconnect the engine harness from the intake manifold temperature sensor.
c. Measure the resistance from the intake manifold temperature return pin on the engine harness inline connector to the intake manifold temperature return pin at the engine harness sensor connector.
d. Measure the resistance from the intake manifold temperature signal pin on the engine harness inline connector to the intake manifold temperature signal pin at the engine harness sensor connector.
e. If all measurements are less than 10 ohms, then the resistance is correct.

4. Faulty extension harness.

Inspect the extension harness and the AUX 105 connector pins.

a. Disconnect the extension harness connector from the AUX 105.
b. Inspect for corroded pins, bent pins, broken pins, pushed-back pins, or expanded pins.
c. Inspect for evidence of moisture in or on the connector.
d. Inspect for missing or damaged connector seals.
e. Inspect for dirt or debris in or on the connector pins.

Check for a short circuit to engine block ground.

a. Disconnect the extension harness from the AUX 105.
b. Disconnect the extension harness from the engine harness.
c. Measure the resistance from the intake manifold temperature signal pin on the extension harness connector to engine block ground.
d. Measure the resistance from the intake manifold temperature return pin on the extension harness connector to engine block ground.
e. If the resistance is more than 100K ohms, the sensor is operating correctly.

Check for a short circuit from pin-to-pin.

a. Disconnect the extension harness from the AUX 105.
b. Disconnect the extension harness from the engine harness.
c. Measure the resistance from the intake manifold temperature return pin on the extension harness connector to all other pins in the extension harness connector.

d. Measure the resistance from the intake manifold temperature signal pin on the extension harness connector to all other pins in the extension harness connector.

e. If all measurements are greater than 100K ohms, then the resistance is correct.

Check for an open circuit.

a. Disconnect the extension harness connector from the AUX 105.

b. Disconnect the extension harness from the engine harness.

c. Measure the resistance from the intake manifold temperature return pin on the extension harness connector to the intake manifold temperature return pin at the extension harness inline connector.

d. Measure the resistance from the intake manifold temperature signal pin on the extension harness connector to the intake manifold temperature signal pin at the extension harness inline connector.

e. If all measurements are less than 10 ohms, then the resistance is correct.

7.6.11 Code 155 - Intake Manifold Temperature High - Critical

Logic:

Engine intake manifold temperature has exceeded the alarm (shutdown) threshold for high intake manifold temperature.

Possible Causes:

1. Inaccurate engine temperature sensor.
2. Fault simulation feature is enabled.
3. Incorrect threshold setting.

Diagnosis and Repair:

1. Verify the sensor accuracy with a thermocouple or similar temperature probe.

   a. Connect the temperature probe to the engine near the intake manifold temperature sensor.

   b. Connect InPower.

   c. Compare the intake manifold temperature reading from the service tool to the reading from the temperature sensor. If the two readings are reasonably close, then the sensor is reading correctly.

NOTE: Only proceed if engine troubleshooting has been completed. Do not attempt to start the engine if there is doubt about the intake manifold temperature, or the generator set may be damaged.

   d. Start the generator set.

   e. Compare the intake manifold temperature reading from the service tool to the reading from the temperature sensor. If the two readings are reasonably close, then the sensor is reading correctly.

2. Verify that the fault simulation feature is not enabled.

   a. Connect InPower.

   b. Verify that the fault simulation is NOT enabled for the intake manifold temperature sensor by connecting to the PCC via InPower. If fault simulation is disabled, there is no problem.

3. Check threshold settings.
   a. Connect InPower.
   b. Verify that the fault threshold is within the normal operating range for the intake manifold temperature sensor. Refer to the engine manual for correct threshold values, and make the appropriate changes using InPower.

7.6.12 Code 197 - Low Coolant Level

Logic:

Low Coolant Level input is active and the threshold response is set to “Warning".

Possible Causes:

1. Low coolant.
2. Faulty sensor or wiring.
3. PCCNet Annunciator (if fitted).
4. Faulty base board.

Diagnosis and Repair:

1. Low coolant.
   a. Visually inspect that the engine coolant is at the correct level.
   b. Remove the radiator cap and check that the coolant is at the correct level.
   c. If coolant is below 2.5 cm (1 in) from the top add manufacture's prescribed coolant.
2. Faulty sensor or wiring.
   a. Disconnect the signal leads at the sensor, so the sensor is no longer connected to the control; then reset the control by pressing the Reset button. If event/fault code 197 clears and does not reappear, then replace the low coolant level sensor.
   b. If event/fault code 197 reappears then check for a short in the wiring between the low coolant level sensor and the input to the control (at J20-17: Input and J20-5: Ground). A ground input into J20-17 will activate the alarm at the control.
3. PCCNet Annunciator.
   a. If a PCCNet Annunciator is not used, go to step 4. If a PCCNet Annunciator is used, check the wiring on the back of the PCCNet Annunciator at TB1-6 to the Low Coolant Level sender. Ensure that an open circuit or short circuit does not exist in the wiring.
   b. Refer to the PCCNet Annunciator Operator's Manual to ensure that the Annunciator is configured correctly; since inputs can be configured to Active Open or Active Closed. Then check the input on the back of the PCCNet Annunciator at TB1–6 and ensure that the input signal into the PCCNet Annunciator is properly configured.
4. Faulty base board.
   a. Replace faulty base board.

7.6.13 Code 212 - Engine Oil Temperature OOR High

Logic:

Engine oil temperature is out of range - shorted high.

Possible Causes:

1. Faulty engine oil temperature sensor connections.
2. Faulty engine oil temperature sensor.
3. Faulty engine harness.
4. Faulty extension harness.

NOTE: Part number 382275800 - Male Deutsch/AMP/Metri-Pack test lead
Part number 382291700 - Female Deutsch/AMP/Metri-Pack test lead

Diagnosis and Repair:

1. Engine oil temperature sensor connections

   Inspect the engine oil temperature sensor and the harness connector pins.

   a. Disconnect the engine harness connector from the engine oil temperature sensor.
   b. Inspect for corroded pins, bent pins, broken pins, pushed-back pins, or expanded pins.
   c. Inspect for evidence of moisture in or on the connector.
   d. Inspect for missing or damaged connector seals.
   e. Inspect for dirt or debris in or on the connector pins.

2. Faulty sensor.

   Check the resistance of the sensor.

   a. Disconnect the engine harness connector from the engine oil temperature sensor.
   b. Measure the resistance between the engine oil temperature signal pin and the engine oil temperature return pin.
   c. Refer to the troubleshooting and repair manual for the specific engine platform for engine oil temperature ranges.

3. Faulty engine harness.

   Inspect the engine harness and the extension harness connector pins.

   a. Disconnect the engine harness connector from the extension harness.
   b. Inspect for corroded pins, bent pins, broken pins, pushed-back pins, or expanded pins.
   c. Inspect for evidence of moisture in or on the connector.
   d. Inspect for missing or damaged connector seals.
   e. Inspect for dirt or debris in or on the connector pins.

   Check for a short circuit from pin-to-pin.

   a. Disconnect the engine harness connector from the extension harness.

b. Disconnect the engine harness from the engine oil temperature sensor.
c. Disconnect the engine harness from all sensors that have a shared return with the engine oil temperature sensor.
d. Measure the resistance from the engine oil temperature return pin on the engine harness inline connector to all other pins in the engine harness inline connector.
e. Measure the resistance from the engine oil temperature signal pin on the engine harness inline connector to all other pins in the engine harness inline connector.
f. If all measurements are greater than 100K ohms, then the resistance is correct.

Check for an open circuit.

a. Disconnect the engine harness connector from the extension harness.
b. Disconnect the engine harness from the engine oil temperature sensor.
c. Measure the resistance from the engine oil temperature return pin on the engine harness inline connector to the engine oil temperature return pin at the engine harness sensor connector.
d. Measure the resistance from the engine oil temperature signal pin on the engine harness inline connector to the engine oil temperature signal pin at the engine harness sensor connector.
e. If all measurements are less than 10 ohms, then the resistance is correct.

4. Faulty extension harness.

Inspect the extension harness and the AUX 105 connector pins.

a. Disconnect the extension harness connector from the AUX 105.
b. Inspect for corroded pins, bent pins, broken pins, pushed-back pins, or expanded pins.
c. Inspect for evidence of moisture in or on the connector.
d. Inspect for missing or damaged connector seals.
e. Inspect for dirt or debris in or on the connector pins.

Check for an open circuit.

a. Disconnect the extension harness connector from the AUX 105.
b. Disconnect the extension harness from the engine harness.
c. Measure the resistance from the engine oil temperature return pin on the extension harness connector to the engine oil temperature return pin at the extension harness inline connector.
d. Measure the resistance from the engine oil temperature signal pin on the extension harness connector to the engine oil temperature signal pin at the extension harness inline connector.
e. If all measurements are less than 10 ohms, then the resistance is correct.

Check for a short circuit from pin-to-pin.

a. Disconnect the extension harness from the AUX 105.
b. Disconnect the extension harness from the engine harness.

c. Measure the resistance from the engine oil temperature return pin on the extension harness connector to all other pins in the extension harness connector.

d. Measure the resistance from the engine oil temperature signal pin on the extension harness connector to all other pins in the extension harness connector.

e. If all measurements are greater than 100K ohms, then the resistance is correct.

7.6.14 Code 213 - Engine Oil Temperature OOR Low

Logic:

Engine oil temperature is out of range - shorted low.

Possible Causes:

1. Faulty engine oil temperature sensor connections.
2. Faulty engine oil temperature sensor.
3. Faulty engine harness.
4. Faulty extension harness.

NOTE: Part number 382275800 - Male Deutsch/AMP/Metri-Pack test lead
Part number 382291700 - Female Deutsch/AMP/Metri-Pack test lead

Diagnosis and Repair:

1. Engine oil temperature sensor connections

   Inspect the engine oil temperature sensor and the harness connector pins.

   a. Disconnect the engine harness connector from the engine oil temperature sensor.
   b. Inspect for corroded pins, bent pins, broken pins, pushed-back pins, or expanded pins.
   c. Inspect for evidence of moisture in or on the connector.
   d. Inspect for missing or damaged connector seals.
   e. Inspect for dirt or debris in or on the connector pins.

2. Faulty sensor.

   Check the resistance of the sensor.

   a. Disconnect the engine harness connector from the engine oil temperature sensor.
   b. Measure the resistance between the engine oil temperature signal pin and the engine oil temperature return pin.
   c. Refer to the troubleshooting and repair manual for the specific engine platform for engine oil temperature ranges.

3. Faulty engine harness.

   Inspect the engine harness and the extension harness connector pins.

   a. Disconnect the engine harness connector from the extension harness.
   b. Inspect for corroded pins, bent pins, broken pins, pushed-back pins, or expanded pins.
   c. Inspect for evidence of moisture in or on the connector.

d. Inspect for missing or damaged connector seals.
e. Inspect for dirt or debris in or on the connector pins.

Check for a short circuit from pin-to-pin.

a. Disconnect the engine harness connector from the extension harness.
b. Disconnect the engine harness from the engine oil temperature sensor.
c. Disconnect the engine harness from all sensors that have a shared return with the engine oil temperature sensor.
d. Measure the resistance from the engine oil temperature return pin on the engine harness inline connector to all other pins in the engine harness inline connector.
e. Measure the resistance from the engine oil temperature signal pin on the engine harness inline connector to all other pins in the engine harness inline connector.
f. If all measurements are greater than 100K ohms, then the resistance is correct.

Check for a short circuit to engine block ground.

a. Disconnect the extension harness from the AUX 105.
b. Disconnect the extension harness from the engine harness.
c. Measure the resistance from the oil temperature signal pin on the extension harness connector to the engine block ground.
d. If the measurement is more than 100K ohms, then the resistance is correct.

Check for an open circuit.

a. Disconnect the engine harness connector from the extension harness.
b. Disconnect the engine harness from the engine oil temperature sensor.
c. Measure the resistance from the engine oil temperature return pin on the engine harness inline connector to the engine oil temperature return pin at the engine harness sensor connector.
d. Measure the resistance from the engine oil temperature signal pin on the engine harness inline connector to the engine oil temperature signal pin at the engine harness sensor connector.
e. If all measurements are less than 10 ohms, then the resistance is correct.

4. Faulty extension harness.

Inspect the extension harness and the AUX 105 connector pins.

a. Disconnect the extension harness connector from the AUX 105.
b. Inspect for corroded pins, bent pins, broken pins, pushed-back pins, or expanded pins.
c. Inspect for evidence of moisture in or on the connector.
d. Inspect for missing or damaged connector seals.
e. Inspect for dirt or debris in or on the connector pins.

Check for a short circuit to engine block ground.

a. Disconnect the extension harness from the AUX 105.

b. Disconnect the extension harness from the engine harness.

c. Measure the resistance from the oil temperature signal pin on the extension harness connector to the engine block ground.

d. Measure the resistance from the oil temperature return pin on the extension harness connector to the engine block ground.

e. If the measurement is more than 100K ohms, then the resistance is correct.

Check for an open circuit.

a. Disconnect the extension harness connector from the AUX 105.

b. Disconnect the extension harness from the engine harness.

c. Measure the resistance from the engine oil temperature signal pin on the extension harness connector to the engine oil temperature signal pin at the extension harness inline connector.

d. Measure the resistance from the engine oil temperature return pin on the extension harness connector to the engine oil temperature return pin at the extension harness inline connector.

e. If all measurements are less than 10 ohms, then the resistance is correct.

Check for a short circuit from pin-to-pin.

a. Disconnect the extension harness from the AUX 105.

b. Disconnect the extension harness from the engine harness.

c. Measure the resistance from the engine oil temperature return pin on the extension harness connector to all other pins in the extension harness connector.

d. Measure the resistance from the engine oil temperature signal pin on the extension harness connector to all other pins in the extension harness connector.

e. If all measurements are greater than 100K ohms, then the resistance is correct.

7.6.15 Code 214 - Engine Oil Temperature High - Critical

Logic:

Engine oil temperature has exceeded the alarm (shutdown) threshold for high engine oil temperature.

Possible Causes:

1. Inaccurate engine temperature sensor.
2. Fault simulation feature is enabled.
3. Incorrect threshold setting.

Diagnosis and Repair:

1. Verify the sensor accuracy with a thermocouple or similar temperature probe.
    a. Connect the temperature probe to the engine near the engine oil temperature sensor.
    b. Connect InPower.

   c. Compare the engine oil temperature reading from the service tool to the reading from the temperature sensor. If the two readings are reasonably close, then the sensor is reading correctly.

2. Verify that the fault simulation feature is not enabled.
   a. Connect InPower.
   b. Verify that the fault simulation is NOT enabled for the engine oil temperature sensor by connecting to the PCC via InPower. If fault simulation is disabled, there is no problem.
3. Check threshold settings.
   a. Connect InPower.
   b. Verify that the fault threshold is set correctly for the normal operating range for the engine oil temperature sensor. Refer to the engine manual for correct threshold values, and make the appropriate changes using InPower.

7.6.16 Code 234 - Engine Speed High - Critical

Logic:

Engine speed signals indicate the engine speed is greater than the shutdown threshold.

Possible Causes:

1. Fault simulation feature is enabled.
2. Incorrect threshold setting.
3. Incorrect fuel type setting.
4. Faulty engine speed sensor connections.
5. Faulty engine harness.
6. Faulty extension harness.
7. Faulty engine speed/position sensor.

Diagnosis and Repair:

1. Verify that the fault simulation feature is not enabled.
   a. Connect InPower.
   b. Verify that the fault simulation is NOT enabled for the engine speed sensor by connecting to the PCC via InPower. If fault simulation is disabled, there is no problem.
2. Check threshold settings.
   a. Connect InPower.
   b. Verify that the fault threshold is set correctly for the normal operating range for the engine overspeed sensor. Refer to the engine manual for correct threshold values, and make the appropriate changes using InPower.
3. Check for the correct fuel type setting.
   a. Connect InPower.
   b. Verify the fuel source set in InPower is the same fuel used by the generator set.
4. Engine speed sensor connections.

Inspect the engine speed sensor and the harness connector pins.

a. Disconnect the engine harness connector from the engine speed sensor.
b. Inspect for corroded pins, bent pins, broken pins, pushed-back pins, or expanded pins.
c. Inspect for evidence of moisture in or on the connector.
d. Inspect for missing or damaged connector seals.
e. Inspect for dirt or debris in or on the connector pins.

5. Faulty engine harness.

Inspect the engine harness and the connector pins.

a. Disconnect the engine harness connector from the extension harness.
b. Inspect for corroded pins, bent pins, broken pins, pushed-back pins, or expanded pins.
c. Inspect for evidence of moisture in or on the connector.
d. Inspect for missing or damaged connector seals.
e. Inspect for dirt or debris in or on the connector pins.

6. Faulty extension harness.

Inspect the extension harness and the AUX 105 connector pins.

a. Disconnect the extension harness connector from the AUX 105.
b. Inspect for corroded pins, bent pins, broken pins, pushed-back pins, or expanded pins.
c. Inspect for evidence of moisture in or on the connector.
d. Inspect for missing or damaged connector seals.
e. Inspect for dirt or debris in or on the connector pins.

7. Faulty engine speed/position sensor.

Inspect the engine speed/position sensor.

a. Disconnect the engine speed/position sensor from the engine and engine harness.
b. Inspect sensor for bent, corroded, or loose pins.
c. Inspect the sensor for structural deficiencies.

7.6.17 Code 235 - Low Coolant Level

Logic:

Low Coolant Level input is active and the threshold response is set to “Shutdown".

Possible Causes:

1. The radiator coolant level is low.
2. Faulty sensor or wiring.
3. PCCNet Annunciator.

4. The base board is faulty.

Diagnosis and Repair:

1. Check the radiator coolant level to see if it is adequate.
    a. Add coolant to the radiator, if coolant level is low.
2. Faulty sensor or wiring.
    a. Disconnect the signal leads at the sensor, so the sensor is no longer connected to the control; then reset the control by pressing the Reset button. If event/fault code 197 clears and does not reappear, then replace the low coolant level sensor.
    b. If event/fault code 197 reappears, check for a short in the wiring between the low coolant level sensor and the input to the control (at J20-17: Input and J20-5: Ground). A ground input into J20-17 will activate the alarm at the control.
3. PCCNet Annunciator.
    a. If a PCCNet Annunciator is not used, go to step 4. If a PCCNet Annunciator is used, check the wiring on the back of the PCCNet Annunciator at TB1-6 to the Low Coolant Level sender. Ensure that an open circuit or short circuit does not exist in the wiring.
    b. Refer to the PCCNet Annunciator Operator's Manual to ensure that the Annunciator is configured correctly; since inputs can be configured to Active Open or Active Closed. Then check the input on the back of the PCCNet Annunciator at TB1 – 6 and ensure that the input signal into the PCCNet Annunciator is properly configured.
4. The base board is faulty.
    a. If the wiring and hardware are not found to be faulty, replace the base board.

7.6.18 Code 236 - Engine Speed/Position Sensor Circuit

Logic:

Engine speed/position sensor signal is not detected.

Possible Causes:

1. Inaccurate engine speed/position sensor.
2. Faulty engine speed sensor connections.
3. Faulty engine harness.
4. Faulty extension harness.
5. Faulty engine speed/position sensor.

If the generator set stalls after starting, this is not a control issue.

NOTE: Part number 382275800 - Male Deutsch/AMP/Metri-Pack test lead
Part number 382291700 - Female Deutsch/AMP/Metri-Pack test lead

Diagnosis and Repair:

1. Inaccurate engine speed/position sensor.

    Check the sensor gap.

    a. Measure the sensor gap.

   b. Refer to the engine manual for appropriate gap size, and adjust as necessary.

2. Engine speed sensor connections

   Inspect the engine speed sensor and the harness connector pins.

   a. Disconnect the engine harness connector from the engine speed sensor.
   b. Inspect for corroded pins, bent pins, broken pins, pushed-back pins, or expanded pins.
   c. Inspect for evidence of moisture in or on the connector.
   d. Inspect for missing or damaged connector seals.
   e. Inspect for dirt or debris in or on the connector pins.

3. Faulty engine harness.

   Inspect the engine harness and the extension harness connector pins.

   a. Disconnect the engine harness connector from the extension harness.
   b. Inspect for corroded pins, bent pins, broken pins, pushed-back pins, or expanded pins.
   c. Inspect for evidence of moisture in or on the connector.
   d. Inspect for missing or damaged connector seals.
   e. Inspect for dirt or debris in or on the connector pins.

   Check for a short circuit from pin-to-pin.

   a. Disconnect the engine harness connector from the extension harness.
   b. Disconnect the engine harness from the engine speed sensor.
   c. Disconnect the engine harness from all sensors that have a shared return with the engine speed sensor.
   d. Measure the resistance from the engine speed return pin on the engine harness inline connector to all other pins in the engine harness inline connector.
   e. Measure the resistance from the engine speed signal pin on the engine harness inline connector to all other pins in the engine harness inline connector.
   f. If all measurements are greater than 100K ohms, then the resistance is correct.

   Check for an open circuit.

   a. Disconnect the engine harness connector from the extension harness.
   b. Disconnect the engine harness from the engine speed sensor.
   c. Measure the resistance from the engine speed return pin on the engine harness inline connector to the engine speed return pin at the engine harness sensor connector.
   d. Measure the resistance from the engine speed signal pin on the engine harness inline connector to the engine speed signal pin at the engine harness sensor connector.
   e. If all measurements are less than 10 ohms, then the resistance is correct.

4. Faulty extension harness.

   Inspect the extension harness and the AUX 105 connector pins.

   a. Disconnect the extension harness connector from the engine extension harness.

b. Inspect for corroded pins, bent pins, broken pins, pushed-back pins, or expanded pins.

c. Inspect for evidence of moisture in or on the connector.

d. Inspect for missing or damaged connector seals.

e. Inspect for dirt or debris in or on the connector pins.

Check for an open circuit.

a. Disconnect the extension harness connector from the AUX 105.

b. Disconnect the extension harness from the engine harness.

c. Measure the resistance from the engine speed signal pin on the extension harness connector to the engine speed signal pin at the extension harness inline connector.

d. Measure the resistance from the engine speed return pin on the extension harness connector to the engine speed return pin at the extension harness inline connector.

e. If all measurements are less than 10 ohms, then the resistance is correct.

Check for a short circuit from pin-to-pin.

a. Disconnect the extension harness from the AUX 105.

b. Disconnect the extension harness from the engine harness.

c. Measure the resistance from the engine speed return pin on the extension harness connector to all other pins in the extension harness connector.

d. Measure the resistance from the engine speed signal pin on the extension harness connector to all other pins in the extension harness connector.

e. If all measurements are greater than 100K ohms, then the resistance is correct.

5. Faulty sensor.

   Inspect the engine speed sensor.

   a. Disconnect the engine speed/position sensor from the engine and engine harness.

   b. Inspect the sensor for bent, corroded, or loose pins.

   c. Inspect the sensor for structural deficiencies.

7.6.19 Code 359 - Fail To Start

Logic:

Engine has failed to start after the last crank cycle.

Possible Causes:

1. There is an insufficient fuel level.
2. There is a restricted fuel supply.
3. The fuel solenoid does not energize.
4. Faulty glow relay or glow plug settings.
5. Faulty ignition relay.
6. Incorrect flywheel teeth setting.
7. Incorrect starter disconnect speed.

8. Faulty engine harness or extension harness.

Diagnosis and Repair:

1. Check to see if there is an insufficient fuel level.
   a. Add fuel to the fuel tank if fuel level is low.
2. Check to see if there is a restricted fuel supply.
   a. Open any closed shutoff valves in the fuel line supplying the engine.
   b. Service clogged fuel injectors; refer to the Engine Service Manual.
   c. Bleed the air in the fuel system; refer to the Engine Service Manual.
   d. Correct any fuel leaks; replace dirty fuel filters and dirty or plugged air filters.
3. Check to see if the fuel solenoid does not energize.
   a. Check the fuse (20 amp) on J20-21. Replace if open.
   b. Measure the voltage at the input of the Fuel Solenoid Relay (E-Stop B+ (B+) and J20-14 (negative)) and attempt to start the engine.
      - If B+ is not available, check the wiring for an open circuit from the base board to the Fuel Solenoid Relay; correct if there is an open circuit. If the wiring is not faulty, replace the base board.
      - If B+ is properly supplied to the relay but not found at the output, replace the Fuel Solenoid Relay.

Glow Plugs

1. Check the glow plug relay at J11-6 and J11-7. When active, J11-6 should have B+, and J11-7 should be ground.
2. Connect to the control via InPower.
   - Make sure *Glow Plug Enable* is Enabled.
   - Make sure *Max Preheat Temperature* and *Min Preheat Temperature* are set appropriately. *Min Preheat Temperature* should be less than *Max Preheat Temperature*.
   - Make sure *Max Glow Time* is set appropriately.

Ignition Relay

Check the ignition relay at J11-6 and J11-7. When normal operation, J11-6 should have B+, and J11-7 should be ground.

Flywheel Teeth

Connect to the control via InPower. Make sure *Teeth Pulses Per Revolution* matches the actual number of flywheel teeth.

Starter Disconnect

Connect to the control via InPower. Make sure *Starter Disconnect Speed* is set to a reasonable value. Check the engine manual.

Governor

Faulty engine harness.

1. Inspect the engine harness and the connector pins.
   a. Disconnect the engine harness connector from the extension harness.
   b. Inspect for corroded pins, bent or broken pins, and pushed back or expanded pins.
   c. Inspect for evidence of moisture in or on the connector.
   d. Inspect for missing or damaged connector seals.
   e. Inspect for dirt or debris in or on the connector pin.
2. Check for a short circuit from pin to pin.
   a. Disconnect the engine harness from the extension harness.
   b. Disconnect the engine harness connector from the oil pressure sensor.
   c. Disconnect the engine harness from all sensors that have a shared supply or return with the oil pressure sensor.
   d. Measure the resistance from the oil pressure 5 VDC supply pin on the engine harness inline connector to all other pins in the engine harness inline connector.
   e. Measure the resistance from the oil pressure return pin on the engine harness inline connector to all other pins in the engine harness inline connector.
   f. Measure the resistance from the oil pressure signal pin on the engine harness inline connector to all other pins in the engine harness inline connector.
   g. If all measurements are greater than 100k ohms, then the resistance is correct.
3. Check for an open circuit.
   a. Disconnect the engine harness from the extension harness.
   b. Disconnect the engine harness connector from the oil pressure sensor.
   c. Measure the resistance from the oil pressure return pin on the engine harness inline connector to the oil pressure return pin on the engine harness sensor connector.
   d. If the measurement is less than 10 ohms, then the resistance is correct.

Faulty extension harness.

1. Inspect the extension harness and the AUX 105 connector pins.
   a. Disconnect the extension harness connector from the AUX 105.
   b. Inspect for corroded pins, bent or broken pins, and pushed back or expanded pins.
   c. Inspect for evidence of moisture in or on the connector.
   d. Inspect for missing or damaged connector seals.
   e. Inspect for dirt or debris in or on the connector pins.
2. Check for an open circuit.
   a. Disconnect the extension harness connector from the AUX 105.
   b. Disconnect the extension harness from the engine harness.
   c. Measure the resistance from the oil pressure return pin on the extension harness connector to the oil pressure return pin on the extension harness inline connection.

   d. If the measurement is less than 10 ohms, then the resistance is correct.

3. Check for a short circuit from pin to pin.
   a. Disconnect the extension harness connector from the AUX 105.
   b. Disconnect the extension harness from the engine harness.
   c. Measure the resistance from the oil pressure 5 VDC supply pin on the extension harness connector to all other pins in the extension harness connector.
   d. Measure the resistance from the oil pressure return pin on the extension harness connector to all other pins in the extension harness connector.
   e. Measure the resistance from the oil pressure signal pin on the extension harness connector to all other pins in the extension harness connector.
   f. If all measurements are greater than 100k ohms, then the resistance is correct.

7.6.20 Code 415 - Engine Oil Pressure Low - Critical

Logic:

Voltage signal indicates oil pressure has dropped below the shutdown threshold.

Diagnosis and Repair:

See Fault Code 143.

7.6.21 Code 421 - Engine Oil Temperature Moderately Above Normal

Logic:

Engine oil temperature has exceeded the warning threshold for high oil temperature.

Possible Causes:

1. Inaccurate engine oil temperature sensor.
2. Fault simulation feature is enabled.
3. Incorrect threshold setting.

Diagnosis and Repair:

1. Verify the sensor accuracy with a thermocouple or similar temperature probe.
   a. Connect the temperature probe to the engine near the engine oil temperature sensor.
   b. Connect InPower.
   c. Compare the engine oil temperature reading from the service tool to the reading from the temperature sensor. If the two readings are reasonably close, then the sensor is reading correctly.
2. Verify that the fault simulation for the sensor is not enabled.
   a. Connect InPower.
   b. Verify that the fault simulation is NOT enabled for the engine oil temperature sensor by connecting to the PCC via InPower. If the fault simulation is disabled, there is no problem.

3. Check threshold settings.
   a. Connect InPower.
   b. Verify that the fault threshold is within the normal operating range for the engine oil temperature sensor. Refer to the engine service manual for correct threshold values, and make the appropriate changes using InPower.

7.6.22 Code 427 - CAN Data Link Degraded

Logic:

Communication between the engine control (ECM) and the genset control is severed.

Possible Causes:

1. The Engine ECM has lost power or failed.
2. The CAN datalink has failed.

Diagnosis and Repair:

1. The Engine ECM has lost power or failed.
   a. Emergency (E-Stop) button is a closed relay when it is pulled out (not active), and open relay when depressed (active). The E-Stop button on the Operator Panel disables power to the engine ECM when it is depressed (active); CAN-LINK communication will cease when power to the ECM is lost. Ensure that the E-Stop is not active on the control. Follow the procedure below:

      Reset the Local/Remote Emergency Stop

      a. Pull-out (not active) the Local/Remote Emergency Stop button.
      b. Press the Off button on the Operator Panel.
      c. Press the Reset button.
      d. Select Manual or Auto as required.
   b. Ensure that the emergency stop button is functioning correctly, measure the outputs of the E-Stop (Normally Open and Normally Closed contacts) and ensure that the outputs switch state correctly when engaged and disengaged, replace the switch if faulty.
   c. Check the wiring from the base board.
   d. Keyswitch control relay is a normally open relay. Ensure that B+ is available at the relay input, then measure the voltage output. If there is a B+ at both the input and output of the Keyswitch control relay, the relay is not faulty. If B+ is noted at the input but not at the output of the Keyswitch control relay, replace the relay.
   e. Connect to the engine ECM with InPower and/or InSite, to verify that the ECM is functioning properly and is communicating with the CAN-LINK network. Refer to the engine service manual for ECM Troubleshooting procedures, if the ECM is faulty, then replace.

2. The CAN datalink has failed.
   a. There is a defective datalink harness connection, or open circuit; inspect the datalink harness and connector pins from J11-20 to J1939+ and from J11-19 to J1039-; also check the shield ground connection at J11-17.
   b. Check the terminating resistors. With connector J11 disconnected from the base board and the engine datalink connection disconnected from the ECM control, measure resistance between Pins J11-19 and J11-20 (60 ohms is satisfactory). If the resistance is not 60 ohms, check the terminating resistors. Each of the two terminating resistors should be 120 ohms, replace if not 120 ohms.

7.6.23 Code 441 - Low Battery Voltage

Logic:

Low battery voltage.

Possible Causes:

1. Damaged battery cable connections.
2. Low battery voltage.
3. Bad battery ground connection.
4. Damaged accessory wiring at B+.
5. Damaged OEM battery harness.
6. Damaged engine harness.
7. Discharged or defective battery.
8. Alternator not functioning properly.
9. Incorrect battery setting.

NOTE: Part Number 382275800 - Male Deutsch/AMP/Metri-Pack test lead
Part Number 382291700 - Female Deutsch/AMP/Metri-Pack test lead

Diagnosis and Repair:

1. Inspect the battery cable connections.
   a. Inspect connections for corrosion.
   b. Inspect connections for loose connections.
2. Measure the battery voltage.
   a. Measure the battery voltage from the positive (+) terminal to the negative (-) terminal. If the voltage is between 17.3 and 34.7 V on a 24 VDC system, then the voltage is within normal range.
3. Inspect the battery ground connection.
   a. Disconnect the engine harness.

   b. Measure the resistance from the negative (-) battery terminal to the engine block ground. If the resistance is less than 10 ohms, then there exists proper grounding. If the resistance is greater than 10 ohms, then the battery ground connection is in need of repair.

4. Check for add-on or accessory wiring at the positive (+) terminal of the battery.

   a. Starting at the positive (+) terminal, follow any add-on or accessory wiring and examine the wire(s) for damaged insulation or installation error that can cause supply wire to be shorted to the engine block.

5. Damaged OEM battery harness.

   Inspect the OEM battery harness and the Inline E connector pins.

   a. Disconnect the OEM battery harness from the Inline E connector.
   b. Inspect for corroded pins, bent or broken pins, pushed back or expanded pins.
   c. Inspect for evidence of moisture in or on the connector.
   d. Inspect for missing or damaged connector seals.
   e. Inspect for dirt and debris in or on the connector pins.

   Check for an open circuit.

   a. Disconnect the OEM battery harness from the engine.
   b. Disconnect the positive (+) battery terminal.
   c. Measure the resistance from all pins being supplied by unswitched battery on the OEM battery harness at the Inline E connector to the positive (+) battery terminal connector. If the resistance is less than 10 ohms, then there is not an open circuit. If the resistance is greater than 10 ohms, then there is an open circuit that is in need of repair.

   Check for a short circuit from pin to pin.

   a. Disconnect the engine harness.
   b. Disconnect the positive (+) battery terminal.
   c. Measure the resistance from all unswitched battery pins on the Inline E connector to all other pins on the Inline E connector. If the resistance is more than 100k ohms, then there is not a short circuit. If the resistance is less than 100k ohms, then there is a short circuit that is in need of repair.

6. Damaged engine harness.

   Inspect the engine harness fuse connection. Inspect that it is installed correctly.

   Check the engine harness fuse.

   a. Disconnect the 20 amp fuse from the OEM harness.
   b. Inspect that the 20 amp to verify the fuse is not blown.

   Inspect the engine harness and the extension harness inline connector pins.

   a. Disconnect the engine harness.
   b. Inspect for corroded pins, bent or broken pins, pushed back or expanded pins.
   c. Inspect for evidence of moisture in or on the connector.

d. Inspect for missing or damaged connector seals.

e. Inspect for dirt and debris in or on the connector pins.

Check for an open circuit.

a. Disconnect the OEM battery harness from the engine connector.

b. Disconnect the positive (+) battery terminal.

c. Measure the resistance from all pins being supplied by unswitched battery on the OEM battery harness at the Inline E connector to the positive (+) battery terminal connector. If the resistance is less than 10 ohms, then there is not an open circuit. If the resistance is greater than 10 ohms, then there is an open circuit that is in need of repair.

Check for a short circuit from pin to pin.

a. Disconnect the engine harness.

b. Disconnect the positive (+) battery terminal.

c. Measure the resistance from all unswitched battery pins on the Inline E connector to all other pins on the Inline E connector. If the resistance is more than 100k ohms, then there is not a short circuit. If the resistance is less than 100k ohms, then there is a short circuit that is in need of repair.

7. Weak or discharged battery. If the battery cannot hold adequate voltage, then replace the battery

   a. Measure the voltage of the battery with a voltmeter. Battery voltage should be 24 VDC or greater in a 24 V system. If the battery voltage is low, check the electrolyte level. Replenish the electrolyte level if low and recharge the battery; the specific gravity of a fully charged lead acid battery is approximately 1.260 at 80 F (27 C).

   b. If the battery cannot hold adequate voltage, then replace the battery.

8. Check engine DC alternator.

   a. Check the engine DC alternator. If charging voltage is not 12-14 VDC for a 12 V system, or 24-26 VDC in a 24 V system, replace the alternator.

9. Check battery voltage setting.

   a. Verify that the battery voltage (12V or 24V) matches calibration.

7.6.24 Code 442 - High Battery Voltage

Logic:

High battery voltage.

Possible Causes:

1. Incorrect battery voltage setup
2. The voltage of the battery is above the high battery voltage threshold.
3. Battery charger is overcharging the battery.
4. Faulty engine DC alternator.

NOTE: Part Number 382275800 - Male Deutsch/AMP/Metri-Pack test lead

Part Number 382291700 - Female Deutsch/AMP/Metri-Pack test lead

Diagnosis and Repair:

1. Incorrect battery voltage setup
   a. Measure the voltage of the battery with a voltmeter. Battery voltage of lead acid batteries should be between 12-14 VDC in a 12 VDC system or 24-28 VDC in a 24 VDC system. Verify that the battery voltage matches the voltage that the control is calibrated for. If the genset has a 24 V battery, but the control is calibrated to 12 V, the high battery voltage alarm will activate. In these cases, change the voltage on the control to 24 V. To access the battery voltage setup menu from the operator panel, go to **Setup > OEM Setup > OEM Engine Setup > Nominal Battery Voltage**. You can also use InPower.
2. The voltage of the battery is above the high battery voltage threshold.
   a. Voltage of the battery is above the “High Battery" threshold for the time set in the “High Battery Set Time" parameter. To access the battery voltage setup menu from the operator panel, go to **Setup > OEM Setup > OEM Engine Setup > Nominal Battery Voltage** and change the battery voltage setup of the control accordingly. You can also use InPower.
3. Battery charger is overcharging the battery.
   a. Ensure that the battery charger is charging the battery at an acceptable rate and not overcharging the battery. Adjust the charge rate of the battery charger if the charge rate is above the recommendation of the manufacturer.
   b. Refer to the battery charger manual, if available.
4. Faulty engine DC alternator.
   a. Check the engine DC alternator for overcharging conditions. If charging voltage is not 12-14 VDC in a 12 V system or 24-28 VDC in a 24 V system, replace the DC alternator.

7.6.25 Code 488 - Intake Manifold Temperature Moderately Above Normal

Logic:

Intake manifold temperature has exceeded the warning threshold for high intake manifold temperature.

Possible Causes:

1. Large load or high ambient temperature.
2. Inaccurate intake manifold temperature sensor.
3. Fault simulation feature is enabled.
4. Threshold setting too low.

Diagnosis and Repair:

1. Large load or high ambient temperature.
   a. Allow the engine to cool down completely.
   b. Look for possible coolant leakage points and repair as necessary.

c. Check the coolant level and replenish if low.

d. Check for obstructions to cooling airflow and correct as necessary.

e. Check the fan belt and repair or tighten if necessary.

f. Check the blower fan and circulation pumps on remote radiator installations.

g. Reset the control and restart.

2. Verify the sensor accuracy with a thermocouple or similar temperature probe.

    a. Connect the temperature probe to the engine near the intake manifold temperature sensor.

    b. Connect InPower.

    c. Compare the intake manifold temperature reading from the service tool to the reading from the temperature probe. If the two readings are reasonably close, then the sensor is reading correctly.

3. Verify that the fault simulation for the sensor is not enabled.

    a. Connect InPower.

    b. Verify that the fault simulation is NOT enabled for the intake manifold temperature sensor by connecting to the PCC via InPower. If the fault simulation is disabled, there is no problem.

4. Check threshold settings.

    a. Connect InPower.

    b. Verify that the fault threshold is within the normal operating range for the intake manifold temperature sensor. Refer to the engine service manual for correct threshold values, and make the appropriate changes using InPower.

7.6.26 Code 611 - Engine Hot Shut Down

Logic:

Engine shutdown hot without a proper cooldown run period.

Possible Causes:

1. Critical Shutdown fault.
2. Emergency shutdown.
3. Incorrect shutdown of genset.

Diagnosis and Repair:

1. Critical Shutdown fault.

    a. A critical shutdown fault (e.g., overspeed) has caused the engine to shut down immediately without allowing the engine to complete the proper cooldown process. Troubleshoot the other shutdown fault(s) that are causing the genset to shut down.

2. Emergency shutdown.

    a. An Emergency Stop command has immediately shutdown the engine, which has bypassed the proper cooldown process for the engine.

3. Incorrect shutdown of genset.
    a. The genset has been shut down without allowing the proper cooldown process for the engine (control switched to OFF manually by user/operator).

7.6.27 Code 781 - The ECM CAN Datalink Has Failed

Logic:

Communication between the engine control module (ECM) and the genset control is severed.

Possible Causes:

1. The Engine ECM has lost power or failed.
2. The CAN datalink has failed.

Diagnosis and Repair:

1. The Engine ECM has lost power or failed.
    a. Check the wiring from the base board.
    b. Keyswitch control relay is a normally open relay. Ensure that B+ is available at the relay input, then measure the voltage output. If there is a B+ at both the input and output of the Keyswitch control relay, the relay is not faulty. If B+ is noted at the input but not at the output of the Keyswitch control relay, replace the relay.
    c. Connect to the engine ECM with InPower and/or InSite, to verify that the ECM is functioning properly and is communicating with the CAN-LINK network. Refer to the engine service manual for ECM Troubleshooting procedures, if the ECM is faulty, then replace.
2. The CAN datalink has failed.
    a. There is a defective datalink harness connection, or open circuit; inspect the datalink harness and connector pins from J11-20 to J1939+ and from J11-19 to J1039-; also check the shield ground connection at J11-17.
    b. Check the terminating resistors. With connector J11 disconnected from the base board and the engine datalink connection disconnected from the ECM control, measure resistance between Pins J11-19 and J11-20 (60 ohms is satisfactory). If the resistance is not 60 ohms, check the terminating resistors. Each of the two terminating resistors should be 120 ohms, replace if not 120 ohms.

7.6.28 Code 1121 - Fail To Disconnect

Logic:

If the “Fail To Disconnect Enable" parameter is set to enable, and the Genset CB and Utility CB Fail to Open Faults are both active, the genset control will display event/fault code 1121.

Possible Causes:

1. Event/fault code 1221 is mapped to a configurable output and event/fault code 1453 and event/fault code 2397 are active.

Diagnosis and Repair:

1. Event/fault code 1221 is mapped to a configurable output and event/fault code 1453 and event/fault code 2397 are active.
   a. Event/fault code 1221 can be mapped to send an external notification thru a configurable customer output relay on the base board to an external device that the Genset CB and Utility CB have failed to open. This fault will become active if the “Fail To Disconnect Enable" parameter is set to enable, event/fault code 1221 is mapped to a configurable output, and if event/fault code 1453 and event/fault code 2397 are active. Troubleshoot event/fault code 1453 and event/fault code 2397 to resolve this issue.

      To disable event/fault code 1221 go to **Setup > Paralleling Setup > Power Transfer Control > Fail to Disc En** on the display and set the “Fail To Disconnect Enable" parameter to Disable, then determine which configurable output is set to activate when event/fault code 1221 is active and go to: **Setup > Configurable I/O** on the display and remove the mapping of event/fault code 1221 to that output.

7.6.29 Code 1122 - Delayed Rated To Idle Transition

Logic:

If the "Rated to Idle Transition Delay" is greater than zero, event/fault code 1122 will become active when the genset transitions from rated to idle.

Possible Causes:

1. The genset is transitioning from rated to idle mode.

Diagnosis and Repair:

1. Event/fault code 1122 is set to “Warning" or “Shutdown" and the genset is transitioning from rated to idle mode.
   a. This event/fault code can be mapped to a configurable customer output relay in order to send external notification via the relay on the base board to users so that proper action can be taken in the time given before the genset transitions to idle. This fault can be disabled by setting the "Rated to Idle Transition Delay" to 0 seconds. To access the setup menu through the Operator Panel, go to **Setup > Genset Setup > Rated to Idle Delay** and set appropriately.

7.6.30 Code 1124 - Delayed Shutdown

Logic:

Provides advance warning of an impending genset shutdown to loads which cannot handle sudden losses of power.

Possible Causes:

1. A shutdown fault.

Diagnosis and Repair:

1. A shutdown fault.

    a. Event/fault code 1124 is activated as a result of another non-critical shutdown fault. Troubleshoot the other non-critical shutdown fault(s) that is(are) causing the genset to shutdown. This event/fault code was designed to send an external notification through a configurable customer output relay on the base board to loads which cannot handle a sudden loss of power. The genset base board will send a signal to critical loads and will wait for the amount of time in the “Delayed Shutdown Time" parameter before shutting down the genset. go to **Setup > Genset Setup > Delayed shutdown delay** from the operator panel and set appropriately.

7.6.31 Code 1131 - Battle Short Active

Logic:

Battle Short has been enabled.

Possible Causes:

1. Battle Short enabled.

Diagnosis and Repair:

1. Disable Battle Short.

    a. The purpose of this fault is to provide a record in the fault history and fault occurrence list that the Battle Short feature is activate. The Battle Short fault becomes active when all of the following are true:

        - The Battle Short parameter is Enabled.
        - One of the configurable inputs on the base board is configured for Battle Short.
        - The configurable input configured for Battle Short becomes Active.

7.6.32 Code 1132 - Controlled Shutdown

Logic:

A fault set to Shutdown with Cooldown is active and has put the genset in a controlled shutdown.

Possible Causes:

1. A fault set to Shutdown with Cooldown is active.

Diagnosis and Repair:

1. A fault is set to Shutdown with Cooldown is active.
   a. Event/fault code 1132 is activated by another active event/fault that is set to "Shutdown with Cooldown". Troubleshoot the other shutdown fault(s) that are causing the genset to shutdown. A controlled shutdown of the system allows first for loads to be transferred or ramped off, and then for a proper cooldown of the genset to take place before shutting down. Go to **Setup > Genset Setup > Ctrld Shutdown Advance** from the Operator Panel in order to appropriately set the Controlled Shutdown Advanced Notice Delay.

7.6.33 Code 1219 - Utility CB Tripped

Logic:

The Utility CB has tripped.

Possible Causes:

1. Overload, Short Circuit, or Ground Fault.
2. Incorrectly wired or short circuit.
3. CB Trip solenoid is incorrectly configured or faulty.
4. Faulty Utility CB.

Diagnosis and Repair:

1. Overload, Short Circuit, or Ground Fault.
   a. Check the load of the application, load cables, and the ground fault relay if available. Repair if necessary.
2. Incorrectly wired or short circuit.
   a. Verify the wiring from the Utility CB to the Utility CB Tripped status input on the base board. The Utility CB Tripped status input is a Normally Open contact at TB10-5 and TB10-1 (B+ Return). Ensure that the connection from the Utility CB to TB10-5 on the base board is not shorted to ground.
3. CB Trip solenoid is incorrectly configured or faulty.
   a. Utility CB Trip settings are configured to trip at a low over-current threshold. Check other settings on the Utility CB that might cause it to trip since circuit breakers can have multiple trip settings. Configure the Utility CB Trip Solenoid to trip at adequate trip settings for the application; refer to the CB Service Manual.
   b. Faulty Trip solenoid, refer to the CB Service Manual for troubleshooting instructions.
4. Faulty Utility CB.
   a. Refer to the Utility CB Service Manual.

7.6.34 Code 1223 - Utility Frequency Error

Logic:

In Power Transfer Control (PTC) Operation, if the “Utility Frequency Sensor Enable" parameter is enabled and the utility frequency exceeds the “Utility Frequency Upper Drop-Out Threshold", or is below the “Utility Frequency Lower Drop-Out Threshold", or is Out of Range Low, for the “Utility Frequency Drop-Out Delay", fault code 1223 will become active.

Possible Causes:

1. Utility Frequency drop-out thresholds are incorrectly set.
2. The frequency of the Utility is not stable.

Diagnosis and Repair:

1. Utility Frequency drop-out thresholds are incorrectly set.
    a. This fault will become active when the Utility Frequency goes above or below the drop-out thresholds. Drop-out threshold are dependent of the following parameters:
        - Utility Center Frequency.
        - Utility Frequency Pick-Up Bandwidth.
        - Utility Frequency Drop-Out Bandwidth.

        To Modify the preceding parameters, on the display go to: **Setup > Paralleling Setup > Power Transfer Control > Center Frequency** or **Pick-Up BW** or **Drop-out BW** or **Drop-Out Delay** and set appropriately. Refer to the PTC section for setup information and instructions.

    b. To disable this function, set the “Utility Frequency Sensor Enable" parameter to disable. On the display go to: **Setup > Paralleling Setup > Power Transfer Control > Enable** and set appropriately. Refer to the PTC section for more information.
2. The frequency of the Utility is not stable.
    a. The frequency of the utility is unstable, check with your utility company.

7.6.35 Code 1224 - High Genset Voltage

Logic:

In Power Transfer Control (PTC) Operation, if the “Genset Overvoltage Sensor Enable" parameter is set to enable, and the genset voltage goes above the “Genset Overvoltage Drop-Out Threshold", for the “Genset Overvoltage Drop-Out Delay" time, fault code 1224 will become active.

Possible Causes:

1. Genset High AC Voltage fault.
2. Genset Overvoltage drop-out thresholds are incorrectly set.

Diagnosis and Repair:

1. Genset High AC Voltage fault.
   a. If the High AC Voltage fault is active on the display, refer to the troubleshooting procedures for High AC Voltage, fault code 1446.
2. Genset Overvoltage drop-out thresholds are incorrectly set.
   a. This fault will become active when the Genset voltage goes above the “Genset Overvoltage Drop-Out Threshold" for the “Genset Overvoltage Drop-Out Delay" time. The genset overvoltage drop-out threshold is dependent of the following parameters:
      - Genset Overvoltage Drop-out percentage.
      - Genset Overvoltage Drop-out Delay.

      To Modify the preceding parameters, on the display go to: **Setup > Paralleling Setup > Power Transfer Control > Drop out** or **Drop-Out Delay** and set appropriately. Refer to the PTC section for setup information and instructions.

   b. To disable this function, set the “Genset Overvoltage Sensor Enable" parameter to disable. On the display go to: **Setup > Paralleling Setup > Power Transfer Control > Enable** and set appropriately. Refer to the PTC section for more information.

7.6.36 Code 1225 - Low Genset Voltage

Logic:

In Power Transfer Control (PTC) Operation, if the genset voltage drops below the “Genset Undervoltage Drop-Out Threshold", for the “Genset Undervoltage Drop-Out Delay" time, fault code 1225 will become active.

Possible Causes:

1. Genset Low AC Voltage fault.
2. Genset Undervoltage drop-out thresholds are incorrectly set.

Diagnosis and Repair:

1. Genset Low AC Voltage fault.
   a. If the Low AC Voltage fault is active on the display, refer to the troubleshooting procedures for Low AC Voltage, fault code 1447.
2. Genset Undervoltage drop-out thresholds are incorrectly set.
   a. This fault will become active when the Genset voltage drops below the “Genset Undervoltage Drop-Out Threshold" for the “Genset Undervoltage Drop-Out Delay" time. The genset Undervoltage drop-out threshold is dependent of the following parameters:
      - Genset Undervoltage Drop-out percentage.
      - Genset Undervoltage Drop-out Delay.

      To Modify the preceding parameters, on the display go to: **Setup > Paralleling Setup > Power Transfer Control > Drop out** or **Drop-Out Delay** and set appropriately. Refer to the PTC section for setup information and instructions.

7.6.37 Code 1226 - Genset Frequency Error

Logic:

In Power Transfer Control (PTC) Operation, if the “Genset Frequency Sensor Enable" parameter is enabled and the genset frequency exceeds the “Genset Frequency Upper Drop-Out Threshold", or is below the “Genset Frequency Lower Drop-Out Threshold", or is Out of Range Low, for the “Genset Frequency Drop-Out Delay", fault code 1226 will become active.

Possible Causes:

1. Genset Frequency drop-out thresholds are incorrectly set.
2. The frequency of the Genset is not stable.

Diagnosis and Repair:

1. Genset Frequency drop-out thresholds are incorrectly set.
   a. This fault will become active when the Genset Frequency goes above or below the drop-out thresholds. Drop-out threshold are dependent of the following parameters:
      - Genset Center Frequency.
      - Genset Frequency Pick-Up Bandwidth.
      - Genset Frequency Drop-Out Bandwidth.

      To Modify the preceding parameters, on the display go to: **Setup > Paralleling Setup > Power Transfer Control > Center Frequency** or **Pick-Up BW** or **Drop-out BW** or **Drop-Out Delay** and set appropriately. Refer to the PTC section for setup information and instructions.
2. The frequency of the Genset is not stable.
   a. If the genset frequency is not stable or the genset is hunting/oscillating while it is running, refer to the troubleshooting procedures for fault codes 1448 and 1449.

7.6.38 Code 1243 - Engine Derated

Logic:

Event/fault code 1243 will become active if the engine has gone into a derate mode to protect itself from a shutdown, and if there are no other active derate events on the PCC.

Possible Causes:

1. A derate condition has been initiated by the engine ECM.

Diagnosis and Repair:

1. A derate condition has been initiated by the engine ECM.
   a. Event/fault code 1243 is activated by another active engine fault. Determine the fault(s) that caused the engine to derate by checking the operator panel or using InPower or InSite to connect to the ECM. Troubleshoot the event/fault(s) and resolve the issue(s) (Reference the Engine Service Manual). After the issue is resolved, press the Reset button on the genset control to allow the genset to return to a normal mode of operation. If the issue is not resolved when the Reset button is pressed, the engine will stay in derated mode.

7.6.39 Code 1244 - Engine Normal Shutdown

Logic:

A normal shutdown request has been received by the engine and no active Shutdown with Cooldown faults exist.

Possible Causes:

1. The genset is going through a normal shutdown.

Diagnosis and Repair:

1. The genset is going through a normal shutdown.
   a. The genset is going through a normal shutdown and there are no active shutdown faults in the ECM for at least 2 seconds.

7.6.40 Code 1245 - Engine Shutdown Fault

Logic:

Engine shutdown fault has occurred in the engine ECM.

Possible Causes:

1. Engine shutdown fault.

Diagnosis and Repair:

1. Engine shutdown fault.
   a. Event/fault code 1245 is activated by another active shutdown fault in the ECM. Connect to the Engine ECM with InPower or InSite to determine the actual shutdown fault that is generating event/fault code 1245; then troubleshoot the shutdown fault(s) (Reference the Engine Service Manual).

7.6.41 Code 1246 - Unknown Engine Fault

Logic:

An unrecognized engine fault has been received over the datalink.

Possible Causes:

1. The genset control has received an unknown event/fault code from the ECM.

Diagnosis and Repair:

1. The genset control has received an unknown event/fault code from the ECM.
   a. Connect directly to the Engine ECM with InPower or InSite to determine the actual warning or shutdown fault that is generating event/fault code 1246. Troubleshoot the fault(s) that are causing the genset to display event/fault code 1246 (Reference the Engine Service Manual).

7.6.42 Code 1248 - Engine Warning

Logic:

An engine warning fault has occurred in the engine ECM.

Possible Causes:

1. An engine warning fault is active.

Diagnosis and Repair:

1. An engine warning fault is active.
    a. Event/fault code 1248 is activated by another active warning fault in the ECM. Connect to the Engine ECM with InPower or InSite to determine the actual warning fault that is generating event/fault code 1248; then troubleshoot the warning fault(s) (Reference the Engine Service Manual).

7.6.43 Code 1312 - Config Input #2 Fault

Logic:

Configurable input #2 fault is active.

Possible Causes:

1. Condition for which "Configurable Input #2" is configured for is active.
2. “Configurable Input #2 Active State Selection" parameter is configured incorrectly.
3. Incorrectly wired; or open circuit or short circuit in the wiring.

Diagnosis and Repair:

1. Condition for which "Configurable Input #2" is configured for is active.
    a. Check the condition for which "Configurable Input #2" has been configured for; ex. if "Configurable Input #2" was configured to become active when the fuel level is low, check the fuel level and add fuel if needed. After the issue is resolved, press the Reset button on the Operator Panel in order to clear the fault, if the fault does not clear go to step 2.
2. “Configurable Input #2 Active State Selection" parameter is configured incorrectly.
    a. With InPower or through the Operator Panel check the switch input setting (active closed or active open) for Configurable Input #2. Ensure that the switch input setting is correctly set. If “Configurable Input #2 Input Function Pointer" parameter is set to default and if “Configurable Input #2 Active State Selection" parameter is set to “active closed", input 2 (event/fault code 1312) will become active when TB1-14 (input 2) and TB1-15 (ground) are connected (shorted) together.

       If “Configurable Input #2 Input Function Pointer" parameter is set to default and if “Configurable Input #2 Active State Selection" parameter is set to “active open", input 2 (event/fault code 1312) will become active when there is an open circuit between TB1-14 (input 2) and TB1-15 (ground).

To access the input configuration on the operator panel go to **Setup > Configurable I/O > Config Input #2 Menu > Active** and set this parameter appropriately for the application.

3. Incorrectly wired; or open circuit or short circuit in the wiring.
   a. Check the wiring at TB1-14 (input 2) and TB1-15 (ground) for an open circuit, short circuit, or a miswired condition.

7.6.44 Code 1317 - Config Input #13 Fault

Logic:

Configurable input #13 (input # 3) fault is active.

Possible Causes:

1. Condition for which "Configurable Input #3" is configured for is active.
2. “Configurable Input #13 (input #3) Active State Selection" parameter is configured incorrectly.
3. Incorrectly wired; or open circuit or short circuit in the wiring.
4. Faulty base board.

Diagnosis and Repair:

1. Condition for which "Configurable Input #3" is configured for is active.
   a. Check the condition for which "Configurable Input #3" has been configured for; ex. if "Configurable Input #3" was configured to become active when the fuel level is low, check the fuel level and add fuel if needed. After the issue is resolved, press the Reset button on the Operator Panel in order to clear the fault, if the fault does not clear go to step2.
2. “Configurable Input #13 (input #3) Active State Selection" parameter is configured incorrectly.
   a. With InPower or through the operator panel check the switch input setting (active closed or active open) for Configurable Input #3. Ensure that the switch input setting is correctly set. If “Configurable Input #13 (input #3) Input Function Pointer" parameter is set to default and if “Configurable Input #13 (input #3) Active State Selection" parameter is set to “active closed", (Input 3, event/fault code 1317) will become active when TB8-7 (input 3) and TB8-12 (ground) are connected (shorted) together.

      If “Configurable Input #13 (input #3) Input Function Pointer" parameter is set to default and if “Configurable Input #13 (input #3) Active State Selection" parameter is set to “active open", (Input 3, event/fault code 1317) will become active when there is an open circuit between TB8-7 (input 3) and TB8-12 (ground).

      To access the input configuration on the operator panel go to **Setup > Configurable I/O > Config Input #13 Menu > Active** and set this parameter appropriately for the application.
3. Incorrectly wired; or open circuit or short circuit in the wiring.
   a. Check the wiring at TB8-7 (input 3) and TB8-12 (ground) for an open circuit, short circuit, or a miswired condition.

4. The base board is faulty.
   a. If the previous steps do not reveal any problems but event/fault code 1317 is still active, replace the base board.

7.6.45 Code 1318 - Config Input #14 Fault

Logic:

Configurable input #14 (input #4) fault is active.

Possible Causes:

1. Condition for which "Configurable Input #4" is configured for is active.
2. “Configurable Input #14 (input #4) Active State Selection" parameter is configured incorrectly.
3. Incorrectly wired; or open circuit or short circuit in the wiring.
4. The base board is faulty.

Diagnosis and Repair:

1. Condition for which "Configurable Input #4" is configured for is active.
   a. Check the condition for which "Configurable Input #4" has been configured for; ex. if "Configurable Input #4" was configured to become active when the fuel level is low, check the fuel level and add fuel if needed. After the issue is resolved, press the Reset button on the Operator Panel in order to clear the fault, if the fault does not clear go to step 2.
2. “Configurable Input #14 (input #4) Active State Selection" parameter is configured incorrectly.
   a. With InPower or through the operator panel, check the switch input setting (active closed or active open) for Configurable Input #4. Ensure that the switch input setting is correctly set. If “Configurable Input #14 (input #4) Input Function Pointer" parameter is set to default and if “Configurable Input #14 (input #4) Active State Selection" parameter is set to “active closed", (Input 4, event/fault code 1318) will become active when TB8-8 (input 4) and TB8-13 (ground) are connected (shorted) together.

      If “Configurable Input #14 (input #4) Input Function Pointer" parameter is set to default and if “Configurable Input #14 (input #4) Active State Selection" parameter is set to “active open", (Input 4, event/fault code 1318) will become active when there is an open circuit between TB8-8 (input 4) and TB8-13 (ground).

      To access the input configuration on the operator panel go to **Setup > Configurable I/O > Config Input #14 Menu > Active** and set this parameter appropriately for the application.
3. Incorrectly wired; or open circuit or short circuit in the wiring.
   a. Check the wiring at TB8-8 (input 4) and TB8-13 (ground) for an open circuit, short circuit, or a miswired condition.
4. The base board is faulty.
   a. If the previous steps do not reveal any problems but event/fault code 1318 is still active, replace the base board.

7.6.46 Code 1322 - kW Setpoint OOR Hi

Logic:

If the “KW Load Setpoint OOR Check Enable" is enabled and the “KW Load Setpoint OOR High Limit" has been exceeded for the time that is registered in the “KW Load Setpoint OOR Time" the genset control will display event/fault code 1322.

Possible Causes:

1. Wiring issue.
2. “Load Govern KW Setpoint RC Enable" is incorrectly set.
3. The base board is faulty.

Diagnosis and Repair:

1. Wiring issue.
   a. Ensure that the KW Load Setpoint analog input (configurable analog Input #1) is not shorted high or disconnected. On the control, the KW Load Setpoint analog input is located at:

      TB9 – 1 Sense

      TB9 – 2 Return
2. "Load Govern KW Setpoint RC Enable" is incorrectly set.
   a. The "Load Govern KW Setpoint RC Enable" limits the KW Load Govern voltage input from 0 - 5 volts, when set to "Enable" (at TB9-1 and TB9-2); if the voltage input into the KW Load Govern input exceeds 5 VDC, the genset control locks the KW output to zero since the control logic states that the voltage input is out of range, and displays event/fault code 1322. When the "Load Govern KW Setpoint RC Enable" parameter is set to "Disable" a greater input voltage than 5 VDC is recognized; a 24 VDC input is treated as a 5 VDC input. To change the "Load Govern KW Setpoint RC Enable" parameter appropriately for the application, on the display go to: **Setup > Paralleling Setup > Basic > Load Govern KW Setpoint RC Enable** and set appropriately.
3. Check to see if the base board is faulty.
   a. Using a voltmeter, monitor the analog voltage input at the kW load setpoint input. If the voltage input into the control is within the acceptable kW load setpoint voltage range that the control is set up for and the fault does not clear when the Fault Reset button is pressed, replace the base board.

7.6.47 Code 1323 - kW Setpoint OOR Lo

Logic:

If the “KW Load Setpoint OOR Check Enable" is enabled and the KW Load Setpoint analog input is below the “KW Load Setpoint OOR Low Limit" for the time that is registered in the “KW Load Setpoint OOR Time" the genset control will display event/fault code 1323.

Possible Causes:

1. Wiring issue.

2. KW Load Setpoint input voltage is too low.
3. The base board is faulty.

Diagnosis and Repair:

1. Wiring issue.
    a. Ensure that the KW Load Setpoint analog input (configurable analog Input #1) is not shorted low, or disconnected. On the control, the speed bias analog input is located at:

       TB9 – 1 Sense

       TB9 – 2 Return
2. KW Load Setpoint input voltage is too low.
    a. If the voltage input at TB9-1 and TB9-2 is below the “KW Load Setpoint OOR Low Limit", the control will register that input as shorted low. Ensure that the voltage input at TB9-1 and TB9-2 is greater than “KW Load Setpoint OOR Low Limit". To verify the voltage value of the “KW Load Setpoint OOR Low Limit" check the parameter section.
3. Check to see if the base board is faulty.
    a. Using a voltmeter, monitor the analog voltage input at the kW load setpoint input. If the voltage input into the control is within the acceptable kW load setpoint voltage range that the control is set up for and the fault does not clear when the Fault Reset button is pressed, replace the base board.

7.6.48 Code 1324 - kVAR Setpoint OOR Hi

Logic:

If the “KVAR Load Setpoint OOR Check Enable" is enabled and the KVAR Load Setpoint analog input exceeds the “KVAR Load Setpoint OOR High Limit" parameter for the time that is registered in the “KVAR Load Setpoint OOR Time"; the genset control will display event/fault code 1324.

Possible Causes:

1. Wiring issue.
2. “Load Govern KVAR Setpoint RC Enable" is incorrectly set.
3. The base board is faulty.

Diagnosis and Repair:

1. Wiring issue.
    a. Ensure that the KVAR Load Setpoint analog input (configurable analog Input #2) is not shorted high or disconnected. On the control, the voltage bias analog input is located at:

       TB9 – 3 Sense

       TB9 – 2 Return

2. "Load Govern KVAR Setpoint RC Enable" is incorrectly set.
   a. The "Load Govern KVAR Setpoint RC Enable" limits the KVAR Load Govern voltage input from 0 - 5 volts, when set to "Enable" (at TB9-3 and TB9-2); if the voltage input into the KVAR Load Govern input exceeds 5 VDC, the genset control locks the KVAR output to zero since the control logic states that the voltage input is out of range, and displays event/fault code 1324. When the "Load Govern KVAR Setpoint RC Enable" parameter is set to "Disable" a greater input voltage than 5 VDC is recognized; a 24 VDC input is treated as a 5 VDC input. To change the "Load Govern KVAR Setpoint RC Enable" parameter appropriately for the application, on the display go to: **Setup > Paralleling Setup > Basic > Load Govern KVAR Setpoint RC Enable** and set appropriately.
3. Check to see if the base board is faulty.
   a. Using a voltmeter, monitor the analog voltage at the kVAR load setpoint input. If the voltage input into the control is within the acceptable kVAR load setpoint range that the control is set up for and the fault does not clear when the Fault Reset button is pressed, replace the base board.

7.6.49 Code 1325 - kVAR Setpoint OOR Lo

Logic:

If the “KVAR Load Setpoint OOR Check Enable" is enabled and the KVAR Load Setpoint analog input is below the “KVAR Load Setpoint OOR Low Limit" for the time that is registered in the “KVAR Load Setpoint OOR Time", the genset control will display event/fault code 1325.

Possible Causes:

1. Wiring issue.
2. KVAR Load Setpoint input voltage is too low.
3. The base board is faulty.

Diagnosis and Repair:

1. Wiring issue.
   a. Ensure that the KVAR Load Setpoint analog input (configurable analog Input #2) is not shorted low. On the control, the KVAR Load Setpoint analog input is located at:

      TB9 – 3 Sense

      TB9 – 2 Return
2. KVAR Load Setpoint input voltage is too low.
   a. If the voltage input at TB9-3 and TB9-2 is below the “KVAR Load Setpoint OOR Low Limit", the control will register that input as shorted low. Ensure that the voltage input at TB9-3 and TB9-2 is greater than “KVAR Load Setpoint OOR Low Limit". To verify the voltage value of the “KVAR Load Setpoint OOR Low Limit" check the parameter section.

3. Check the base board to see if it is faulty.
   a. Using a voltmeter, monitor the analog voltage at the kVAR load setpoint input. If the voltage input into the control is within the acceptable kVAR load setpoint range that the control is set up for and the fault does not clear when the Fault Reset button is pressed, replace the base board.

7.6.50 Code 1328 - Genset CB Tripped

Logic:

The Genset CB has tripped.

Possible Causes:

1. Correct any active genset faults.
2. Incorrectly wired or short circuit.
3. CB Trip solenoid is incorrectly configured or faulty.
4. Faulty Genset CB.

Diagnosis and Repair:

1. Correct any active genset faults.
   a. Check for active genset faults on the display (especially Overload, Short Circuit, or Ground Faults); then correct these faults.
2. Incorrectly wired or short circuit.
   a. Verify the wiring from the Genset CB to the Genset CB Tripped status input on the base board. The Genset CB Tripped status input is a Normally Open contact at TB10-10 and TB10-2 (B+ Return). Ensure that the connection from the Genset CB to TB10-10 on the base board is not shorted to ground.
3. CB Trip solenoid is incorrectly configured or faulty.
   a. Genset CB Trip settings are configured to trip at a low over-current threshold. Check other settings on the Genset CB that might cause it to trip since circuit breakers can have multiple trip settings. Configure the Genset CB Trip Solenoid to trip at adequate trip settings for the application; refer to the CB Service Manual.
   b. Faulty Trip solenoid, refer to the CB Service Manual for troubleshooting instructions.
4. Faulty Genset CB.
   a. Refer to the Genset CB Service Manual.

7.6.51 Code 1336 - Cooldown Complete

Logic:

Provides a record in the fault history that the engine cooldown period has been completed successfully during a Shutdown with Cooldown condition and fault code 1336 (shutdown) active.

Possible Causes:

1. Cooldown period has been completed after an active shutdown with cooldown fault.

Diagnosis and Repair:

1. Cooldown period has been completed after an active shutdown with cooldown fault.
   a. Event /fault code 1336 is activated as a result of another active fault that is set to "Shutdown with Cooldown." Connect with InPowere service tool to determine the actual shutdown fault(s) and then troubleshoot the shutdown fault(s).

7.6.52 Code 1416 - Fail To Shutdown

Logic:

To provide a record in the fault history that genset shutdown faults were bypassed while the control was in Battle Short mode.

Possible Causes:

1. A shutdown fault was bypassed while the Battle Short feature was enabled on the control.

Diagnosis and Repair:

1. A shutdown fault was bypassed while the Battle Short feature was enabled on the control.
   a. Event/fault code 1416 is activated because of an active “Shutdown fault" while the control is operating in battle-short mode. Troubleshoot the other shutdown fault(s) that are causing the genset to display event/fault code 1416.

7.6.53 Code 1417 - Power Down Failure

Logic:

The control has failed to go to sleep.

Possible Causes:

1. Faulty base board.

Diagnosis and Repair:

1. Faulty base board.
   a. Remove power (B+) from the control for 5-10 seconds and reconnect B+ to the control. If the control fails to go to sleep after power is cycled from the control and the control shows event/fault code 1417 again, replace the base board.

7.6.54 Code 1433 - Local E-Stop

Logic:

The Local Emergency Stop has been activated.

Possible Causes:

1. The Local Emergency Stop button has been activated.
2. Faulty connection or faulty Emergency Stop switch.

Diagnosis and Repair:

1. The Local Emergency Stop button has been activated.
    a. Reset the Local Emergency Stop:
        1. Pull the Local Emergency stop button out.
        2. Press the Off button.
        3. Press the Reset button.
        4. Select Manual or Auto as required.
2. Faulty connection or faulty Emergency Stop switch.
    a. Check the Emergency Stop button, and verify that it is working properly. The Emergency Stop button is a closed relay when it is pulled out (not active), and open relay when depressed (active).
    b. Verify that the connection/wiring from the Local Emergency Stop switch to the control for an open circuit condition. A ground connection to the Local E-Stop control input (J25 - 2 Input; J25 - 6 Ground) disables the emergency stop alarm. An open circuit should activate the Emergency stop alarm.

        J25 - 2 Input

        J25 - 6 Ground

7.6.55 Code 1434 - Remote E-Stop

Logic:

The Remote Emergency Stop has been activated.

Possible Causes:

1. The Remote Emergency stop button has been activated.
2. Faulty connection or faulty Emergency Stop switch.
3. The base board is faulty.

Diagnosis and Repair:

1. The Remote Emergency stop button has been activated.
    a. Reset the Remote Emergency Stop:
        1. Pull the Remote Emergency stop button out.
        2. Press the Off button.
        3. Press the Reset button.
        4. Select Manual or Auto as required.
    b. If the Remote Emergency Stop is not used, then install a jumper between:

        TB1 – 16 Input

        TB1 – 15 Ground

        And repeat step 1a.

2. Faulty connection or faulty Emergency Stop switch.
   a. Check the Emergency Stop button, and verify that it is working properly. The Emergency Stop button is a closed relay when it is pulled out (not active), and open relay when depressed (active).
   b. Verify that the connection/wiring from the Remote Emergency Stop switch to the control for an open circuit condition. A ground connection to the Remote E-Stop control input (TB1 – 16 Input; TB1 – 15 Ground) disables the emergency stop alarm. An open circuit should activate the Emergency stop alarm.

      TB1 – 16 Input

      TB1 – 15 Ground.
3. Check to see if the base board is faulty.
   a. If the base board is faulty, replace it.

7.6.56 Code 1435 - Low Coolant Temperature

Logic:

Engine coolant temperature is below the low coolant temperature warning threshold.

Possible Causes:

1. The coolant level is low.
2. Threshold is set too high.
3. Faulty or incorrectly configured PCCNet Annunciator.
4. Coolant heater(s) is/are not operating properly.
5. Low ambient temperature.
6. Thermostat not operating properbly.

Diagnosis and Repair:

1. Check the coolant level.
   a. If low, add coolant to the radiator.
2. Threshold is set too high.
   a. Check the LCT Warning Threshold parameter and verify it is set to an appropriate threshold. On the operator panel, to access the LCT Warning Threshold parameter, go to **Setup > Genset Setup > LCT Warning Threshold.**
3. Faulty or incorrectly configured PCCNet Annunciator.
   a. If a PCCNet Annunciator is not used, go to step 3. If a PCCNet Annunciator is used, check the wiring from the back of the PCCNet Annunciator at TB2-8 to the Low Coolant Temp sender and ensure that an open circuit or short circuit does not exist in the wiring.
   b. Refer to the PCCNet Annunciator Operator's Manual to ensure that the Annunciator is configured correctly; since inputs can be configured to Active Open or Active Closed. Then check the input on the back of the PCCNet Annunciator at TB2–8 and insure that the input signal into the PCCNet Annunciator is properly configured.

4. Coolant heater(s) is/are not operating properly.
   a. Ensure that the coolant heater(s) is/are connected properly to a power supply, check for open circuits in the wiring. Ensure that the power supply of the coolant heater is working properly.
   b. Measure the temperature of the coolant heater(s) using a proper temperature measuring device. If the ambient temperature is above 40 degrees F, the measured temperature of the coolant heater(s) should be above close to 90 degrees F (dependent on ambient temperature). If the temperature of the coolant heater(s) is close to the ambient temperature, replace the coolant heater(s). If the ambient temperature is very low, do not replace the coolant heaters, go to step 5.
5. Low ambient temperature.
   a. If the coolant heaters are working properly and the radiator has enough coolant, but the ambient temperature around the genset is very cold (less than 40 degrees F); the coolant heaters might not have the capability to keep the coolant temperature above 70 degrees F. This could be an application issue and will need to be further investigated.
6. Thermostat not operating properbly.
   a. Check the operation of the thermostat.

7.6.57 Code 1438 - Fail to Crank

Logic:

The engine has failed to crank when given a start signal.

Possible Causes:

1. Low battery voltage or weak battery.
2. Faulty starter.
3. Faulty Emergency Stop switch or faulty connection.
4. Faulty base board or relays.
5. Inadequate air supply (air start only, LBNG).
6. Rotating mechanisms are locked or faulty (LBNG).

Diagnosis and Repair:

1. Low battery voltage or weak battery.
   a. During cranking if the battery voltage goes below the engine ECM minimum operating voltage, the ECM will reset and event/fault code 1438 will become active. Refer to event/fault code 441 and 1442.
2. Faulty starter.
   a. Reset the control by pressing the Reset button on the operator panel. Then test for B+ at the starter while attempting to start the genset. If there is B+ at the starter, and the starter does not crank, then the starter could be faulty. Test the starter (see engine service manual), and replace if faulty. If B+ is not present at the starter, go to the next step.

3. Faulty emergency stop switch or faulty connection.
   a. If the emergency stop is depressed (engaged), the control will not provide voltage to the starter pilot relay or the starter control relay. Ensure that the emergency stop button is functioning correctly, measure the outputs of the E-Stop (Normally Open and Normally Closed contacts) and ensure that the outputs switch state correctly when engaged and disengaged, replace the switch if faulty.
   b. Check the wiring from the base board (E-Stop B+ and J20 - 14 (negative)) to the FSO relay for short or open circuits. If short or open circuits are found, correct the wiring.
   c. Check the wiring from the base board (E-Stop B+ and J20-15 (negative)) to the starter control relay for short or open circuits. If short or open circuits are found, correct the wiring.
4. Faulty base board or relays.
   a. Ensure that the control board is sending a signal to the FSO control relay. Measure the voltage at E-Stop B+ and J20 - 14 (negative) while cranking the genset; if a B+ signal is not available, the base board is faulty; replace the base board. If a B+ signal is available at the input of the FSO control relay, go to the next step.
   b. The FSO relay is a normally-open relay. Ensure that B+ is available to the relay and then measure the voltage output. If there is a B+ at both the input and output of the FSO Control relay, the relay is not faulty. If B+ is noted at the input but not at the output of the FSO Control relay, replace the relay.
   c. Ensure that the control board is sending a signal to the starter control relay. Measure the voltage at E-Stop B+ and J20-15 (negative) while cranking the genset; if a B+ signal is not available, the base board is faulty; replace the base board. If a B+ signal is available at the input of the starter control relay, go to the next step.
   d. The starter control relay is a normally-open relay. Ensure that B+ is available to the input of the relay and then measure the voltage output. If there is a B+ at both the input and output of the starter control relay, the relay is not faulty. If B+ is noted at the input but not at the output of the starter control relay, replace the relay.
5. Inadequate air supply (air start only, LBNG).
   a. Verify all valves controlling air supply to the starter are completely open/functioning properly.
   b. Verify the line supply pressure is per genset spec.
   c. During crank attempts, verify line pressure does not drop below the minimum required for cranking.
6. Rotating mechanisms are locked or faulty (LBNG).
   a. Properly lock-out the genset to prevent accidental starting during this diagnosis.
   b. Check for machine rotation by physically barring the engine.

NOTE: Each genset's barring interface is different, verify a means of barring per your genset service manual.

   c. If the machine rotates without significant effort, the fail to crank issue lies with another component.

d. If the machine rotated with significant effort or does not rotate at all, contact your service provider for further investigation. Do not attempt to force the machine to rotate with tremendous effort as you may propagate the issue.

7.6.58 Code 1439 - Low Day Tank Fuel

Logic:

Indicates day tank fuel supply is running low.

Possible Causes:

1. The fuel level has dropped below the low fuel level trip point.
2. Fuel sender incorrectly wired.
3. Faulty fuel sender.
4. The “Configurable Input Active State Selection" parameter is configured incorrectly.
5. The control board is faulty.

Diagnosis and Repair:

1. Check to see if the fuel level has dropped below the low fuel level trip point.
    a. Check the fuel level in the day tank, if the fuel level is low, then add fuel and clear the warning fault by pressing the Fault Acknowledge button on the display. If the fuel level is not low, then go to step 2.
2. Fuel sender incorrectly wired.
    a. Check the wiring for improper wiring, a short or open circuit from the fuel sensor to the discrete configurable input on the base board that was configured for the “Low Day Tank Fuel Level". If a short or open circuit or improper wiring is found, correct the wiring.
3. Faulty fuel sender.
    a. Measure the resistance of the fuel sender at the day tank. If the sender is reading incorrectly (Shorted or Open Circuit), replace the fuel sender.
4. The "Configurable Input Active State Selection" parameter is configured incorrectly.
    a. With InPower or through the operator panel, check the switch input setting (active closed or active open) for the configurable input that was configured to “Low Fuel in Day Tank Switch". Ensure that the switch input setting is correctly set. If the “Configurable Input Function Pointer" parameter is set to “Low Fuel in Day Tank Switch" and the “Configurable Input Active State Selection" parameter is set to “active closed", event/fault code 1439 will become active when the configurable input that was configured to “Low Fuel in Day Tank Switch" is connected to ground.

       If the “Configurable Input Function Pointer" parameter is set to “Low Fuel in Day Tank Switch" and the “Configurable Input Active State Selection" parameter is set to “active open", event/fault code 1439 will become active when the configurable input that was configured to “Low Fuel in Day Tank Switch" is an open circuit.

       To access the input configuration on the operator panel go to **Setup > Configurable I/O >** and set the “Configurable Input Active State Selection" parameter appropriately for the configurable input that was configured to “Low Fuel in Day Tank Switch".

5. Check to see if there is a faulty control board.

   a. Manually change the state of the configurable input that was configured to "Low Fuel in Day Tank Switch". Disconnect the input of the "Low Fuel in Day Tank" sender from the base board. Press the Fault Acknowledge button in order to reset the control. If the fault clears, go back to step 1.

      Make a jumper and connect the configurable input that was configured to "Low Fuel in Day Tank Switch" to a ground input on the base board. If the fault clears, go back to step 1. If the fault does not clear, replace the base board.

7.6.59 Code 1441 - Low Fuel Level

Logic:

The "Fuel level % (AUX 101)" input has gone below the "Low Fuel Level Threshold (AUX 101)" setting for the time in the "Low Fuel Level Time (AUX 101)" setting.

Possible Causes:

1. The fuel level has dropped below the low fuel level trip point.
2. Fuel sender incorrectly wired.
3. Faulty fuel sender.
4. The “Low Fuel Set/Clear Time" parameter is configured incorrectly.
5. The base board is faulty.

Diagnosis and Repair:

1. Check to see if the fuel level has dropped below the low fuel level trip point.

   a. Check the fuel level in the fuel tank. If the fuel level is low, add fuel and clear the warning fault by pressing the Fault Acknowledge button on the display. If the fuel level is OK (not low), then go to step 2.

2. Check the wiring of the fuel sensor.

   a. Ensure that the sender is correctly wired to the base board. Check the wiring for a short circuit from the fuel sensor to the input on the base board that is configured for the “Fuel Level". If a short circuit is found, correct the wiring.

3. Faulty fuel sender.

   a. Measure the resistance between the fuel level signal pin and the fuel level return pin. The resistance should be between 600 Ohms to 2500 Ohms when the tank is full. Replace the sender if the resistance value is below the recommended threshold when the fuel tank is full.

4. The "Low Fuel Set/Clear Time" parameter is configured incorrectly.

   a. Check the low fuel level setup parameter. To access the input configuration on the operator panel go to **Setup > Genset Setup** and set the "Low Fuel Set/Clear Time" parameter appropriately for the application.

5. Check to see if the base board is faulty.

   a. If the previous steps did not reveal any problems, replace the base board.

7.6.60 Code 1442 - Weak Battery

Logic:

This fault occurs when the engine is starting (cranking) and the voltage of the battery drops below the “Weak Battery Voltage threshold" for the time set in the “Weak Battery Voltage Set Time".

Possible Causes:

1. Weak or discharged battery.
2. Battery connections are loose or dirty.
3. “Weak battery" voltage threshold parameter is set too high.
4. Insufficient battery charging voltage.
5. Faulty engine DC alternator.
6. The base board or harness is faulty.

Diagnosis and Repair:

1. Weak or discharged battery.
   a. Measure the voltage of the battery with a voltmeter. Battery voltage should be 12 VDC or greater in a 12 V system or 24 VDC or greater in a 24 VDC system. If the battery voltage is low, check the electrolyte level in the battery. Replenish the electrolyte level if low and recharge the battery; the specific gravity for a fully charged lead acid battery is approximately 1.260 at 80 F (27 C).
   b. If the battery cannot hold adequate voltage, then replace the battery.
2. Battery connections are loose or dirty.
   a. Clean and tighten battery terminals and battery cable connectors. If the battery cable connectors are cracked or worn out, then replace.
3. "Weak battery" voltage threshold parameter is set too high.
   a. Ensure that the Weak Battery Voltage parameter is set to an appropriate voltage value that takes into account voltage drop during cranking (refer to the parameter list to see the default value). To access the battery voltage setup menu from the operator panel, go to **Setup > OEM Setup > OEM Engine Setup > Weak Battery** and change the weak battery voltage parameter of the control accordingly.
4. Insufficient battery charging voltage.
   a. Ensure that the battery charger is charging the battery at an acceptable rate. Adjust the charge rate if the rate is below the recommendation of the manufacturer.
   b. If the battery located far from the battery charger, ensure that a proper wire size is used to compensate for voltage drop.
5. Faulty engine DC alternator.
   a. Check the engine DC alternator. If normal charging voltage is not 12 to 14 VDC in a 12 V system or 24 to 26 VDC in a 24 V system then replace the DC alternator.

6. Check to see if the base board or harness is faulty.
   a. Measure the battery voltage at the battery terminals and then measure the battery voltage at the base board input. Measure the voltage at B+ (J20-9, J20-10, J20-20, J20-21) and B- (negative) input (J20-2, J20-4, J20-7, J20-12).
   - If the voltage at the battery terminals and the control is the same, replace the base board.
   - If the voltage at the battery terminals and the control is not the same, check the harness and replace if necessary.

7.6.61 Code 1443 - Dead Battery

Logic:

During cranking, the battery voltage drops below the operating voltage of the control, which resets the control. After the control has reset three consecutive times, event/fault code 1443 will become active.

Possible Causes:

1. Weak or discharged battery.
2. Battery connections are loose or dirty.
3. Insufficient battery charging voltage.
4. Faulty engine DC alternator.
5. The base board or harness is faulty.

Diagnosis and Repair:

1. Weak or discharged battery.
   a. Measure the voltage of the battery with a voltmeter. Battery voltage should be 12 VDC or greater in a 12 V system or 24 VDC or greater in a 24 VDC system. If the battery voltage is low, check the electrolyte level in the battery. Replenish the electrolyte level if low and recharge the battery; the specific gravity for a fully charged lead acid battery is approximately 1.260 at 80 F (27 C).
   b. If the battery cannot hold adequate voltage, then replace the battery.
2. Battery connections are loose or dirty.
   a. Clean and tighten battery terminals and battery cable connectors. If the battery cable connectors are cracked or worn out, then replace.
3. Insufficient battery charging voltage.
   a. Ensure that the battery charger is charging the battery at an acceptable rate. Adjust the charge rate if the rate is below the recommendation of the manufacturer.
   b. If the location of the battery is a far distance from the battery charger, ensure that a proper wire size is used to compensate for voltage drop.
4. Faulty engine DC alternator.
   a. Check the engine DC alternator. If normal charging voltage is not 12 to 14 VDC in a 12 V system or 24 to 26 VDC in a 24 V system then replace the DC alternator.

5. Check to see if the base board or harness is faulty.
   a. Measure the battery voltage at the battery terminals while the generator set is cranking and then measure the battery voltage at the base board input while the generator set is cranking. Measure the voltage at B+ (J20-9, J20-10, J20-20, J20-21) and B- (negative) input (J20-2, J20-4, J20-7, J20-12).
      - If the voltage at the battery terminals and the control is not the same, check the harness and replace if necessary.
      - If the voltage input at the base board is above 8 VDC during cranking, replace the base board.

7.6.62 Code 1444 - kW Overload

Logic:

The "Overload Threshold" has been exceeded for the time that is registered in the "Overload Set Time" parameter.

Possible Causes:

1. The "Overload Threshold" parameter is set too low.
2. Short in the load or load cables.
3. Incorrect CT Ratio, CTs, or CT connections.
4. Incorrect PT Ratio, PTs, or PT connections.

Diagnosis and Repair:

1. The "Overload Threshold" parameter is set too low.
   a. To access the input configuration on the operator panel go to **Setup > Genset Setup** and set the "Overload Threshold" parameter appropriately for the application. Refer to the parameter section to see the default value for Overload (Setting the overload threshold too high can cause damage to the alternator).
2. Short in the load or load cables.
   a. Check the load and load cables. Repair if necessary.
3. Incorrect CT Ratio, CTs, or CT connections.
   a. Check the CT Ratio, CTs, and CT connections, reference event/fault code 2814.
4. Incorrect PT Ratio, PTs, or PT connections.
   a. Check the PT Ratio, PTs, and PT connections, reference event/fault code 2816.

7.6.63 Code 1445 - Short Circuit

Logic:

The generator output current has exceeded 175% of rated current.

NOTE: **This fault remains active and cannot be reset until the Alternator Overheat Integral time has expired (which takes up to five minutes). The Alternator Overheat Integral time allows the alternator to cool down before allowing a restart.**

Possible Causes:

1. Short in the load or load cables.
2. Faulty CTs, incorrect CT ratio, CTs, CT connections.
3. The base board is faulty.

Diagnosis and Repair:

1. Short in the load or load cables.
   a. Check the load and load cables. Repair if necessary.
2. Faulty CTs, incorrect CT ratio, CTs, CT connections.
   a. Verify the CT connections are correct from the CTs to the input of the base board.
   b. Ensure the control is set up for the correct CT ratio. Reference event/fault code 2814 for CT ratio troubleshooting information.
   c. Check the current going into the CT input on the control board (use a current probe to check the secondary output of the CT). This should be the value that the control secondary is calibrated with. (e.g. If the control is calibrated with a CT Ratio of 1000:5, the current input into the base board should not be more than 5 A.)
   d. If previous steps check out ok, replace the base board.
3. The base board is faulty.
   a. If the previous steps did not identify any faulty component, replace the control board.

7.6.64 Code 1446 - High AC Voltage

Logic:

One or more of the phase voltages has exceeded the high AC voltage threshold.

Possible Causes:

1. Fault simulation is enabled.
2. The High AC Voltage Trip parameter is incorrectly set for the application.
3. The High AC Voltage threshold is set too low for the application.
4. Faulty PTs, incorrect PT ratio, PTs, PT connections.
5. Faulty AVR.
6. Faulty PMG.
7. Governor preload offset percentage too high.
8. The base board is faulty.

Diagnosis and Repair:

1. Fault simulation is enabled.
   a. Connect with InPower and ensure that the fault simulation for High AC Voltage is not enabled. If InPower is not available, cycle power to the control:
      1. Depress the Emergency Stop button and wait 30 seconds.

2. Disconnect/disable the battery charger.

3. Disconnect the battery (disconnect negative first).

4. Leave the controller without power for 1 minute.

5. Reconnect the battery, enable the battery charger, pullout the E-Stop button, and reset the control (in this order).

2. The High AC Voltage Trip parameter is incorrectly set for the application.

   a. Ensure that the High AC voltage parameter is set correctly for the application.

      If the control is set up as “Inverse time", it will be more sensitive to voltage spikes and will trip more rapidly; “Inverse time" follows the “Instantaneous High AC Voltage Threshold".

      If the control is set to “Fixed Time", it will allows a greater time delay until shutdown when voltage overshoots; when trying to start a large motor, the “Fixed time" setting is recommended. This parameter works with the “High AC Voltage Delay" parameter.

      To access the configuration menu on the operator panel go to **Setup > OEM Setup > OEM ALT Setup > High AC Voltage Trip** and set the “High AC Voltage Trip" parameter appropriately for the application.

3. The High AC Voltage threshold is set too low for the application.

   a. To access the High AC Voltage configuration menu on the operator panel go to **Setup > OEM Setup > OEM ALT Setup > High AC Voltage Threshold** and set the “High AC Voltage Threshold" parameter appropriately for the application. Refer to the parameter list to see the default value for High AC Voltage.

4. Faulty PTs, incorrect PT ratio, PTs, PT connections.

   a. Check the connections from the alternator to the PT, and from the PT to the base board. (Three phase inputs on the base board: L1 = J22-1, L2 = J22-2, L3 = J22-3, LN = J22-4; for single phase use L1, L2 and LN). If the wires are incorrectly connected, or there is an open circuit, correct the wiring issue. (If the voltage input is less than 600 VAC, a PT is not required.)

   b. Ensure that the control is set up with the correct PT ratio (primary vs. secondary). Reference event/fault code 2816 for troubleshooting information on the PT ratio. To access the PT Ratio configuration menu on the operator panel go to **Setup > OEM Setup > OEM ALT Setup > PT Primary or PT Sec** and set the PT ratio appropriately for the application.

   c. Measure the voltage going into the PT from the alternator.

WARNING: High voltages are present in this step. Special equipment and training is required to work on or around high-voltage equipment. Operation and maintenance must be done only by persons trained and qualified to work on such devices. Improper use or procedures may result in severe personal injury or death.

Then measure the voltage output of PT to the base board. (Three phase inputs on the base board: L1 = J22-1, L2 = J22-2, L3 = J22-3, LN = J22-4; for single phase use L1, L2 and LN). The control calibrated PT ratio (PT voltage input: PT voltage output) should match the voltage input into and output of the PT.

   d. If the control calibrated PT ratio matches the voltage input into the PT, but does not match the voltage output (e.g., control calibrated PT ratio is 13,500:480, the voltage input into the PT is 13,500 VAC, but the output of the PT is 589 VAC instead of 480 VAC), replace the PT module.

5. Faulty AVR.
   a. Measure the output of the AVR at J17-1 and J17-2. The output should be at 9-12 VDC when the genset is operating at “No Load". If the voltage output of J17-1 and J17-2 is constantly high, then the AVR portion of the base board is faulty. Replace the base board.
   b. Using a True RMS meter, measure the PWM at J19-2 (AVR PWM +) and J19-9 (AVR PWM -) while turning the genset “ON". This is a 2.5 VDC max output from the base board to the AUX 103 AVR; if the voltage at J19-2 and J19-9 is continuously 2.0-2.5 VDC, without any change, then replace the base board.
   c. Measure the output of the AUX 103 AVR at J17-1 and J17-2, the output should be at 9-12 VDC when the genset is operating at “No Load", if the voltage output of J17-1 & J17-2 is constantly high, then the AUX 103 AVR is faulty replace the AUX 103 AVR.
6. Faulty PMG.
   a. Start the genset and run at rated speed. Measure the voltages at the AVR terminals P2 (J18-1), P3 (J18-2), and P4 (J18-3). These should be balanced and within the following ranges:

      50Hz generators - 170-180 Volts

      60Hz generators - 200-216 Volts

      Should the voltages be unbalanced, stop the genset, remove the PMG sheet metal cover from the non drive end bracket and disconnect the multi-pin plug in the PMG output leads. Check leads P2, P3, and P4 for continuity. Check the PMG stator resistances between output leads. These should be balanced and within +/-10% of 2.3 Ohms. If resistances are unbalanced and/or incorrect the PMG stator must be replaced. If the voltages are balanced but low and the PMG stator winding resistances are correct the PMG rotor must be replaced.
7. Governor preload offset percentage too high.

   If this fault code occurs during startup,
   a. Connect with InPower.
   b. Check the governor preload offset percentage. The higher the percentage, the larger the overshoot. Lower the governor preload offset.
8. The base board is faulty.
   a. If the previous steps did not identify a faulty component, replace the control.

7.6.65 Code 1447 - Low AC Voltage

Logic:

Voltage has decreased below the “Low AC Voltage Threshold" for the time that is registered in the “Low AC Voltage Delay" parameter.

Possible Causes:

1. Fault simulation is enabled.
2. The Low AC Voltage threshold is set too high.
3. Faulty PTs, incorrect PT ratio, PTs, PT connections.
4. Faulty AVR.
5. Faulty PMG.
6. Faulty rotating rectifier assembly.
7. The base board is faulty.
8. Refer to Generator troubleshooting.

Diagnosis and Repair:

1. Fault simulation is enabled.
   a. Connect with InPower and ensure that the Fault simulation for Low AC Voltage is not enabled. If InPower is not available, cycle power to the control:

      1. Depress the Emergency Stop button and wait 30 seconds.

      2. Disconnect/disable the battery charger.

      3. Disconnect the battery (disconnect negative first).

      4. Leave the controller without power for 1 minute.

      5. Reconnect the battery, enable the battery charger, pullout the E-Stop button, and reset the control (in this order).
2. The Low AC Voltage threshold is set too high.
   a. To access the Low AC Voltage configuration menu on the operator panel go to **Setup > OEM Setup > OEM ALT Setup > Low AC Voltage Threshold** and set the “Low AC Voltage Threshold" Parameter appropriately for the application. Refer to the parameter list to see the default value for Low AC Voltage.
3. Faulty PTs, incorrect PT ratio, PTs, PT connections.
   a. Check the connections from the alternator to the PT and from the PT to the base board. (Three phase inputs on the base board: L1 = J22-1, L2 = J22-2, L3 = J22-3, LN = J22-4; for single phase use L1, L2 and LN). If the wires are incorrectly connected, or there is an open or short circuit correct the wiring issue. (If the voltage input is less than 600 VAC, a PT is not required.)

   b. Ensure that the control is set up with the correct PT ratio (primary vs. secondary). Reference event/fault code 2817 for troubleshooting information on the PT ratio. To access the PT Ratio configuration menu on the operator panel go to **Setup > OEM Setup > OEM ALT Setup > PT Primary or PT Sec** and set the PT ratio appropriately for the application.

   c. Measure the voltage going into the PT from the alternator.

WARNING: High voltages are present in this step. Special equipment and training is required to work on or around high-voltage equipment. Operation and maintenance must be done only by persons trained and qualified to work on such devices. Improper use or procedures may result in severe personal injury or death.

Then measure the voltage output of PT to the base board. (Three phase inputs on the base board: L1 = J22-1, L2 = J22-2, L3 = J22-3, LN = J22-4; for single phase use L1, L2 and LN.) The control calibrated PT ratio (PT voltage input: PT voltage output) should match the voltage input into the PT and voltage output of the PT. If the control calibrated PT ratio matches the voltage input into the PT, but does not match the voltage output (e.g., control calibrated PT ratio is 13,500:480, the voltage input into the PT is 13,500 VAC, but the output of the PT is 320 VAC instead of 480 VAC), replace the PT module.

4. Faulty AVR.

   a. Measure the output of the AVR at J17 -1 and J17-2, the output should be at least 9-12 VDC when the genset is operating at “No Load". If the voltage output of J17-1 and J17-2 is constantly zero or less than 9-12 VDC, then the AVR portion of the PCC is faulty. To double-check, disconnect the J17-1 and J17-2 connection from the AVR board (the AVR board will no longer be connected to the field wires) and place a 9-12 VDC power supply (Depending on the alternator) to the field wires (J17-1 is positive, and J17-2 is negative). If the genset produces adequate voltage (Nominal Voltage or Greater), the AVR portion of the base board is faulty, replace the base board.

   b. Check the Power Supply to the AVR. Ensure that the 10 Amp fuses at J18-1 and J18-2 are not open, replace if open circuit. Make sure that the AVR has sufficient power at:

      - J18-1 and J18-2 if it is a Shunt application or
      - J18-1, J18-2, and J18-3 if it is a PMG application

      If the AVR has no power, you will need to troubleshoot the power supply connections.

   c. Using a True RMS meter, measure the PWM at J19-2 (AVR PWM +) and J19-9 (AVR PWM -) while turning the genset “ON". This is a 0-2.5 VDC max output from the base board to the AUX 103 AVR; if the voltage at J19-2 and J19-9 is continuously 0 VDC, without any change, check the wiring between J26-16 and J19-2 and between J26-3 and J19-9 to ensure than a short circuit does not exist. Correct the wiring if a short circuit exists in the wiring. If the wiring is OK, but there is no voltage from the base board to the AUX 103 AVR, then replace the base board.

   d. Measure the output of the AVR at J17-1 and J17-2, the output should be at least 9-12 VDC when the genset is operating at “No Load", if the voltage output of J17-1 & J17-2 is constantly zero or less than 9-12, then the AUX 103 AVR is faulty. To double check, disconnect the J17-1 and J17-2 connection from the AUX 103 AVR (the AVR board will no longer be connected to the field wires) and place a 9-12 VDC power supply (Depending on the alternator) to the field wires (J17-1 is positive, and J17-2 is negative). If the genset produces adequate voltage (Nominal Voltage or Greater) with the power supply connected to the field wires, the AUX 103 AVR is faulty, replace the AUX 103 AVR.

5. Faulty PMG.

   a. Start the genset and run at rated speed. Measure the voltages at the AVR terminals P2 (J18-1), P3 (J18-2), and P4 (J18-3). These should be balanced and within the following ranges:

      50Hz generators - 170-180 Volts

      60Hz generators - 200-216 Volts

Should the voltages be unbalanced:

1. Stop the genset.

2. Remove the PMG sheet metal cover from the non drive end bracket and disconnect the multi-pin plug in the PMG output leads.

3. Check leads P2, P3, and P4 for continuity. Check the PMG stator resistances between output leads. These should be balanced and within +/-10% of 2.3 Ohms.

4. If resistances are unbalanced and/or incorrect the PMG stator must be replaced.

5. If the voltages are balanced but below the voltage range noted above, and the PMG stator winding resistances are correct - the PMG rotor must be replaced.

6. Faulty rotating rectifier assembly.
   a. This procedure is carried out with leads J17-1 and J17-2 disconnected at the AVR or transformer control rectifier bridge and using a 12 volt D.C. supply to leads J17-1 and J17-2 (J17-1 is positive, and J17-2 is negative).

   1. Start the set and run at rated speed.

   2. Measure the voltages at the main output terminals L1, L2 and L3.

   3. If voltages are balanced but below the voltage range in step 5, there is a fault in the rotating diode assembly or the main excitation windings (Refer to Servicing the Generator section in the manual to troubleshoot the main excitation windings).

   4. The diodes on the main rectifier assembly can be checked with a multimeter. The flexible leads connected to each diode should be disconnected at the terminal end, and the forward and reverse resistance checked. A healthy diode will indicate a very high resistance (infinity) in the reverse direction, and a low resistance in the forward direction. A faulty diode will give a full deflection reading in both directions with the test meter on the 10,000 Ohms scale, or an infinity reading in both directions. On an electronic digital meter a healthy diode will give a low reading in one direction, and a high reading in the other. Replace diode(s) if faulty.

7. The base board is faulty.
   a. If the previous steps did not identify a faulty component, replace the control.

7.6.66 Code 1448 - Underfrequency

Logic:

The frequency has dropped below the “Underfrequency Threshold" for the time set in the “Underfrequency Delay" parameter.

Possible Causes:

1. Fault simulation is enabled.
2. Underfrequency threshold is set too high.
3. There are fuel or air delivery problems.
4. Overload.
5. The base board is faulty.
6. Refer to Generator troubleshooting.

Diagnosis and Repair:

1. Fault simulation is enabled.
   a. Connect with InPower and ensure that the Fault simulation for Low Frequency is not enabled. If InPower is not available, cycle power to the control:

      1. Depress the Emergency Stop button and wait 30 seconds.

      2. Disconnect/disable the battery charger.

      3. Disconnect the battery (disconnect negative first).

      4. Leave the controller without power for 1 minute.

      5. Reconnect the battery, enable the battery charger, pullout the E-Stop button, and reset the control (in this order).

2. Underfrequency threshold is set too high.

   A. To access the Underfrequency configuration menu on the operator panel go to **Setup > OEM Setup > OEM ALT Setup > Underfrequency Threshold** and set the “Underfrequency Threshold" Parameter appropriately for the application. Refer to the parameter list to see the default value for Underfrequency.

3. Check to see if there are any fuel or air delivery problems.
   a. Refer to the Engine Service Manual.

4. Overload.
   a. Ensure that the load on the genset does not exceed the Genset KW Rating. If the genset is producing correct frequency with no load, but shutting down on underfrequency when the genset picks up certain loads, the underfrequency shutdowns are being cause by the load. Motors, Uninterruptible Power Supply (UPS), Variable Frequency Drive (VFD), Medical Diagnostic Imagining Equipment, Fire Pumps and certain types of lighting have a considerable and different influence on a generator and might require starting these loads when there is a minimum load on the genset. Revisit the genset sizing process to ensure that the genset is correctly sized for the application, especially if new loads have been introduced into the system (reference the T-030 manual).

5. The base board is faulty.
   a. If the previous steps did not identify a faulty component, replace the control board.

7.6.67 Code 1449 - Overfrequency

Logic:

Frequency has gone above the "Overfrequency Threshold" for the time that is registered in the "Overfrequency Delay" parameter.

Possible Causes:

1. Fault simulation is enabled.
2. Overfrequency threshold is set too low.
3. There are fuel or air delivery problems.
4. The base board is faulty.

5. Refer to Generator troubleshooting.

Diagnosis and Repair:

1. Fault simulation is enabled.
   a. Connect with InPower and ensure that the Fault simulation for Overfrequency Enable is not enabled. If InPower is not available, cycle power to the control:

      1. Depress the Emergency Stop button and wait 30 seconds.

      2. Disconnect/disable the battery charger.

      3. Disconnect the battery (disconnect negative first).

      4. Leave the controller without power for 1 minute.

      5. Reconnect the battery, enable the battery charger, pullout the E-Stop button, and reset the control (in this order).
2. Overfrequency threshold is set too low.
   a. To access the Overfrequency configuration menu on the operator panel go to **Setup > OEM Setup > OEM ALT Setup > Overfrequency Threshold** and set the "Overfrequency Threshold" Parameter appropriately for the application. Refer to the parameter list to see the default value for Overfrequency.
3. Check to see if there are fuel or air delivery problems.
   a. Refer to the Engine Service Manual.
4. The base board is faulty.
   a. If the previous steps did not identify a faulty component, replace the control board.

7.6.68 Code 1451 - Genset/Bus V Mismatch

Logic:

Five seconds after the Genset circuit breaker (CB) closes, the base board continuously verifies whether the genset and bus voltages are within 5% of each other; if the difference between the genset and bus voltage is greater than 5%, event/fault code 1451 becomes active.

Possible Causes:

1. The genset and bus voltages are not properly setup or calibrated.

Diagnosis and Repair:

1. The genset and bus voltages are not properly calibrated.
   a. Calibrate the genset and bus voltage (all phases) in order to improve the voltage match performance, as well as the metering accuracy. Refer to the calibration section.
   b. If the voltage is greater than 600 VAC, ensure that the PT ratio is correctly set. To change the Utility PT ratio parameter appropriately for the application, go to: **Setup > Paralleling Setup > Power Transfer Control > PT Primary or PT Secondary** and set appropriately. To change the Genset PT ratio parameter appropriately for the application, go to: **Setup > OEM Setup > OEM Alt Setup > PT Primary or PT Secondary** and set appropriately.

7.6.69 Code 1452 - Genset CB Fail To Close

Logic:

Genset circuit breaker (CB) has failed to close for the time that is registered in the “Gen CB Fail to Close Time Delay" parameter.

Possible Causes:

1. Incorrectly wired.
2. Faulty Genset Circuit Breaker (CB).
3. The base board is faulty.
4. Refer to Generator troubleshooting.

Diagnosis and Repair:

1. Incorrectly wired.
   a. The base board is sending the Genset CB a close command, but the Genset CB Position Status remains open. Correct the wiring from the CB Close Control output on the base board at TB5-1 and TB5-2 to the Genset breaker; check for an open circuit at the circuit breaker. The Genset CB Close control output is a NO Relay at TB5-1 and TB5-2 (Relay Common) on the base board. When the relay on the base board is closed, the Genset Breaker should be closed. The output of TB5-2 and TB5-3 should match the status of the Genset CB Close command; go to: **Setup > Paralleling Setup > Basic > Pos Contacts > Genset Breaker Position Contacts** and ensure that the status of the CB close position command at the display matches the output.
   b. Verify the wiring of the CB position status from the Genset breaker to the base board. The CB position sensing can be set up as single or dual sensing in the base board; check the display if the base board is setup as single or dual sensing. To access the CB position sensing, go to: **Setup > Paralleling Setup > Basic > Pos Contacts > Genset Breaker Position Contacts**
      - If the CB position sensing is set up as single, verify the connection at CB A (NO) status at TB10-7 and the Return at TB10-2.
      - If the CB position sensing is set up as dual, verify the connection at CB A (NO) status at TB10-7 and the Return at TB10-2 and also verify the connection at CB B (NC) status at TB10-8 and TB10-2 (Return). The input status at CB A (NO) and CB B (NC) should be opposite; one input will be open while the other is closed, if they are the same check the wiring between the Genset breaker and the CB status input on the base board.

        Ensure that the connections on the base board are correctly connected and that a short and/or open circuit does not exist. The physical connection to the base board should match the status of the CB position; go to: **Setup > Paralleling Setup > Basic > Pos Contacts > Genset Breaker Position Contacts** and ensure that the status of the CB position matches the connection.
2. Faulty Genset CB.
   a. Refer to the Genset CB Service Manual.
3. The base board is faulty.
   a. If the wiring and generator set CB are not found to be faulty, replace the base board.

7.6.70 Code 1453 - Genset CB Fail To Open

Logic:

Genset circuit breaker (CB) has failed to open for the time that is registered in the “Gen CB Fail to Open Time Delay" parameter.

Possible Causes:

1. Incorrectly wired.
2. Faulty Genset Circuit Breaker (CB).
3. Faulty base board.

Diagnosis and Repair:

1. Incorrectly wired.
   a. The base board is sending the Genset CB an open command, but the Genset CB Position Status remains closed. Correct the wiring from the CB Open Control output on the base board at TB5-5 and TB5-4 to the Genset breaker; check for a short circuit. The Genset CB Open control output is a NC Relay at TB5-5 and TB5-4 (Relay Common) on the base board. When the relay is closed the Genset Breaker is closed. The output of TB5-4 and TB5-5 should match the status of the Genset CB Open position command; go to: **Setup > Paralleling Setup > Basic > Pos Contacts > Genset Breaker Position Contacts**, and ensure that the status of the CB Open position command at the display matches the output.

   b. Verify the wiring of the CB position status from the Genset breaker to the base board. The CB position sensing can be set up as single or dual sensing in the base board; check the display if the base board is setup as single or dual sensing. To access the CB position sensing, go to: **Setup > Paralleling Setup > Basic > Pos Contacts > Genset Breaker Position Contacts**

      - If the CB position sensing is set up as single, verify the connection at CB A (NO) status at TB10-7 and the Return at TB10-2.
      - If the CB position sensing is set up as dual, verify the connection at CB A (NO) status at TB10-7 and the Return at TB10-2 and also verify the connection at CB B (NC) status at TB10-8 and TB10-2 (Return). The input status at CB A (NO) and CB B (NC) should be opposite; one input will be open while the other is closed, if they are the same check the wiring between the Genset breaker and the CB status input on the base board.

        Ensure that the connections on the base board are correctly connected and that a short and/or open circuit does not exist. The physical connection to the base board should match the status of the CB position; go to: **Setup > Paralleling Setup > Basic > Pos Contacts > Genset Breaker Position Contacts**, and ensure that the status of the CB position matches the connection.

2. Faulty Genset CB.
   a. Refer to the Genset CB Service Manual.

3. Faulty base board.
   a. If the wiring and Genset CB are not found to be faulty, then replace the base board.

7.6.71 Code 1454 - Genset CB Pos Error

Logic:

A mismatch in the Genset position status exists.

Possible Causes:

1. Mismatch in the Genset position sensing.
2. Faulty Genset CB.
3. Faulty base board.

Diagnosis and Repair:

1. Mismatch in the Genset position sensing.
    a. Verify the wiring of the CB position status from the Genset breaker to the base board. The CB position sensing can be set up as single or dual sensing in the base board; check the display if the base board is setup as single or dual sensing. To access the CB position sensing, go to: **Setup > Paralleling Setup > Basic > Pos Contacts > Genset Breaker Position Contacts**

    b. When the Genset Breaker Position contact is set to Single, the base board monitors current going thru the Genset CB (Amps going thru the CB means it is closed) and CB A position status to determine the position of the Genset CB. If there is a mismatch between the current-based breaker position and CB A position sensing, fault code 1454 will occur. Verify the connection at CB A (NO) status at TB10-7 and the Return at TB10-2, and ensure that an open/short circuit does not exist.

    c. If the CB position sensing is set up as dual, verify the connection at CB A (NO) status at TB10-7 and the Return at TB10-2 and also verify the connection at CB B (NC) status at TB10-8 and TB10-2 (Return). The input status at CB A (NO) and CB B (NC) should be opposite; one input will be open while the other is closed, if they are the same, check the wiring between the Genset breaker and the CB status input on the base board. Ensure that the connections on the base board are correctly connected and that a short and/or open circuit does not exist. The physical connection to the base board should match the status of the CB position; go to: **Paralleling Status > Paralleling Status-Iso Bus Sc 1 > Genset CB Pos > Genset CB Position Status**, and ensure that the status of the CB position matches the connection.
2. Faulty Genset CB.
    a. Refer to the Genset CB Service Manual.
3. Faulty base board.
    a. If the wiring and Genset CB are not found to be faulty, then replace the base board.

7.6.72 Code 1455 - Utility CB Pos Error

Logic:

A mismatch in the Utility position status exists.

Possible Causes:

1. Utility Single Mode Verify Switch is Inactive.

2. Mismatch in the Utility position sensing.
3. Faulty Utility CB.
4. Faulty base board.

Diagnosis and Repair:

1. Utility Single Mode Verify Switch is Inactive.
   a. Event/fault code 1455 will become active, if the genset is setup to operate in the following genset application types; Utility Single, Utility Multiple, or PTC, and the Utility Single Mode Verify Switch is not active, The base board will not close the Utility breaker until the Utility Single Mode Verify Switch input is activated. This procedure is to ensure that the whole system has been rechecked before allowing the base board to close the Utility Breaker. To activate the Utility Single Mode Verify Switch, make a connection between TB10-12 (Single Mode Verify Input) and TB10-16 (Return); then press the fault reset button on the display to clear the fault.
2. Mismatch in the Utility position sensing.
   a. Verify the wiring of the CB position status from the Utility breaker to the base board. The CB position sensing can be set up as single or dual sensing in the base board; check the display if the base board is setup as single or dual sensing. To access the CB position sensing, go to: **Setup > Paralleling Setup > Basic > Pos Contacts > Utility Breaker Position Contacts**.
   b. When the Utility Breaker Position contact is set to Single, the base board monitors current going thru the Utility CB (Amps going thru the CB means it is closed) and CB A position status to determine the position of the Utility CB. If there is a mismatch between the current-based breaker position and CB A position sensing, fault code 1455 will occur. Verify the connection at CB A (NO) status at TB10-3 and the Return at TB10-1, and ensure that an open/short circuit does not exist.
   c. If the CB position sensing is set up as dual, verify the connection at CB A (NO) status at TB10-3 and the Return at TB10-1 and also verify the connection at CB B (NC) status at TB10-4 and TB10-1 (Return). The input status at CB A (NO) and CB B (NC) should be opposite; one input will be open while the other is closed, if they are the same check the wiring between the Utility breaker and the CB status input on the base board. Ensure that the connections on the base board are correctly connected and that a short and/or open circuit does not exist. The physical connection to the base board should match the status of the CB position; go to: **Paralleling Status > Paralleling Status-PTC Sc 1 > Util CB Pos > Utility CB Position Status**, and ensure that the status of the CB position matches the connection.
3. Faulty Utility CB.
   a. Refer to the Utility CB Service Manual.
4. Faulty base board.
   a. If the wiring and Utility CB are not found to be faulty, then replace the base board.

7.6.73 Code 1456 - Bus Out Of Sync Range

Logic:

The Synchronizer cannot be enabled because the Bus Voltage and/or Frequency are not within 60 – 110% of nominal.

Possible Causes:

1. System bus voltage cables are incorrectly wired or open circuit to the paralleling breaker.
2. System bus voltage sensing connections are incorrectly wired at the base board.
3. Faulty PT.
4. Faulty base board.

Diagnosis and Repair:

1. System bus voltage cables are incorrectly wired or open circuit to the paralleling breaker.

WARNING: High voltages are present in this step. Special equipment and training is required to work on or around high-voltage equipment. Operation and maintenance must be done only by persons trained and qualified to work on such devices. Improper use or procedures may result in severe personal injury or death.

   a. The system bus has lost a phase, using a phase rotation meter or a synchronizing light; verify that the phase rotation of the system bus at the paralleling breaker is correct; in synchronization with the generator set phase rotation. For proper phase rotation measurement procedures, refer to the phase rotation meter instructions. If the phase rotation check shows that a phase is missing, check for blown fuses, and an open circuit at the system bus voltage cables connected to the paralleling breaker.

2. System bus voltage sensing connections are incorrectly wired at the base board.

   a. If the nominal voltage is 600 VAC or lower, ensure that the voltage sensing connections are correct.

      - Measure the phase rotation and voltage input into the base board from the System bus at: L1, TB7-1; L2, TB7-2; and L3, TB7-3. The voltage should match nominal voltage, and the phase rotation should be “L1 – L2 –L3", for proper phase rotation measurement procedures, refer to the phase rotation meter instructions. If the phase rotation and/or voltage are not correct, re-check the wiring.

   b. If the nominal voltage is over 600 VAC, check the voltage sensing connections from the base board to the PT and the PT to the System bus.

      - Measure the phase rotation and voltage input into the base board from the PT (Potential Transformer) at: L1, TB7-1; L2, TB7-2; and L3, TB7-3. The voltage should match nominal voltage, and the phase rotation should be “L1 – L2 –L3", for proper phase rotation measurement procedures, refer to the phase rotation meter instructions. If the phase rotation and/or voltage are not correct, re-check the wiring from the base board to the PT.
      - Measure the phase rotation and voltage input into the TB8 - 5 and TB8 – 1

3. Faulty PT.

   a. With a calibrated Voltage meter, measure the voltage input and output of the PT. The Input and output of the PT should be proportional; ex. Inputs: L1 = 4160, L2 = 4160, L3 = 4160; Outputs: L1 = 120, L2 = 120, L3 = 120. If the inputs and outputs of the PT are not proportional, replace the PT.

4. Faulty base board.
   a. If the phase rotation and the system bus voltage sensing connections are correct at the input of the base board, L1, TB7-1; L2, TB7-2; L3, TB7-3; but the display shows incorrect bus voltage and phase rotation, replace the base board. To check the System bus voltage and phase rotation on the display go to: **Paralleling Status - Iso Bus Sc 1 > Bus Avg Voltage** and **Paralleling Status > Phase Rot.**

7.6.74 Code 1457 - Fail To Synchronize

Logic:

Synchronizer has not met the synch check conditions within the “Fail To Synchronize Time" parameter

Possible Causes:

1. Improper adjustment of bus or generator set voltage.
2. Faulty PT.
3. Permissive window parameters are set too tight.
4. The engine is unstable.

Diagnosis and Repair:

1. Improper adjustment of bus or generator set voltage.
   a. Ensure that that the base board is calibrated correctly by checking that the generator set is operating at proper voltage and frequency. With a calibrated Frequency and Voltage meter, measure the frequency and voltage output of the genset at the alternator; while thru the display, ensuring that the base board is displaying the same voltage and frequency that is shown on the meter. (Go to the Servicing the Generator section in the manual)
   b. Ensure that that the base board is calibrated correctly by checking the System bus voltage and frequency. With a calibrated Frequency and Voltage meter, measure the frequency and voltage of the System bus; while thru the display, ensuring that the base board is displaying the same voltage and frequency that is shown on the meter. To view and adjust the Bus Voltage, go to: **Setup > Calibration > L12 (L23, L31) Adjust > Genset Bus L1L2 (L2L3, L3L1) Voltage Calibration** and if appropriate, change the Bus Voltage to reflect the voltage that is shown on the meter. To view and adjust the Bus Frequency go to: **Setup > Adjust > Frequency Calibration > Frequency Calibration** and if appropriate, change the Bus Frequency to reflect the frequency that is shown on the meter.
2. Faulty PT.
   a. With a calibrated Voltage meter, measure the voltage input and output of the PT. The Input and output of the PT should be proportional; ex. Inputs: L1 = 4160, L2 = 4160, L3 = 4160; Outputs: L1 = 120, L2 = 120, L3 = 120. If the inputs and outputs of the PT are not proportional, replace the PT.

3. Permissive window parameters are set too tight.
   a. The synch check function monitors the genset and bus voltage, frequency, and phase rotation, to determine whether the two sources can be paralleled. The difference in voltage, frequency, and phase rotation between the genset and system bus must be smaller than the Permissive parameter windows. Set the following parameters appropriately for the application:
      - Permissive Frequency Window
      - Permissive Voltage Window
      - Permissive Window Time
      - Permissive Phase Window

      To access the Permissive Parameters Window setup menu from the display, . Refer to the parameter section for the default value, and limits.
   b. Synchronizer has failed to synchronize the Generator set to the System bus within the “Fail To Synchronize Time" parameter. To increase the “Fail To Synchronize Time" parameter from the display, go to: Setup > Paralleling Setup > Basic > Sync Time and change the “Fail To Synchronize Time" parameter of the control appropriately. Refer to the parameter section for the default value, and limits.
4. Check to see if the engine is unstable.
   a. Check the engine:
      - Fuel filters, which can trap air in the heads if recently replaced.
      - Fuel line routing for overhead loops which can trap air in the fuel system.
      - Air filters to see if they are clogged.

      Refer to the engine service manual.

7.6.75 Code 1458 - Sync Ph Rot Mismatch

Logic:

Mismatch in phase rotation between the generator set output and the system bus.

Possible Causes:

1. Generator set or system bus voltage cables are incorrectly wired to the paralleling breaker.
2. Generator set or system bus voltage sensing connections are incorrectly wired at the base board.
3. The base board is faulty.
4. Refer to Generator troubleshooting.

Diagnosis and Repair:

1. Generator set or system bus voltage cables are incorrectly wired to the paralleling breaker.

WARNING: High voltages are present in this step. Special equipment and training is required to work on or around high-voltage equipment. Operation and maintenance must be done only by persons trained and qualified to work on such devices. Improper use or procedures may result in severe personal injury or death.

a. Using a phase rotation meter or a synchronizing light; verify that the phase rotation of the generator set output relative to the system bus. Energize the system bus and start the generator set in question in Manual mode, but do not close the paralleling breaker. First check the phase rotation of the system bus with the phase rotation meter. Then check the phase rotation of the generator set. The generator set and the system bus should have the same phase rotation, L1–L2–L3. For proper phase rotation measurement procedures, refer to the phase rotation meter instructions. Correct the wiring if the phase rotation between the generator set and system bus is different. If the phase rotation check shows that a phase is missing, check for blown fuses and an open circuit at the system bus voltage cables and the generator set voltage cables connected to the paralleling breaker.

2. Generator set or system bus voltage sensing connections are incorrectly wired at the base board.

   a. If the nominal voltage is 600 VAC or lower, ensure that the voltage sensing connections are correct.

      - Measure the phase rotation at base board from the system bus at: L1, TB7-1; L2, TB7-2; L3, TB7-3. The phase rotation should be “L1 – L2 –L3", for proper phase rotation measurement procedures, refer to the phase rotation meter instructions. If the phase rotation is not correct, re-check the wiring.
      - Measure the phase rotation at base board from the Generator set at: L1, J22-1; L2, J22-2; L3, J22-3. The phase rotation should be “L1 – L2 –L3", for proper phase rotation measurement procedures, refer to the phase rotation meter instructions. If the phase rotation is not correct, re-check the wiring.

   b. If the nominal voltage is over 600 VAC, check the voltage sensing connections from the base board to the PT and the PT to the System bus.

WARNING: High voltages are present in this step. Special equipment and training is required to work on or around high-voltage equipment. Operation and maintenance must be done only by persons trained and qualified to work on such devices. Improper use or procedures may result in severe personal injury or death.

- Measure the phase rotation at the input of the PT (Potential Transformer) from the system bus. The phase rotation at the input of the PT should match the phase rotation at the input of the base board. The phase rotation (“L1 – L2 –L3") at the input of the PT should be the same as the phase rotation at the input of the base board at L1, TB7-1; L2, TB7-2; L3, TB7-3; if the phase rotation does not match, correct the wiring from the System bus to the PT and/or from the PT the base board.

- Measure the phase rotation at the input of the PT (Potential Transformer) from the generator set. The phase rotation at the input of the PT should match the phase rotation at the input of the base board. The phase rotation (“L1 – L2 –L3") at the input of the PT should be the same as the phase rotation at the input of the base board at J22-1; L2, J22-2; L3, J22-3; if the phase rotation does not match, correct the wiring from the Generator set to the PT and/or from the PT the base board.

3. Check to see if the base board is faulty.
   a. To check the generator set phase rotation on the display, go to Advanced Status -> Adv Genset Status -> Phase Rotation -> Genset Phase Rotation and check the phase rotation while the generator set is running. If the phase rotation sensing connections are correct at the input of the base board (L1, J22-1; L2, J22-2; L3, J22-3) but the display shows incorrect generator set phase rotation, replace the base board.
   b. To check the System bus phase rotation on the display, go to Paralleling Status -> Phase Rot and check the phase rotation of the system bus. If the phase rotation sensing connections are correct at the input of the base board (L1, TB7-1; L2, TB7-2; L3, TB7-3) but the display shows incorrect System bus phase rotation, replace the base board.

7.6.76 Code 1459 - Reverse Power

Logic:

The “Reverse KW threshold" has been exceeded for the time that is registered in the “Reverse KW time delay" setting.

Possible Causes:

1. CTs are incorrectly connected or installed.
2. There are fuel or air delivery problems.
3. Reverse KW threshold is set too low.
4. Loading issue.
5. The generator set and/or Bus voltage and frequency are incorrectly calibrated.
6. kW load share lines.
7. Refer to Generator troubleshooting.

Diagnosis and Repair:

1. CTs are incorrectly connected or installed.
   a. If event/fault code 1459 becomes active as soon as the genset picks up load, check the genset operator panel under the **Alternator Data** menu and view the **L1 KW, L2 KW, and L3 KW** parameters when the genset picks up load (right before the genset shuts down). If L1 KW, L2 KW, or L3 KW is a negative value, it is likely that the CT connected to the negative KW value has an incorrect orientation or is connected backwards. Verify the CT orientation and CT wiring at L1: J12-1 and J12-4, L2: J12-2 and J12-5, L3: J12-3 and J12-6, correct if miswired.
2. Check for fuel or air delivery problems.
   a. Refer to the engine service Manual.

3. Reverse KW threshold is set too low.
    a. To access the Reverse KW threshold configuration menu on the operator panel go to **Setup > Genset Setup > Reverse KW Threshold** and set the “Reverse KW Threshold" Parameter appropriately for the application. Refer to the parameter list to see the default value for Reverse KW.
4. Loading issue.
    a. Ensure that the load on the genset does not exceed the Genset KW Rating. Motors, Uninterruptible Power Supply (UPS), Variable Frequency Drive (VFD), Medical Diagnostic Imagining Equipment, and Fire Pumps have a considerable and different influence on a generator. Revisit the genset sizing process to ensure that the genset is correctly sized for the application, especially if new loads have been introduced into the system (reference the T-030 manual).

CAUTION: Increasing the KW threshold or time delay may have adverse effects on the alternator. Always check the capability of the alternator.

5. Check to see if the generator set and/or Bus voltage and frequency are incorrectly calibrated.
    a. Verify that the generator set voltage and frequency is the same as the Bus voltage and frequency. If the Bus voltage and frequency is greater than the generator set voltage and frequency, the generator set is no longer exporting power to the electric bus, but is rather drawing power from the electric bus. This condition is called reverse kW. Calibrate the generator set and bus voltage and frequency; refer to the Calibration section of the PowerCommand 3.x Service Manual (900-0670).
6. kW load share lines.
    a. Make sure the kW load share lines are wired correctly.

       Negative: TB9-7 to TB9-7

       Positive: TB9-8 to TB9-8

       Shield: TB9-9 to TB9-9
    b. Disconnect the kW load share lines wires, including the shield. Check the continuity of the each kW load share line. The resistance should be less than 10 ohms.

7.6.77 Code 1461 - Loss of Field

Logic:

The “Reverse KVAR threshold" has been exceeded for the time that is registered in the “Reverse KVAR time delay" setting.

Possible Causes:

1. Improper voltage calibration of the genset.
2. Load sharing lines incorrectly connected.
3. Improperly set Leading Power Factor.
4. kVAR load share lines.

Diagnosis and Repair:

1. Improper voltage calibration of the genset.

   a. If the genset is not operating in droop paralleling mode, go to step 2. Using a voltmeter measure the AC voltage of the Electric Bus that the genset is paralleled to (voltage of the Genset Bus or the Utility). Then measure the output voltage of the genset and ensure that the genset output voltage is +3 VAC/-0 VAC that of the source which the genset is paralleled to. Event/fault code 1461 is a result of the genset not matching or exceeding the voltage of the electric bus, which causes the genset to import current from the electric bus (Reverse KVAR). To access the voltage calibration menu on the operator panel go to **Setup > Adjust > Voltage Calibration** and increase the genset output voltage.

   b. Using a volt-meter measure the AC voltage of the Electric Bus that the genset is paralleled to (voltage of the Genset Bus or the Utility). Then measure the output voltage of the genset and ensure that the genset output voltage is +3 VAC/-0 VAC that of the source which the genset is paralleled to. Event/fault code 1461 is a result of the generator set not matching or exceeding the voltage of the electric bus, which causes the genset to import current from the electric bus (Reverse KVAR). To access the voltage calibration configuration menu on the display go to: **Setup > Adjust > Voltage Calibration** and increase the genset output voltage.

2. Load sharing lines incorrectly connected.

   a. Ensure that the orientation of the load sharing connections is correct, and that the shield is only grounded at one point. Check for damaged or disconnected wires at TB9-8, KW+ ; TB9-7, KW- ; TB9-10, KVAR+ ; TB9-11, KVAR- ; TB9-9, Shield (shield should be grounded at only one genset). Correct connections if faulty.

3. Improperly set Leading Power Factor.

   a. If Loss of excitation occurs when the genset is lightly loaded, a leading power factor may be the cause. Leading Power factor can be caused by operation of filters and power factor correction capacitors when the KW load level on the genset is low. Motors, Uninterruptible Power Supply (UPS), Variable Frequency Drive (VFD), Medical Diagnostic Imagining Equipment, Fire Pumps and certain types of lighting have a considerable and different influence on a generator and can also cause a leading power factor. Leading power factor loads can cause the genset to lose control of the output voltage of the genset. To access the Power Factor menu on the operator panel go to **Alternator Data** and view the value of L1 PF, L2 PF, L3 PF, and Total PF, right before the genset shuts down on event/fault code 1461. Revisit the genset sizing process if the power factor is leading to ensure that the genset is correctly sized for the application, especially if new loads have been introduced into the system (reference the T-030 manual).

CAUTION: Increasing the KVAR threshold or time delay may have adverse effects on the alternator. Always check the capability of the alternator.

4. kVAR load share lines.

   a. Make sure the kVAR load share lines are wired correctly.

   Negative: TB9-11 to TB9-11

   Shield: TB9-9 to TB9-9

   Positive: TB9-10 to TB9-10

b. Disconnect the kVAR load share lines wires, including the shield. Check the continuity of the each kVAR load share line. The resistance should be less than 10 ohms.

7.6.78 Code 1464 - Load Dump

Logic:

If the "Load Dump" parameter is enabled and the genset KW output exceeds the "Overload Threshold" for the "Overload Set Time" or the output frequency of the genset drops below the "Under-frequency Offset" for the "Under-frequency Set Time"; the genset will dump its electrical load.

Possible Causes:

1. Active fault code is set to Derate.
2. The "Overload Threshold" is set too low.
3. The "Under-frequency Offset" is set too low.
4. The "Overload Set Time" or "Under-frequency Set Time" is set too low.
5. There are fuel or air delivery problems.
6. Incorrect CTs or CT Connections.
7. The base board is faulty.
8. Refer to Generator troubleshooting.

Diagnosis and Repair:

1. Active fault code is set to Derate.
   a. Event/fault code 1464 can be activated as a result of another active fault that is set to "Derate". Troubleshoot the other active fault(s) that are set to Derate.
2. The "Overload Threshold" is set too low.
   a. To access the Overload Threshold configuration menu on the operator panel go to **Setup > Genset Setup** and set the "Overload Threshold" parameter appropriately for the application. Refer to the parameter list to see the default value for "Overload Threshold".
3. The "Under-frequency Offset" is set too low.
   a. To access the Under-frequency Offset configuration menu on the operator panel go to **Setup > Genset Setup** and set the "Under-frequency Offset" parameter appropriately for the application. Refer to the parameter list to see the default value for "Under-frequency Offset".
4. The "Overload Set Time" or "Under-frequency Set Time" is set too low.
   a. To access the "Overload Set Time" and "Under-frequency Set Time" configuration menu on the operator panel go to **Setup > Genset Setup** and set the "Overload Set Time" and "Under-frequency Set Time" Parameters appropriately for the application. Refer to the parameter list to see the default values for "Overload Set Time" and "Under-frequency Set Time".

5. Check to see if there are incorrect CTs, CT connections, or CT ratio.
   a. Check the CTs, CT connections, and the CT ratio. For installation instructions, refer to the section on Current Transformer Installation or reference event/fault code 2814 and event/fault code 2815.
6. Incorrect CTs, CT Connections, or CT ratio.
   a. Check the CTs, CT Connections, and CT ratio. For installation instructions, refer to the section on Current Transformer Installation or reference event/fault code 2814 and event/fault code 2815.
7. The base board is faulty.
   a. If the previous steps did not identify any problems, replace the control board.

7.6.79 Code 1469 - Speed/Hz Mismatch

Logic:

Engine speed and genset output frequency do not match.

Possible Causes:

1. Fly wheel teeth number is incorrectly set.
2. Faulty Magnetic Pick-up.
3. Incorrect engine speed data from the ECM.
4. A new alternator was installed with a different number of poles.
5. Load induced.
6. Speed/frequency mismatch threshold set too low.
7. Speed/frequency mismatch fault time.
8. Frequency-to-speed gain select.
9. Gearbox teeth incorrect.

Diagnosis and Repair:

1. Fly wheel teeth number is incorrectly set.
   a. If this genset has an ECM, go to step number 3. For a hydro-mechanical genset, access the Flywheel Teeth setup screen through the Operator Panel and ensure that the PCC is set up with the correct number of engine flywheel teeth.
2. Faulty Magnetic Pick-up
   a. If this genset has an ECM, go to step number 3. For a Hydro-mechanical application, inspect the MPU wires/connector pins for shorts and open circuits. Remove the MPU connectors and check for 3.5 to 15 VAC at the MPU while cranking. If the MPU tests satisfactorily, then check the voltage output of the board at J11-9 (MPU +) and J11-10 (MPU -).

3. Incorrect engine speed data from the ECM.
    a. If the engine has an ECM ensure that the correct engine speed information is being communicated to the genset control via the CAN datalink. Through the operator panel verify the engine speed by going to **Engine Data > Engine Speed.** Refer to the engine service manual to correct.

       Correct Speeds

       1800 RPM at 60 Hz

       1500 RPM at 50 Hz
4. A new alternator was installed with a different number of poles.
    a. If a new alternator with a different number of poles replaced an original alternator, then the speed and frequency ratio is inaccurate. Go to **Setup > OEM Setup >OEM Engine Setup > Freq/Speed** and adjust the “Frequency to Speed Gain Select" parameter accordingly to the alternator. To calculate the Frequency to Speed value use the following equation:

       Frequency to Speed = 120 / Number of poles of the Alternator
5. Load induced.
    a. Non-linear loads like Uninterruptible Power Supply (UPS) and certain types of lighting have a considerable and different influence on a generator which can cause significant frequency fluctuations that do not match measured engine speed; ex: a UPS causes 62 Hz at 1800 RPM. This is an application issue; correct the application issue and refer to the T030 manual.
6. Speed/frequency mismatch threshold set too low.
    a. Connect with InPower.
    b. Make sure the speed/frequency mismatch threshold is set within 0.1-20 Hz.
7. Speed/frequency mismatch fault time.
    a. Connect with InPower.
    b. Make sure the speed/frequency mismatch threshold time is set within 0.2-10 sec.
8. Frequency-to-speed gain select.
    a. Connect with InPower.
    b. Make sure the frequency-to-speed gain select is set properly.
9. Gearbox teeth incorrect.

   In the case of gearbox setup, make sure the settings are correct.
    a. Connect with InPower.
    b. Make sure the flywheel teeth parameter is set to the number of teeth of the gearbox.

7.6.80 Code 1471 - High Current Warning

Logic:

Genset output current has exceeded 110% for 60 seconds.

Possible Causes:

1. Overload.
2. Incorrect CT Ratio, CTs, or CT connections.
3. The base board is faulty.
4. Refer to Generator troubleshooting.

Diagnosis and Repair:

1. Overload.
   a. Reference the first 2 steps of event/fault code 1444.
2. Incorrect CT Ratio, CTs, or CT connections.
   a. Check the CT Ratio, CTs, and CT connections, reference event/fault code 2814.
3. The base board is faulty.
   a. If the previous steps did not identify any problems, replace the control board.

7.6.81 Code 1472 - High Current Shutdown

Logic:

The AmpSentry High Current Shutdown threshold has been exceeded.

NOTE: **This fault remains active and cannot be reset until the Alternator Overheat Integral time has expired (which takes up to five minutes). The Alternator Overheat Integral time allows the alternator to cool down before allowing a restart.**

Possible Causes:

1. Short or overload.
2. Incorrect CT Ratio, CTs, or CT connections.
3. The base board is faulty.
4. Refer to Generator troubleshooting.

Diagnosis and Repair:

1. Short or overload.
   a. Check the load and load cables. Repair if necessary.
2. Incorrect CT Ratio, CTs, or CT connections.
   a. Check the CT Ratio, CTs, and CT connections, reference event/fault code 2814.
3. The base board is faulty.
   a. If the previous steps did not identify any problems, replace the control board.

7.6.82 Code 1475 - First Start Backup Fail

Logic:

Genset has not received permission to close the Genset CB to a dead bus from the First Start Input within the “First Start Back up time" parameter.

Possible Causes:

1. Wiring issue at the First Start Arbitration input.
2. The base board is faulty.

Diagnosis and Repair:

1. Wiring issue at the First Start Arbitration input.
    a. The First Start Arbitration input is incorrectly wired between generator sets or an open circuit exists at the First Start Arbitration input. Check the wiring at TB3-11 (First Start Arbitration) and TB3-12 (Return) between this and all gensets that are interconnected, and ensure that the wiring is correct.
2. The base board is faulty.
    a. If previous steps do not reveal any problems, replace the base board.

7.6.83 Code 1483 - Common Alarm

Logic:

The control has detected a warning fault and/or shutdown fault.

Possible Causes:

1. A warning fault and/or shutdown fault is active.

Diagnosis and Repair:

1. A warning fault and/or shutdown fault is active.
    a. This fault is activated as a result of another warning or shutdown fault. Troubleshoot the other fault(s) that are causing the genset to generate this event/fault code.

7.6.84 Code 1540 - Common Warning

Logic:

The control has detected a warning fault.

Possible Causes:

1. Active warning fault.

Diagnosis and Repair:

1. Active warning fault.
    a. This fault is activated as a result of another warning fault. Troubleshoot the other warning fault(s) that are causing the genset to generate a warning fault.

7.6.85 Code 1541 - Common Shutdown

Logic:

The control has detected a shutdown fault.

Possible Causes:

1. Active shutdown fault.

Diagnosis and Repair:

1. Active shutdown fault.
    a. This fault is activated as a result of another shutdown fault. Troubleshoot the other shutdown fault(s) that are causing the genset to shut down.

7.6.86 Code 1573 - Config Input #1 Fault

Logic:

Configurable input #1 fault is active.

Possible Causes:

1. Condition for which "Configurable Input #1" is configured for service.
2. "Configurable Input #1 Active State Selection" parameter is configured incorrectly.
3. Incorrectly wired; or open circuit or short circuit in the wiring.
4. The base board is faulty.

Diagnosis and Repair:

1. Condition for which "Configurable Input #1" is configured for service.
    a. Check the condition for which "Configurable Input #1" has been configured for; ex. if "Configurable Input #1" was configured to become active when the fuel level is low, check the fuel level and add fuel if needed. After the issue is resolved, press the Reset button on the Operator Panel in order to clear the fault, if the fault does not clear go to step 2.
2. "Configurable Input #1 Active State Selection" parameter is incorrectly configured.
    a. With InPower or through the operator panel check the switch input setting (active closed or active open) for Configurable Input #1. Ensure that the switch input setting is correctly set. If "Configurable Input #1 Input Function Pointer" parameter is set to default and if "Configurable Input #1 Active State Selection" parameter is set to "active closed", input 1 (event/fault code 1573) will become active when TB1-12 (input 1) and TB1-13 (ground) are connected (shorted) together.

       If "Configurable Input #1 Input Function Pointer" parameter is set to default and if "Configurable Input #1 Active State Selection" parameter is set to "active open", input 1 (event/fault code 1573) will become active when there is an open circuit between TB1-12 (input 1) and TB1-13 (ground).

       To access the input configuration on the operator panel go to **Setup > Configurable I/O > Config Input #1 Menu > Active** and set this parameter appropriately for the application.

3. Incorrectly wired; or open circuit or short circuit in the wiring.
   a. Check the wiring at TB1-12 (input 1) and TB1-13 (ground) for an open circuit, short circuit, or a miswired condition.
4. The base board is faulty.
   a. If the previous steps did not reveal and problems but event/fault code 1573 is still active, replace the base board.

7.6.87 Code 1689 - Reset Real Time Clock

Logic:

Power to the Real Time Clock (RTC) chip on the base board has been lost and the clock is no longer accurate.

Possible Causes:

1. Battery power has been lost.
2. The base board is faulty.

Diagnosis and Repair:

1. Battery power has been lost.
   a. The RTC chip requires little, but constant, power to keep the control's internal clock accurate. It has an internal capacitor that keeps the RTC operating for up to 1 hour when the battery is disconnected or dead. If battery power is lost for over 1 hour, the RTC will stop functioning. When battery power is supplied to the control again, the control will display event/fault code 1689, because the RTC is no longer accurate. If the fault clears after being acknowledged, then the control is OK. To set the real time clock, on the operator panel go to **Setup > Clock Setup** and set the RTC clock appropriately.
2. The base board is faulty.
   a. If the generator set battery voltage is satisfactory, but the fault is constantly displaying on the control and cannot be cleared, replace the base board.

7.6.88 Code 1847 - Engine Coolant Temperature High

Logic:

Engine coolant temperature has exceeded the alarm (shutdown with cooldown) threshold for high coolant temperature.

Possible Causes:

1. Inaccurate engine temperature sensor.
2. Fault simulation feature is enabled.
3. Threshold setting too low.

Diagnosis and Repair:

1. Verify the sensor accuracy with a thermocouple or similar temperature probe.
   a. Connect the temperature probe to the engine near the coolant temperature sensor.

   b. Connect InPower.
   c. Compare the coolant temperature reading from the service tool to the reading from the temperature probe. If the two readings are reasonably close, then the sensor is reading correctly.
2. Verify that the fault simulation for the sensor is not enabled.
   a. Connect InPower.
   b. Verify that the fault simulation is NOT enabled for the coolant temperature sensor by connecting to the PCC via InPower. If the fault simulation is disabled, there is no problem.
3. Check threshold settings.
   a. Connect InPower.
   b. Verify that the fault threshold is within the normal operating range for the coolant temperature sensor. Refer to the engine service manual for correct threshold values, and make the appropriate changes using InPower.

7.6.89 Code 1853 - Annunciator Input 1 Fault

Logic:

Customer fault 1 (input 1, LED 1) on the Universal Annunciator is active.

Possible Causes:

1. Condition for which "Annunciator Input #1" is configured for is active.
2. Incorrectly configured or wiring issue.
3. Faulty annunciator.

Diagnosis and Repair:

1. Condition for which "Annunciator Input #1" is configured for is active.
   a. Check the condition for which "Annunciator Input #1" has been configured for; ex. if "Annunciator Input #1" was configured to become active when the fuel level is low, check the fuel level and add fuel if needed. After the issue is resolved, press the Reset button on the Operator Panel in order to clear the fault, if the fault does not clear go to step 2.
2. Incorrectly configured or wiring issue.
   a. Customer input 1 on the Universal Annunciator can be configured to conform to different applications. Below are two configurations that have an impact on how input 1 becomes active.

Configurable Parameter	**Option 1 (Default)**	**Option 2**
Negative or Positive Input 1 Activation	Negative Input (ground input)	Positive Input (B+ input)
Inverting Active Hardware Signals	Don't Invert	Invert

Negative or positive Input 1 activation: Allows the user to activate with a negative (ground) or positive (B+) input; the default setting is a negative (ground) input.

Inverting active hardware signals: Input 1 has the capability to be inverted. If annunciator input 1 is set to inverted, then an active hardware signal will be considered inactive and an inactive signal will be considered active, default is set to non-inverted.

When set to default, event/fault code 1853 (customer input 1) becomes active when there is a ground input at TB1-1 on the back of the Universal Annunciator.

Ensure that the Universal Annunciator is correctly configured; for setup and configuration instructions, refer to the Universal Annunciator operator's manual (P/N 0900-0301).

b. Check the wiring at TB1-1 and ensure that customer input 1 is not wired incorrectly. Depending on the configuration of the annunciator in step 1A, ensure that there is not a short or open circuit at the TB1-1 connection.

c. Check the sender, relay, or device that is activating Input 1 on the Universal Annunciator, replace if faulty.

3. Faulty Annunciator.

   a. If the wiring and configuration is satisfactory, replace the Universal Annunciator.

7.6.90 Code 1854 - Annunciator Input 2 Fault

Logic:

Customer fault 2 (input 2, LED 2) on the Universal Annunciator is active.

Possible Causes:

1. Condition for which "Annunciator Input #2" is configured for is active.
2. Incorrectly configured or wiring issue.
3. Faulty annunciator.

Diagnosis and Repair:

1. Condition for which "Annunciator Input #2" is configured for is active.

   a. Check the condition for which "Annunciator Input #2" has been configured for; ex. if "Annunciator Input #2" was configured to become active when the fuel level is low, check the fuel level and add fuel if needed. After the issue is resolved, press the Reset button on the Operator Panel in order to clear the fault, if the fault does not clear go to step 2.

2. Incorrectly configured or wiring issue.

   a. Customer input 2 on the Universal Annunciator can be configured to conform to different applications. Below are two configurations that have an impact on how input 2 becomes active.

Configurable Parameter	Option 1 (Default)	Option 2
Negative or Positive Input 2 Activation	Negative Input (ground input)	Positive Input (B+ input)

Inverting Active Hardware Signals	Don't Invert	Invert

Negative or positive Input 2 activation: Allows the user to activate with a negative (ground) or positive (B+) input; the default setting is a negative (ground) input.

Inverting active hardware signals: Input 2 has the capability to be inverted. If annunciator input 2 is set to inverted, then an active hardware signal will be considered inactive and an inactive signal will be considered active, default is set to non-inverted.

When set to default, event/fault code 1854 (customer input 2) becomes active when there is a ground input at TB1-2 on the back of the Universal Annunciator.

Ensure that the Universal Annunciator is correctly configured; for setup and configuration instructions, refer to the Universal Annunciator operator's manual (P/N 0900-0301).

b. Check the wiring at TB1-2 and ensure that customer input 2 is not wired incorrectly. Depending on the configuration of the annunciator in step 1A, ensure that there is not a short or open circuit at the TB1-2 connection.

c. Check the sender, relay, or device that is activating Input 2 on the Universal Annunciator, replace if faulty.

3. Faulty Annunciator.

    a. If the wiring and configuration is satisfactory, replace the Universal Annunciator.

7.6.91 Code 1855 - Annunciator Input 3 Fault

Logic:

Customer fault 3 (input 3, LED 3) on the Universal Annunciator is active.

Possible Causes:

1. Condition for which "Annunciator Input #3" is configured for is active.
2. Incorrectly configured or wiring issue.
3. Faulty annunciator.

Diagnosis and Repair:

1. Condition for which "Annunciator Input #3" is configured for is active.

    a. Check the condition for which "Annunciator Input #3" has been configured for; ex. if "Annunciator Input #3" was configured to become active when the fuel level is low, check the fuel level and add fuel if needed. After the issue is resolved, press the Reset button on the Operator Panel in order to clear the fault, if the fault does not clear go to step 2.

2. Incorrectly configured or wiring issue.

    a. Customer input 3 on the Universal Annunciator can be configured to conform to different applications. Below are two configurations that have an impact on how input 3 becomes active.

Configurable Parameter	Option 1 (Default)	Option 2
Negative or Positive Input 3 Activation	Negative Input (ground input)	Positive Input (B+ input)
Inverting Active Hardware Signals	Don't Invert	Invert

Negative or positive Input 3 activation: Allows the user to activate with a negative (ground) or positive (B+) input; the default setting is a negative (ground) input.

Inverting active hardware signals: Input 3 has the capability to be inverted. If annunciator input 3 is set to inverted, then an active hardware signal will be considered inactive and an inactive signal will be considered active, default is set to non-inverted.

When set to default, event/fault code 1855 (customer input 3) becomes active when there is a ground input at TB1-3 on the back of the Universal Annunciator.

Ensure that the Universal Annunciator is correctly configured; for setup and configuration instructions, refer to the Universal Annunciator operator's manual (P/N 0900-0301).

b. Check the wiring at TB1-3 and ensure that customer input 3 is not wired incorrectly. Depending on the configuration of the annunciator in step 1A, ensure that there is not a short or open circuit at the TB1-3 connection.

c. Check the sender, relay, or device that is activating Input 3 on the Universal Annunciator, replace if faulty.

3. Faulty Annunciator.

   a. If the wiring and configuration is satisfactory, replace the Universal Annunciator.

7.6.92 Code 1912 - Utility Loss Of Phase

Logic:

In Power Transfer Control (PTC) Operation, if the phase angle between phases drops below 90 degrees or exceeds 150 degrees, for the “Utility Loss of Phase Drop-Out Delay" time parameter, fault code 1912 will become active.

Possible Causes:

1. Open circuit at the utility voltage sensing inputs.
2. Utility voltage or frequency is unstable.
3. The base board is faulty.

Diagnosis and Repair:

1. Open circuit at the utility voltage sensing inputs.

   a. The phase angle between phases L1-L2, L2-L3, and L3-L1 should be 120 degrees. At least one connection point that is used to calculate phase angle has been lost. Check the voltage sensing connections at L1: TB7-1; L2: TB7-2, L3: TB7-3 for an open circuit, and ensure that voltage and phase angle is correct. If using a PT also check the inputs and outputs of the PT.

2. Utility phase angle is unstable.
   a. Check with your utility company.
3. The base board is faulty.
   a. Replace the base board if the phase angle at L1: TB7-1; L2: TB7-2, L3: TB7-3 is correct, but the display does not register correct values.

7.6.93 Code 1913 - Genset Loss Of Phase

Logic:

In Power Transfer Control (PTC) Operation, if the phase angle between phases drops below 90 degrees or exceeds 150 degrees, for the “Genset Loss of Phase Drop-Out Delay" time parameter, fault code 1913 will become active.

Possible Causes:

1. Correct any active genset faults.
2. Open circuit at the genset voltage sensing inputs.
3. The base board is faulty.
4. Refer to Generator troubleshooting.

Diagnosis and Repair:

1. Correct any active genset faults.
   a. Correct any active genset faults on the display, especially faults that might cause the engine to hunt/oscillate.
2. Open circuit at the genset voltage sensing inputs.
   a. The phase angle between phases L1-L2, L2-L3, and L3-L1 should be 120 degrees. At least one connection point that is used to calculate phase angle has been lost. Check the voltage sensing connections at L1, J22-1; L2, J22-2; L3, J22-3 for an open circuit, and ensure that voltage and phase angle is correct. If using a PT also check the inputs and outputs of the PT.
3. The base board is faulty.
   a. Replace the base board if the phase angle at L1, J22-1, L2, J22-2, L3, J22-3 is correct, but the display does not register correct values.

7.6.94 Code 1914 - Utility Ph Rotation Error

Logic:

Utility Phase rotation is incorrect.

Possible Causes:

1. Utility voltage sensing connections are incorrectly wired at the base board.
2. The base board is faulty.
3. Refer to Generator troubleshooting.

Diagnosis and Repair:

1. Utility voltage sensing connections are incorrectly wired at the base board.
   a. If the nominal voltage is 600 VAC or lower, ensure that the voltage sensing connections are correct.
      - Measure the phase rotation and voltage input into the base board from the Utility bus at: L1, TB7-1; L2, TB7-2; L3, TB7-3. The voltage should match nominal voltage, and the phase rotation should be “L1 – L2 –L3", for proper phase rotation measurement procedures, refer to the phase rotation meter instructions. If the phase rotation and/or voltage are not correct, re-check the wiring.

   b. If the nominal voltage is over 600 VAC, measure the voltage sensing connections from the base board to the PT and the PT to the Utility bus.

***WARNING:** High voltages are present in this step. Special equipment and training is required to work on or around high-voltage equipment. Operation and maintenance must be done only by persons trained and qualified to work on such devices. Improper use or procedures may result in severe personal injury or death.*

- Measure the phase rotation and voltage input into the base board from the PT (Potential Transformer) at: L1, TB7-1; L2, TB7-2; L3, TB7-3, L4, TB7-4. The voltage should match nominal voltage, and the phase rotation should be “L1 – L2 –L3", for proper phase rotation measurement procedures, refer to the phase rotation meter instructions. If the phase rotation and/or voltage are not correct, re-check the wiring from the base board to the PT and correct if necessary.
- Measure the phase rotation and voltage input into the PT (Potential Transformer) from the Utility bus. The voltage into the PT should match the Utility bus voltage, and the phase rotation should be “L1 – L2 –L3", for proper phase rotation measurement procedures, refer to the phase rotation meter instructions. If the phase rotation and/or voltage are not correct, re-check the wiring from the PT to the Utility bus and correct if necessary.

2. The base board is faulty.
   a. If the phase rotation and the Utility bus voltage sensing connections are correct at the input of the base board, L1, TB7-1; L2, TB7-2; L3, TB7-3; but the display shows incorrect Utility bus voltage and phase rotation, replace the base board. To check the Utility bus voltage and phase rotation using the display, go to Paralleling Status - Paralleling Status-PTC Sc 1 -> Bus Avg Voltage -> Utility LL Average Voltage and Paralleling Status -> Phase Rot -> Utility Phase Rotation.

7.6.95 Code 1915 - Genset Phase Rotation

Logic:

Genset Phase rotation is incorrect.

Possible Causes:

1. Genset voltage sensing connections are incorrectly wired at the base board.
2. The base board is faulty.
3. Refer to Generator troubleshooting.

Diagnosis and Repair:

1. Genset voltage sensing connections are incorrectly wired at the base board.

   a. If the nominal voltage is 600 VAC or lower, ensure that the voltage sensing connections are correct.

      - Measure the phase rotation and voltage input into the base board from the Generator set at: L1, J22-1; L2, J22-2; L3, J22-3. The voltage should match nominal voltage, and the phase rotation should be “L1 – L2 –L3", for proper phase rotation measurement procedures, refer to the phase rotation meter instructions. If the phase rotation and/or voltage are not correct, re-check the wiring.

   b. If the nominal voltage is over 600 VAC, measure the voltage sensing connections from the base board to the PT and the PT to the Generator set.

WARNING: High voltages are present in this step. Special equipment and training is required to work on or around high-voltage equipment. Operation and maintenance must be done only by persons trained and qualified to work on such devices. Improper use or procedures may result in severe personal injury or death.

      - Measure the phase rotation and voltage input into the base board from the PT (Potential Transformer) at: L1, J22-1; L2, J22-2; L3, J22-3. The voltage should match nominal voltage, and the phase rotation should be “L1 – L2 –L3", for proper phase rotation measurement procedures, refer to the phase rotation meter instructions. If the phase rotation and/or voltage are not correct, re-check the wiring from the base board to the PT and correct if necessary.
      - Measure the phase rotation and voltage input into the PT (Potential Transformer) from the Generator set. The voltage into the PT should match the Generator set voltage, and the phase rotation should be “L1 – L2 –L3", for proper phase rotation measurement procedures, refer to the phase rotation meter instructions. If the phase rotation and/or voltage are not correct, re-check the wiring from the PT to the Generator set and correct if necessary.

2. The base board is faulty.

   a. If the phase rotation and the generator set voltage sensing connections are correct at the input of the base board, L1, J22-1; L2, J22-2; L3, J22-3; but the display shows incorrect generator set voltage and phase rotation, replace the base board. To check the generator set voltage and phase rotation using the display, go to Advanced Status -> Adv Genset Status.

7.6.96 Code 1944 - HMI 113 Out Config Error

Logic:

PCCNet Annunciator (HMI 113) output relay(s) are being activated by more than one source.

Possible Causes:

1. PCCNet Annunciator (HMI 113) output relay(s) are being activated by more than one source at the same time.
2. Faulty annunciator.

Diagnosis and Repair:

1. PCCNet Annunciator (HMI 113) output relay(s) are being activated by more than one source at the same time.
   a. The Universal Annunciator(s) should only be connected to one genset control; only one genset control should active the relays. Event/fault code 1944 becomes active when any of the four PCCNet annunciator relays are being driven by more than one source in the PCCNet network; if the PCCNet annunciator is connected to two genset controls or more, this is the cause of the fault. Ensure that the PCCNet annunciator(s) are only connected to one genset control.
2. Faulty annunciator.
   a. If the previous steps are satisfactory, then replace the annunciator.

7.6.97 Code 1999 – Maximum Parallel time

Logic:

In Power Transfer Control (PTC) Operation, if the genset remains paralleled to the utility for a time that is longer than the "Maximum Parallel Time" parameter, fault code 1999 will become active.

Possible Causes:

1. "Maximum Parallel Time" parameter is set too low.

Diagnosis and Repair:

1. "Maximum Parallel Time" parameter is set too low.
   a. Fault code 1999 becomes active when the genset remains paralleled to the utility for a time that is longer than the "Maximum Parallel Time" parameter. Check the setting of the Maximum Parallel Time parameter and ensure that it is set to an appropriate value for the application. To modify the "Maximum Parallel Time" parameter on the display, go to: **Setup > Paralleling Setup > Power Transfer Control > Max Parallel** and set appropriately for the application.

7.6.98 Code 2331 - Low Utility Voltage

Logic:

In Power Transfer Control (PTC) Operation, if the utility voltage is below the “Utility Undervoltage Drop-Out Threshold", for the “Utility Undervoltage Drop-Out Delay", fault code 2331 will become active.

Possible Causes:

1. Utility undervoltage drop-out thresholds are incorrectly set.
2. The voltage of the utility is low and/or unstable.

Diagnosis and Repair:

1. Utility undervoltage drop-out thresholds are incorrectly set.
   a. This fault will become active when the Utility voltage goes below the “Utility undervoltage drop-out threshold" for the “Utility Undervoltage Drop-Out Delay". Utility undervoltage drop-out threshold is dependent of the following parameters:
      - Utility Undervoltage Drop-out percentage.
      - Utility Undervoltage Drop-out Delay.

      To Modify the preceding parameters, on the display go to: **Setup > Paralleling Setup > Power Transfer Control > Drop out or Drop-Out Delay** and set appropriately. Refer the PTC section for setup information and instructions.
2. The voltage of the utility is low and/or unstable.
   a. The voltage of the utility is low and/or unstable, check with your utility company.

7.6.99 Code 2335 - Excitation Fault

Logic:

The control has detected the simultaneous loss of all phases of sensing.

Possible Causes:

1. Incorrectly configured or wiring issue.
2. The base board is faulty.
3. Refer to Generator troubleshooting.

Diagnosis and Repair:

1. Incorrectly configured or wiring issue.
   a. Ensure that the configuration of the “Lost AC Voltage Threshold" parameter is set appropriately for the application. To access the Lost AC Voltage Threshold configuration menu on the operator panel go to **Setup > OEM Setup > OEM ALT Setup > Lost AC Voltage Threshold** and set the “Lost AC Voltage Threshold" parameter appropriately for the application. Refer to the parameter list to see the default value for “Lost AC Voltage Threshold".
   b. All the connections that are used to calculate voltage and current by the control have been lost (either by disconnection or no voltage, current, frequency input into the control, etc.) Check the voltage sensing (L1: J22 -1; L2: J22 -2, L3: J22-3, L4: J22-4) and current sensing (L1: J12-1, J12-4; L2: J12-2, J12-5; L3: J12-3, J12-6;) connections into the control and ensure that voltage and current are available at these connections when the genset is running. If using a PT also check the inputs and outputs of the PT.
2. The base board is faulty.
   a. If the previous steps did not reveal any problems, replace the base board.

7.6.100 Code 2336 - Checksum Fault

Logic:

Integrity check has found corrupted memory block(s) in the PCC.

Possible Causes:

1. PCC has corrupted memory block(s).

Diagnosis and Repair:

1. PCC has corrupted memory block(s).
   a. The PCC has corrupted memory block(s), this is indicated by all of the LEDs on the base board flashing. Perform an initial calibration on the base board with the newest Incal files. If the Incal update does not resolve the issue, then replace the base board.

7.6.101 Code 2342 - Too Long In Idle

Logic:

The engine has been running at Low Speed Idle for a time longer than the "Max Idle Time" parameter.

Possible Causes:

1. "Idle Time" parameters are configured incorrectly.
2. The Coolant Heater(s) is/are faulty.

Diagnosis and Repair:

1. Idle Time parameters are configured incorrectly.
   a. If the genset has been running in Idle and displays event/fault code 2342, ensure that the genset is not configured to run in idle for more that 10 min. Long periods of engine idling (more than 10 min) can eventually affect engine performance and may not be covered by the engine warranty. Set the **"Idle Warmup Time"** and **"Idle Cooldown Time"** to an appropriate value. To access these parameters, on the operator panel go to **Setup > Genset Setup > Idle Warmup Time** or **Idle Cooldown Time** and set these parameter appropriately for the application. Refer to the parameter list to see the default value for "Idle Warmup Time" and "Idle Cooldown Time".
   b. The "Max Idle Time" parameter might be set too low. To access the Max Idle Time configuration menu on the operator panel go to **Setup > Genset Setup > Max Idle Time** and set the "Max Idle Time" parameter appropriately for the application. Refer to the parameter list to see the default value for "Max Idle Time" parameter.
   c. If the "Idle Warmup Coolant Temp" is set too high, the genset will idle for a longer period of time until the temperature of the engine reaches this set point. To access the Idle Warmup Coolant Temp configuration menu on the operator panel go to **Setup > Genset Setup > Idle Warmup Coolant Temp** and set the "Idle Warmup Coolant Temp" parameter appropriately for the application. Refer to the parameter list to see the default value for "Idle Warmup Coolant Temp" parameter.

2. The Coolant Heater(s) is/are faulty.
   a. With the generator set in the Off position, check the wiring and make sure that there is AC voltage available to the coolant heaters. If voltage is not available, correct the wiring. If voltage is available, go to step b.
   b. Measure the temperature of the coolant heater(s) using a proper temperature measuring device. If the ambient temperature is above 40 degrees F, the measured temperature of the coolant heater(s) should be above close to 90 degrees F (dependent on the ambient temperature). If the temperature of the coolant heater(s) is close to the ambient temperature, replace the coolant heater(s).

7.6.102 Code 2358 - High Utility Voltage

Logic:

In Power Transfer Control (PTC) Operation, if the “Utility Overvoltage Sensor Enable" parameter is set to enable, and the utility voltage goes above the “Utility Overvoltage Drop-Out Threshold", for the “Utility Overvoltage Drop-Out Delay" time, fault code 2358 will become active.

Possible Causes:

1. Utility Overvoltage drop-out thresholds are incorrectly set.
2. The voltage of the Utility is not stable.

Diagnosis and Repair:

1. Utility Overvoltage drop-out thresholds are incorrectly set.
   a. This fault will become active when the Utility voltage goes above the “Utility Overvoltage Drop-Out Threshold" for the “Utility Overvoltage Drop-Out Delay" time. The utility overvoltage drop-out threshold is dependent of the following parameters:
      - Utility Overvoltage Drop-out percentage.
      - Utility Overvoltage Drop-out Delay.

      To Modify the preceding parameters, on the display go to: **Setup > Paralleling Setup > Power Transfer Control > Drop out or Drop-Out Delay** and set appropriately. Refer the PTC section for setup information and instructions.
   b. To disable this function, set the “Utility Overvoltage Sensor Enable" parameter to disable. On the display go to: **Setup > Paralleling Setup > Power Transfer Control > Enable** and set appropriately. Refer the PTC section for more information.
2. The voltage of the utility is very high and/or unstable.
   a. The voltage of the utility is very high and/or unstable, check with your utility company.

7.6.103 Code 2396 - Utility CB Fail To Close

Logic:

Utility circuit breaker (CB) has failed to close for the time that is registered in the “Util CB Fail to Close Time Delay" parameter.

Possible Causes:

1. Incorrectly wired.

2. Faulty Utility Circuit Breaker (CB).
3. The base board is faulty.

Diagnosis and Repair:

1. Incorrectly wired.
   a. The base board is sending the Utility CB a close command, but the Utility CB Position Status remains open. Correct the wiring from the CB Close Control output on the base board at TB5-6 and TB5-7 to the Utility breaker; check for an open circuit at the Utility breaker. The Utility CB Close control output is a NO Relay at TB5-6 and TB5-7 (Relay Common) on the base board. When the relay on the base board is closed, the Utility Breaker should be closed. The output of TB5-6 and TB5-7 should match the status of the Utility CB Close command; go to: **Advanced Status > Advanced Controller Status**, and ensure that the status of the CB close position command at the display matches the output.
   b. Verify the wiring of the CB position status from the Utility breaker to the base board. The CB position sensing can be set up as single or dual sensing in the base board; check the display if the base board is setup as single or dual sensing. To access the CB position sensing, go to: **Setup > Paralleling Setup > Basic > Pos Contacts > Utility Breaker Position Contacts**
      - If the CB position sensing is set up as single, verify the connection at CB A (NO) status at TB10-3 and the Return at TB10-1.
      - If the CB position sensing is set up as dual, verify the connection at CB A (NO) status at TB10-3 and the Return at TB10-1 and also verify the connection at CB B (NC) status at TB10-4 and TB10-1 (Return). The input status at CB A (NO) and CB B (NC) should be opposite, one input will be open while the other is closed, if they are the same check the wiring between the Utility breaker and the CB status input on the base board.

        Ensure that the connections on the base board are correctly connected and that a short and/or open circuit does not exist. The physical connection to the base board should match the status of the CB position; go to: **Paralleling Status > Paralleling Status-PTC Sc 1 > Util CB Pos > Utility CB Position Status**, and ensure that the status of the CB position matches the connection.
2. Faulty Utility CB.
   a. Refer to the Utility CB Service Manual.
3. The base board is faulty.
   a. If the wiring and utility CB are not found to be faulty, replace the base board.

7.6.104 Code 2397 - Utility CB Fail To Open

Logic:

Utility circuit breaker (CB) has failed to open for the time that is registered in the “Utility CB Fail to Open Time Delay" parameter.

Possible Causes:

1. Incorrectly wired.

2. Faulty Utility Circuit Breaker (CB).
3. The base board is faulty.

Diagnosis and Repair:

1. Incorrectly wired.
   a. The base board is sending the Utility CB an open command, but the Utility CB Position Status remains closed. Correct the wiring from the CB Open Control output on the base board at TB5-8 and TB5-9 to the Utility breaker; check for a short circuit. The Utility CB Open control output is a NO Relay at TB5-8 and TB5-9 (Relay Common) on the base board. When the relay is closed the Utility Breaker is closed. The output of TB5-8 and TB5-9 should match the status of the **Utility CB Open position command**; go to: **Advanced Status > Advanced Controller Status**, and ensure that the status of the Utility CB Open position command at the display matches the output.
   b. Verify the wiring of the CB position status from the Utility breaker to the base board. The CB position sensing can be set up as single or dual sensing in the base board; check the display if the base board is setup as single or dual sensing. To access the CB position sensing, go to: **Setup > Paralleling Setup > Basic > Pos Contacts > Utility Breaker Position Contacts.**
      - If the CB position sensing is set up as single, verify the connection at CB A (NO) status at TB10-3 and the Return at TB10-1.
      - If the CB position sensing is set up as dual, verify the connection at CB A (NO) status at TB10-3 and the Return at TB10-1 and also verify the connection at CB B (NC) status at TB10-4 and TB10-1 (Return). The input status at CB A (NO) and CB B (NC) should be opposite, one input will be open while the other is closed, if they are the same check the wiring between the Utility breaker and the CB status input on the base board.

        Ensure that the connections on the base board are correctly connected and that a short and/or open circuit does not exist. The physical connection to the base board should match the status of the Utility CB position; go to: **Paralleling Status > Paralleling Status-PTC Sc 1 > Util CB Pos > Utility CB Position Status**, and ensure that the status of the Utility CB position matches the connection.
2. Faulty Utility CB.
   a. Refer to the Utility CB Service Manual.
3. The base board is faulty.
   a. If the wiring and utility CB are not found to be faulty, replace the base board.

7.6.105 Code 2678 - Charging Alternator Fail

Logic:

Battery charging alternator is not charging.

Possible Causes:

1. Faulty engine DC alternator or open circuit.

Diagnosis and Repair:

1. Faulty engine DC alternator or open circuit.
   a. Check the wiring of the alternator for open circuits. If the wiring is satisfactory, measure the output voltage of the alternator to the battery while the engine is running. Normal charging voltage is 12-14 VDC in a 12 V system or 24-26 VDC in a 24 V system. If the appropriate output is not observed, replace the DC alternator.

7.6.106 Code 2814 - Genset CT Ratio Low

Logic:

The genset CT ratio (primary vs. secondary) is too small for the control to function properly for the voltage and KW rating of this genset.

Possible Causes:

1. Incorrect CT ratio setup (or feature code).
2. The CTs are incorrectly sized.
3. Incorrect voltage or kW rating setup.

Diagnosis and Repair:

1. Incorrect CT ratio setup (or feature code).
   a. The control uses voltage, kW, and the CT ratio in order to determine if the CT ratio is correct for the operation of the genset. Use the **CT ratio calculator** in InPower to determine the correct CT ratio for this genset. Then enter the correct CT ratio via InPower or through the operator panel. To access the Genset CT ratio configuration menu on the operator panel go to **Setup > OEM Setup > OEM Alt Setup > Genset CT Ratio** and set the “Genset CT Ratio primary" and “Genset CT Ratio secondary" parameters appropriately for the application.
2. The CTs are incorrectly sized.
   a. Change the CTs to the correct size.
3. Incorrect voltage or kW rating setup.
   a. The PCC uses voltage, kW, and the CT ratio in order to determine if the CT ratio is correct for the operation of the genset. If the voltage or kW setup is incorrect, event/fault code 2814 can become active. Use the CT calculator in InPower to determine the correct voltage and kW rating for this genset. To access the genset voltage and kW rating setup on the Operator Panel, go to **Setup > OEM Setup > OEM Alt Setup > Genset Nominal Voltage** and **Setup > OEM Setup > OEM Genset Setup** and set the parameters appropriately for the application.

7.6.107 Code 2815 - Genset CT Ratio High

Logic:

The ratio of the genset CT is too large for this genset. The genset CT ratio (primary vs. secondary) is too large for the control to calculate current accurately at the voltage and KW ratings for this genset.

Possible Causes:

1. The control is set up with the incorrect CT ratio (or feature code).
2. The CTs are incorrectly sized.
3. Incorrect voltage or kW rating setup.

Diagnosis and Repair:

1. The control is set up with the incorrect CT ratio (or feature code).
   a. The control uses voltage, kW, and the CT ratio in order to determine if the CT ratio is correct for the operation of the genset. Use the CT ratio calculator in InPower to determine the correct CT ratio for this genset. Then enter the correct CT ratio via InPower or through the operator panel. To access the Genset CT ratio configuration menu on the operator panel go to **Setup > OEM Setup > OEM Alt Setup >** and set the “Genset CT Ratio primary" and “Genset CT Ratio secondary" parameters appropriately for the application.
2. The CTs are incorrectly sized.
   a. Change the CTs to the correct size.
3. Incorrect voltage or kW rating setup.
   a. The PCC uses voltage, kW, and the CT ratio in order to determine if the CT ratio is correct for the operation of the genset. If the voltage or kW setup is incorrect, event/fault code 2815 can become active. Use the CT calculator in InPower to determine the correct voltage and kW rating for this genset. To access the Genset voltage and kW rating setup on the Operator Panel go to **Setup > OEM Setup > OEM Alt Setup > Genset Nominal Voltage** and Setup > OEM Setup > OEM Genset Setup and set the parameters appropriately for the application.

7.6.108 Code 2816 - Genset PT Ratio Low

Logic:

The genset PT ratio is too small for the genset rating. The genset PT ratio (primary vs. secondary) is too small and will cause high voltage readings.

Possible Causes:

1. The control is set up with the incorrect PT ratio.
2. The PTs are incorrectly sized.

Diagnosis and Repair:

1. The control is set up with the incorrect PT ratio.
   a. The control uses nominal voltage and the PT ratio in order to determine if the PT ratio is correct for proper operation of the genset. Voltage input into the control board should not exceed 600 VAC, whether an external PT is used or not. Use the following equation to determine if you have the correct PT ratio: If (Genset Nominal Voltage / Genset PT Primary voltage) * Genset PT Secondary voltage > 600 VAC, your PT ratio is too small.

Then configure the control with the correct PT Ratio. To access the genset PT ratio configuration menu on the operator panel go to **Setup > OEM Setup > OEM Alt Setup >** and set the “Genset PT Ratio primary" and “Genset PT Ratio secondary" parameters appropriately for the application.

2. The PTs are incorrectly sized.

   a. Use the following equation to determine if the correct PT for the application is installed: (Genset Nominal Voltage / Genset PT Primary voltage) * Genset PT Secondary voltage > 600 VAC, your PT ratio is too small.

   b. Check the voltage input into the control board. When the genset is running the voltage input between L1 and L2 (J22-1 and J22-2) or L2 and L3 (J22-2 and J22-3) should not be more that 600 VAC.

7.6.109 Code 2817 - Genset PT Ratio High

Logic:

The genset PT ratio is too large, which causes an inaccurate reading of nominal voltage during normal operation; when the genset PT is used (above 600 VAC).

Possible Causes:

1. The control is set up with the incorrect PT ratio.
2. The PTs are incorrectly sized.

Diagnosis and Repair:

1. The control is set up with the incorrect PT ratio.

   a. The control uses nominal voltage and the PT ratio in order to determine if the PT ratio is correct for the operation of the genset. Voltage input into the control board should exceed 50% of the nominal voltage to allow the control to obtain an accurate voltage reading, whether an external PT is used or not. Use the following equation to determine if you have the correct PT ratio: If (Genset Nominal Voltage / Genset PT Primary voltage) * Genset PT Secondary voltage < (Nominal voltage *.5), the PT ratio is too large.

   Then configure the control with the correct PT ratio. To access the genset PT ratio configuration menu on the operator panel go to **Setup > OEM Setup > OEM Alt Setup >** and set the “Genset PT Ratio primary" and “Genset PT Ratio secondary" parameters appropriately for the application.

2. The PTs are incorrectly sized.

   a. Use the following equation to determine if you have the correct PT for the application: (Genset Nominal Voltage / Genset PT Primary voltage) * Genset PT Secondary voltage < (Nominal voltage *.5), your PT ratio is too large.

   B. Check the voltage input into the control board. When the genset is running the voltage input between L1 and L2 (J22-1 and J22-2) or L2 and L3 (J22-2 and J22-3) should be greater than (Genset Bus Nominal Voltage *.5) VAC.

7.6.110 Code 2818 - Bus PT Ratio Low

Logic:

The Genset Bus PT ratio is too small for the Genset Bus rating. The Bus PT ratio (primary vs. secondary) is too small and will cause high voltage readings

Possible Causes:

1. The control is set up with the incorrect PT Ratio.
2. The PT's are incorrectly sized.

Diagnosis and Repair:

1. The control is set up with the incorrect PT Ratio.
   a. The control uses nominal voltage and the PT ratio in order to determine if the PT ratio is correct for proper operation of the bus. Voltage input into the control board should not exceed 600 VAC, whether an external PT is used or not. Use the following equation to determine if you have the correct PT Ratio: If (Genset Bus Nominal Voltage / Genset Bus PT Primary voltage) * Genset Bus PT Secondary voltage > 600 VAC, your PT Ratio is too small.

      Then configure the control with the correct PT Ratio. To access the Bus PT ratio configuration menu on the display go to: **Setup > Paralleling Setup > Basic > PT Primary and PT Secondary** and set the “Genset Bus PT Primary Voltage" and “Genset Bus PT Secondary Voltage" parameters appropriately for the application.
2. The PT's are incorrectly sized.
   a. Use the following equation to determine if the correct PT for the application is installed: If (Genset Bus Nominal Voltage / Genset Bus PT Primary voltage) * Genset Bus PT Secondary voltage > 600 VAC, your PT Ratio is too small.
   b. Check the voltage input into the control board between L1 & L2 (J22-1 & J22-2) or L2 & L3 (J22-2 & J22-3) the voltage reading should not be more that 600 VAC.

7.6.111 Code 2819 - Bus PT Ratio High

Logic:

The Genset Bus PT ratio is too large, which causes an inaccurate reading of Genset Bus Nominal voltage during normal operation; when the Genset PT is used (above 600 VAC)

Possible Causes:

1. The control is set up with the incorrect Genset Bus PT Ratio.
2. The PT's are incorrectly sized.

Diagnosis and Repair:

1. The control is set up with the incorrect Genset Bus PT Ratio.

    a. The control uses Genset Bus Nominal voltage and the PT ratio in order to determine if the PT ratio is correct for the operation of the genset. Voltage input into the control board should exceed 50% of the Genset Bus Nominal voltage (up to 600 VAC), to allow the control to obtain an accurate voltage reading, whether an external PT is used or not. Use the following equation to determine if you have the correct PT Ratio: If (Genset Bus Nominal Voltage / Genset Bus PT Primary voltage) * Genset Bus PT Secondary voltage < (Genset Bus Nominal voltage *.5), the PT Ratio is too large.

    Then configure the control with the correct PT Ratio. To access the Genset Bus PT ratio configuration menu on the display go to: **Setup > Paralleling Setup > Basic > PT Primary and PT Secondary** and set the "Genset Bus PT Primary Voltage" and "Genset Bus PT Secondary Voltage" parameters appropriately for the application.

2. The PT's are incorrectly sized.

    a. Use the following equation to determine if you have the correct PT for the application: If (Genset Bus Nominal Voltage / Genset Bus PT Primary voltage) * Genset Bus PT Secondary voltage < (Genset Bus Nominal voltage *.5), the PT Ratio is too large.

    b. Check the voltage input into the control board between L1 & L2 (J22-1 & J22-2) or L2 & L3 (J22-2 & J22-3) the voltage should be greater than (Genset Bus Nominal Voltage *.5) VAC.

7.6.112 Code 2821 - Utility PT Ratio Low

Logic:

The Utility PT ratio is too small for the Utility rating. The Utility PT ratio (primary vs. secondary) is too small and will cause high voltage readings

Possible Causes:

1. The control is set up with the incorrect PT Ratio.
2. The PT's are incorrectly sized.

Diagnosis and Repair:

1. The control is set up with the incorrect PT Ratio.

    a. The control uses nominal utility voltage and the PT ratio in order to determine if the PT ratio is correct for proper operation of the utility. Voltage input into the control board should not exceed 600 VAC, whether an external PT is used or not. Use the following equation to determine if you have the correct PT Ratio: If (Utility Nominal Voltage / Utility PT Primary voltage) * Utility PT Secondary voltage > 600 VAC, your PT Ratio is too small.

    Then configure the control with the correct PT Ratio. To access the utility PT ratio configuration menu on the display go to: **Setup > Paralleling Setup > Basic > PT Primary and PT Secondary** and set the “Utility PT Primary Voltage" and “Utility PT Secondary Voltage" parameters appropriately for the application.

2. The PT's are incorrectly sized.
    a. Use the following equation to determine if the correct PT for the application is installed: If (Utility Nominal Voltage / Utility PT Primary voltage) * Utility PT Secondary voltage > 600 VAC, your PT Ratio is too small.
    b. Check the voltage input into the control board between L1 & L2 (J22-1 & J22-2) or L2 & L3 (J22-2 & J22-3) the voltage reading should not be more that 600 VAC.

7.6.113 Code 2822 - Utility PT Ratio High

Logic:

The Utility PT ratio is too large, which causes an inaccurate reading of Utility Nominal voltage during normal operation; when the Genset PT is used (above 600 VAC)

Possible Causes:

1. The control is set up with the incorrect Utility PT Ratio.
2. The PT's are incorrectly sized.

Diagnosis and Repair:

1. The control is set up with the incorrect Utility PT Ratio.
    a. The control uses Utility Nominal voltage and the PT ratio in order to determine if the PT ratio is correct for the operation of the genset. Voltage input into the control board should exceed 50% of the Utility Nominal voltage (up to 600 VAC), to allow the control to obtain an accurate voltage reading, whether an external PT is used or not. Use the following equation to determine if you have the correct PT Ratio: If (Utility Nominal Voltage / Utility PT Primary voltage) * Utility PT Secondary voltage < (Utility Nominal voltage *.5), the PT Ratio is too large.

       Then configure the control with the correct PT Ratio. To access the Utility PT ratio configuration menu on the display go to: **Setup > Paralleling Setup > Basic > PT Primary and PT Secondary** and set the “Utility PT Primary Voltage" and “Utility PT Secondary Voltage" parameters appropriately for the application.
2. The PT's are incorrectly sized.
    a. Use the following equation to determine if you have the correct PT for the application: If (Utility Nominal Voltage / Utility PT Primary voltage) * Utility PT Secondary voltage < (Utility Nominal voltage *.5), the PT Ratio is too large.
    b. Check the voltage input into the control board between L1 & L2 (J22-1 & J22-2) or L2 & L3 (J22-2 & J22-3) the voltage should be greater than (Utility Nominal Voltage *.5) VAC.

7.6.114 Code 2895 - PCCnet Device Failed

Logic:

A non-critical PCCNet device has failed.

Possible Causes:

1. PCCNet communication has been lost or PCCNet device is faulty.

Diagnosis and Repair:

1. PCCNet communication has been lost or PCCNet device is faulty.
   a. If a PCCNet device has lost network communication, the network status light for that device will turn RED. Locate the device with the red network status LED to identify the affected device.
   b. Ensure that the network device has sufficient voltage (12-24 V), as measured at the input of the device, not at the source or battery. Also verify that the device is awake and has a heartbeat. A heartbeat is a LED on the PCCNet device that blinks every 1 second to inform the operator that the device is functioning.
   c. Check the network cable connections of the device(s) and ensure that there are no open or short circuits. The PCCNet network devices are polarity sensitive. For example: Control (RS485+) to Annunciator (RS485+) and Control (RS485-) to Annunciator (RS485-). If the connections are incorrect, the devices will not properly communicate over the network. Ensure that the shield is grounded at one point ONLY. Refer to the respective PCCNet device manual for line limitations and cable requirements.
   d. If previous steps are satisfactory, replace the network device.
   e. If replaced device is still exhibiting network issues, this can be due to a grounding loop or ground referencing for remotely mounted and powered network, incorrect network wire, or a noise (EMI) issue. As a test, connect the PCCNet device close (2-5 FT) to the base board, using the power supply from the base board (TB1-5, B+ and TB1-3 ground) and use the required network wire. If the network device functions appropriately, correct the grounding issue, EMI issue, or replace the network wire with the required network wire.

7.6.115 Code 2896 - Critical PCCnet Dev Fail

Logic:

A critical PCCNet device has failed and has caused the genset to shutdown.

Possible Causes:

1. PCCNet communication has been lost or PCCNet device is faulty.

Diagnosis and Repair:

1. PCCNet communication has been lost or PCCNet device is faulty.
   a. If a PCCNet device has lost network communication, the network status light for that device will turn red. Locate the device with the red network status LED to identify the affected device.
   b. Ensure that the network device has sufficient voltage (12-24 V), as measured at the input of the device, not at the source or battery. Also verify that the device is awake and has a heartbeat. A heartbeat is a LED on the PCCNet device that blinks every 1 second to inform the operator that the device is functioning.

c. Check the network cable connections of the device(s) and ensure that there are no open or short circuits. The PCCNet network devices are polarity sensitive. For example: Control (RS485+) to Annunciator (RS485+) and Control (RS485-) to Annunciator (RS485-). If the connections are incorrect, the devices will not properly communicate over the network. Ensure that the shield is grounded at one point ONLY. Refer to the respective PCCNet device manual for line limitations and cable requirements.

d. If previous steps are satisfactory, replace the network device.

e. If replaced device is still exhibiting network issues, this can be due to a grounding loop or ground referencing for remotely mounted and powered network, incorrect network wire, or a noise (EMI) issue. As a test, connect the PCCNet device close (2-5 FT) to the base board, using the power supply from the base board (TB1-5, B+ and TB1-3 ground), and use the required network wire. If the network device functions appropriately, correct the grounding issue, EMI issue, or replace the network wire with the required network wire.

7.6.116 Code 2914 - Genset AC Meter Failed

Logic:

Metering chip has failed and can no longer accurately monitor genset current and voltage.

Possible Causes:

1. An over-voltage/-current condition has damaged the metering chip.
2. The base board is faulty.

Diagnosis and Repair:

1. An over-voltage or over-current condition has damaged the metering chip.
   a. Measure the voltage (L1: J22 -1; L2: J22 -2, L3: J22-3, L4: J22-4) and current (L1: J12-1, J12-4; L2: J12-2, J12-5; L3: J12-3, J12-6;) input into the control. Voltage input into the board should not exceed 600 VAC, (damage to board occurs at 750 VAC). Current input into the board should not exceed 5 Amps. If a short circuit or an over-voltage/-current issue exists, correct the problem(s).
2. The base board is faulty.
   a. If the previous step did not reveal any problems, replace the base board.

7.6.117 Code 2915 - Gen Bus AC Meter Failed

Logic:

Metering chip has failed and can no longer accurately monitor genset bus current and voltage.

Possible Causes:

1. An over-voltage/-current condition has damaged the metering chip.
2. The base board is faulty.

Diagnosis and Repair:

1. An over-voltage or over-current condition has damaged the metering chip.
   a. Measure the voltage using a volt-meter at L1: TB7-1; L2: TB7-2, L3: TB7-3, L4: TB7-4; and the current using a current probe at CT1, CT2, and CT3. Voltage input into the board should not exceed 600 VAC, (damage to board occurs at 750 VAC). Current input into the board should not exceed 5 Amps. If a short circuit or over-voltage/-current condition exists, correct the problem.
2. The base board is faulty.
   a. If the previous step did not reveal any problems, replace the base board.

7.6.118 Code 2916 - Utility AC Meter Failed

Logic:

Metering chip has failed and can no longer accurately monitor utility current and voltage.

Possible Causes:

1. An over-voltage/-current condition has damaged the metering chip.
2. The base board is faulty.

Diagnosis and Repair:

1. An over-voltage or over-current condition has damaged the metering chip.
   a. Measure the voltage using a volt-meter at L1: TB7-1; L2: TB7-2, L3: TB7-3, L4: TB7-4; and the current using a current probe at CT1, CT2, and CT3. Voltage input into the board should not exceed 600 VAC, (damage to board occurs at 750 VAC). Current input into the board should not exceed 5 Amps. If a short circuit or over-voltage/-current condition exists, correct the problem.
2. The base board is faulty.
   a. If the above steps do not reveal any problems, replace the base board.

7.6.119 Code 2917 - Gen Bus Voltage OOR HI

Logic:

If the Paralleling Application parameter is set to “Genset Bus", and the Genset Bus Voltage sensing input into the base board exceeds 1020 VAC for the time that is registered in the “Genset Bus Voltage OOR Delay; the genset control will display event/fault code 2917.

Possible Causes:

1. The control is set up with the incorrect Genset Bus PT Ratio or the PT's are incorrectly sized.
2. The voltage of the Genset Bus is too high and/or unstable.
3. The base board is faulty.

Diagnosis and Repair:

1. The control is set up with the incorrect Genset Bus PT Ratio or the PT's are incorrectly sized.
   a. Refer to event/fault code 2819.
2. The voltage of the Genset Bus is too high and/or unstable.
   a. Ensure that the voltage of the Genset Bus is at nominal or stable; high genset bus voltage can also damage the base board.
3. Check to see if the base board is faulty.
   a. Using a voltmeter, monitor the voltage at L1: TB7-1; L2: TB7-2, L3: TB7-3. If the voltage input into the control is within the acceptable voltage bias range that the control is set up for and the fault does not clear when the Fault Reset button is pressed, replace the board.

7.6.120 Code 2918 - Utility Voltage OOR Hi

Logic:

If the Paralleling Application parameter is set to “Utility", and the Utility Voltage sensing input into the base board exceeds 1020 VAC for the time that is registered in the “Utility Voltage OOR Delay; the genset control will display event/fault code 2918.

Possible Causes:

1. The control is set up with the incorrect Utility PT Ratio or the PT's are incorrectly sized.
2. The voltage of the Utility is too high and/or unstable.
3. The base board is faulty.

Diagnosis and Repair:

1. The control is set up with the incorrect Utility PT Ratio or the PT's are incorrectly sized.
   a. Refer to event/fault code 2819.
2. The voltage of the Utility is too high and/or unstable.
   a. Check with your utility company.
3. Check to see if the base board is faulty.
   a. Using a voltmeter, monitor the voltage at L1: TB7-1; L2: TB7-2, L3: TB7-3. If the voltage input into the control is within the acceptable voltage bias range that the control is set up for and the fault does not clear when the Fault Reset button is pressed, replace the board.

7.6.121 Code 2919 - Utility Current OOR Hi

Logic:

If the Paralleling Application parameter is set to “Utility", and the Utility Current sensing input into the base board exceeds 140% for the time that is registered in the “Utility Current OOR Delay; the genset control will display event/fault code 2919.

Possible Causes:

1. The control is set up with the incorrect Utility CT Ratio or the CT's are incorrectly sized.
2. Short Circuit
3. The Current of the Utility is too high and/or unstable.
4. The base board is faulty.

Diagnosis and Repair:

1. The control is set up with the incorrect Utility CT Ratio or the CT's are incorrectly sized.
    a. If this fault becomes active during the commissioning processes, verify the sizing of the CT's and the setup of the Utility CT Ratio. The Utility secondary CT ratio can be set to 1 or 5 Amps; Fault code 2919 will become active when the Utility secondary CT current going into the base board is 1.4 amps or 7 amps. Ensure that the Maximum Utility primary CT current, Full Load Amps (FLA) of the building/application is correct.

       Use the following equation to determine the FLA:

       - FLA (one phase) = Maximum KW / Voltage
       - FLA (three phases) = Maximum KW / Voltage * (1.732)
       - Primary CT : Secondary CT = (FLA * 1.1) : (1 or 5 Amps).

         Ex. The maximum building load is 100KW, at 480 VAC, three phase.

         FLA = 100000 / 480*1.73 = 120.42

         The Utility primary CT size and CT Ratio should be at least 121 * (1.1) = 133 (1.1 is used as a buffer)

         Primary CT: Secondary CT = 133 : (1 or 5 Amps).

    b. To change the Utility CT Primary Current and Utility CT Secondary Current ratio parameter appropriately for the application, go to: **Setup > Paralleling Setup > Basic > CT Primary or CT Secondary** and set appropriately.
2. Check for a short circuit.
3. The current of the Utility is too high and/or unstable.
    a. Check with your utility company.
4. Check to see if the base board is faulty.
    a. Using a ammeter, monitor the current at CT1, CT2, and CT3. If the current going thru the CTs on the base board is within the acceptable current range (below 1 amp or below 5 amps) that the control is set up for and the fault does not clear when the Fault Reset button is pressed, then replace the board.

7.6.122 Code 2921 - Gen Bus Current OOR Hi

Logic:

If the Paralleling Application parameter is set to “Genset bus", and the Genset bus Current sensing input into the base board exceeds 140% for the time that is registered in the “Genset bus Current OOR Delay; the genset control will display event/fault code 2921.

Possible Causes:

1. The control is set up with the incorrect Genset bus CT Ratio or the CT's are incorrectly sized.
2. The Current of the Genset bus is too high and/or unstable.
3. The base board is faulty.

Diagnosis and Repair:

1. The control is set up with the incorrect Genset bus CT Ratio or the CT's are incorrectly sized.
   a. If this fault becomes active during the commissioning processes, verify the sizing of the CT's and the setup of the Genset bus CT Ratio. The Genset bus secondary CT ratio can be set to 1 or 5 Amps; Fault code 2919 will become active when the Genset bus secondary CT current going into the base board is 1.4 amps or 7 amps. Ensure that the Maximum Genset bus primary CT current, Full Load Amps (FLA) of the building/application is correct.
      - Use the following equation to determine the FLA:
      - FLA (one phase) = Maximum KW / Voltage
      - FLA (three phases) = Maximum KW / Voltage * (1.732)

      Primary CT : Secondary CT = (FLA * 1.1) : (1 or 5 Amps).

      Ex. The maximum building load is 100KW, at 480 VAC, three phase.

      FLA = 100000 / 480*1.73 = 120.42

      The Genset bus primary CT size and CT Ratio should be at least 121 * (1.1) = 133 (1.1 is used as a buffer)

      Primary CT: Secondary CT = 133 : (1 or 5 Amps).

   b. To change the Genset bus CT Primary Current and Genset bus CT Secondary Current ratio parameter appropriately for the application, go to: **Setup > Paralleling Setup > Basic > CT Primary or CT Secondary** and set appropriately.
2. The current of the Genset bus is too high and/or unstable.
   a. Ensure that the current of the Genset Bus is at nominal or stable; high genset bus current can also damage the base board.
3. Check to see if the base board is faulty.
   a. Using an ammeter, monitor the current at CT1, CT2, and CT3. If the current going through the CTs on the base board is within the acceptable current range (below 1 amp or below 5 amps) that the control is set up for and the fault does not clear when the Fault Reset button is pressed, replace the base board.

7.6.123 Code 2922 - Genset Neutral Curr OOR Hi

Logic:

The Genset Neutral current is above the “Genset Neutral Current Calibration" parameter for the time in the “Genset Neutral Current OOR Delay" time parameter.

Possible Causes:

1. CT ratio is too small or the CTs are not sized correctly for the genset voltage and kW rating.
2. Genset Neutral current is above the “Genset Neutral Current Calibration" parameter.
3. Faulty CT.

Diagnosis and Repair:

1. CT ratio is too small or the CTs are not sized correctly for the genset voltage and kW rating.
   a. Please see event/fault code 2814.
2. Genset Neutral current is above the “Genset Neutral Current Calibration" parameter.
   a. Measure the Genset Neutral current input into the control board with a current probe at J22-4. The maximum value of current going into the control CTs should not be more than the value of the “Genset CT Secondary Current" value that the control is calibrated for. For example, if secondary setting in the control is 1 Amp, current going into the control should not be more than 1 Amp. To access the Genset CT Secondary Current configuration menu on the operator panel go to **Setup > OEM Setup > OEM Alt Setup > CT Sec** and set the “Genset CT Secondary Current" parameter appropriately for the application.
3. Faulty CT.
   a. If the above is satisfactory, check the CT and replace if faulty.

7.6.124 Code 2923 - Gen Bus kW OOR Hi

Logic:

If the Paralleling Application parameter is set to “Genset Bus", and the Genset Bus KW exceeds 32,767 KW or is below -32768 KW for the time that is registered in the “Genset Bus KW OOR Delay; the genset control will display event/fault code 2923.

Possible Causes:

1. Incorrect application or setup.
2. The base board is faulty.

Diagnosis and Repair:

1. Incorrect application or setup.
   a. Genset is being used in an incorrect application in which the power monitoring is out of range. Ex. If there are 25 paralleled gensets operating at 2 MW and 13.8 KV, the genset will not be able to monitor power above 32.767 MW and will display event/fault code 2923. This application will require external switchgear to monitor power.
   b. Genset Bus CT Ratio is incorrectly set, refer to event/fault code 2921.
   c. Genset Bus PT Ratio is incorrectly set, refer to event/fault code 2917.
2. The base board is faulty.
   a. If previous steps do not reveal any problems, replace the base board.

7.6.125 Code 2924 - Gen Bus kVAR OOR Hi

Logic:

If the Paralleling Application parameter is set to “Genset Bus", and the Genset Bus KVAR exceeds 32,767 KVAR or is below -32768 KVAR for the time that is registered in the “Genset Bus KVAR OOR Delay; the genset control will display event/fault code 2924.

Possible Causes:

1. Incorrect application or setup.
2. The base board is faulty.

Diagnosis and Repair:

1. Incorrect application or setup.
    a. Genset is being used in an incorrect application in which the power monitoring is out of range. Ex. If there are 25 paralleled gensets operating at 2 MVAR and 13.8 KV, the genset will not be able to monitor power above 32.767 MVAR and will display event/fault code 2924. This application will require external switchgear to monitor power.
    b. Genset Bus CT Ratio is incorrectly set, refer to event/fault code 2921.
    c. Genset Bus PT Ratio is incorrectly set, refer to event/fault code 2917.
2. The base board is faulty.
    a. If previous steps do not reveal any problems, replace the base board.

7.6.126 Code 2925 - Gen Bus kVA OOR Hi

Logic:

If the Paralleling Application parameter is set to “Genset Bus", and the Genset Bus KVA exceeds 65,535 KVA for the time that is registered in the “Genset Bus KVA OOR Delay; the genset control will display event/fault code 2925.

Possible Causes:

1. Incorrect application or setup.
2. The base board is faulty.

Diagnosis and Repair:

1. Incorrect application or setup.
    a. Genset is being used in an incorrect application in which the power monitoring is out of range. Ex. If there are 35 paralleled gensets operating at 2 MVA and 25 KV, the genset will not be able to monitor power above 65.535 MVA and will display event/fault code 2925. This application will require external switchgear to monitor power.
    b. Genset Bus CT Ratio is incorrectly set, refer to event/fault code 2921.
    c. Genset Bus PT Ratio is incorrectly set, refer to event/fault code 2917.

2. The base board is faulty.
    a. If previous steps do not reveal any problems, replace the base board.

7.6.127 Code 2926 - Utility kW OOR Hi

Logic:

If the Paralleling Application parameter is set to “Utility", and the Utility KW exceeds 32,767 KW or is below -32768 KW for the time that is registered in the “Utility KW OOR Delay; the genset control will display event/fault code 2926.

Possible Causes:

1. Incorrect application or setup.
2. The base board is faulty.

Diagnosis and Repair:

1. Incorrect application or setup.
    a. Genset is being used in an incorrect application in which the power monitoring is out of range. Ex. If the Utility power is 40 MW, the genset will not be able to monitor power above 32.767 MW and will display event/fault code 2926. This application will require external switchgear to monitor power.
    b. Utility CT Ratio is incorrectly set, refer to event/fault code 2919.
    c. Utility PT Ratio is incorrectly set, refer to event/fault code 2918.
2. The base board is faulty.
    a. If previous steps do not reveal any problems, replace the base board.

7.6.128 Code 2927 - Utility kVAR OOR Hi

Logic:

If the Paralleling Application parameter is set to “Utility", and the Utility KVAR exceeds 32,767 KVAR or is below -32768 KVAR for the time that is registered in the “Utility KVAR OOR Delay; the genset control will display event/fault code 2927.

Possible Causes:

1. Incorrect application or setup.
2. The base board is faulty.

Diagnosis and Repair:

1. Incorrect application or setup.
    a. Genset is being used in an incorrect application in which the power monitoring is out of range. Ex. If the Utility power is 40 MVAR, the genset will not be able to monitor power above 32.767 MVAR and will display event/fault code 2927. This application will require external switchgear to monitor power.
    b. Utility CT Ratio is incorrectly set, refer to event/fault code 2919.
    c. Utility PT Ratio is incorrectly set, refer to event/fault code 2918.

2. The base board is faulty.
    a. If the previous steps do not reveal any problems, replace the base board.

7.6.129 Code 2928 - Utility kVA OOR Hi

Logic:

If the Paralleling Application parameter is set to “Utility", and the Utility KVA exceeds 65,535 KVA for the time that is registered in the “Utility KVA OOR Delay; the genset control will display event/fault code 2928.

Possible Causes:

1. Incorrect application or setup.
2. The base board is faulty.

Diagnosis and Repair:

1. Incorrect application or setup.
    a. Genset is being used in an incorrect application in which the power monitoring is out of range. Ex. If the Utility power is 70 MVAR, the genset will not be able to monitor power above 65.535 MVA and will display event/fault code 2928. This application will require external switchgear to monitor power.
    b. Utility CT Ratio is incorrectly set, refer to event/fault code 2919.
    c. Utility PT Ratio is incorrectly set, refer to event/fault code 2918.
2. The base board is faulty.
    a. If the previous steps do not reveal any problems, replace the base board.

7.6.130 Code 2938 – Earth/Ground Fault

Logic:

Short to ground in the external wiring.

Possible Causes:

1. "Configurable Input Active State Selection" parameter is incorrectly configured for Ground Fault.
2. Incorrectly wired; open or short circuit in the wiring.
3. Faulty ground fault alarm relay.

Diagnosis and Repair:

1. "Configurable Input Active State Selection" parameter is incorrectly configured for Ground Fault.
    a. Through the operator panel, check the switch input setting (active closed or open) for the Configurable Input setup for Ground Fault. Ensure that the switch input setting is correctly set. If "Configurable Input Function Pointer" parameter is set to Ground Fault and if "Configurable Input Active State Selection" parameter is set to "active closed", event/fault code 2938 will become active when the input is a ground input.

If "Configurable Input Function Pointer" parameter is set to Ground Fault and if "Configurable Input Active State Selection" parameter is set to "active open", event/fault code 2938 will become active when the input is an open circuit.

To access the input configuration on the operator panel go to **Setup > Configurable I/O > Config Input Menu > Active** and set the "Configurable Input Active State Selection" parameter appropriately for the application.

2. Incorrectly wired; open or short circuit in the wiring.
   a. Depending on the "Configurable Input Active State Selection" parameter setting, check the wiring for an open/short circuit, or mis-wired condition from the genset (L1, J22-1; L2, J22-2; L3, J2-3; LN, J22-4) to the Ground Fault Alarm Relay (Input 6 and 8), correct if faulty.
3. Faulty ground fault alarm relay (refer to instruction sheet C648a).
   a. Ensure that the input voltage to the Ground Fault Alarm Relay is 24 VDC, at input 1 and 2.
   b. Verify that the Trip Current and Time Delay settings on the Ground Fault Alarm Relay are set appropriately for the application.
   c. If the previous steps are satisfactory, replace the Ground Fault Alarm Relay.

7.6.131 Code 2939 - MODBUS Failure

Logic:

If any of the Modbus parameters are Active, and the Modbus device stops communicating with the base board for a time period longer than in the “Modbus Failure Time Delay", event/fault code 2939 becomes active.

Possible Causes:

1. Active Modbus fault or wiring issue.
2. Faulty Modbus device.
3. The base board is faulty.

Diagnosis and Repair:

1. Active Modbus fault or wiring issue.
   a. Check the following parameters for an “Active" Modbus state. If any of the below listed Modbus parameters are Active and have stopped communicating with the base board for a time period longer than in the “Modbus Failure Time Delay", event/fault code 2939 becomes active. Communication with these items will need to be restored.
      - Exercise Switch
      - Remote Start Switch
      - Load Demand Stop
      - Start Type
      - Fault Reset
      - Battle Short Switch

- Genset CB Inhibit Switch
- Utility CB Inhibit Switch
- Synch Enable Switch
- Ramp Load Unload Switch
- Speed Droop Enable Switch
- Voltage Droop Enable Switch
- Genset CB Tripped Switch
- Utility CB Tripped Switch
- Extended Parallel Switch
- PTC Mode Switch

b. Check the Modbus connection from the parameters listed above to that base board connection at TB15-3 (RS485+) and TB15-4 (RS485-) for open/short circuits or miswiring. There should be a 120 Ohm terminating resistor at each end of the Modbus network (a resistor at the PCC TB15-3 (RS485+) and TB15-4 (RS485-) and at the last device of the Modbus network). Also ensure that the shield is grounded at TB15-1. the shield should be grounded at ONLY this point.

2. Faulty Modbus device.

   a. Check the Modbus device that is transmitting information to the base board. If this device is faulty and/or has stopped communicating with the base board, event/fault code 2939 becomes Active. If the external Modbus device is faulty then repair or replace.

3. Faulty base board.

   a. If previous steps do not reveal any problems, replace the base board.

7.6.132 Code 2942 - Shutdown Override Fail

Logic:

The genset has failed to transition to Battle Short mode or Delayed Shutdown mode.

Possible Causes:

1. Battle Short or Delayed Shutdown is not enabled in the genset control.
2. Battle Short is not enabled in the Engine Control Module (ECM).

Diagnosis and Repair:

1. Battle Short or Delayed Shutdown is not enabled in the genset control.

   a. Through the operator panel, verify that the “Battle Short" parameter is set to enable. To access the “Battle Short" configuration menu on the operator panel go to **Setup > OEM Setup > OEM Genset Setup > Battle Short** and set the parameter to enable, if the battle short mode is required by the customer.

b. Ensure that one of the configurable inputs is set up to activate Battle Short mode (e.g., Configurable Input #1 = Battle Short). Battle Short may now be enabled by activating the configurable input that was set up for Battle Short (e.g., Enable Configurable Input #1 with a ground input).

c. Through the operator panel, verify that the “Delayed Shutdown" parameter is set to enable. To access the “Delayed Shutdown" configuration menu on the operator panel go to **Setup > OEM Setup > OEM Genset Setup > Delayed Shutdown** and set the parameter to enable, if the Delayed Shutdown mode is required by the customer.

2. Battle Short is not enabled in the Engine Control Module (ECM).

   a. Connect to the ECM with InSite or InPower and enable the Battle Short parameter in the ECM. Under “Engine Protection", set “Shutdown Manual Override" to “Enable".

7.6.133 Code 2943 - Manual Sw Config Fail

Logic:

Event/fault code 2943 is activated when the control receives an active Manual input from both the operator panel and the PCCNet network at the same time for two seconds or more.

Possible Causes:

1. Two Manual command inputs that are active at the same time.

Diagnosis and Repair:

1. Two Manual command inputs that are active at the same time.

   a. Ensure there is only one Manual switch input to the control that is active, either through the operator panel or PCCNet Network (PCCNet DIM) but not both at the same time.

7.6.134 Code 2944 - Auto Switch Config Fail

Logic:

Event/fault code 2944 is activated when the control receives an active Auto input from both the operator panel and the PCCNet network at the same time for two seconds or more.

Possible Causes:

1. Two Auto command inputs that are active at the same time.

Diagnosis and Repair:

1. Two Auto command inputs that are active at the same time.

   a. Ensure there is only one Auto switch input to the control that is active, either through the operator panel or through PCCNet Network (PCCNet DIM) but not both at the same time.

7.6.135 Code 2945 - Rupture Basin

Logic:

Main fuel tank is leaking into the rupture basin.

Possible Causes:

1. "Rupture Basin/Configurable Input #12 Active State Selection" parameter is incorrectly configured.
2. Incorrectly wired; open or short circuit in the wiring.
3. Faulty sender.
4. The base board is faulty.

Diagnosis and Repair:

1. "Rupture Basin/Configurable Input #12 Active State Selection" parameter is incorrectly configured.
   a. Through the operator panel check the switch input setting (active closed or open) for the Rupture Basin/Configurable Input #12 Active State Selection. Ensure that the switch input setting is correctly set. If "Rupture Basin/Configurable Input #12 Function Pointer" parameter is set to Default and if "Rupture Basin/Configurable Input #12 Active State Selection" parameter is set to "active closed", event/fault code 2945 will become active when the input is a ground input.

      If ""Rupture Basin/Configurable Input #12 Function Pointer" parameter is set to Default and if "Rupture Basin/Configurable Input #12 Active State Selection" parameter is set to "active open", event/fault code 2945 will become active when the input is an open circuit.

      To access the input configuration on the operator panel go to **Setup > Configurable I/O > Rupture Basin/Configurable Input #12 Active State Selection** and set the "Rupture Basin/Configurable Input #12 Active State Selection" parameter appropriately for the application.
2. Incorrectly wired; open or short circuit in the wiring.
   a. Depending on the "Rupture Basin/Configurable Input #12 Active State Selection" parameter setting, check the wiring at for an open/short circuit, or miswired condition, from the rupture basin sender to the base board at J20-19 and J20-8; correct if wiring is faulty.
3. Faulty sender.
   a. Measure the rupture basin sender for an open or short circuit reading, replace if faulty.
4. The base board is faulty.
   a. If the previous steps do not reveal any problems and event/fault code 2945 is still active, replace the base board.

7.6.136 Code 2972 - Field Overload

Logic:

If the time that the Field AVR Duty Cycle is operating at maximum output is longer than the time in the “Max Field Time" parameter, event/fault code 2972 will become active.

Possible Causes:

WARNING: Excessive voltage is possible during testing. Make sure your meter can handle alternator full voltage.

1. Max Field Time Delay is set too low.
2. Voltage sensing into the base board is too low, or there is an open/short circuit.
3. Application issue.
4. The base board is faulty.

Diagnosis and Repair:

1. Max Field Time Delay is set too low.
   a. Through the operator panel, check the “Max Field Time" parameter setting. Verify that the “Max Field Time" is not set to zero. The “Max Field Time" parameter may require adjustment to a value more appropriate for the application. To access the Max Field Time configuration menu on the operator panel go to **Setup > OEM Setup > OEM Alt Setup > Max Field Time** and set the “Max Field Time" parameter appropriately for the application. Refer to the parameter list to see the default value for “Max Field Time".
2. Voltage sensing into the base board is too low, or there is an open/short circuit.
   a. Measure the voltage going into the base board at L1 = J22-1, L2 = J22-2, L3 = J22-3, and LN = J22-4 (for single phase applications use L1, L2 and LN). If the genset control is not sensing voltage, it will try to overcompensate by maxing out the AVR output. If the voltage going into the control board is zero, or less than the voltage that the control was calibrated for (Nominal Voltage), then check the wiring from the alternator to the base board for an open circuit or short circuit.
   b. If the genset is over 600 VAC, check connections from the alternator to the PT, and from the PT to the base board. If there is voltage going into the PT, but not coming out of the PT, replace the PT.
   c. Measure the output of the AVR at J17 -1 and J17-2 while turning the genset on. The output should be at least 300 VDC when the genset is starting, but the voltage should decrease significantly when the genset builds up voltage. If the output of J17-1 and J17-2 is constantly high or is locked in, then the AVR portion of the PCC is faulty. Replace the base board if the AVR is faulty.
   d. Using a True RMS meter, measure the PWM at J19-2 (AVR PWM +) and J19-9 (AVR PWM -) while turning the genset “ON". This is a 2.5 VDC max output from the base board to the AUX 103 AVR; if the voltage at J19-2 and J19-9 is continuously 2.0-2.5 VDC, without any change, then replace the base board.
   e. Measure the output of the AUX 103 AVR at J17-1 and J17-2, the output should be at 9-12 VDC when the genset is operating at “No Load", if the voltage output of J17-1 & J17-2 is constantly high, then the AUX 103 AVR is faulty replace the AUX 103 AVR.
3. Application issue.
   a. If the genset runs adequately with no load or some load but as soon as additional load is applied, the genset shuts down on “Field Overload"; then this might be an application issue (load issue, genset undersized, etc.).
4. The base board is faulty.
   a. If the previous steps do not reveal any problems, replace the base board.

7.6.137 Code 2977 - Low Coolant Level 2

Logic:

Low Coolant Level switch #2 indicates that the coolant level is low in the second radiator.

Possible Causes:

1. The radiator coolant level is low.
2. Coolant sender incorrectly wired.
3. Faulty coolant level sender.
4. The "Configurable Input Active State Selection" parameter is configured incorrectly.
5. The base board is faulty.

Diagnosis and Repair:

1. Check the radiator coolant level.
   a. Check the coolant level at the second radiator and add coolant if low. Clear the warning fault by pressing the Reset button on the operator panel.
2. Coolant sender incorrectly wired.
   a. Check for improper wiring, such as a short or open circuit from the coolant sensor to the discrete configurable input on the base board that was configured for the "Low Coolant Level 2 Switch". If a short/open circuit or improper wiring is found, correct the wiring.
3. Faulty coolant level sender.
   a. Measure the resistance of the coolant level sender at the radiator that is full of coolant, if the sender is short or open circuit, replace the coolant sender.
4. The "Configurable Input Active State Selection" parameter is configured incorrectly.
   a. Through the operator panel, check the switch input setting (active closed or active open) for the Configurable Input that was configured to "Low Coolant Level 2 Switch". Ensure the setting is correct. If the "Configurable Input Function Pointer" parameter is set to "Low Coolant Level 2 Switch" and the "Configurable Input Active State Selection" parameter is set to "active closed", event/fault code 2977 will become active when the Configurable Input that was configured to "Low Coolant Level 2 Switch" is connected to ground.

      If the "Configurable Input Function Pointer" parameter is set to "Low Coolant Level 2 Switch" and the "Configurable Input Active State Selection" parameter is set to "active open", event/fault code 2977 will become active when the Configurable Input that was configured to "Low Coolant Level 2 Switch" is an open circuit.

      To access the input configuration on the operator panel go to **Setup > Configurable I/O >** and set the "Configurable Input Active State Selection" parameter appropriately for the Configurable Input that was configured to "Low Coolant Level 2 Switch".
5. The base board is faulty.
   a. If the previous steps did not reveal any problems, replace the base board.

7.6.138 Code 2979 - High Alternator Temp

Logic:

Indicates that the alternator temperature is high.

Possible Causes:

1. Alternator temperature sender incorrectly wired.
2. Faulty alternator temperature sender.
3. The "Configurable Input Active State Selection" parameter is configured incorrectly.
4. Faulty base board.

Diagnosis and Repair:

1. Alternator temperature sender incorrectly wired.
   a. Check for improper wiring or a short/open circuit from the alternator temperature sender to the discrete configurable input on the base board that was configured for the "High Alternator Temp Switch". If a short/open circuit or improper wiring is found, correct the wiring.
2. Faulty alternator temperature sender.
   a. Measure the resistance between the alternator temperature signal pin and return pin. The resistance should be between 530 Ohms to 2214 Ohms. Replace the sender if the resistance value is out of specification.
3. The "Configurable Input Active State Selection" parameter is configured incorrectly.
   a. Through the operator panel, check the switch input setting (active closed or open) for the Configurable Input that was configured to "High Alternator Temp Switch". Ensure the setting is correct. If the "Configurable Input Function Pointer" parameter is set to "High Alternator Temp Switch" and the "Configurable Input Active State Selection" parameter is set to "active closed", event/fault code 2979 will become active when the Configurable Input that was configured to "High Alternator Temp Switch" is connected to ground.

      If the "Configurable Input Function Pointer" parameter is set to "High Alternator Temp Switch" and the "Configurable Input Active State Selection" parameter is set to "active open", event/fault code 2979 will become active when the Configurable Input that was configured to "High Alternator Temp Switch" is an open circuit.

      To access the input configuration on the operator panel go to **Setup > Configurable I/O >** and set the "Configurable Input Active State Selection" parameter appropriately for the Configurable Input that was configured to "High Alternator Temp Switch".
4. Faulty base board.
   a. If the previous steps did not reveal any problems, then replace the base board.

7.6.139 Code 2993 - Battery Charger Failed

Logic:

Indicates that the battery charger has failed.

Possible Causes:

1. Faulty battery charger.
2. Battery Charger switch incorrectly wired.
3. Faulty switch.
4. The "Configurable Input Active State Selection" parameter is configured incorrectly.
5. The base board is faulty.

Diagnosis and Repair:

1. Faulty battery charger.
   a. Check the output voltage of the battery charger. If the battery charger is overcharging, or not charging the batteries at all, then repair or replace the battery charger.
2. Battery Charger switch incorrectly wired.
   a. Check for improper wiring, a short circuit, or an open circuit from the Battery Charger switch to the discrete configurable input on the base board that was configured for the "Battery Charger Switch Fail". If a short circuit, open circuit or improper wiring is found, correct the wiring.
3. Faulty switch.
   a. Measure the resistance of the battery charger switch, if the switch is shorted or open circuit, replace the switch.
4. The "Configurable Input Active State Selection" parameter is configured incorrectly.
   a. Through the operator panel, check the switch input setting (active closed or active open) for the Configurable Input that was configured to "Battery Charger Switch Fail". Ensure that the switch input setting is correctly set. If the "Configurable Input Function Pointer" parameter is set to "Battery Charger Switch Fail" and the "Configurable Input Active State Selection" parameter is set to "active closed", event/fault code 2993 will become active when the Configurable Input that was configured to "Battery Charger Switch Fail" is connected to ground.

      If the "Configurable Input Function Pointer" parameter is set to "Battery Charger Switch Fail" and the "Configurable Input Active State Selection" parameter is set to "active open", event/fault code 2993 will become active when the Configurable Input that was configured to "Battery Charger Switch Fail" is an open circuit.

      To access the input configuration on the operator panel go to **Setup > Configurable I/O >** and set the "Configurable Input Active State Selection" parameter appropriately for the Configurable Input that was configured to "Battery Charger Switch Fail".
5. The base board is faulty.
   a. If the previous steps do not reveal any problems, replace the base board.

7.6.140 Code 3411 - DC Power Supply Fault

Logic:

WARNING: Due to AUX101 sensed DC power supply unit (PSU) state is below inactive threshold lower limit for the duration of DC PSU Dwell Time.

Possible Causes:

1. Inadequate DC PSU Dwell Time.
2. Faulty or poor DC power supply.
3. Faulty DC power supply to AUX101 wiring.
4. Faulty AUX101.

Diagnosis and Repair:

1. Inadequate DC PSU Dwell Time.
   a. Via InPower, verify and adjust DC PSU Dwell Time (default = 5 seconds) to permit surge power recovery or battery charger engagement to attain voltage within inactive threshold limits. Note that a high DC PSU Dwell Time may mask DC power supply issues.
2. Faulty or poor DC power supply.
   a. Check source state of charge and physical condition as faulty or poor component state has resulted in voltage below AUX101 inactive threshold lower limit. Clean and replace as necessary.
3. Faulty DC power supply to AUX101 wiring.
   a. Check for continuity in powered mode, between DC PSU and AUX101 (including but not limited to fuses and key switches) as failed component resulted in voltage below AUX101 inactive threshold lower limit. Repair as necessary.
4. Faulty AUX101.
   a. AUX101 isn't communicating DC PSU properly and/or is falsely presenting DC PSU state as below inactive threshold lower limit to PCC. Check wiring and connections to AUX101 or refer to AUX101 troubleshooting with respect to DC PSU.

7.6.141 Code 3416 - Start System

See the troubleshooting procedures for fault code 359 or 1438.

7.6.142 Code 3417 - Alternator Heater Trip

Logic:

WARNING: Due to AUX101 sensed active alternator heater circuit protection state during alternator heater control active from PCC.

Possible Causes:

1. Inadequate circuit protection.
2. Faulty alternator heater or wiring.
3. Faulty alternator heater relay.
4. Faulty AUX101.

Diagnosis and Repair:

1. Inadequate circuit protection.
   a. Check heater wiring, heater relays and circuit protection device(s) are sized to suit circuit's current capability as faulty component resulted in current greater than heater circuit protection active threshold. Replace as necessary.
2. Faulty alternator heater or wiring.
   a. Check the following circuits, repair as needed:
      - AUX101 to alternator heater relay input for loose connections and short circuit between wires as fault will result in failure to deliver the electrical current required to close the alternator heater relay switch and mimic alternator heater current greater than circuit protection active threshold.
      - AUX101 to alternator heater relay sense for loose connections and short circuit between wires as fault will result in failure to report alternator heater circuit current and mimic alternator heater current greater than circuit protection active threshold.
      - Alternator heather circuit protection to alternator heater relay for short to ground as fault will result in alternator heater current greater than circuit protection active threshold.
3. Faulty alternator heater relay.
   a. Check that the alternator heater relay for closure when AUX 101 input is applied by measuring resistance of relay's high current circuit; replace if open as fault will mimic circuit protection active.
4. Faulty AUX101.
   a. AUX101 isn't communicating alternator heater circuit current properly and/or is falsely representing state to PCC. Check wiring and connections to AUX101 or refer to AUX101 troubleshooting with respect to alternator heater circuit protection.

7.6.143 Code 3457 - Loss of Bus Voltage Sensing

Logic:

An open circuit condition exists in all 3 phases of the bus voltage sensing in Isolated Bus or Utility Multiple applications.

Possible Causes:

1. Genset bus voltage sensing connections are open circuit or incorrectly wired at the base board.
2. kW load share and kVAR lines are switched.
3. Faulty PT.
4. The base board is faulty.

Diagnosis and Repair:

1. Genset bus voltage sensing connections are open circuit or incorrectly wired at the base board.
   a. The purpose of this event/fault code is to prevent closing the genset circuit breaker to a bus which is actually live, but which appears to the controller to be dead. Check and ensure that the following are OK: TB7 is securely connected to the base board, bus fuses have been re-closed after troubleshooting/maintenance procedures, blow bus fuses have been checked and replaced as needed, and disconnected medium voltage set of PTs have been reconnected.
   b. If the nominal voltage is 600 VAC or lower, ensure that the voltage sensing connections are correct.
      - Measure the phase rotation, frequency, and voltage input into the base board from the Genset bus at: L1, TB7-1; L2, TB7-2; and L3, TB7-3. The voltage and frequency should match the Genset bus nominal voltage and frequency. The phase rotation should be "L1-L2-L3" at TB7-1, TB7-2, and TB7-3 on the base board; for proper phase rotation measurement procedures, refer to the phase rotation meter instructions. If the phase rotation, voltage and/or frequency are not correct, re-check the wiring.
   c. If the nominal voltage is over 600 VAC, check the voltage sensing connections from the base board to the PT and the PT to the Genset bus.
      - Measure the phase rotation, frequency, and voltage input into the base board from the PT (Potential Transformer) at: L1, TB7-1; L2, TB7-2; and L3, TB7-3. The voltage input into the base board should match the secondary voltage of the PT (for example, if the PT ratio is 13,800:240, the voltage measured at the base board should be 240 VAC). The phase rotation at TB7-1, TB7-2, and TB7-3 should be "L1-L2-L3" for proper phase rotation measurement procedures; refer to the phase rotation meter instructions. The frequency should match the Genset bus nominal frequency. If the phase rotation, frequency, and/or voltage are not correct at the base board, correct the wiring from the base board to the PT.
2. kW load share and kVAR lines are switched.
   a. Ensure kW load share line on genset 1 is connected to kW load share line on genset 2 and kVAR load share is connected to kVAR it will cause this FC.
3. Faulty PT.
   a. With a calibrated voltage meter, measure the voltage input and output of the PT. The input and output of the PT should be proportional; ex. Inputs: L1 = 13,800, L2 = 13,800, L3 = 13,800; Outputs: L1 = 240, L2 = 240, L3 = 240. If the inputs and outputs of the PT are not proportional, replace the PT.
4. The base board is faulty.
   a. If the previous steps did not reveal any problems, replace the base board.

7.6.144 Code 3629 - Device Calibration Update Recommended

Logic:

The PCC may have setup parameters that the AUX 105 does not have.

Possible Causes:

1. Incorrect calibration file in the PCC.
2. Incorrect calibration file in AUX 105.

Diagnosis and Repair:

1. Verify the calibration files for the PCC.
   a. Connect InPower to the PCC.
   b. Download the latest calibration to the PCC.
2. Verify the calibration files for the AUX 105.
   a. Connect InPower to the AUX 105.
   b. Download the latest calibration to the AUX 105.

7.6.145 Code 3631 - Device Calibration Update Required

Logic:

The AUX 105 did not receive a setup parameter from the PCC.

Possible Causes:

1. Incorrect calibration file in the PCC.
2. Incorrect calibration file in AUX 105.

Diagnosis and Repair:

1. Verify the calibration files for the PCC.
   a. Connect InPower to the PCC.
   b. Download the latest calibration to the PCC.
2. Verify the calibration files for the AUX 105.
   a. Connect InPower to the AUX 105.
   b. Download the latest calibration to the AUX 105.

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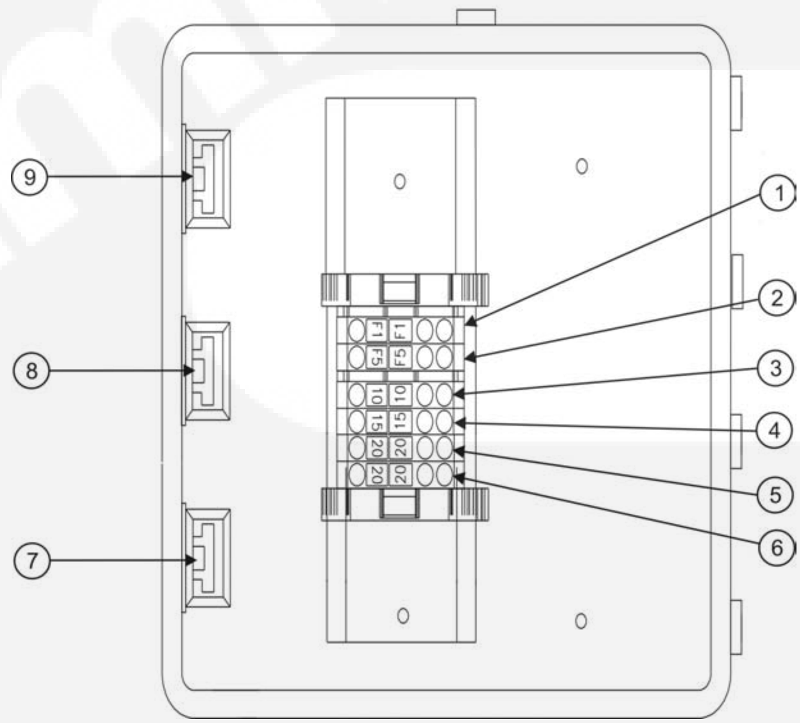
8 Customer Relays

8.1 Skid Mounted Fuse and Relay Box

WARNING: ***To prevent accidental or remote starting while working on the generator set, Isolate the battery. Failure to do so may result in severe personal injury or death.***

CAUTION: Only the correct size amperage fuses and relays must be used to replace a fuse or relay. Failure to use the correct fuse or relay may result in damage to the protected circuit components.

The fuse and relay box contains the fuses and relays for various circuits as illustrated see **Figure 1** and are of the Push-fit type. For additional information refer to the wiring diagrams provided with your generator set.



No.	Description	No.	Description
1	Service tool supply fuse 1A	6	Remote supply fuse 20A
2	Keyswitch fuse 5A	7	Keyswitch Relay
3	ECM Power fuse 10A	8	Starter Relay
4	Switched B+ fuse 15A	9	Switched B+ Relay
5	Controller fuse 20A		

FIGURE 1. SKID MOUNTED FUSE AND RELAY BOX

To replace a fuse or relay.

1. Using the Isolation switch isolate the battery.
2. Remove the fuse box cover.
3. Remove the faulty fuse or relay.
4. Check the fuse or relay for continuity if open circuit replace the fuse or relay.
5. Install a new fuse or relay.
6. If the replaced fuse or relay open circuits again do not replace the fuse or relay.
7. Carry out further investigation to find the fault condition.
8. Carry out any repairs necessary to rectify the fault condition.
9. Install a new fuse or relay.
10. Replace the box cover, do not tighten down at this stage.
11. Re-set the battery isolation switch.
12. Start the generator to see if the fault condition is rectified.
13. If the fault condition is rectified secure the fuse box cover.

9 Frequency Changing

9.1 Frequency Changing - PowerCommand 1.2

9.1.1 Frequency Changing

WARNING: Any change to the frequency settings must only be carried out by the rental fleet owner.

WARNING: Adjusting the frequency settings must only be done by technically trained and experienced service personnel. The frequency settings must only be adjusted to correspond to the parameters of the installed input power supply. Saving settings that do not correspond to the power supply can cause severe personal injury and equipment or property damage.

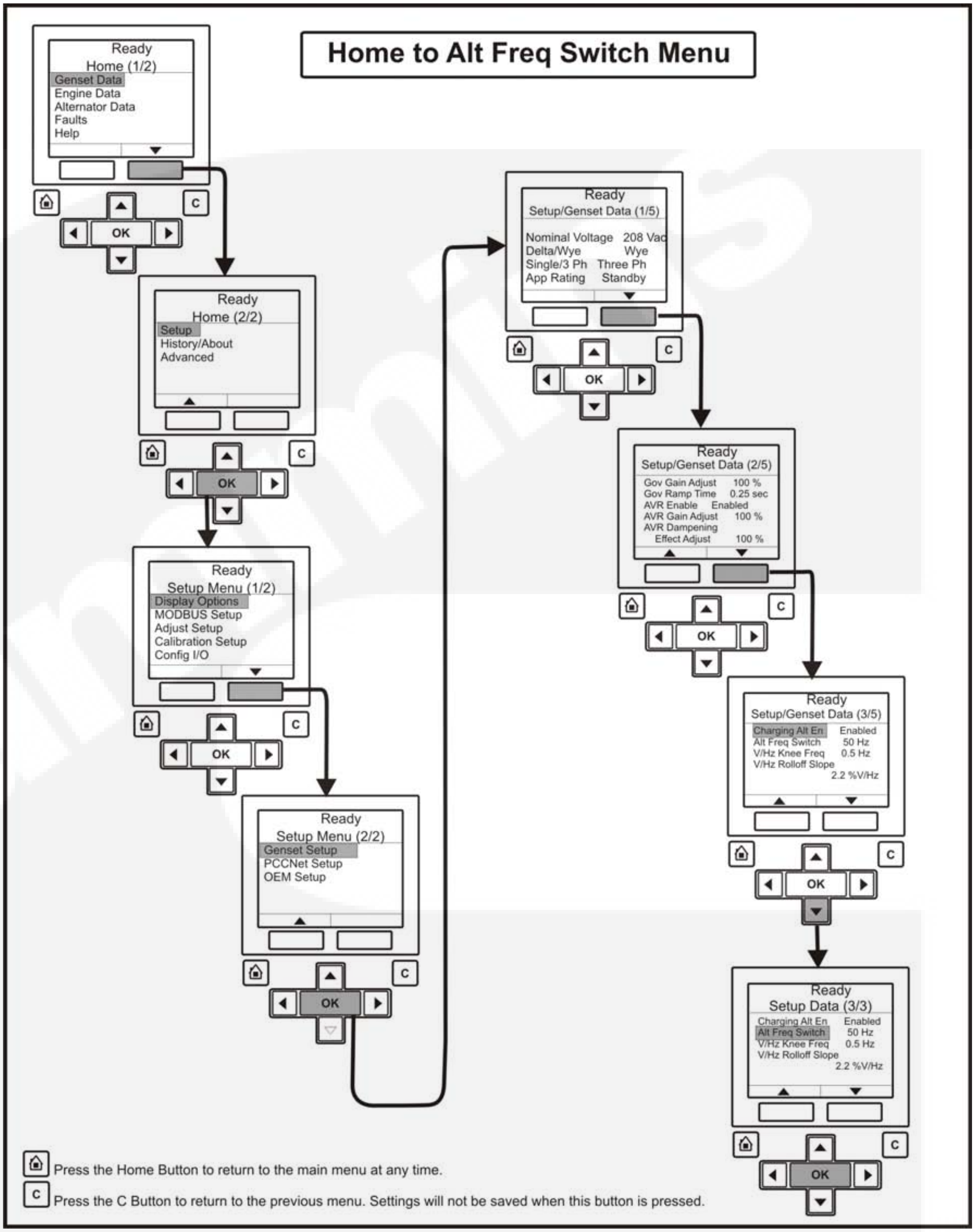
Within the PowerCommand® control Set-up menu is the option to select 50 Hz or 60 Hz running. This option is Password protected and is determined at the initial setting up of the set.

The Set-up menu is used to control the displaying of a further menu that allows for adjusting the generator set frequency settings.

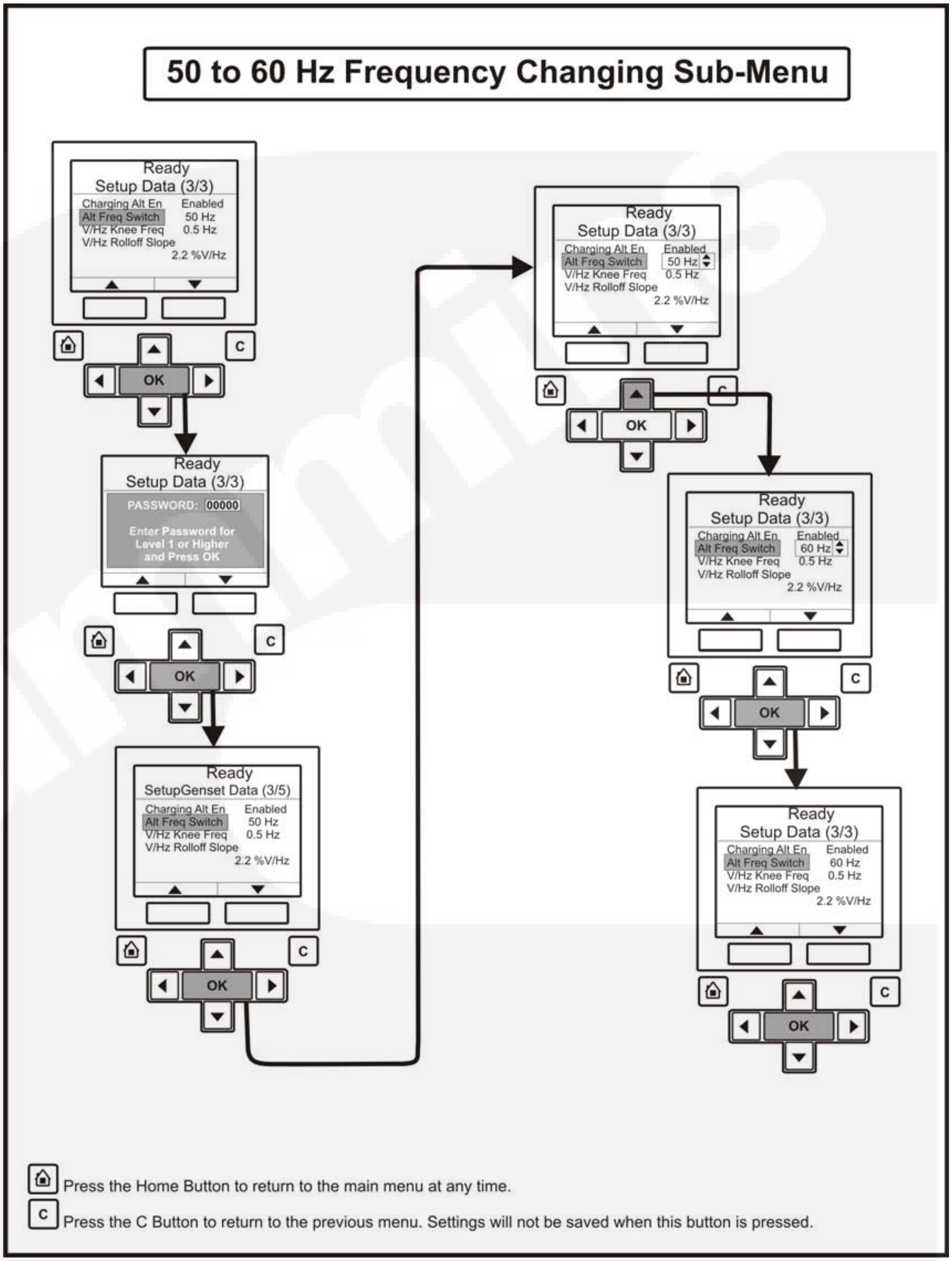
The Frequency menu is designed only for use with rental sets. Changing the parameters on this menu MUST ONLY be done by trained service personnel.

9.1.2 50 Hz to 60 Hz Procedure

1. Press the Stop button and make sure the generator set is switched Off.
2. At the display panel navigate through the menus from the Home menu to the Alt Freq Switch menu, as shown.



3. At the display panel continue navigating through the menus from the Alt Freq Switch menu as shown.



NOTE: **A password is required to access the frequency changing menu, this Access password menu will appear when the OK button is pressed against the Alt Freq Switch menu. To enter this password refer to the Operator Manual supplied with the generator set.**

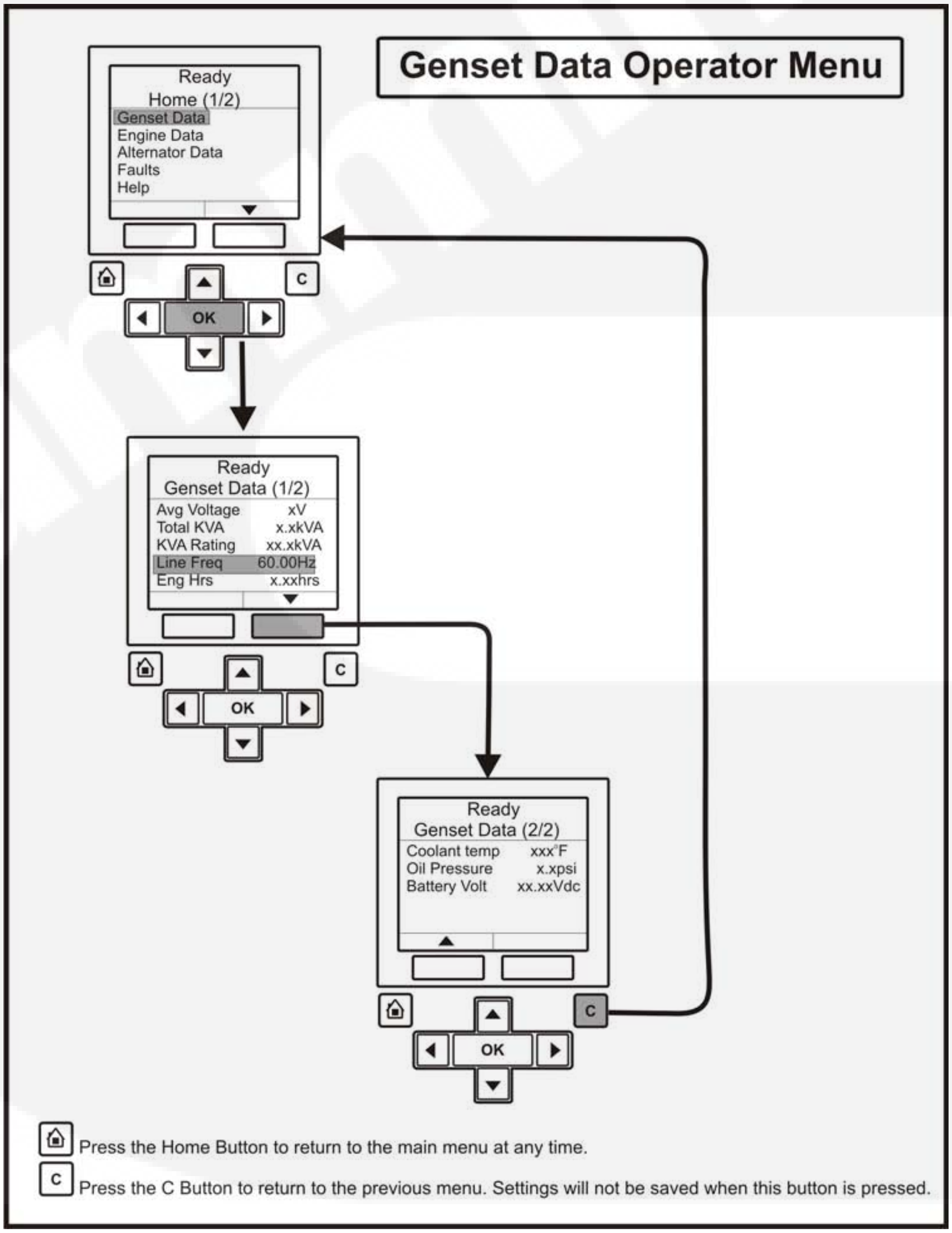
4. The generator set is now set to run at 60Hz nominal.
5. At the generator set control panel – start the set in Manual mode:

Press the Manual button on the display module front panel, and then press the Start button within ten seconds. Failure to press the Start button within this time will result in the generator set changing to the Off mode. (Refer to generator set Operator Manual).

NOTE: If the mode change access code feature has been enabled, enter the access code when prompted. (Refer to generator set Operator Manual).

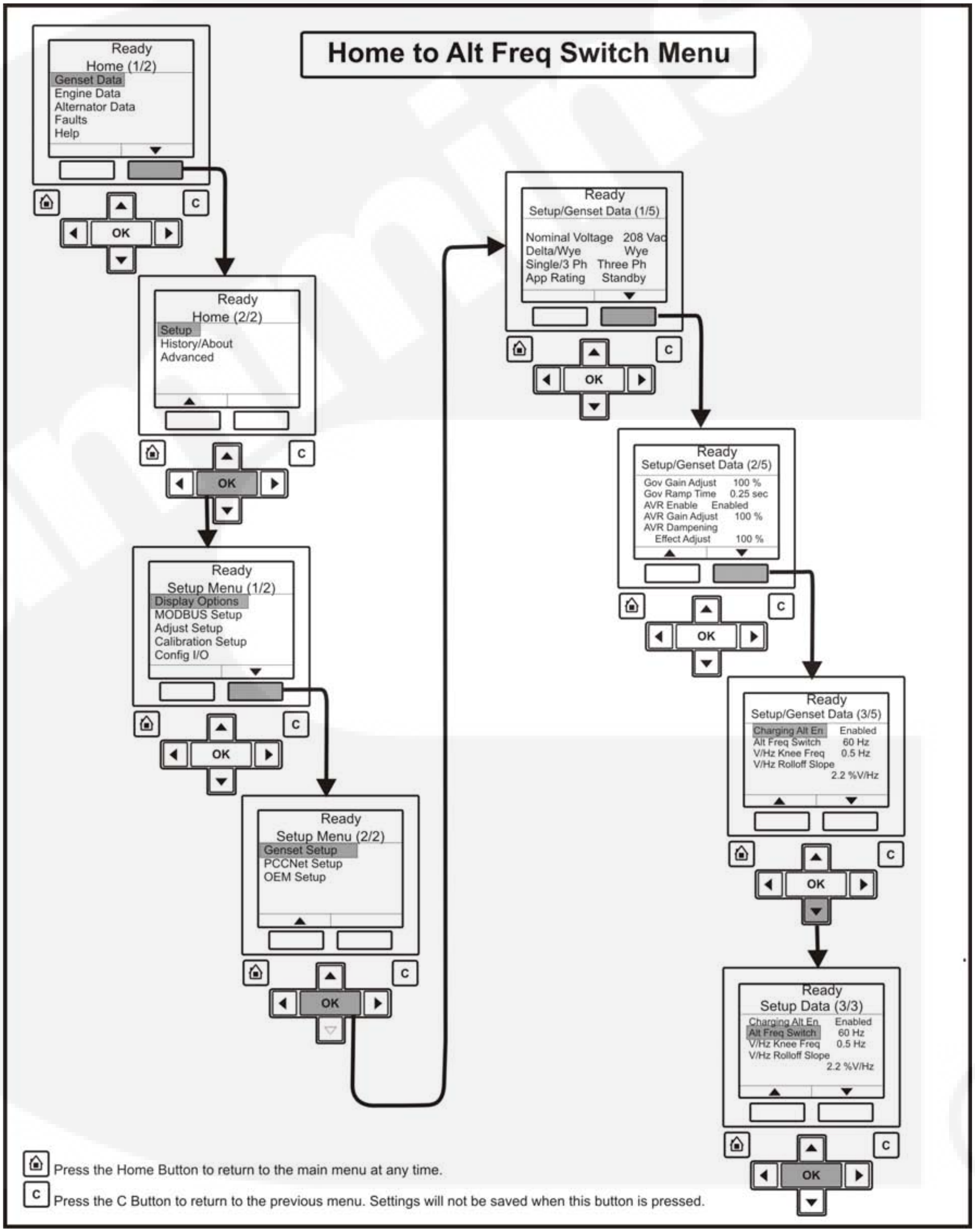
WARNING: Make sure that all Pre-start Checks are carried out before starting the generator set. Do not attempt to start the generator until it is safe to do so. Warn all others in the vicinity that the set is about to start.

6. Check the settings are correct for your installation criteria.

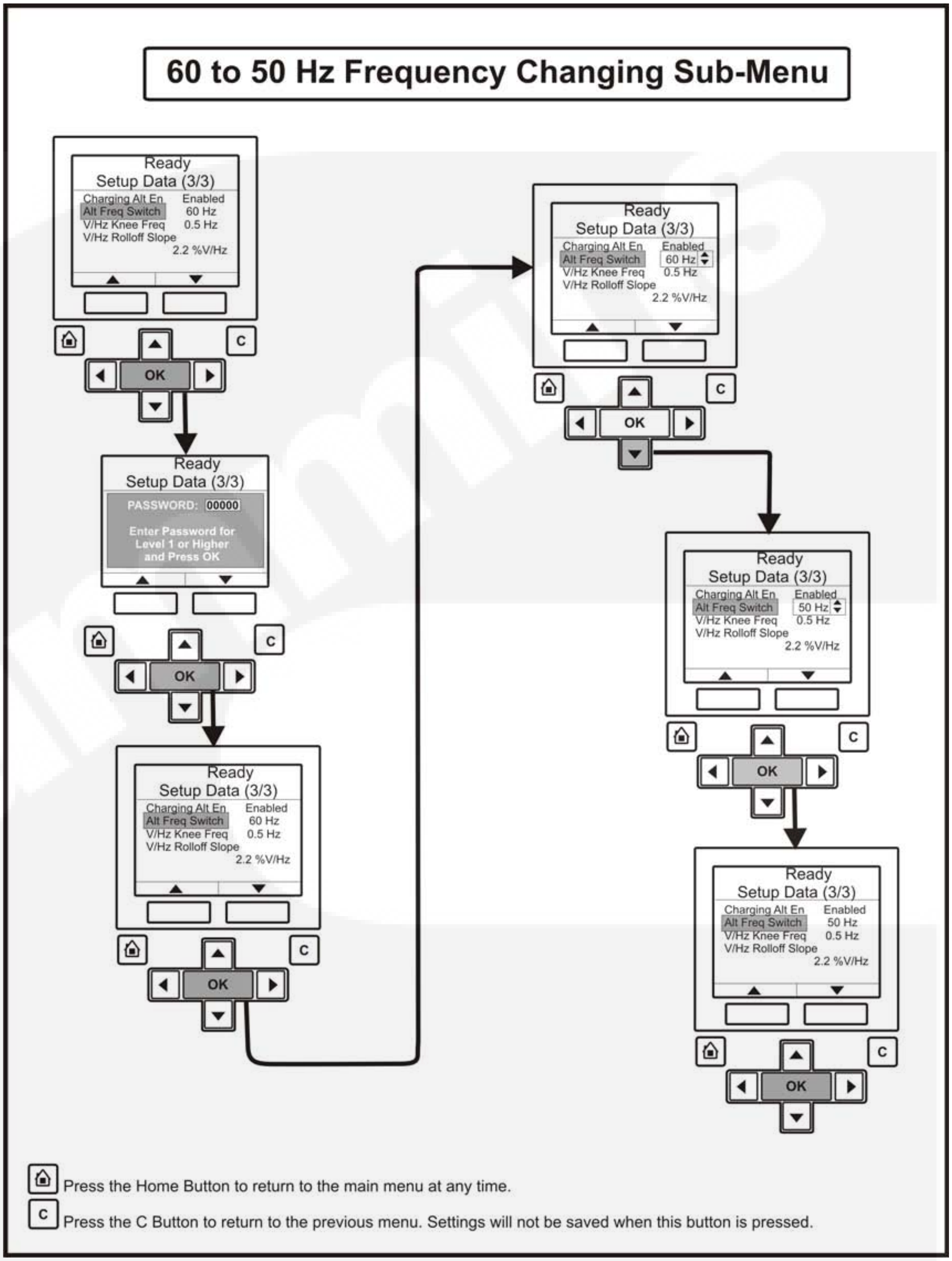


9.1.3 60 Hz to 50 Hz Procedure

1. Press the Stop button and make sure the generator set is switched Off.
2. At the display panel navigate through the menus from the Home menu to the Alt Freq Switch menu, as shown.



3. At the display panel continue navigating through the menus from the Alt Freq Switch menu as shown.



NOTE: ***A password is required to access the frequency changing menu, this Access password menu will appear when the OK button is pressed against the Alt Freq Switch menu. To enter this password refer to the generator set Operator Manual.***

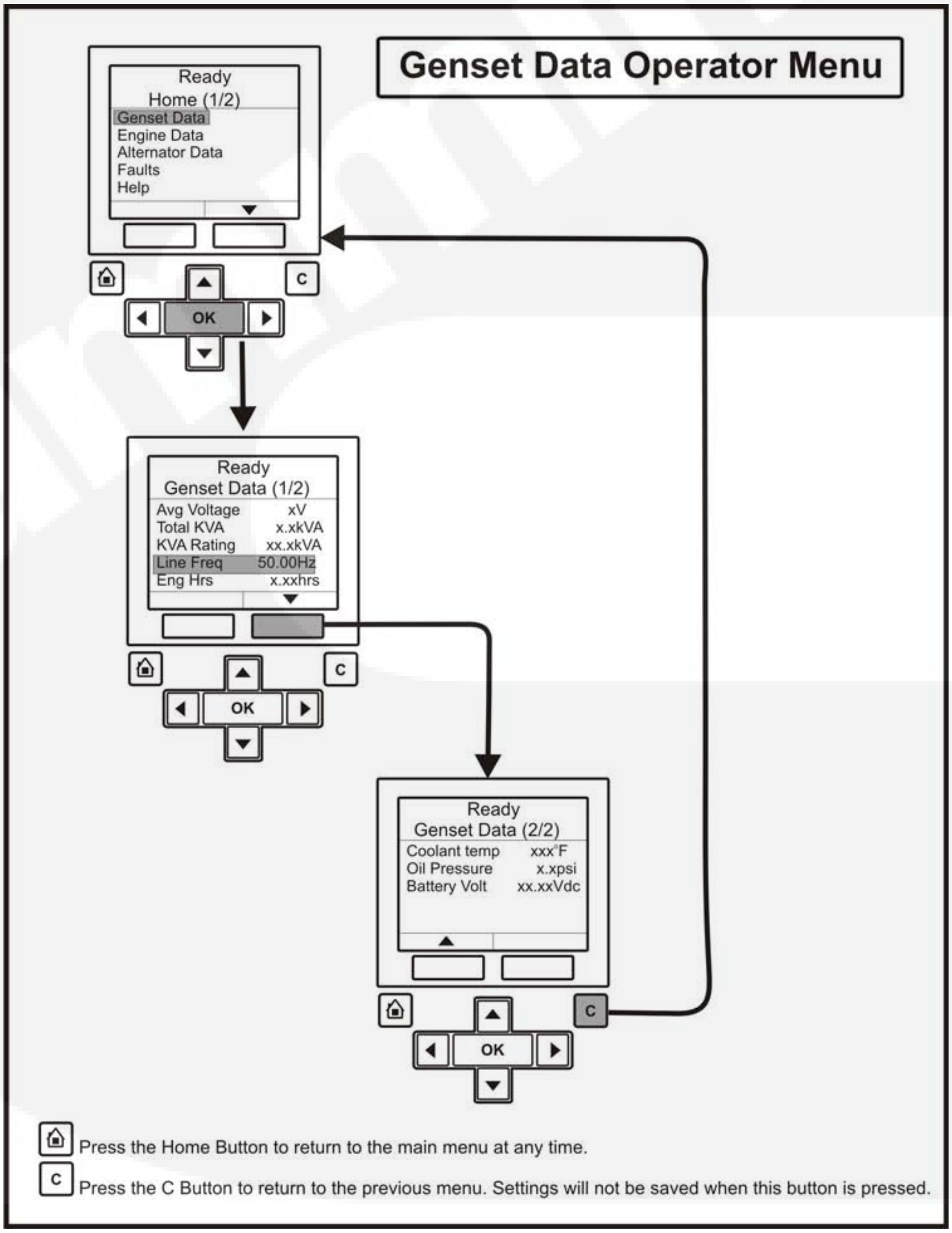
4. The generator set is now set to run at 50Hz nominal.
5. At the generator set control panel – start the set in Manual mode:

Press the Manual button on the display module front panel, and then press the Start button within ten seconds. Failure to press the Start button within this time will result in the generator set changing to the Off mode. (Refer to the generator set Operator Manual).

NOTE: If the mode change access code feature has been enabled, enter the access code when prompted. (Refer to generator set Operator Manual)

WARNING: Make sure that all Pre-start Checks are carried out before starting the generator set. Do not attempt to start the generator until it is safe to do so. Warn all others in the vicinity that the set is about to start.

6. Check the settings are correct for your installation criteria:



9.2 Frequency Changing - PowerCommand 3.3

9.2.1 Frequency Changing

WARNING: Any change to the frequency settings must only be carried out by the rental fleet owner.

WARNING: Adjusting the frequency settings must only be done by technically trained and experienced service personnel. The frequency settings must only be adjusted to correspond to the parameters of the installed input power supply. Saving settings that do not correspond to the power supply can cause severe personal injury and equipment or property damage.

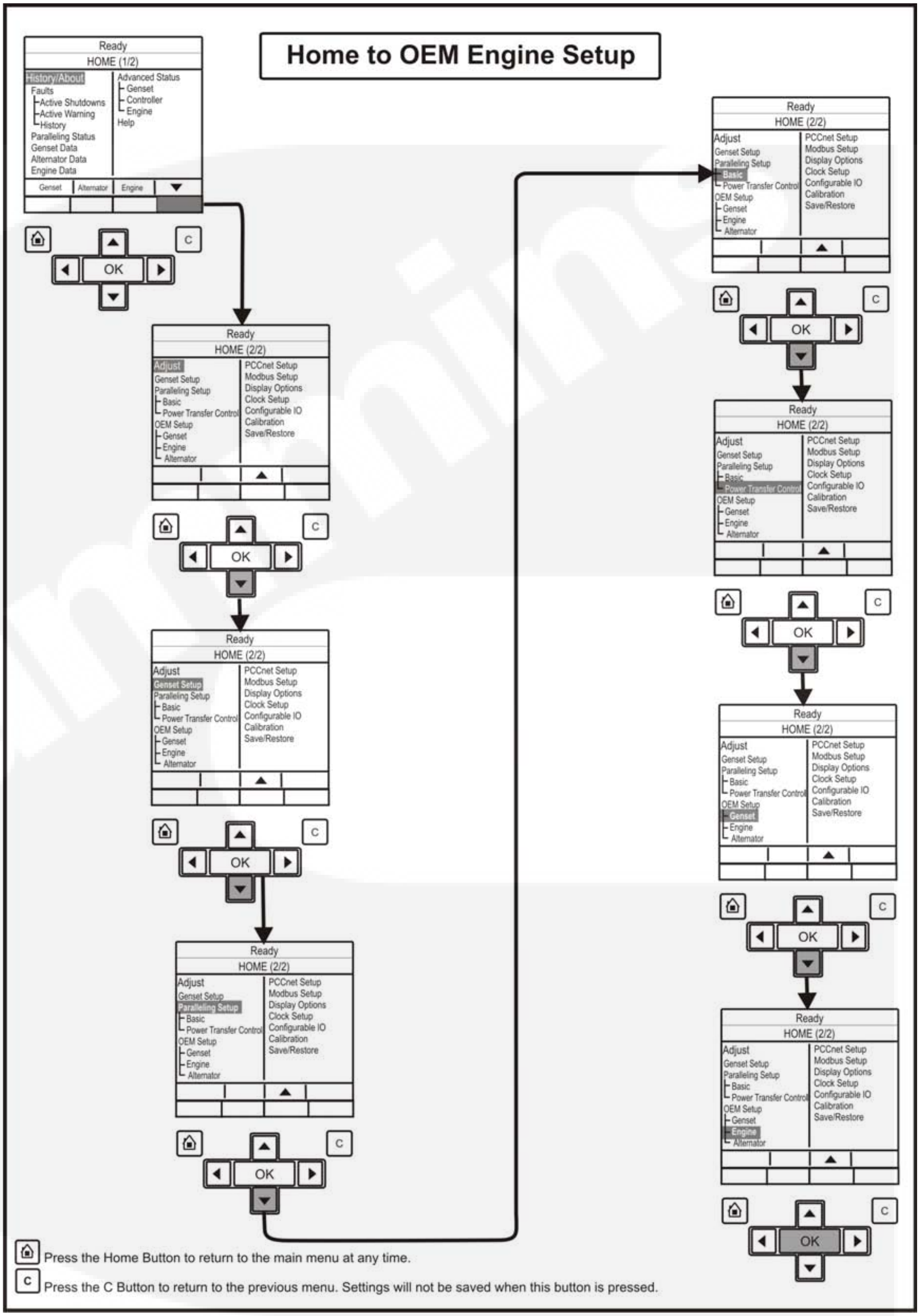
Within the PowerCommand® control Set-up menu is the option to select 50 Hz or 60 Hz running. This option is Password protected and is determined at the initial setting up of the set.

The Set-up menu is used to control the displaying of a further menu that allows for adjusting the generator set frequency settings.

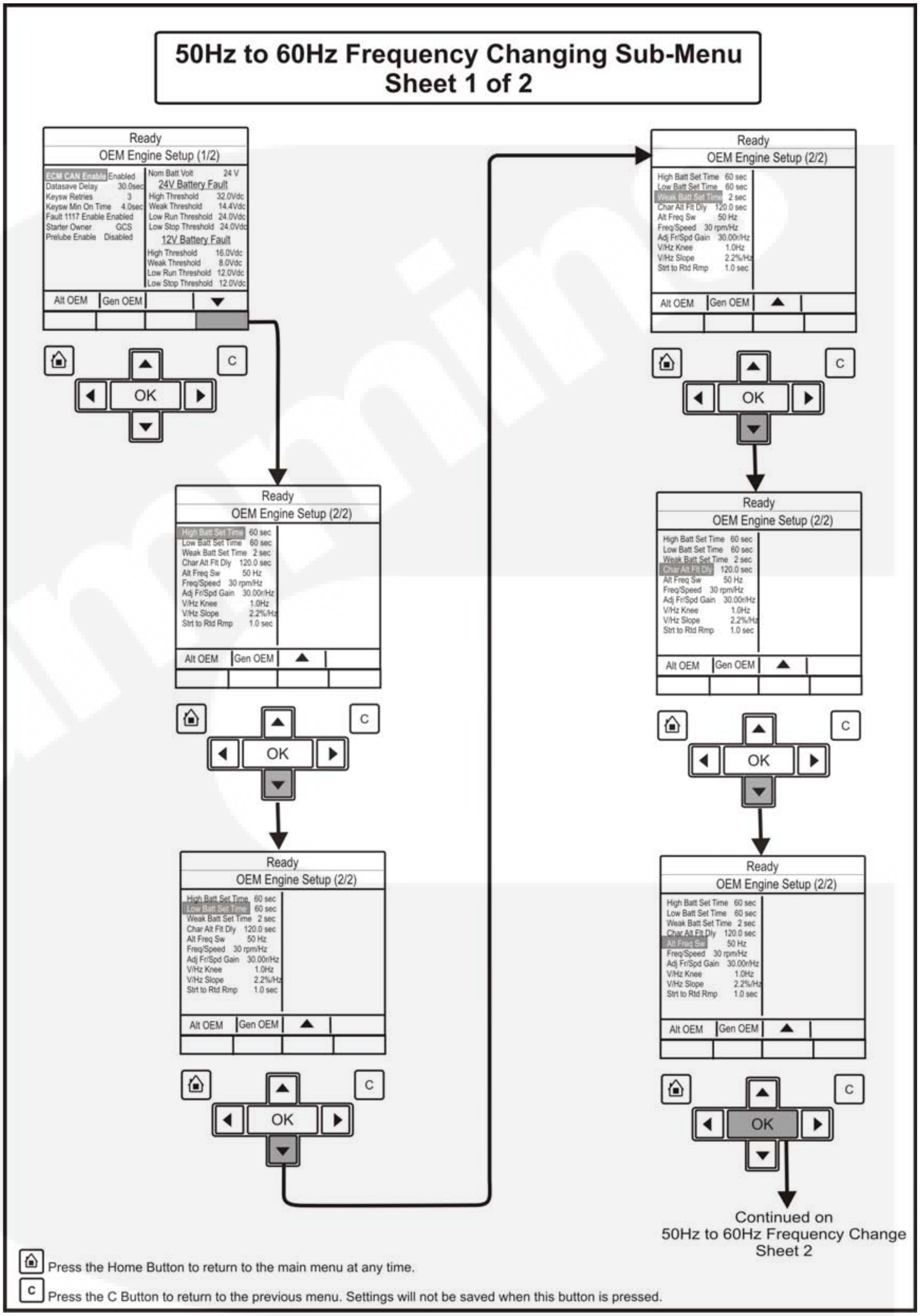
The Frequency menu is designed only for use with rental sets. Changing the parameters on this menu MUST ONLY be done by trained service personnel.

9.2.2 50 Hz to 60 Hz Procedure

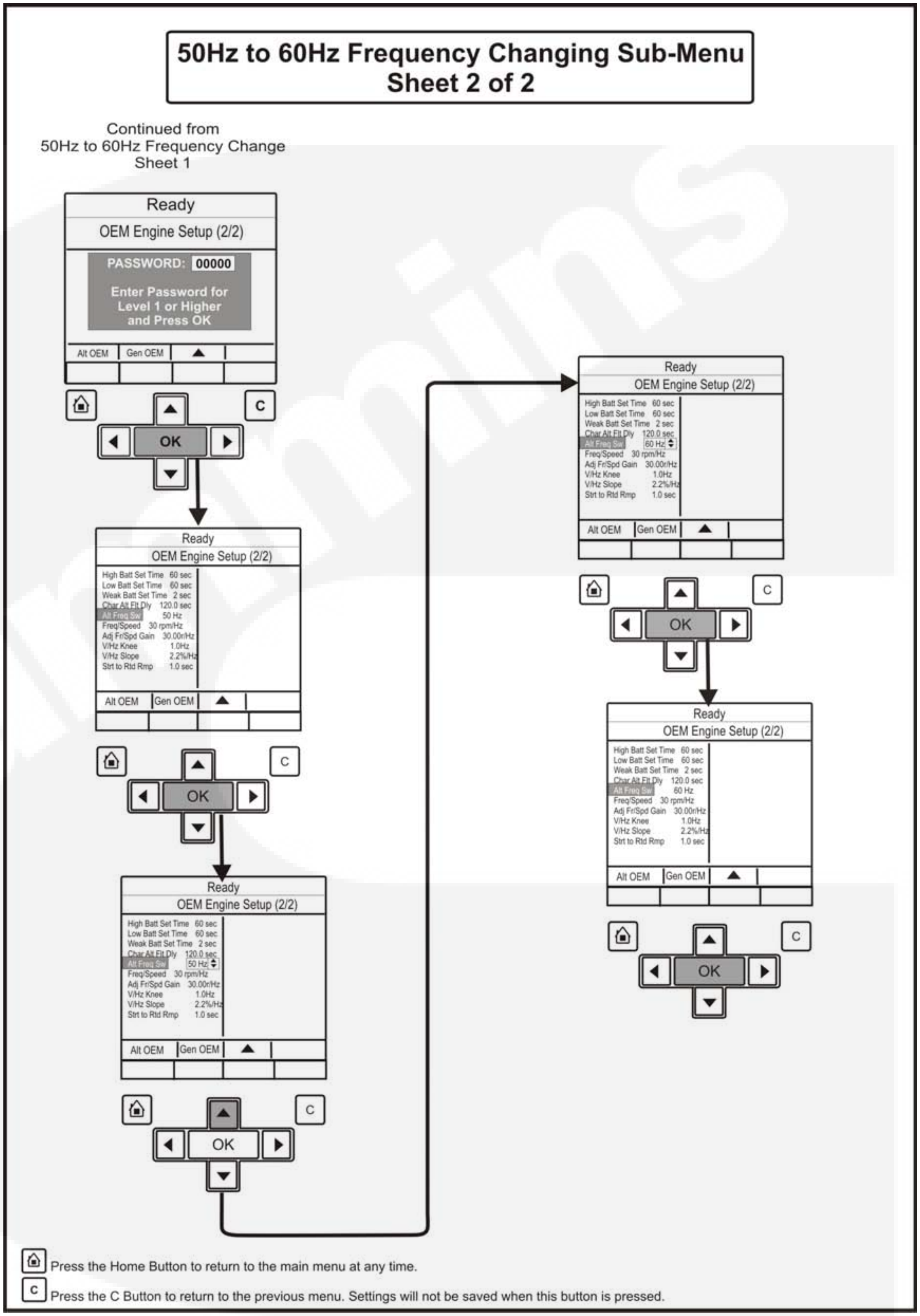
1. Press the Stop button and make sure the generator set is switched Off.
2. At the display panel navigate through the menus from the Home menu to the OEM Engine Setup menu, as shown:



3. At the display panel continue navigating through the menus from the OEM Engine Setup menu as shown:



NOTE: **A password is required to access the frequency changing menu, this Access password menu will appear when the OK button is pressed against the Alt Freq Switch menu. To enter this password refer to the generator set Operator Manual.**



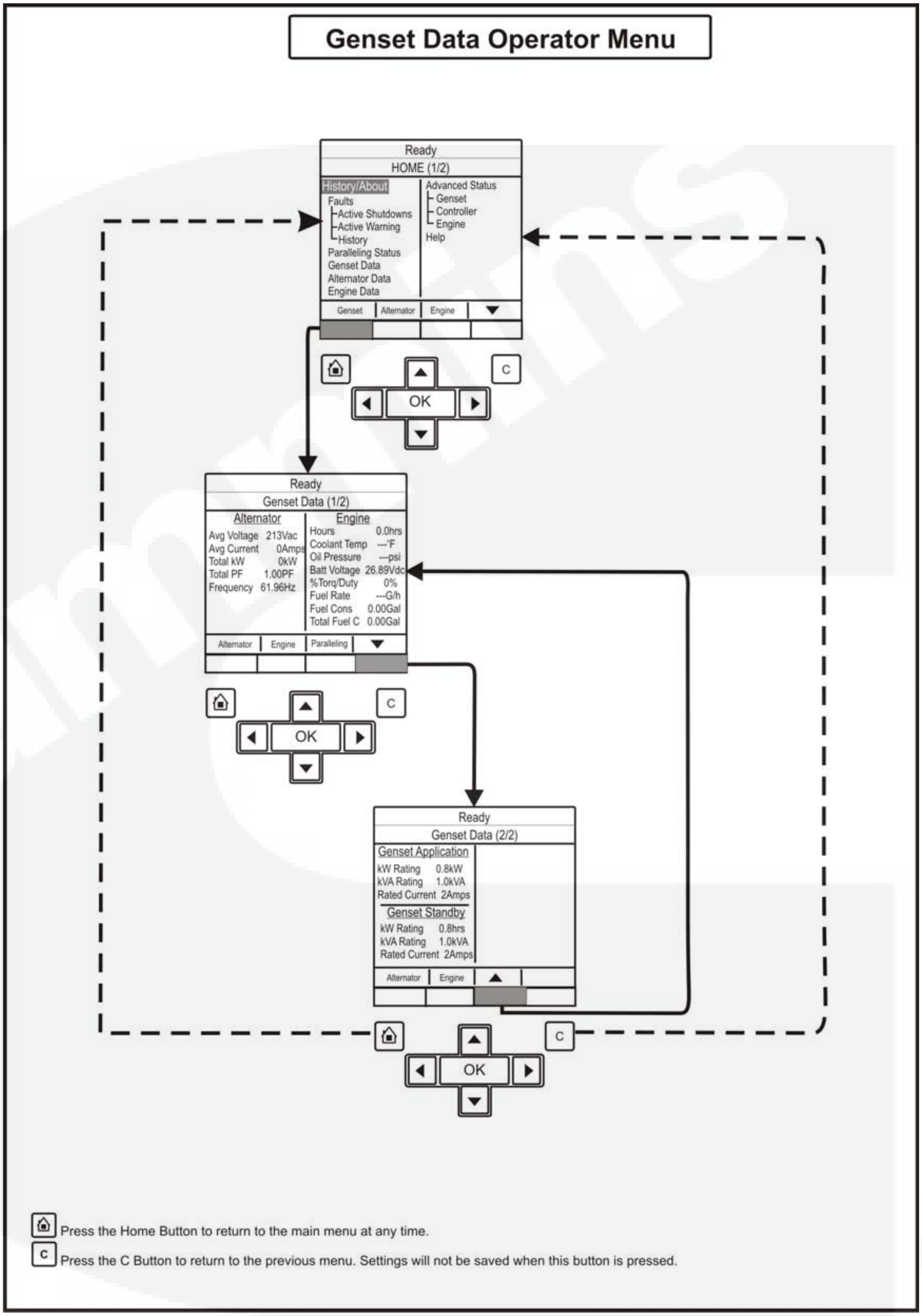
4. The generator set is now set to run at 60Hz nominal.

5. Press the Manual button on the display module front panel, and then press the Start button within ten seconds. Failure to press the Start button within this time will result in the generator set changing to the Off mode. (Refer to the generator set Operator Manual)

NOTE: If the mode change access code feature has been enabled, enter the access code when prompted. (Refer to the generator set Operator Manual).

WARNING: Make sure that all Pre-start Checks are carried out before starting the generator set. Do not attempt to start the generator until it is safe to do so. Warn all others in the vicinity that the set is about to start.

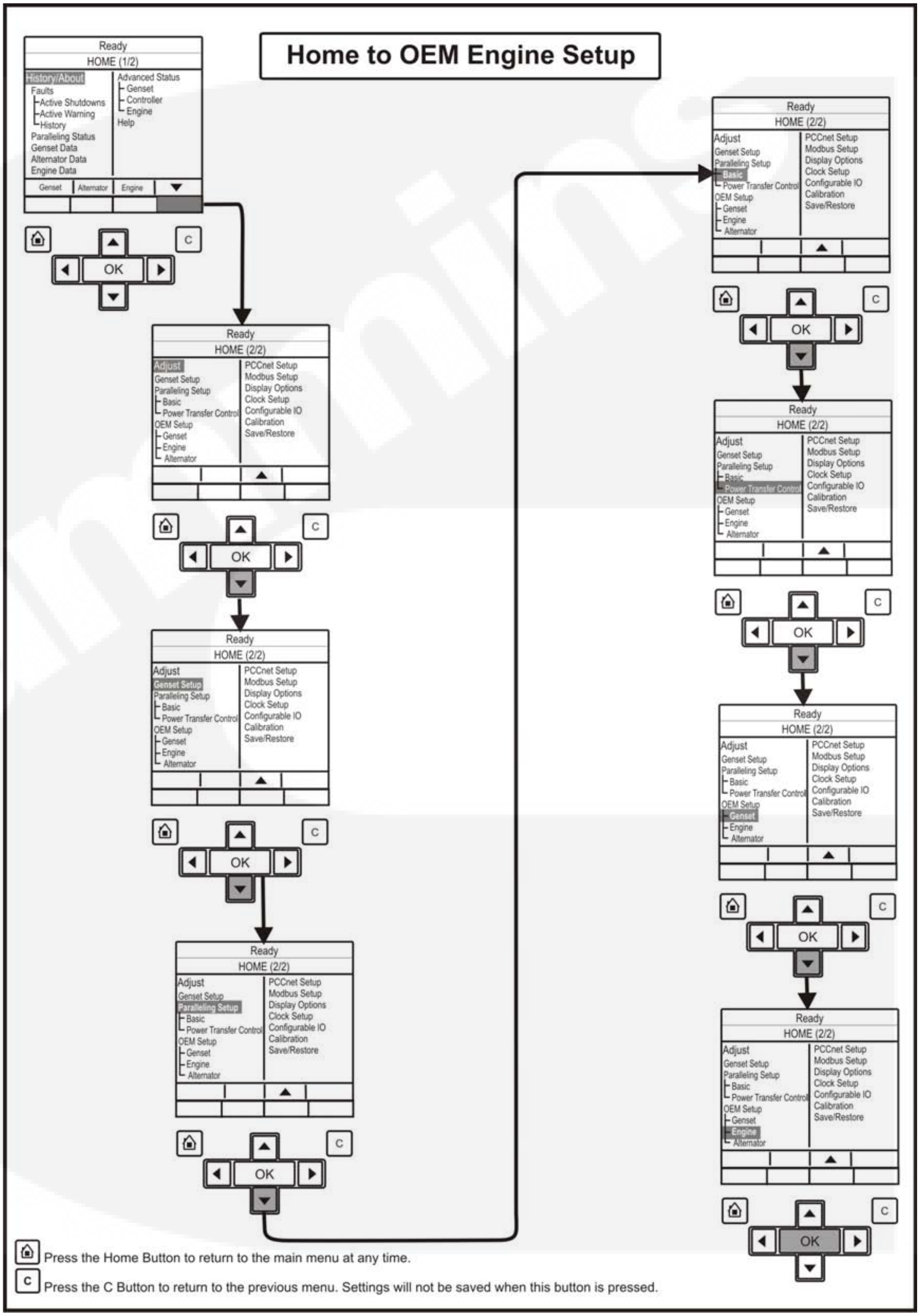
6. Check the settings are correct for your installation criteria:



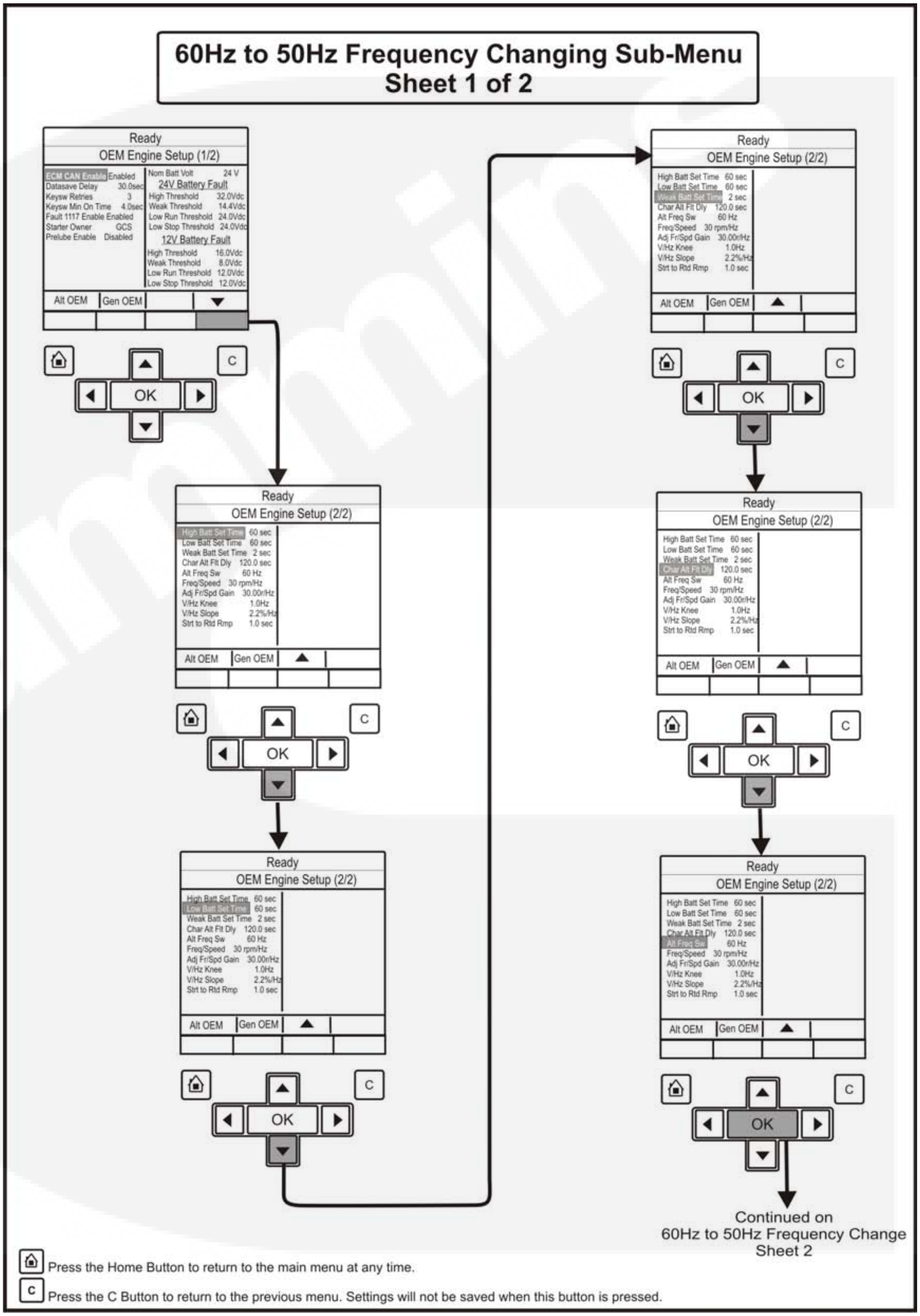
9.2.3 60 Hz to 50 Hz Procedure

1. Press the Stop button and make sure the generator set is switched Off.

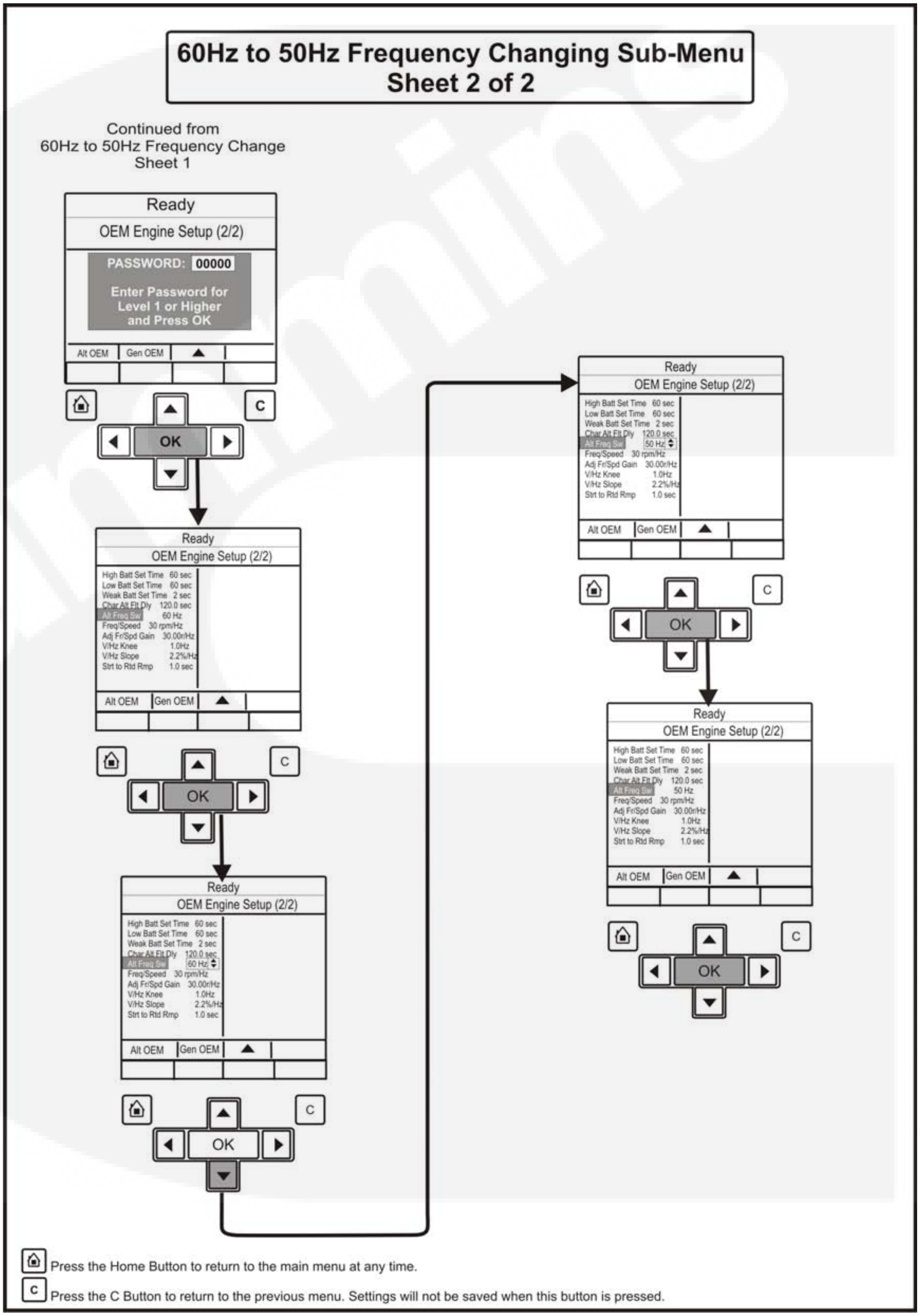
2. At the display panel navigate through the menus from the Home menu to the OEM Engine Setup menu, as shown:



3. At the display panel continue navigating through the menus from the OEM Engine Setup menu as shown:



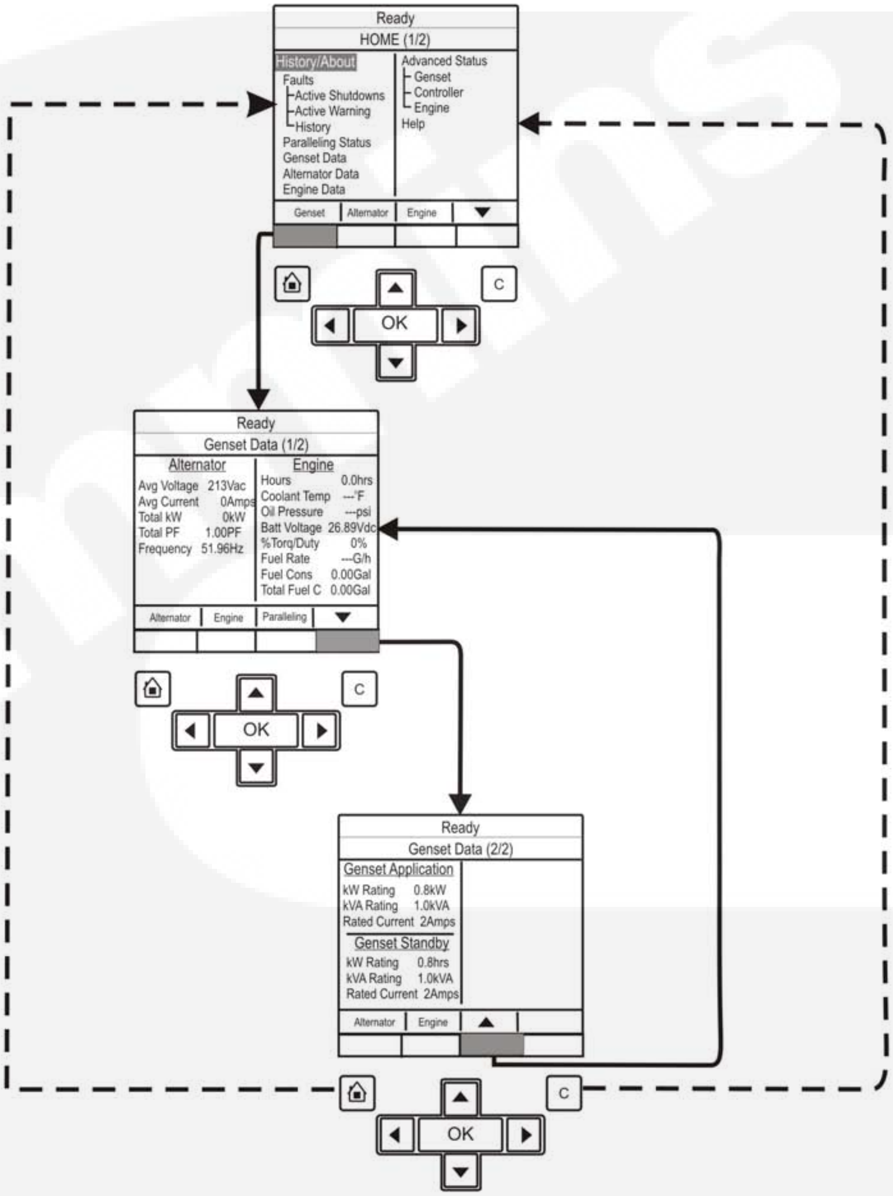
NOTE: A password is required to access the frequency changing menu, this Access password menu will appear when the OK button is pressed against the Alt Freq Switch menu. To enter this password refer to the generator set Operator Manual.



4. The generator set is now set to run at 60Hz nominal.
5. At the generator set control panel – start the set in Manual mode:

   Press the Manual button  on the display module front panel, and then press the Start button  within ten seconds. Failure to press the Start button within this time will result in the generator set changing to the Off mode. (Refer to the generator set Operator Manual)
6. Check the settings are correct for your installation criteria:

Genset Data Operator Menu



Press the Home Button to return to the main menu at any time.

Press the C Button to return to the previous menu. Settings will not be saved when this button is pressed.

10 Engine Control Module (ECM)

The Engine Control Module (ECM) monitors signal inputs from engine sensors to control the fuel metering and speed of the engine (see figure below). The ECM also provides diagnostic control over the engine and fuel system. The PCC controls the starting and stopping sequence of the engine through the ECM.

In the event of an engine fault, the ECM provides a signal output, via the CAN datalink, to the PCC. If the ECM triggers an engine shutdown, the PCC displays an engine shutdown or service fault. The PCC will display an additional fault to determine the root cause of the engine shutdown. If no additional fault is displayed in the PCC, the engine fault code can be determined by connecting to the ECM with the InSite service tool.

The wiring harness and InSite software required to perform engine diagnostics are available from your authorized distributor.

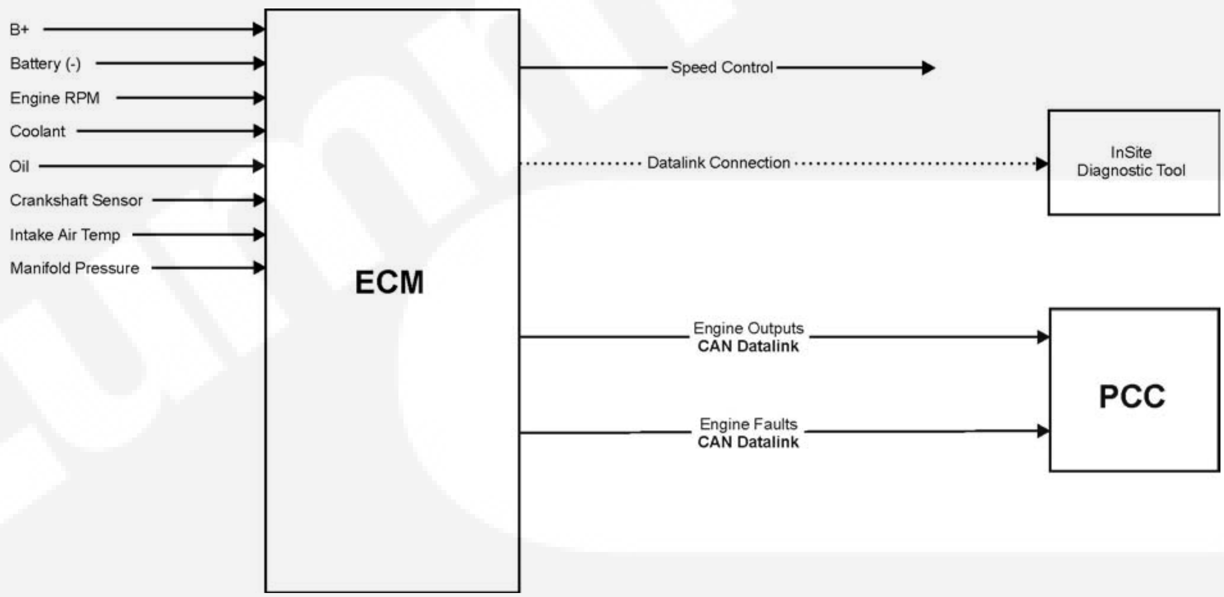


FIGURE 2. ECM INPUT AND OUTPUT

10.1 Keyswitch Control

The Keyswitch input to the ECM remains active during all controller modes other than when the Sleep Mode is active or the Emergency Stop is engaged. The PCC sends a start signal to the ECM via the Keyswitch Relay and the Start Relay. When the PCC detects a start command, both relays become charged, sending the start signal to the ECM, causing the engine to crank .

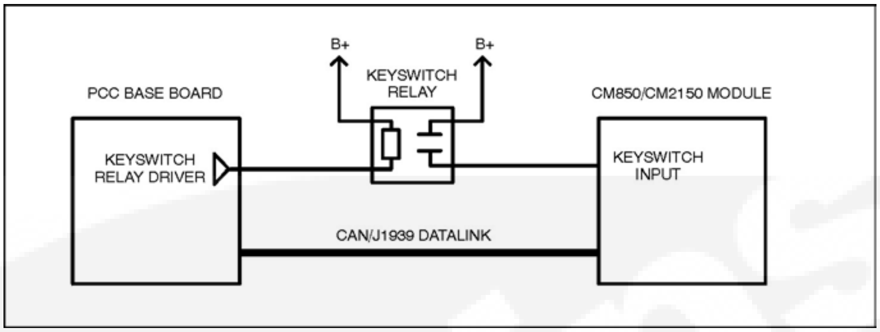


FIGURE 3. CONTROL SYSTEM BLOCK DIAGRAM

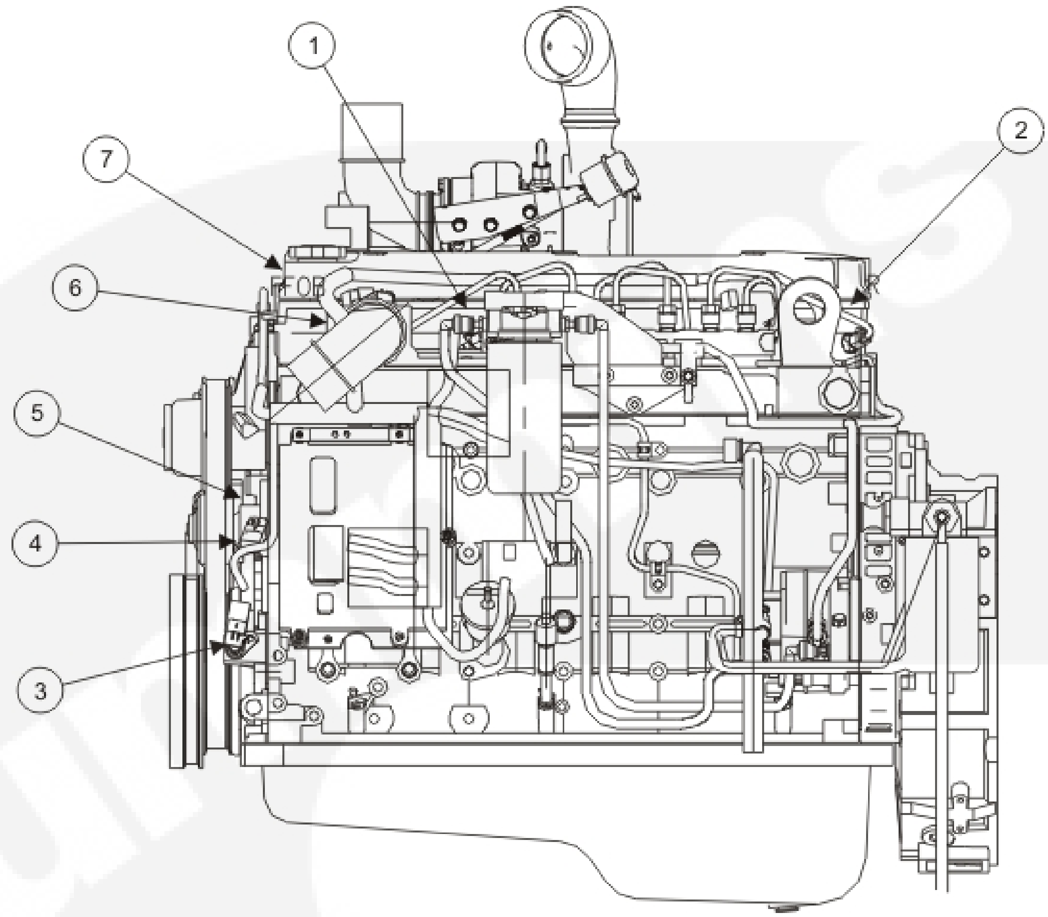
11 Engine Sensors

Figure 4 on page 318 shows the locations of the coolant temperature and oil pressure senders to which the PCC responds for the engine.

The coolant temperature sender functions by varying the resistance with the coolant temperature. With 5 VDC supplied to the sensors, the output signal (which varies with temperature) is supplied to the base board. The coolant sender enables the base board to detect low, pre-high and high coolant temperatures.

The oil pressure sender functions by converting the sensed oil pressure to voltage which varies the supplied 5 VDC to the sender. The output signal of the sender is approximately 0.5 VDC at 0 psi (0 kPa) and 4.5 VDC at 100 psi (689.5 kPa).

The low coolant level switch functions by closing the circuit to the engine chassis ground (battery negative [**–**]). The low coolant level switch is not shown in Figure 4 on page 318; this switch is located near the top of the radiator.



No.	Description	No.	Description
1	Intake pressure and temperature sensor	5	Oil pressure Sender
2	Fuel rail pressure sensor	6	Barometric pressure sensor
3	Engine speed sensor (crankshaft)	7	Coolant temperature sensor
4	Engine position sensor (camshaft)		

FIGURE 4. ENGINE SENSOR LOCATIONS

11.1 Oil Pressure Sensor

The oil pressure sensor is a normally open switch. When engine oil pressure falls below 6 psi, the switch closes. Once the ECM detects that the switch is grounded it sends a shutdown signal to the engine. The ECM will allow the engine to be restarted but will continue to send a shutdown signal if the pressure remains below 6 psi.

11.2 Cylinder Head Temperature Sensor (CHT)

The cylinder head temperature (CHT) sensor is a thermistor device, which uses changes in resistance dependant on the temperature. The sensor is installed in the aluminum cylinder head and measures the temperature of the metal. The CHT can provide complete engine temperature and is used to infer coolant temp.

11.3 Crankshaft Position Sensor (CKP)

The crankshaft position sensor (CKP) is used to determine engine RPM and crankshaft position. The CKP functions similar to a traditional magnetic pickup sensor. The CKP is located next to the trigger wheel mounted on the end of the crankshaft. The trigger wheel contains 39 teeth spaced 9 degrees apart with one tooth missing. By magnetically locating the empty space on each revolution, the ECM can determine the position of the crankshaft and engine speed.

11.4 Camshaft Position Sensor (CMP)

The camshaft position sensor (CMP) uses a Hall Effect type sensor which generates a square wave form. The CMP is used to determine when cylinder 1 reaches its compression stroke. The ECM uses this information to control fuel and spark delivery to the proper cylinder.

11.5 Additional Sensors

In addition to the sensors already mentioned, the ECM monitors a throttle position sensor (TIP) and temperature manifold absolute pressure (TMAP) sensor to maintain fuel control and emissions.

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12 SAE J1939 CAN (Controlled Area Network)

The following section describes the function and operation of the J1939 Controlled Area Network (CAN) datalink, as it applies to this generator set. The engine control module (ECM) communicates, to the generator set controller (PCC), over this network.

CAN communications follow the SAE J1939 communication protocol standard. The CAN datalink is based on a main trunk (no more than 40 meters long and 30 devices) that is terminated by a 120 ohm resistor at each end. Stubs (no longer than 1 meter) extend from the main trunk to each module in the bus.

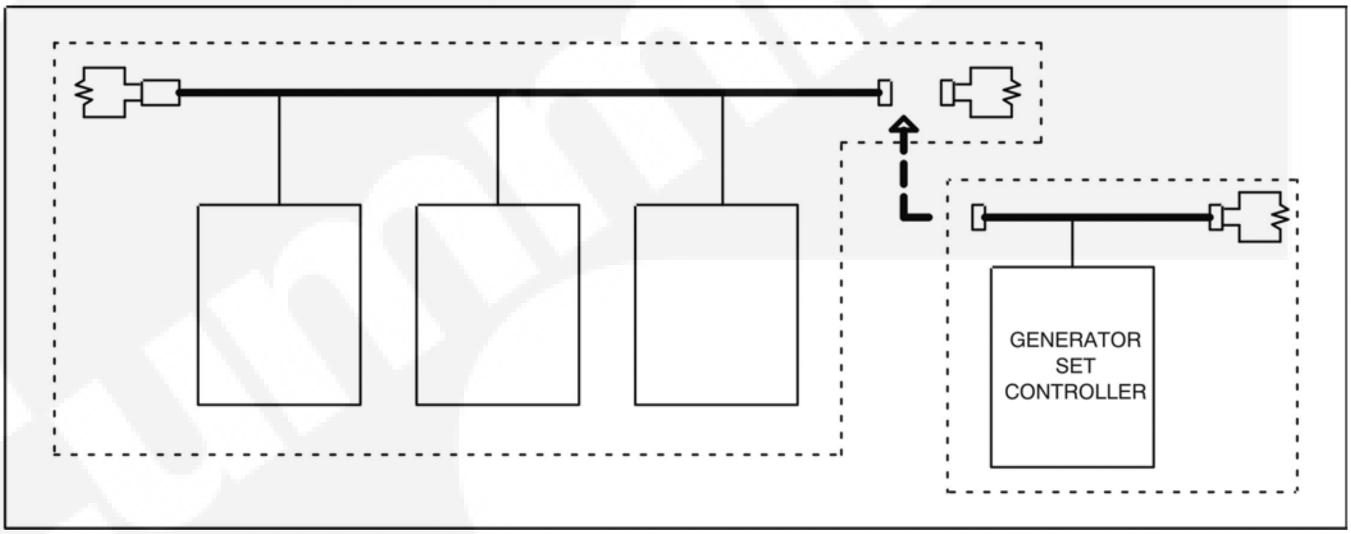

FIGURE 5. CAN DATALINK

12.1 CAN Datalink Signals

The CAN datalink carries the binary signal between the ECM (Engine Control Module) and the PCC controller. The binary signal is expressed by a change in voltage. Table 11 shows how the generator set controller distinguishes between the voltage signals.

TABLE 11. CAN DATALINK VOLTAGE DIFFERENTIALS

Signal	0	1
J1939 High (+)	2.5 V	3.5 V
J1939 Low (-)	2.5 V	1.5 V
Voltage Differential	0 V	2 V

The CAN datalink transmits the signal at 250 KBaud, or 250 kilobits per second. Hence, it is possible for the voltages on J1939 High (+) and J1939 Low (-) to change 250,000 times per second.

Figure 6 on page 322 and Figure 7 on page 322 show examples of good and bad datalink signals, on a high-resolution oscilloscope. The bad signal is caused by termination problems (no termination, wrong termination, or bad termination).

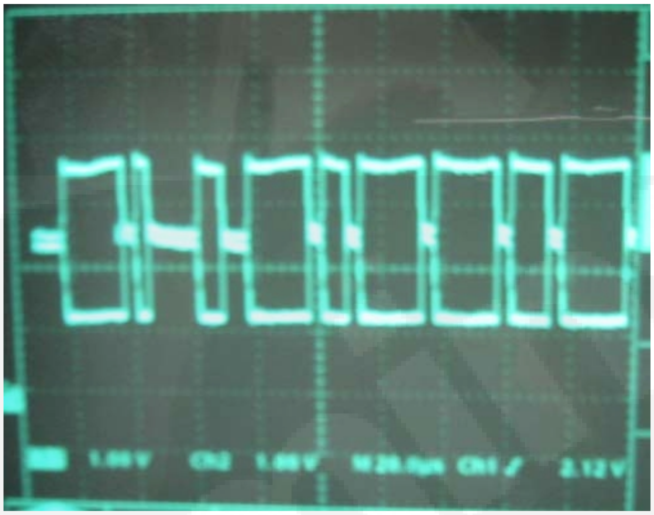

FIGURE 6. CAN DATALINK: GOOD SIGNAL

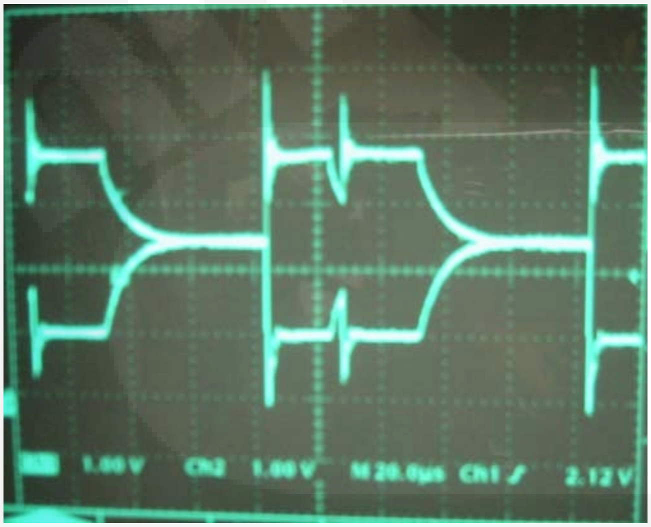

FIGURE 7. CAN DATALINK: BAD SIGNAL

12.2 Connections

The CAN datalink connects to the PCC baseboard via connector J11. J11 pin connections are identified in the table below.

TABLE 12. CONNECTOR J11

Description	Pin
CAN +	J11-20
CAN -	J11-19
CAN Shield	J11-17
Keyswitch -	J11-21

The PCC uses this data to display engine status (sensor, warning and shutdown conditions). The datalink must remain active at all times. If not, the PCC will detect the inactive datalink and display a datalink error shutdown condition.

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13 Fuel Filter Maintenance

13.1 Fuel Filter Canister Removal and Replacement

WARNING: Only authorized and competent personnel who are familiar with the equipment and its operation should carry out maintenance.

WARNING: Before carrying out any maintenance, isolate all supplies to the generator set and any control panels. Render the set inoperative by disconnecting the plant battery.

WARNING: Benzine and lead, found in some diesel oils, have been identified as causing cancer or reproductive toxicity. When checking, draining, or adding diesel, take care not to ingest, breathe the fumes, or come into physical contact with the diesel.

NOTE: Shut down the generator set as described in the Operation and Maintenance Manual supplied with the generator set.

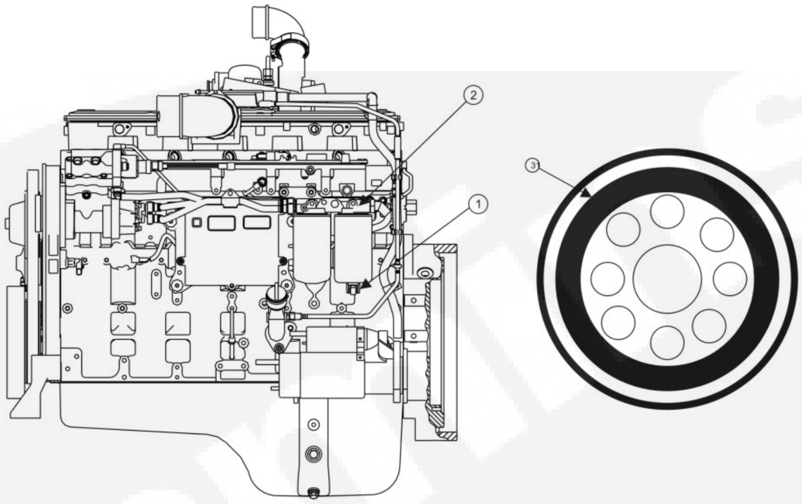
This procedure is to be used with canister-type fuel filters that do not include a separate, removeable, washable filter element. These canisters are disposable

and are to be removed and replaced with a new canister, instead of cleaning the internal element.

The following equipment is required to remove the fuel filter canister.

- Strap wrench
- Container to drain the remaining fuel from the filter into
- Lint free cloth
- Clean fuel
- Disposable gloves

TABLE 13. CANISTER LOCATION AND O-RING SEAL



1	Water sensor connector
2	Filter housing
3	O-ring seal

1. If the canister is fitted with one, disconnect the fuel/water sensor connector.
2. Place the lint free cloth below the fuel canister(s).
3. Using a suitable strap wrench, release the fuel filter canister from the fuel filter housing.
4. Unscrew the fuel filter canister and empty the fuel into a suitable container.

NOTE: Dispose of the fuel filter canister in accordance with local regulations.

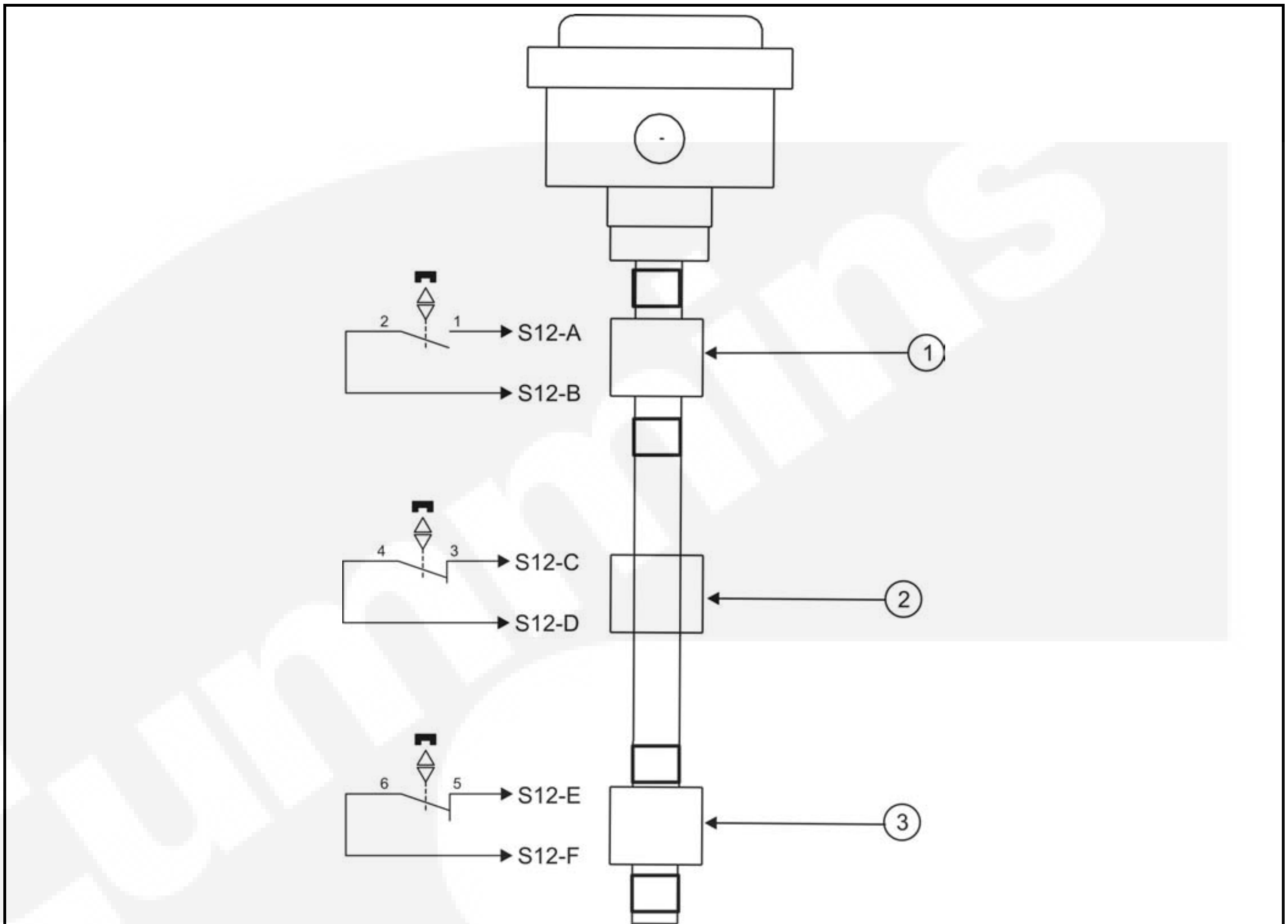
5. Using the lint free cloth, clean the filter housing.
6. Lubricate the O-ring seal on the new fuel filter canister with clean fuel.
7. Fill the new fuel filter canister with clean fuel.

CAUTION: Over-tightening of the fuel filter canister may distort the threads or damage the seal.

8. Screw the fuel filter canister to the filter housing and tighten by hand.
9. If the canister is fitted with one, connect the water sensor connector.
10. Wipe the fuel filter canister, cleaning off any spilled fuel.
11. Remove the lint free cloth from below the fuel filter(s).
12. Start the generator set and check for leaks.

13.2 Testing the Float Switch Assembly

The float switch assembly consists of three switches. Each switch has a pair of color-coded leads connected to a common jack.



No.	Description	No.	Description
1	Switch 1 - High Fuel	3	Switch 3 - Low Fuel Shutdown
2	Switch 2 - Low Fuel		

FIGURE 8. FUEL SWITCH ASSEMBLY

To test the float switches, disconnect the wiring jack from the main wiring harness, and unscrew the assembly from the top of the fuel tank. Test as follows:

1. With an ohmmeter, test for electrical continuity (switch closed) between each pair of terminals in the wiring jacks, while holding the assembly vertical. Replace the assembly if any switch is open. (All the readings should be zero.)
2. Lift each float, in turn, to 1/8 inch (3 mm) below the C-clip stop above it (use a feeler gauge), and test for electrical continuity. Replace the assembly if any switch does not open. (All the readings should be infinity.)

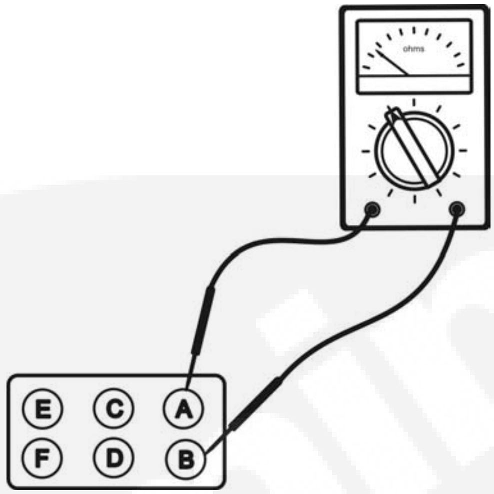


FIGURE 9. FLOAT SWITCH WIRING JACK

- Switch 1 Connect between terminals A&B
- Switch 2 Connect between terminals C&D
- Switch 3 Connect between terminals E&F

3. Use pipe thread sealant when replacing the assembly.
4. Reconnect the wiring jack to the main wiring harness.

14 Air Intake System

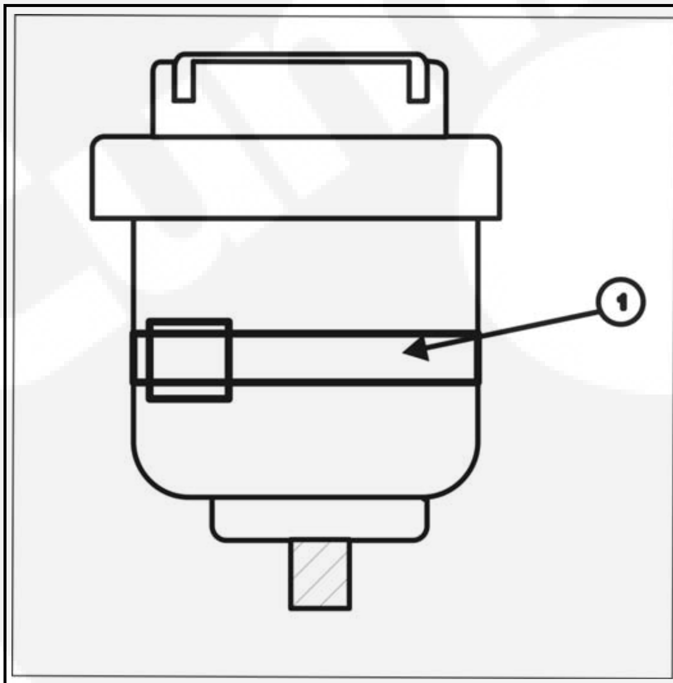
14.1 Air Cleaner Service Indicator

WARNING: Exhaust components become very hot when the generator set is in use and remain hot for a period of time after the generator set has been shut down. These components can cause severe personal injury or death from contact. Allow these components to cool completely before performing any maintenance tasks.

WARNING: Moving parts can cause severe personal injury or death. Use extreme caution around hot manifolds, moving parts, etc.

The Air Cleaner Service Indicator is located either on the the Air Cleaner Assembly or beteween the assembly and the inlet side of the turbocharger.

Check the air cleaner service indicator. If the gauge has crossed the red mark (1), replace the filter.



No	Description
1	Red Mark

FIGURE 10. AIR CLEANER SERVICE INDICATOR

14.2 Air Cleaner

14.2.1 Air Cleaner Element Removal

CAUTION: Holes, loose-end seals, dented sealing surfaces, corrosion of pipes, and other forms of damage render the air cleaner inoperative and require immediate element replacement or engine damage can occur.

NOTE: Cummins Inc. does not recommend cleaning paper-type air cleaner elements. Elements that have been cleaned will clog, and airflow to the engine will be restricted.

1. Before disassembly, wipe dirt from the cover of the air cleaner.
2. Remove the air cleaner housing cover.
   a. Release the locking clip (1).
   b. Rotate the air cleaner housing cover (2) anti-clockwise to remove.
3. Remove the dirty air cleaner element.

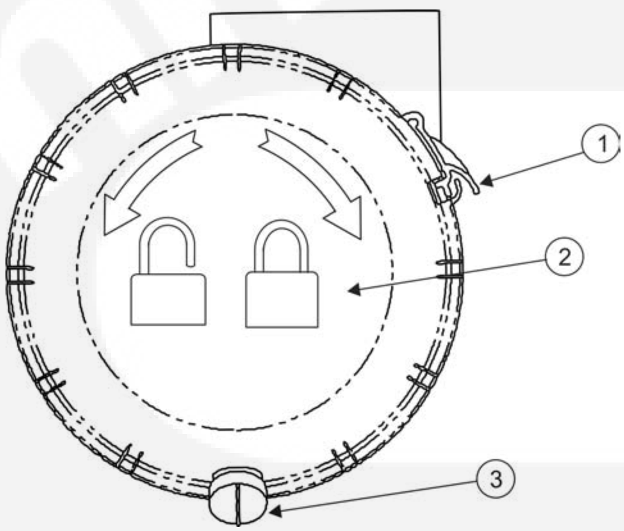


FIGURE 11. AIR CLEANER ASSEMBLY COVER

14.2.2 Air Cleaner Element Installation

1. Clean the interior of the air cleaner housing.
2. Check the rubber breather tube (3) at the bottom of the air filter housing is free of dust and dirt (if fitted).
3. Clean or replace the element.
4. To install the air cleaner housing cover (2) rotate clockwise and secure the locking clip (1).

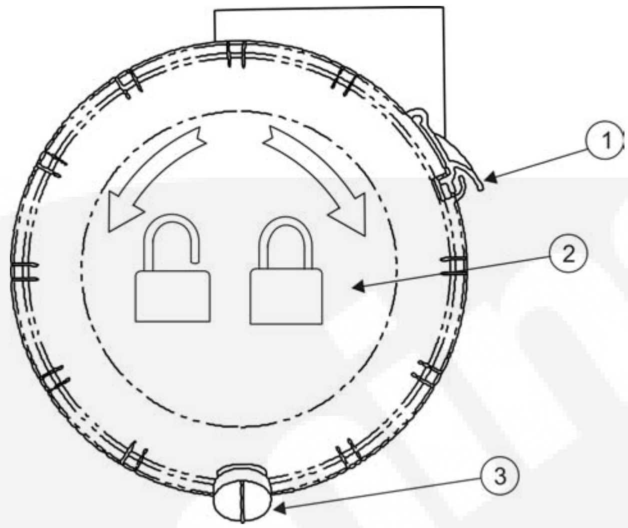


FIGURE 12. AIR CLEANER ASSEMBLY COVER

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15 Heaters

15.1 Auxiliary Electrical Connection

An Auxiliary Electrical Connection (IP44 2P+E plug), is supplied fitted to the pedestal to enable an external electrical supply connection for the alternator heater, coolant heater and battery charger whilst the generator is in standby.

It is the sole responsibility of the customer to provide AC power via (IP44 2P+E power socket) for connection to the auxiliary plug and the means to isolate the AC input; these must comply to local electrical codes and regulations.

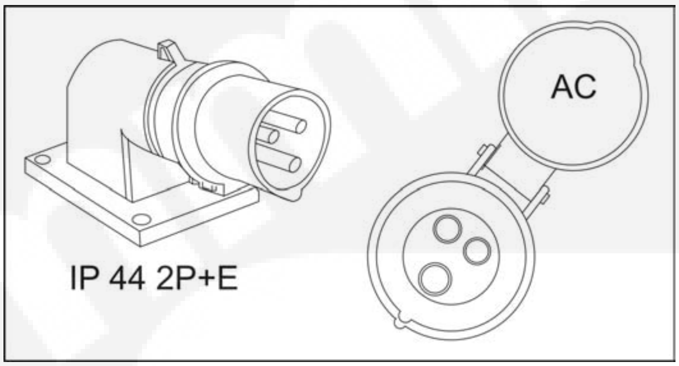


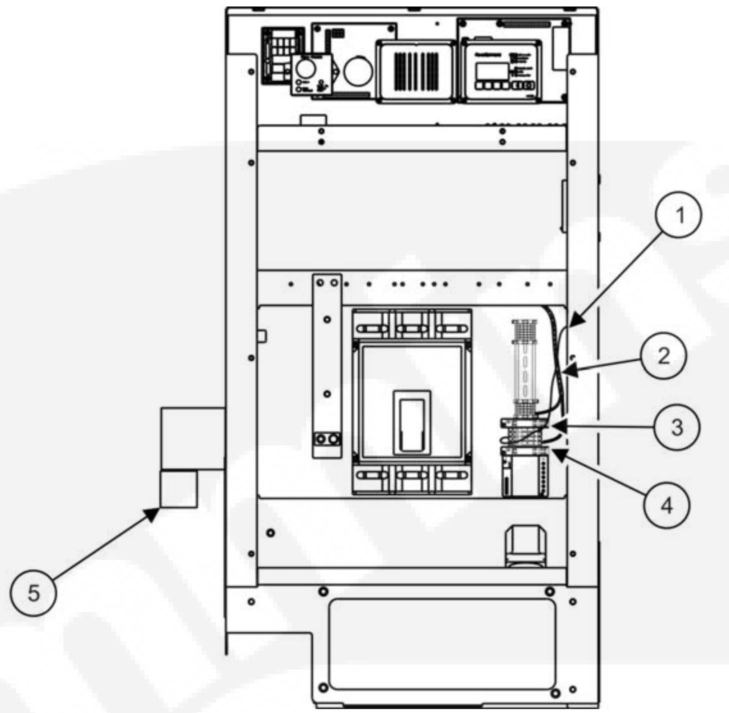
FIGURE 13. AUXILIARY SOCKET

15.2 Alternator Heater Connection

An alternator heater is used to help keep the alternator free of condensation when the generator set is not running. During cool and humid conditions, condensation can form within an alternator, creating flashing and shock hazards.

WARNING: Water or moisture inside an alternator increases the possibility of flashing and electrical shock, which can cause equipment damage and severe personal injury or death. Do not use an alternator which is not dry inside and out.

Alternator heaters are supplied fitted as an option. Connect the external electrical input socket (5) (fitted on the side of the control panel) to a source of power that will be on during the time the engine is not running. Be sure the supply voltage and circuit amperage is correct for the heater element rating.



No.	Description	No.	Description
1	Harness switch	4	Fuse
2	Harness AC	5	External electrical connection socket
3	Jumper terminal		

FIGURE 14. ALTERNATOR HEATER

15.3 Alternator Heater Removal_UC

CAUTION: To prevent accidental or remote starting while working on the generator set, disconnect the negative (–) battery cable at the battery using an insulated wrench or by using the battery isolator switch (if fitted). Failure to do so may cause personal injury or damage to the equipment.

NOTE: This procedure is based on the premise that the heater element is faulty and that the supply voltage and wiring harness are serviceable.

Tools Required

- Wire cutters
- 8mm (5/16 in) Impact socket

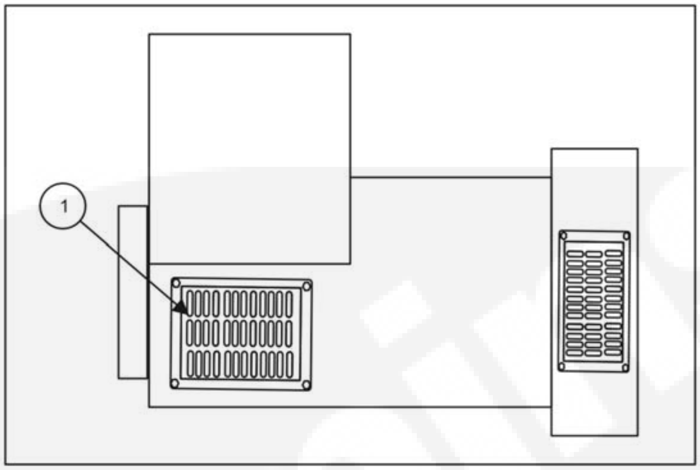


FIGURE 15. AIR INLET GRILL NON-PEDASTAL SIDE

1. Using a 8mm (5/16 in) Impact socket remove the 4 air inlet grill retaining bolts and remove the grill.

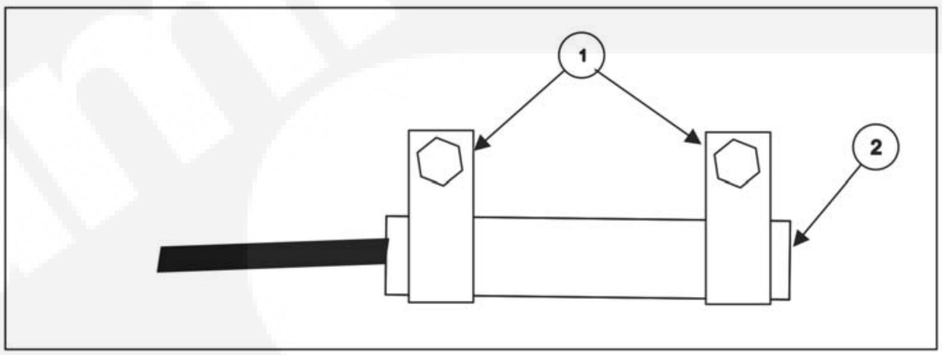


FIGURE 16. ALTERNATOR HEATER

2. Using a 8mm (5/16 in) Impact socket remove the two P-Clips (2) and detach the alternator heater (1) from the alternator base.

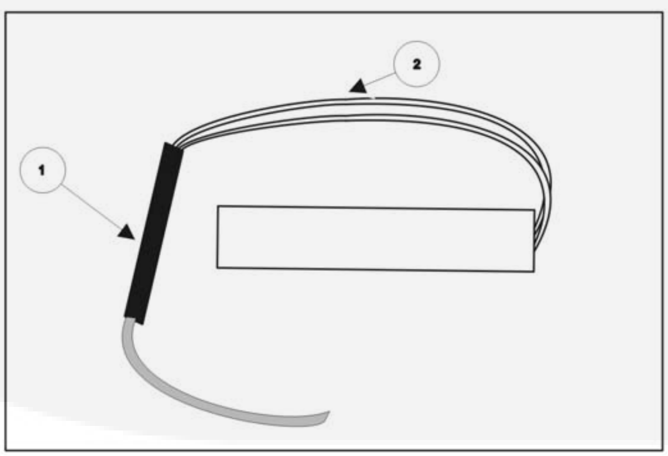


FIGURE 17. ALTERNATOR HEATER WIRING HARNESS

3. Pull back the wiring harness sleeve (1). Using the wire cutters cut the wires (2) and remove the alternator heater.

15.4 Alternator Heater Installation_UC

CAUTION: To prevent accidental or remote starting while working on the generator set, disconnect the negative (–) battery cable at the battery using an insulated wrench or by using the battery isolator switch (if fitted). Failure to do so may cause personal injury or damage to the equipment.

NOTE: This procedure is based on the premise that the heater element was faulty and that the supply voltage and wiring harness are serviceable.

Tools Required

- Wire strippers
- Crimping pliers
- 8mm (5/16 in) Impact socket

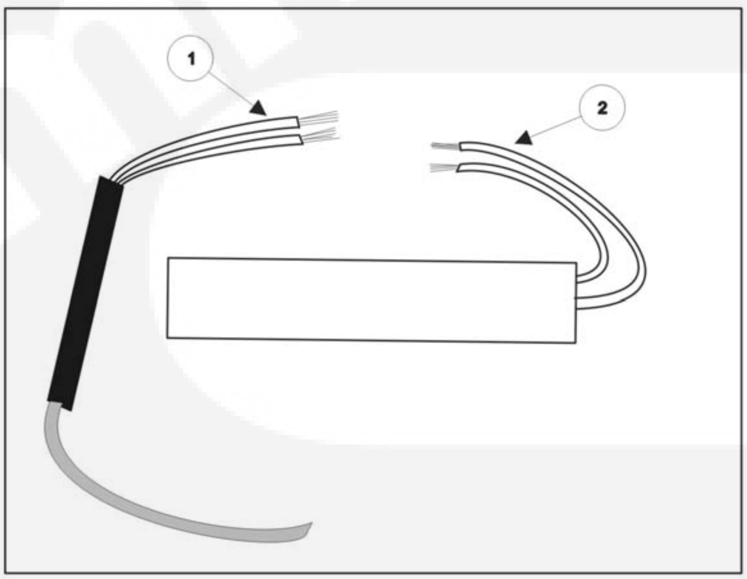


FIGURE 18. WIRING

1. Using the wire strippers remove 5mm (1/4 in) of insulation from the wiring harness (1) and alternator heater wiring (2).

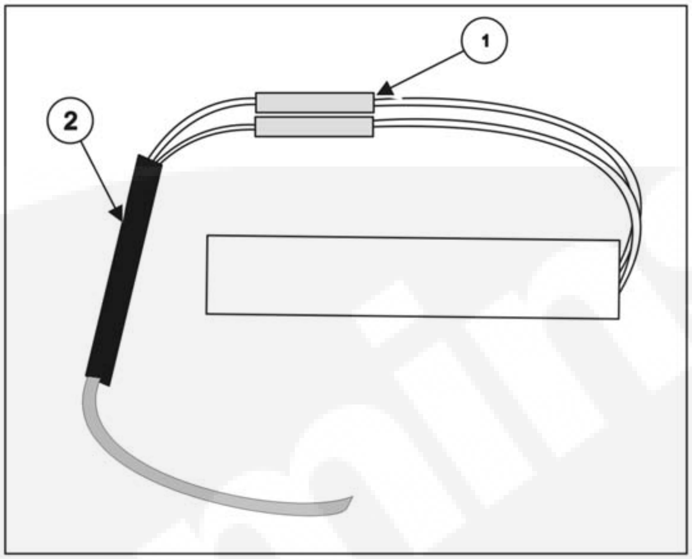


FIGURE 19. CRIMPING

2. Insert the wires into the inline crimp (1), and using the crimping pliers crimp the wires together. Cover the connections and exposed cable with the insulation sleeve (2).

NOTE: **Make sure the wires are fully clamped onto the bare wire and not the insulation.**

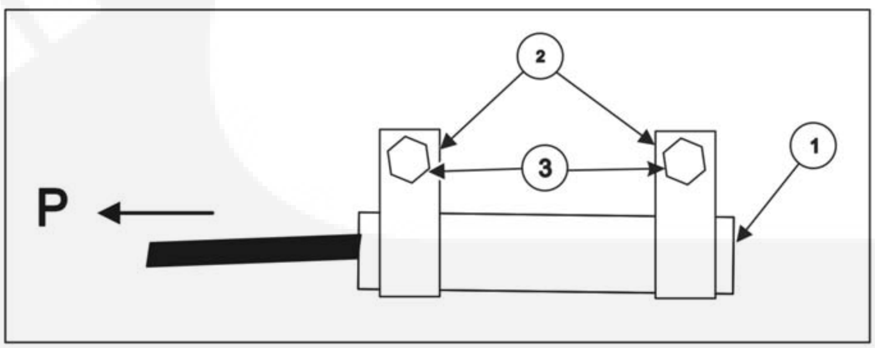


FIGURE 20. ALTERNATOR HEATER

3. Install the Alternator Heater.
   a. Slide the P Clips (2) over the alternator heater (1).
   b. Using the self tapping screws (3) and 8mm (5/16 in) impact socket secure the alternator heater to the base of the generator with the wiring harness facing towards the pedestal (P).

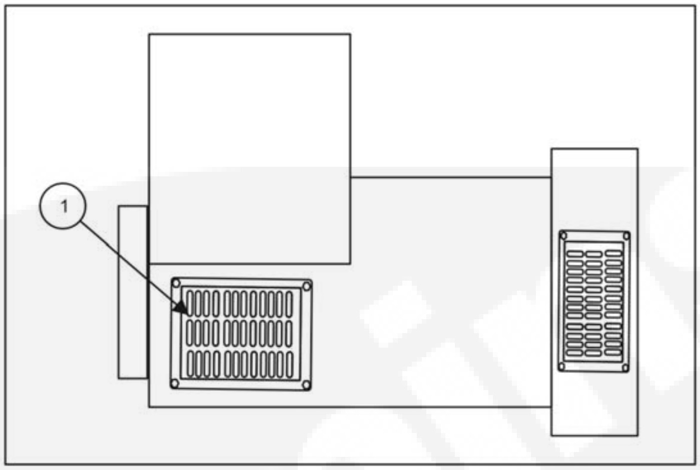


FIGURE 21. AIR INLET GRILL

4. Using a 8mm (5/16 in) impact socket, replace the air inlet grill (1).

15.5 Coolant Heater Removal

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

Tools Required

- Hose Clamps
- 8mm (5/16 in) 13mm (1/2 in) Impact sockets
- Fluid container

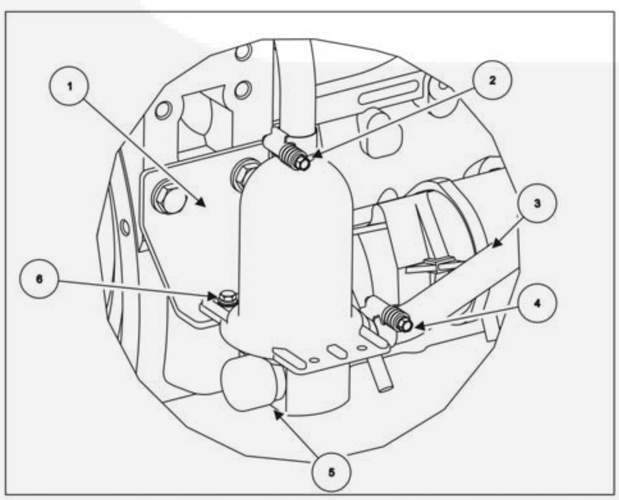


FIGURE 22. COOLANT HEATER

1. Place a suitable fluid container under the coolant heater.
2. Using a suitable hose clamp, clamp the hoses (1) (3).

3. Using a 8mm (5/16 in) impact socket loosen the coolant hose clamps and disconnect the hoses.
4. Disconnect the electrical heater (5).
5. Using a 13mm (1/2 in) impact socket remove the coolant heater mounting bolts (6).
6. Remove the coolant heater.

15.6 Coolant Heater Installation

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

Tools Required

- 8mm (5/16 in) 13mm (1/2 in) Impact sockets
- Torque wrench 0-50 Nm (0-37 ft-lb)

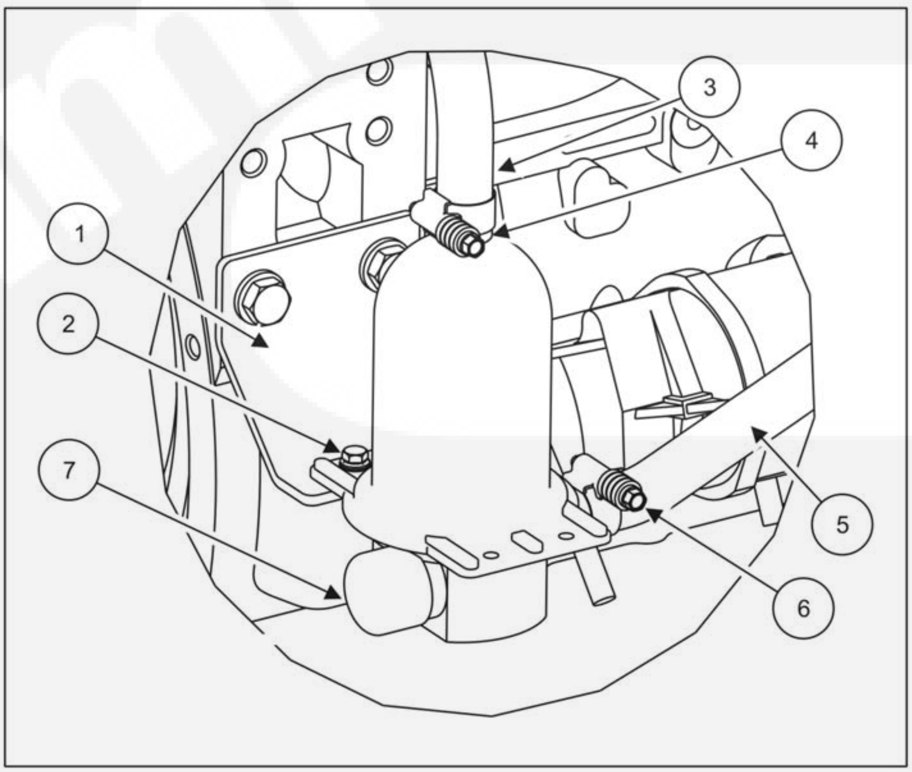


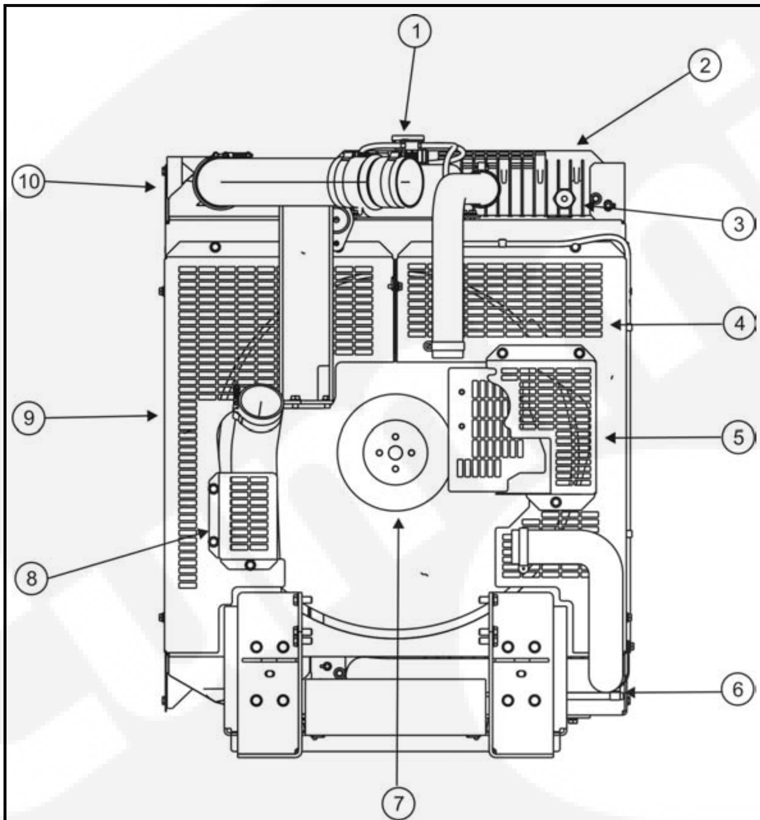
FIGURE 23. COOLANT HEATER

1. Align the coolant heater to the mounting bracket (1).
2. Using a 13mm (1/2 in) impact socket install the coolant heater mounting bolts (2).
3. Connect the coolant hoses (3) (4) and using a 8mm (5/16 in) impact socket tighten the coolant hose clamps (4) (6) to 6 Nm.
4. Reconnect the electrical connector (7).

5. Remove the hose clamps.
6. Remove the fluid container and dispose of any coolant in accordance with local regulations.
7. Clean up any spilt coolant.
8. Check the coolant level and top up as required.
9. Start the generator, check for leaks and that the coolant heater is working correctly.

16 Cooling System

16.1 Cooling System Components



No.	Description	No.	Description
1	Radiator cap	6	Coolant drain
2	Radiator	7	Fan (supplied on engine)
3	Coolant level glass	8	Radiator guard
4	Radiator guard	9	Radiator guard
5	Alternator guard	10	Radiator

FIGURE 24. COOLING SYSTEM FOR QSB7 GENERATOR SET

16.2 Radiator Information

This section provides information on cleaning the radiator and updated information regarding bearings has been provided by our supplier to enable efficient and prolonged life of the equipment.

NOTE: **The following information regarding the correct choice and fitting of hose clamps has also been provided by our supplier to assist and guide the user.**

16.2.1 Hose Clamp Installation

This section provides general installation guidelines for the correct positioning, orientation and torque figures required when fitting hose clamps. Recommended hose and clamp combinations are also included.

16.2.1.1 Choosing the Right Hose Size

The recommended fit for hose to pipe is a 0.5 mm interference fit, i.e. the inner diameter of the hose should be 0.5 mm smaller than the overall diameter of the pipe.

16.2.1.2 Types of Hose Clamps

There are three main types of hose clamps:

- Constant Torque Clamps
- T-Clamps
- Worm Drive Clamps

16.2.1.2.1 Constant Torque Clamps

DIA. RANGE (mm)	BOLT SIZE	PIPE DIA. (mm)	HOSE TYPE	INSTALLATION TORQUE
25.4 – 44.4	3/8”	25.4	EPDM RUBBER	8 Nm
31.7 – 54.1	3/8”	38.1	APT THICK WALL	14 Nm
31.7 – 54.1	3/8”	38.1	EPDM RUBBER	14 Nm
31.7 – 54.1	3/8”	38.1	SILICONE NOMEX	14 Nm
57.1 – 79.5	3/8”	57.1	EPDM RUBBER	14 Nm
57.1 – 79.5	3/8”	57.1	APT THICK WALL	14 Nm
69.8 – 92.2	3/8”	76.2	APT THICK WALL	14 Nm
69.8 – 92.2	3/8”	76.2	SILICONE NOMEX	14 Nm
69.8 – 92.2	3/8”	76.2	EPDM RUBBER	14 Nm
82.5 – 104.9	3/8”	88.9	APT THICK WALL	14 Nm
95.2 – 117.65	3/8”	101.6	APT THICK WALL	14 Nm
95.2 – 117.65	3/8”	101.6	SILICONE NOMEX	14 Nm
95.2 – 117.65	3/8”	101.6	EPDM RUBBER	14 Nm
133.3 – 155.7	3/8”	127	APT THICK WALL	14 Nm

16.2.1.2.2 T-Clamps

DIA. RANGE (mm)	BOLT SIZE	PIPE DIA. (mm)	HOSE TYPE	INSTALLATION TORQUE
43 – 47	M6 X 50	38.1	SILICONE NOMEX	4 Nm
63 – 68	M7 X 60	57.1	EPDM RUBBER	4 Nm
68 – 73	M8 X 80	63.5	EPDM RUBBER	12 Nm
97 -104	M8 X 80	88.9	SILICONE NOMEX	12 Nm
121 – 130	M8 X 80	114.3	EPDM RUBBER	12 Nm
121 – 130	M8 X 80	114.3	SILICONE NOMEX	12 Nm
130 – 140	M8 X 80	127	EPDM RUBBER	12 Nm
130 – 140	M8 X 80	127	SILICONE NOMEX	12 Nm
162 - 174	M10 X 110	152.4	SILICONE NOMEX	30 Nm

16.2.1.2.3 Worm Drive Clamps

DIA. RANGE (mm)	INSTALLATION TORQUE	SOCKET REQUIRED	HOSE TYPE
8 - 16	3 Nm	7 mm	EPDM Rubber
12 - 20	3 Nm	7 mm	EPDM Rubber
16 - 25	4.5 Nm	7 mm	EPDM Rubber
25 - 40	4.5 Nm	7 mm	EPDM Rubber
20 - 32	4.5 Nm	7 mm	EPDM Rubber
32 - 50	4.5 Nm	7 mm	EPDM Rubber
40 - 60	4.5 Nm	7 mm	EPDM Rubber

50 - 70	4.5 Nm	7 mm	EPDM Rubber
60 - 80	4.5 Nm	7 mm	EPDM Rubber
70 - 90	4.5 Nm	7 mm	EPDM Rubber
80 - 100	4.5 Nm	7 mm	EPDM Rubber
90 - 110	4.5 Nm	7 mm	EPDM Rubber
100 - 120	4.5 Nm	7 mm	EPDM Rubber
120 - 140	4.5 Nm	7 mm	EPDM Rubber

16.2.2 Cleaning

16.2.2.1 General Cleaning

The Cleaning Of Radiator Cores Using Pressurized Water Equipment:

NOTE: ***In specific dust laden environments, this procedure should not be used as the initial cleaning operation; it should follow Cleaning - Dust Laden Environments.***

On enclosed generator sets with removable end panel(s), remove the end panel(s) to assit in the cleaning of the radiator.

Inspect the exterior of the radiator for obstructions. During the service life of a radiator, a build up of foreign matter can obstruct the flow of air through the radiator cores, reducing the cooling capability. To ensure the continued efficiency of the radiator, the core will require cleaning.

For thorough cleaning, pressure wash in the opposite direction to the airflow. A suitable proprietary degreasing additive (as recommended by the manufacturer of the pressure washer) should be applied via the pressure washer but this must not contain ammonia as it will corrode the core.

The recommended equipment for cleaning a radiator core is an industrial pressure washer, but it must be used in the correct manner as misuse can reduce the performance of the core. Protect the generator set from any over spray during this procedure.

To be effective, it is recommended that a hot water washer be used.

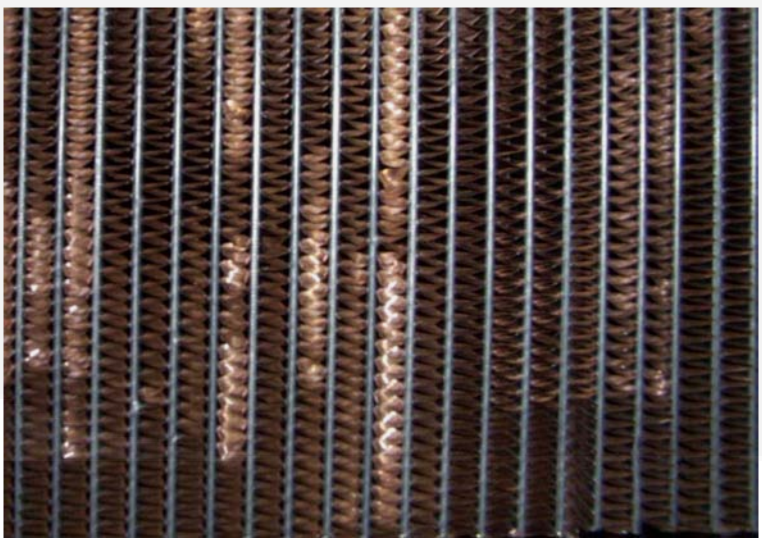


FIGURE 25. FINS DAMAGED BY PRESSURE WASHING AT ACUTE ANGLES TO CORE FACE

CAUTION: *With the pressures involved it is important that the distance between the core face and the nozzle is a minimum of 450 mm (18 inches); any closer and damage may occur.*

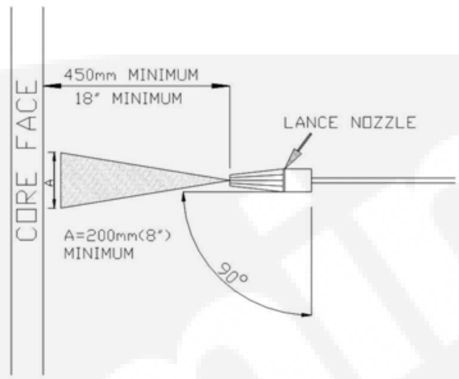


FIGURE 26. PRESSURE WASHER NOZZLE POSITIONING

CAUTION: *Most Industrial pressure washers work at pressures of around 1500 psi to 3000 psi (103 bar to 206 bar). It is very important that, when washing a core in this way, the lance must be kept at a right angle to the core*

CAUTION: *If your pressure washer works above 3000 psi, then the gap between the nozzle and the core face must be increased or fin damage will occur.*

NOTE: ***Always follow pressure washer Manufacturer's Health and Safety Guidelines.***

Replace the end panel(s) where necessary.

16.2.2.2 Dust Laden Environments

Specific Instructions for the Cleaning of Radiator Cores Used in an Environment Subjected to Crushed Aggregate or Ceramic Dust Contamination:

On enclosed generator sets with removable end panel(s), remove the end panel(s) to assit in the cleaning of the radiator.

Inspect the exterior of the radiator for obstructions. During the service life of a radiator a build up of foreign matter can obstruct the flow of air through the radiator cores, reducing the cooling capability. To continue the efficiency of the radiator the core will require cleaning.

Unless the radiator can be dismantled and the core treated in a professional caustic immersion cleaning system, the radiator should not be “wet” cleaned. This is because of the tendency of this type of contamination to coalesce and become extremely difficult to remove.

The correct procedure is to regularly blow through the entire core area with low pressure compressed air (against the direction of cooling airflow). It is very important to ensure that resultant debris blown from the core is subsequently removed and disposed of before engine start-up. An industrial vacuum cleaner will achieve this requirement. In most installations it will necessary to remove cowls and guarding.

To prevent damage to fins and resultant loss of cooling, it is important to ensure that the air gun used is maintained at right angles to the core face.

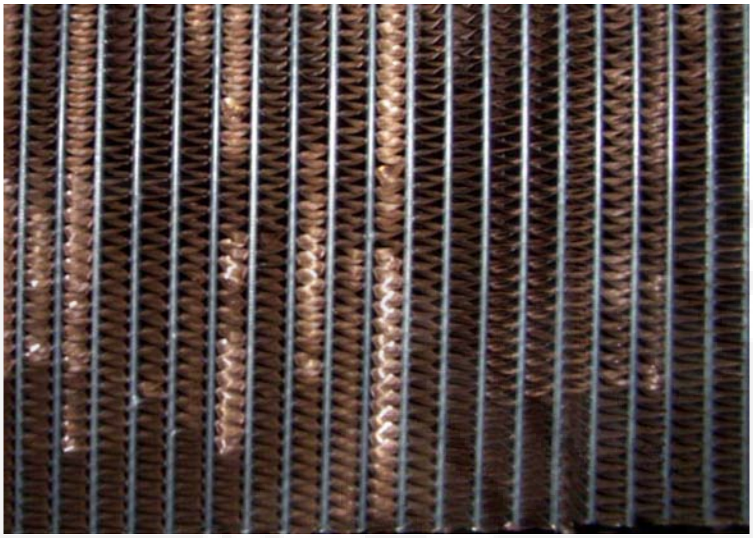


FIGURE 27. FINS DAMAGED BY COMPRESSED AIR AT ACUTE ANGLES TO CORE FACE

Immediately after this procedure has been effectively carried out with only the lightest of dust remaining, if deemed essential, it may be followed by cleaning the radiator cores using pressurized water equipment.

Replace the end panel(s) where necessary.

CAUTION: It is vitally important that the core is thoroughly dried before start-up.

16.2.2.3 Enclosed Set Endpanel Removal

WARNING: The failure to use suitable equipment when moving components can result in severe personal injury or death. To complete the installation, suitable equipment for performing these tasks must be used in accordance with the local guidelines and legislation.

The following tools and equipment are required to remove the endpanel.

- 10mm (13/32 in) and 13mm (1/2 in) Wrenches
- 13mm (1/2 in) Impact socket
- Air ratchet wrench or 12V/18V cordless drill
- Ladder

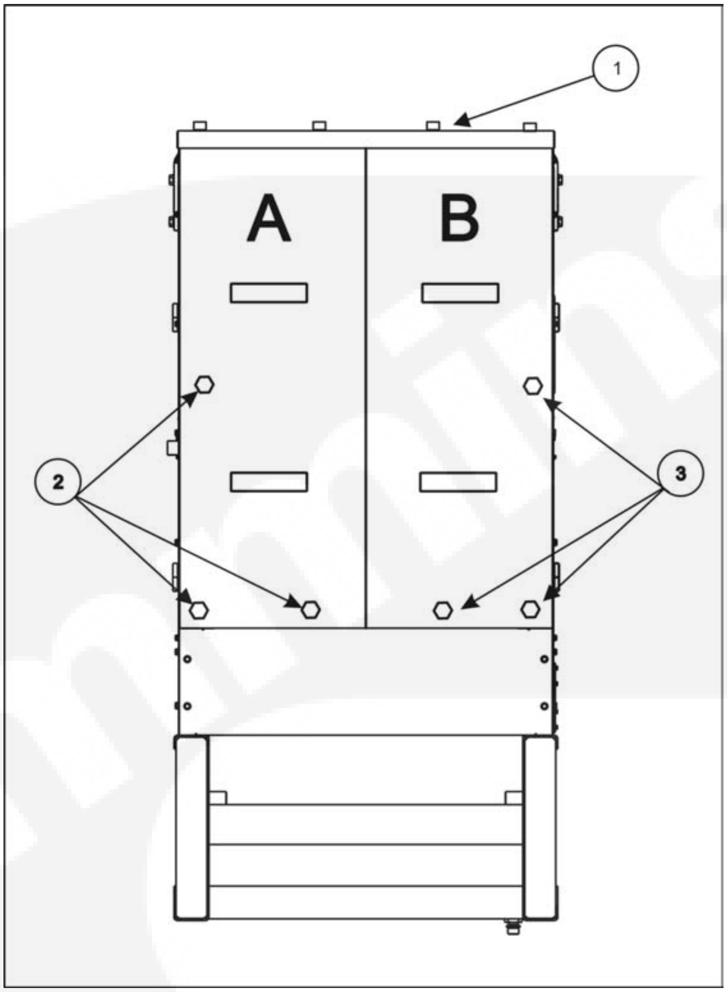


FIGURE 28. ENCLOSURE END PANEL

1. Using a 13mm (1/2 in) socket, remove the 4 bolts from the top panel (1).
2. Using a 13mm (1/2 in) socket, remove the remaining 3 panel A retaining bolts (2).
3. Using the handles carefully remove the panel and place to one side.
4. Using a 13mm (1/2 in) socket, remove the remaining 3 panel B retaining bolts(3).
5. Using the handles carefully remove the panel and place to one side.

16.2.2.4 Enclosed Set End Panel Installation

WARNING: The failure to use suitable equipment when moving components can result in severe personal injury or death. To complete the installation, suitable equipment for performing these tasks must be used in accordance with the local guidelines and legislation.

The following tools and equipment are required to install the end panel.

- 13mm (1/2 in) Wrench
- 13mm (1/2 in) Impact socket
- Air ratchet wrench or 12V/18V cordless drill
- Hoist

- Ladder
- Dowel bolt

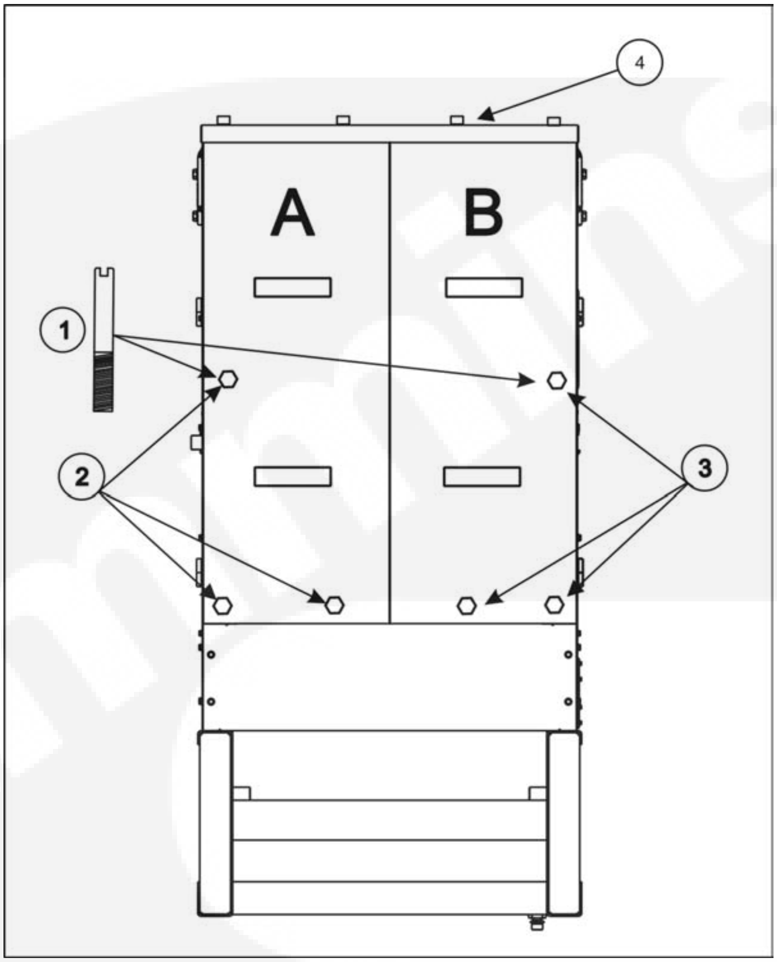


FIGURE 29. ENCLOSURE END PANEL

1. Insert a dowel bolt (1) to support the end panels while installing.
2. Using the handles insert panel B into the enclosure.
3. Using a 13mm (1/2 in) impact socket loosely install 1 of the retaining bolts (3).
4. Remove the dowel bolt (1), loosely install the remaining retaining bolts (3).
5. Using the handles insert panel A into the enclosure.
6. Using a 13mm (1/2 in) impact socket loosly install 1 of the retaining bolts (2).
7. Remove the dowel bolt (1), loosly install the remaing retaining bolts (2).
8. Using a 13mm (1/2 in) impact socket loosely install the 4 top panel (4) retaining bolts.
9. Fully tighten all the retaining bolts.

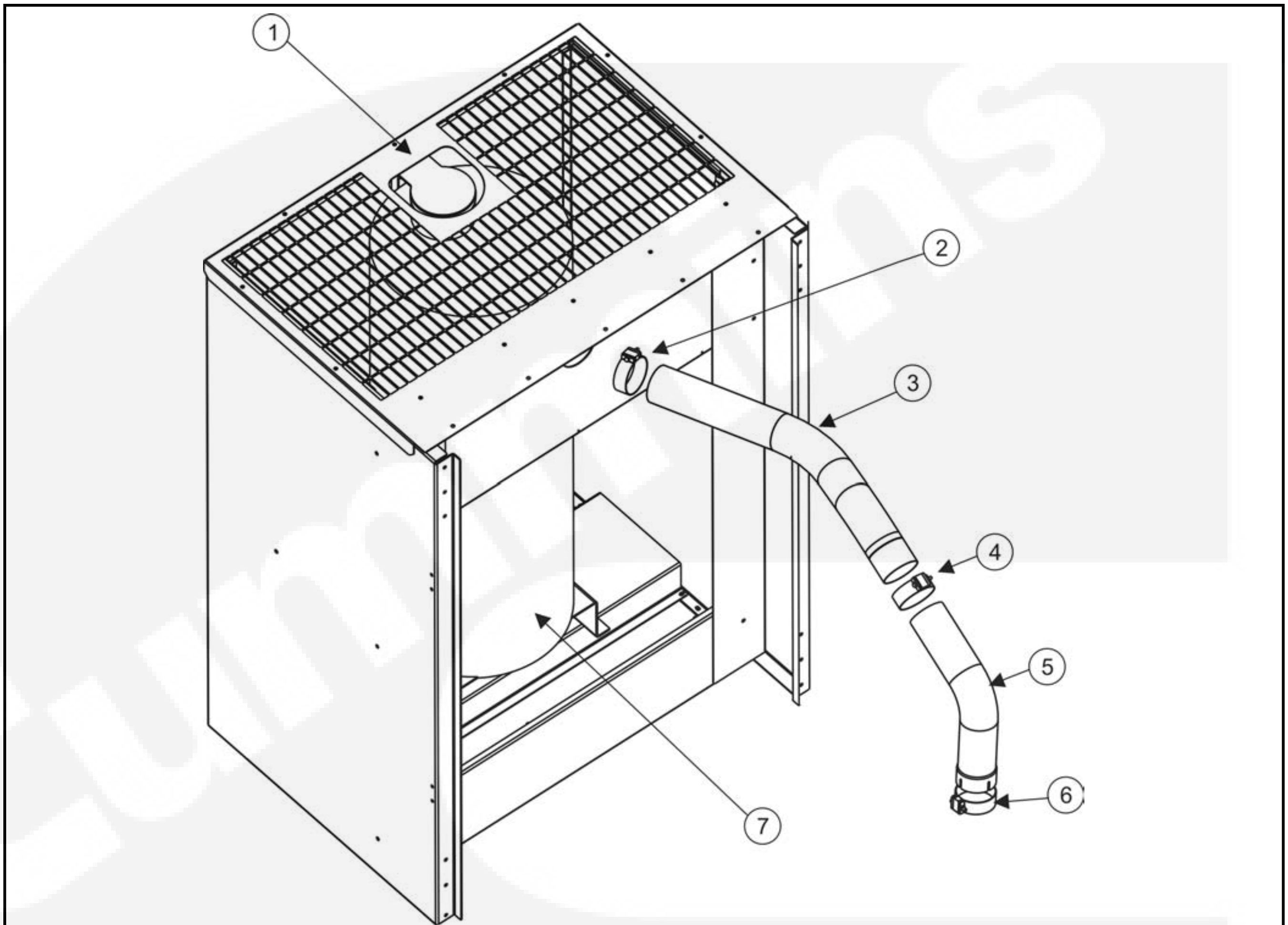
17 Exhaust System

17.1 Overview

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

The exhaust system is comprised of up to three active components - the turbocharger (if equipped), the oxygen sensor, and the muffler/catalytic converter (if equipped) - in addition to manifold(s) and piping connecting the components.

17.2 Enclosed Exhaust System



No.	Description	No.	Description
1	Rain cap	5	Elbow
2	Clamp	6	Clamp
3	Flexible pipe	7	Muffler
4	Clamp		

FIGURE 30. EXHAUST SYSTEM

17.3 Enclosed Set Muffler Removal

WARNING: ***Dropping the muffler assembly can cause severe personal injury or death. The muffler assembly is heavy, with an approximate dry weight of 54 Kg (119 pounds). Use a hoist of sufficient capacity for lifting and moving the muffler assembly to the desired position.***

WARNING: ***Exhaust pipes and mufflers are very hot and can cause severe personal injury or death from direct contact or from fire hazard. Allow the muffler to cool down before removing.***

WARNING: The failure to use suitable equipment when moving components can result in severe personal injury or death. To complete the installation, suitable equipment for performing these tasks must be used in accordance with the local guidelines and legislation.

The following tools and equipment are required to remove the muffler.

- Lifting strap with shackle capable of lifting 54kg (119 lbs)
- Torque wrench, minimum value 0-100 Nm (0-74 ft-lb)
- 10mm (13/32 in) and 13mm (1/2 in) Wrenches
- 10mm (13/32 in) and 13mm (1/2 in) Impact sockets
- Air ratchet wrench or 12V/18V cordless drill
- Hoist
- Ladder

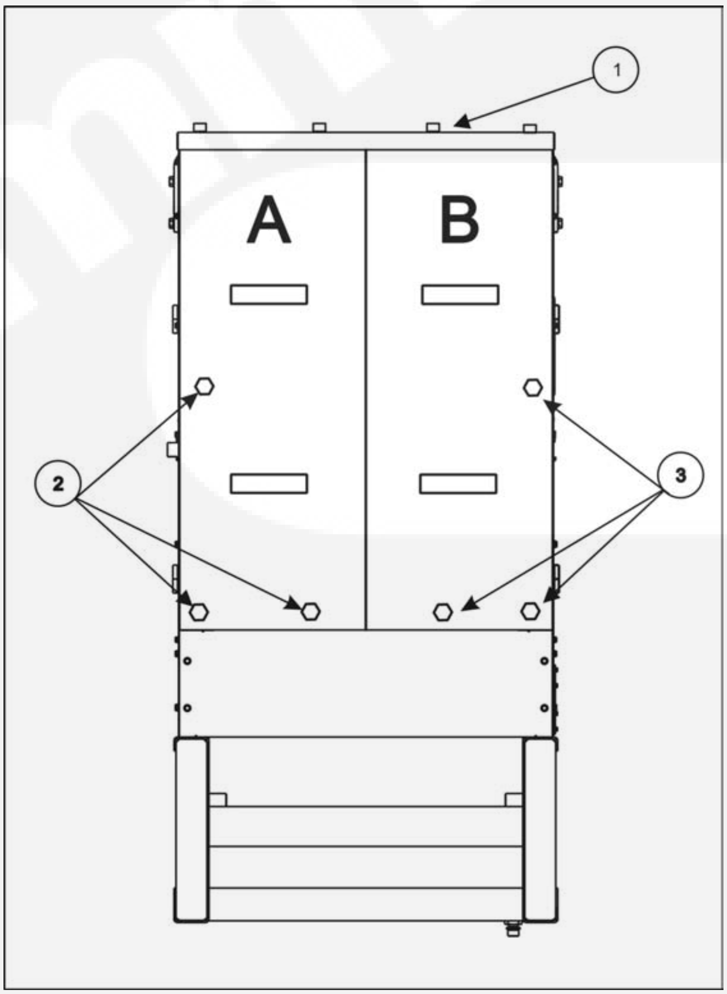
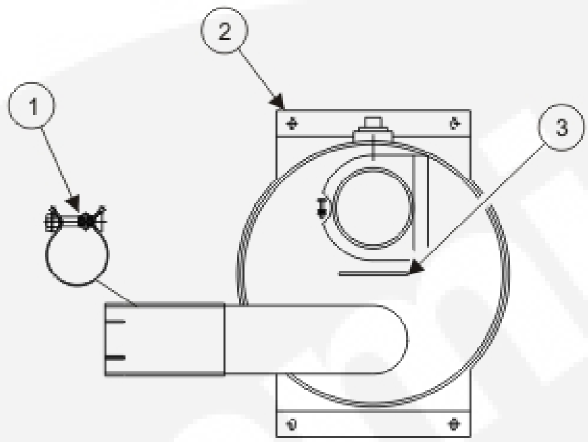


FIGURE 31. ENCLOSURE END PANEL

1. Using a 13mm (1/2 in) impact socket, remove the 4 bolts from the top panel (1).
2. Using a 13mm (1/2 in) impact socket, remove the remaining 3 panel A retaining bolts (2).
3. Using the handles carefully remove the panel and place to one side.

4. Using a 13mm (1/2 in) impact socket, remove the remaining 3 panel B retaining bolts(3).
5. Using the handles carefully remove the panel and place to one side.

CAUTION: The exhaust flange connection between the muffler and the exhaust pipe may be corroded and may need to be heated to release the pipe.



6. Using a 10mm (13/32 in) wrench, remove the clamp (1).
7. Using a 13mm (1/2 in) impact socket, remove the 4 mounting bolts (2).
8. Using a suitable hoist and lifting sling attached to the bracket (3), lift the muffler just clear of the enclosure floor.
9. With the aid of another person, remove the muffler from the enclosure.

17.4 Enclosed Set Muffler Installation

WARNING: Dropping the muffler assembly can cause severe personal injury or death. The muffler assembly is heavy, with an approximate dry weight of 54 Kg (119 pounds). Use a hoist of sufficient capacity for lifting and moving the muffler assembly to the desired position.

WARNING: The failure to use suitable equipment when moving components can result in severe personal injury or death. To complete the installation, suitable equipment for performing these tasks must be used in accordance with the local guidelines and legislation.

The following tools and equipment are required to install the muffler assembly.

- Lifting strap with shackle capable of lifting 54kg (119 lbs)
- Torque wrench, minimum value 0-100 Nm (0-74 ft-lb)
- 10mm (13/32 in) and 13mm (1/2 in) Wrenches
- 10mm (13/32 in) and 13mm (1/2 in) Impact sockets
- Air ratchet wrench or 12V/18V cordless drill
- Hoist
- Ladder
- Dowel bolt

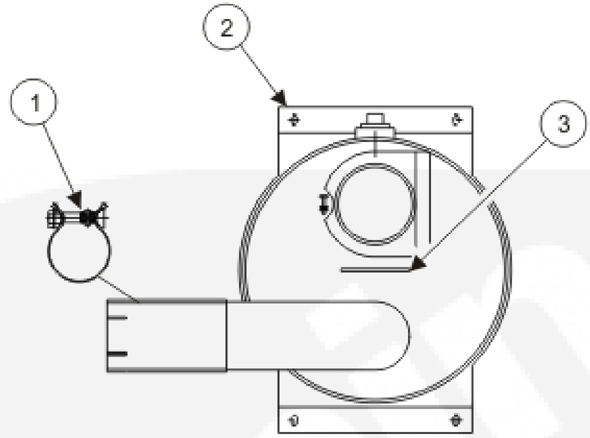


FIGURE 32. MUFFLER (TOP VIEW)

1. Using a suitable hoist and lifting sling attached to the bracket (3), lift the muffler so it just clears the enclosure floor.
2. With the aid of another person, install the muffler into the enclosure.
3. Connect the muffler to the exhaust pipe. Do not tighten the clamp at this time.
4. Align the muffler with the four mounting points.
5. Using a 13mm (1/2 in) impact socket, install the 4 mounting bolts (2).
6. Using a 10mm (13/32 in) wrench, fully tighten the clamp (1).

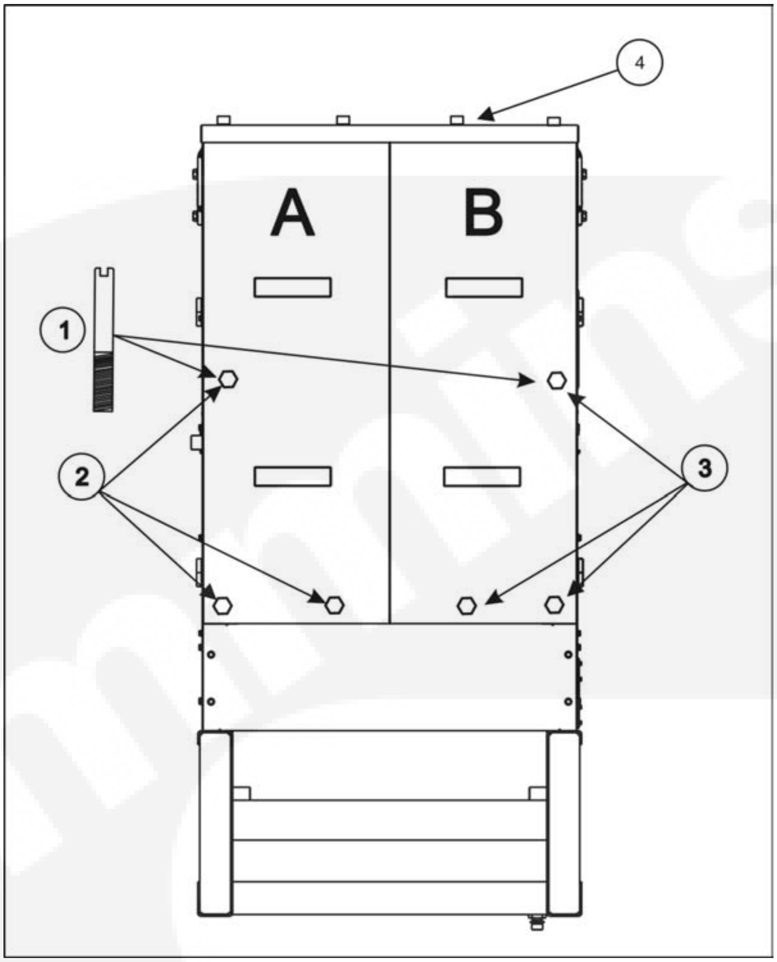


FIGURE 33. ENCLOSURE END PANEL

7. Insert a dowel bolt (1) to support the end panels while installing.
8. Using the handles insert panel B into the enclosure.
9. Using a 13mm (1/2 in) impact socket loosely install 1 of the retaining bolts (3).
10. Remove the dowel bolt (1), loosely install the remaining retaining bolts (3).
11. Using the handles insert panel A into the enclosure.
12. Using a 13mm (1/2 in) impact socket loosly install 1 of the retaining bolts (2).
13. Remove the dowel bolt (1), loosly install the remaing retaining bolts (2).
14. Using a 13mm (1/2 in) impact socket loosely install the 4 top panel (4) retaining bolts.
15. Fully tighten all the retaining bolts.

18 Manufacturing Facilities

NORTH AMERICA	EMEA, CIS	ASIA PACIFIC
Cummins Power Generation Limited 1400 73rd Ave. NE Minneapolis, MN 55432 USA	Cummins Power Generation Limited Columbus Avenue Manston Park Manston, Ramsgate Kent CT12 5BF United Kingdom	Cummins Power Generation Limited 10 Toh Guan Road #07-01 TT International Tradepark Singapore 608838
Phone +1 763 574 5000 Toll Free +1 800 888 6626 Fax +1 763 574 5298	Phone +44 1843 255000 Fax +44 1843 255902	Phone +65 6417 2388 Fax +65 6417 2399
BRAZIL	**CHINA**	**INDIA**
Rua Jati, 310, Cumbica Guarulhos, SP 07180-900 Brazil	Cummins Power Generation 2 Rongchang East Street, Beijing Economic – Technological Development Area Beijing 100176, P.R.China	35A/1/2, Erandawana Pune 411 038 India
Phone +55 11 2186 4195 Fax +55 11 2186 4729	Phone +86 10 5902 3000 Fax +86 10 5902 3199	Phone +91 020 6602 7525 Fax +91 020 6602 8090
LATIN AMERICA	**MEXICO**	
3350 Southwest 148th Ave. Suite 205 Miramar, FL 33027 USA	Eje 122 No. 200 Zona Industrial San Luis Potosi, S.L.P. 78395 Mexico	
Phone +1 954 431 551 Fax +1 954 433 5797	Phone +52 444 870 6700 Fax +52 444 824 0082	

18.1 How to Obtain Service

When a product requires servicing, contact your nearest Cummins Power Generation distributor. To locate your local Cummins Power Generation distributor, refer to **www.cumminspower.com** and select Distributor Locator. When contacting your distributor, always supply the complete model, specification, and serial number as shown on the nameplate.

18.1.1 Locating Your Distributor

In North America

Telephone +1 800 888 6626 (this is an automated service for touch-tone phones only) to contact the nearest Cummins Power Generation distributor in the United States or Canada. By selecting Option 1 (press 1), you will be automatically connected to the distributor nearest you.

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

GENERATORS – ELECTRIC or

ENGINES – GASOLINE OR DIESEL

If you have difficulty arranging service or resolving an issue, please contact the Service Manager at the nearest Cummins Power Generation distributor for assistance.

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

Outside North America

If you are outside North America, telephone Cummins Power Generation at +1 763 574 5000 from 7:30 am to 4:00 pm, Central Standard Time, Monday through Friday, or fax +1 763 528 7229.

18.1.2 Fuel Information Needed for Service Issue

When servicing is needed on a failed fuel tank, the following questions must be answered and conveyed via the submission of a Service Issue in the Issues Tracking System (ITS).

1. Is there an actual confirmed leak?
    - Has the rupture basin alarm gone off?
    - What Fault Code(s) are present?
    - Is the sensor functioning properly?
    - Is there visible fuel in the basin or outside the tank (i.e. is there an EPA concern)?
    - If so, what is the leak rate?
    - Is the fluid fuel and NOT water?
    - What is the level of the fuel, in inches, in the tank and basin? A dipstick may be required to obtain an accurate reading.
    - Can the leak locale be identified?

WARNING: Do not exceed 2 psig when testing a tank or basin, excessive pressurization may pose a hazard. There must be no fuel or other liquid in the tank or basin during pressure testing.

    - Has the tank been previously repaired?
    - Is there evidence of physical damage that may be contributing to the leak?
    - Pictures may convey a great deal of information and should be considered.
2. What are the CPG and manufacturer's details associated with the tank? Include the following in the Issue:
    - CPG part number.
    - Manufacturer's part number, model, serial number and date of manufacture.
3. What time frame is required for the needed repair or replacement (i.e. how sensitive of an issue is this with the client and do they have any flexibility in the repair timing)?
    - If replacement, has there been an order placed for a new tank?
    - If ordered, is it categorized as machine down?
    - If not, then please update the order accordingly.
    - If an order has been placed, the Issue is to reflect this data (order number) as well.

18.1.2.1 Helpful Information to Aid in Obtaining Information Needed For Fuel Tank Service Issues

WARNING: Do not exceed 2 psig when testing a tank or basin, excessive pressurization may pose a hazard. There must be no fuel or other liquid in the tank or basin during pressure testing.

To aid in identifying/isolating the leak or obtaining some of the information needed for Fuel Tank Service Issues:

1. Seal all penetrations/fittings with plugs except for one.
2. For the remaining penetration, fit up a regulated pressure source with a calibrated pressure gage and a pressure relief valve (set to no more than 2.5 psig).
3. Pressurize the tank or basin to 2 psig and observe for the following:
   - For secondary tank (basin) work, spray all exterior weld seams with a soap water solution. Observe the pressure gage for no change in a 30 minute period and visually observe the exterior seams for bubbling. Results are to be conveyed in the Issue details.
   - For the primary fuel tank, spray all exterior weld seams with a soap water solution. Observe the pressure gage for no change in a 30 minute period and visually inspect the interior of the basin to the maximum extent possible. Results are to be conveyed in the Issue details.

NOTE: For further questions or concerns regarding the information stated above, please contact (in the following order):

1. Your local Service Manager
2. DFSE-Counterpart
3. The Cummins Distributor Technical Support Line (1-812-377-6517)

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Appendix A. Customer Connections

Table of Contents

The drawings included in this section are representative. For current complete information, refer to the drawing package that was shipped with the unit.

A.2 Customer Connections with PowerCommand 1.2 Control

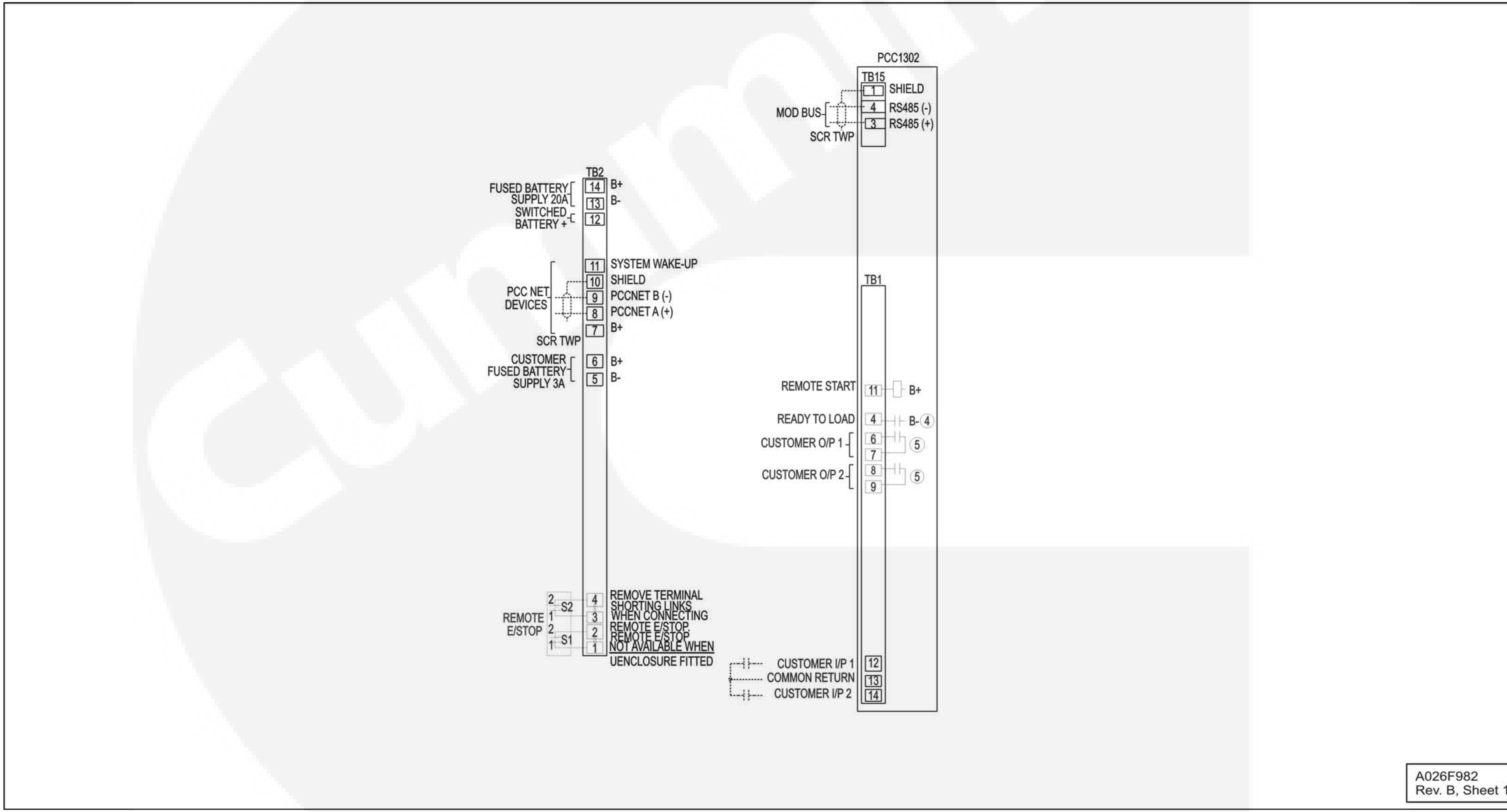


FIGURE 34. CUSTOMER CONNECTIONS WITH POWERCOMMAND 1.2 CONTROL

A.3 Customer Connections with PowerCommand 3.3 Control

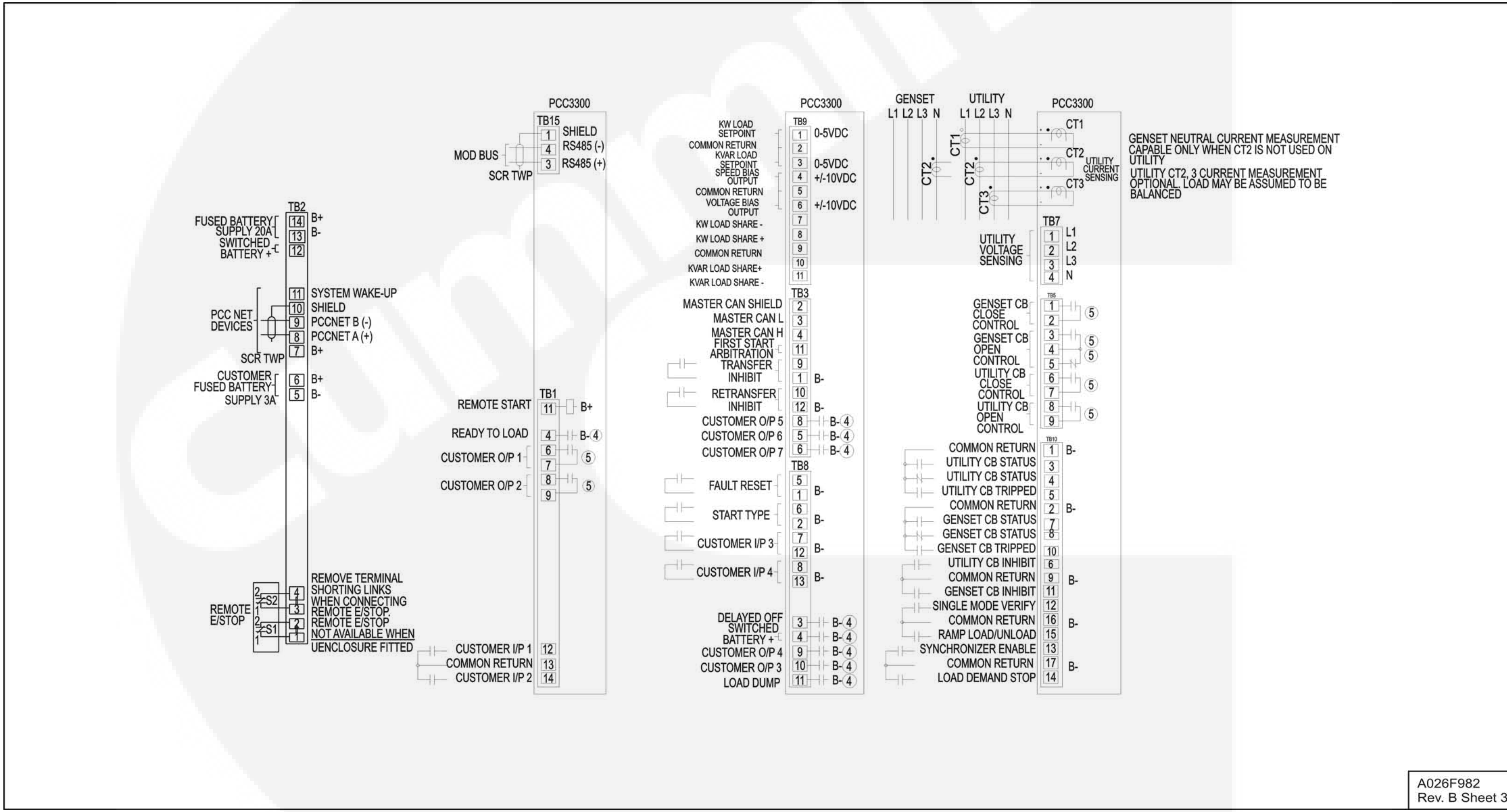


FIGURE 35. CUSTOMER CONNECTIONS WITH POWERCOMMAND 3.3 CONTROL

A.4 Skid Mounted Ground Connection

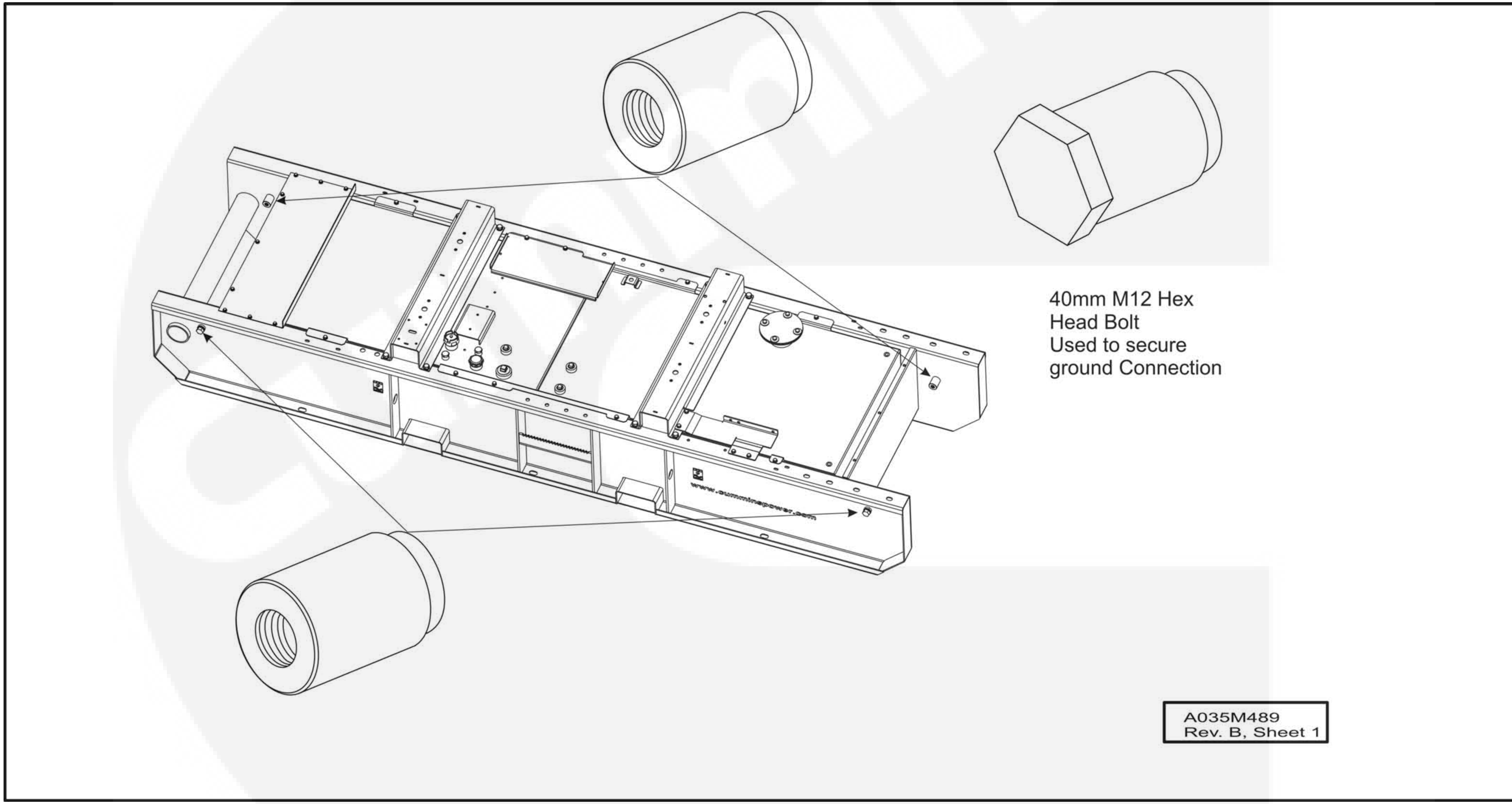


FIGURE 36. GROUND CONNECTIONS

A.5 Power Receptacle Connections

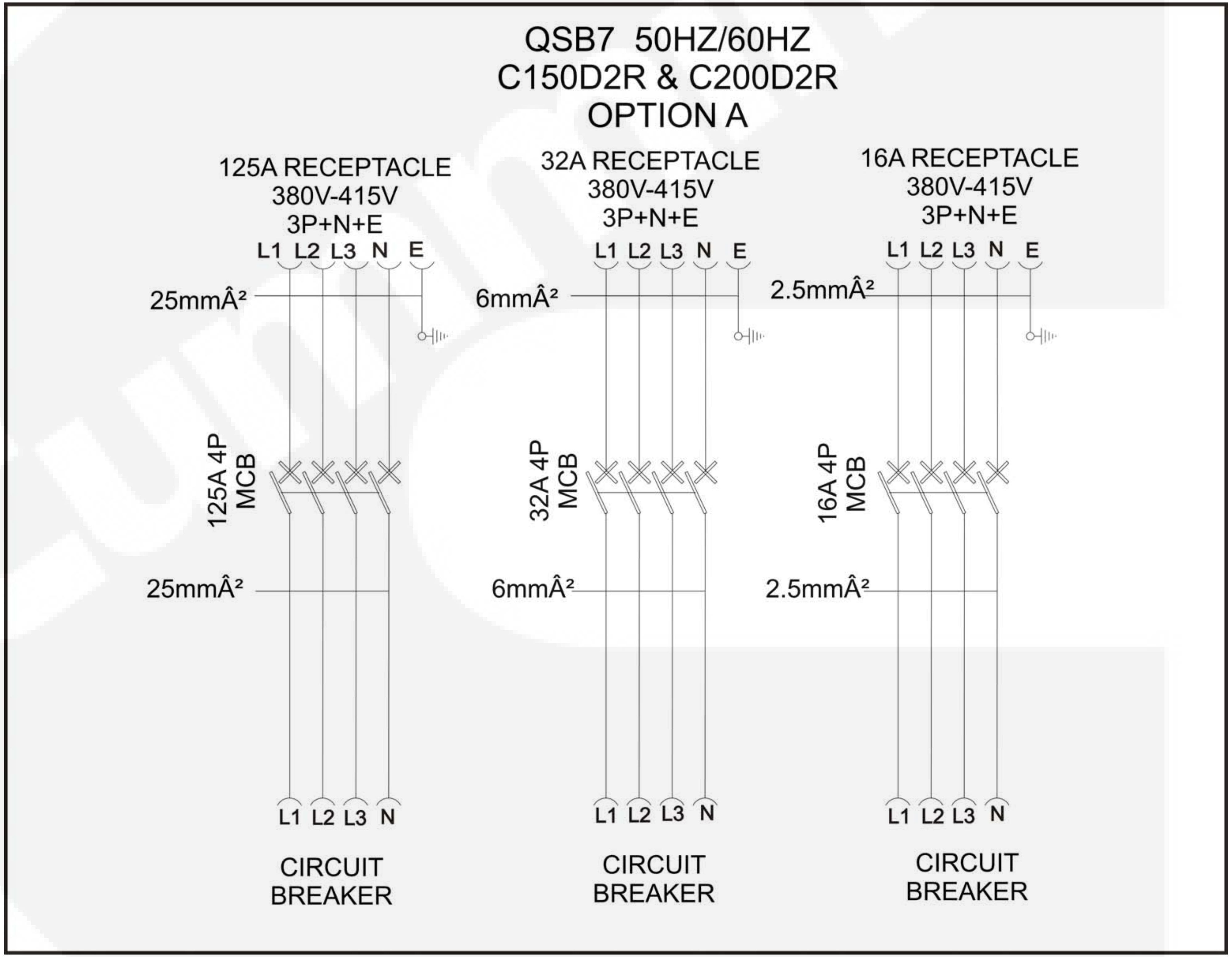


FIGURE 37. POWER RECEPTACLE CONNECTIONS OPTION A

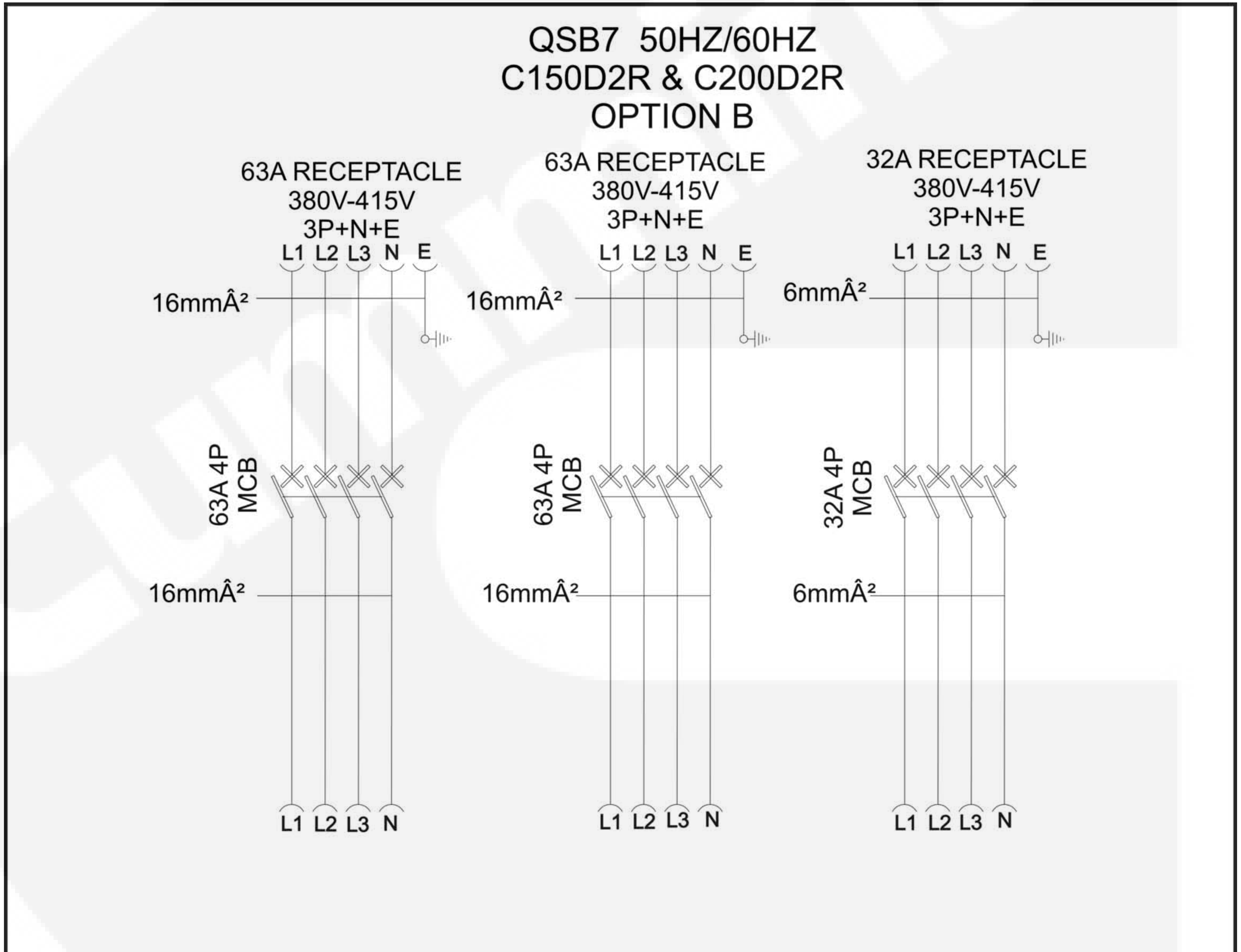
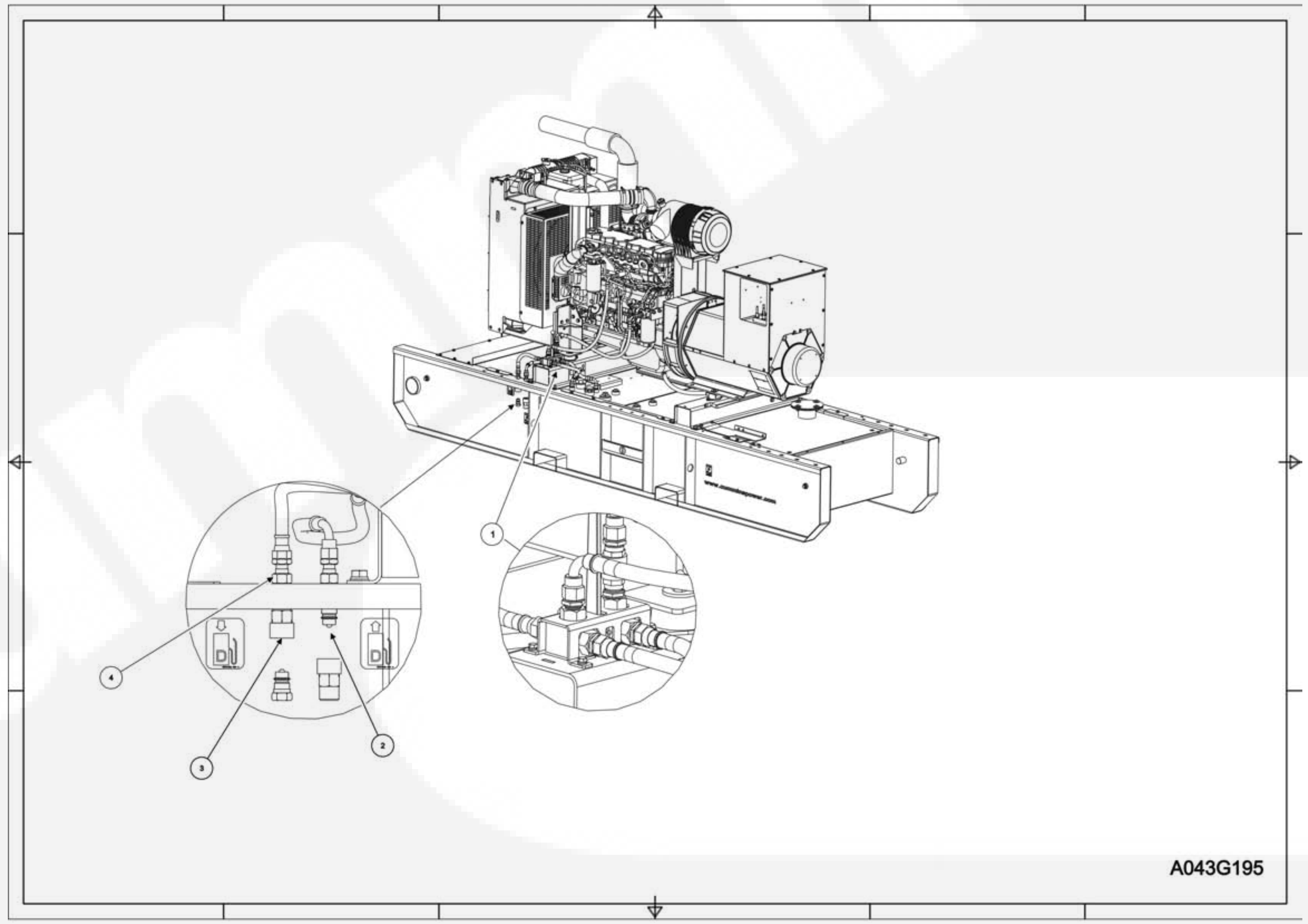


FIGURE 38. POWER RECEPTACLE CONNECTIONS OPTION B

A.6 External Fuel Connection



No	Description	No	Description
1	Three way valve	3	Fuel Return
2	Fuel Inlet	4	Coupling,7/8" BSP Flat Faced Q/R Female

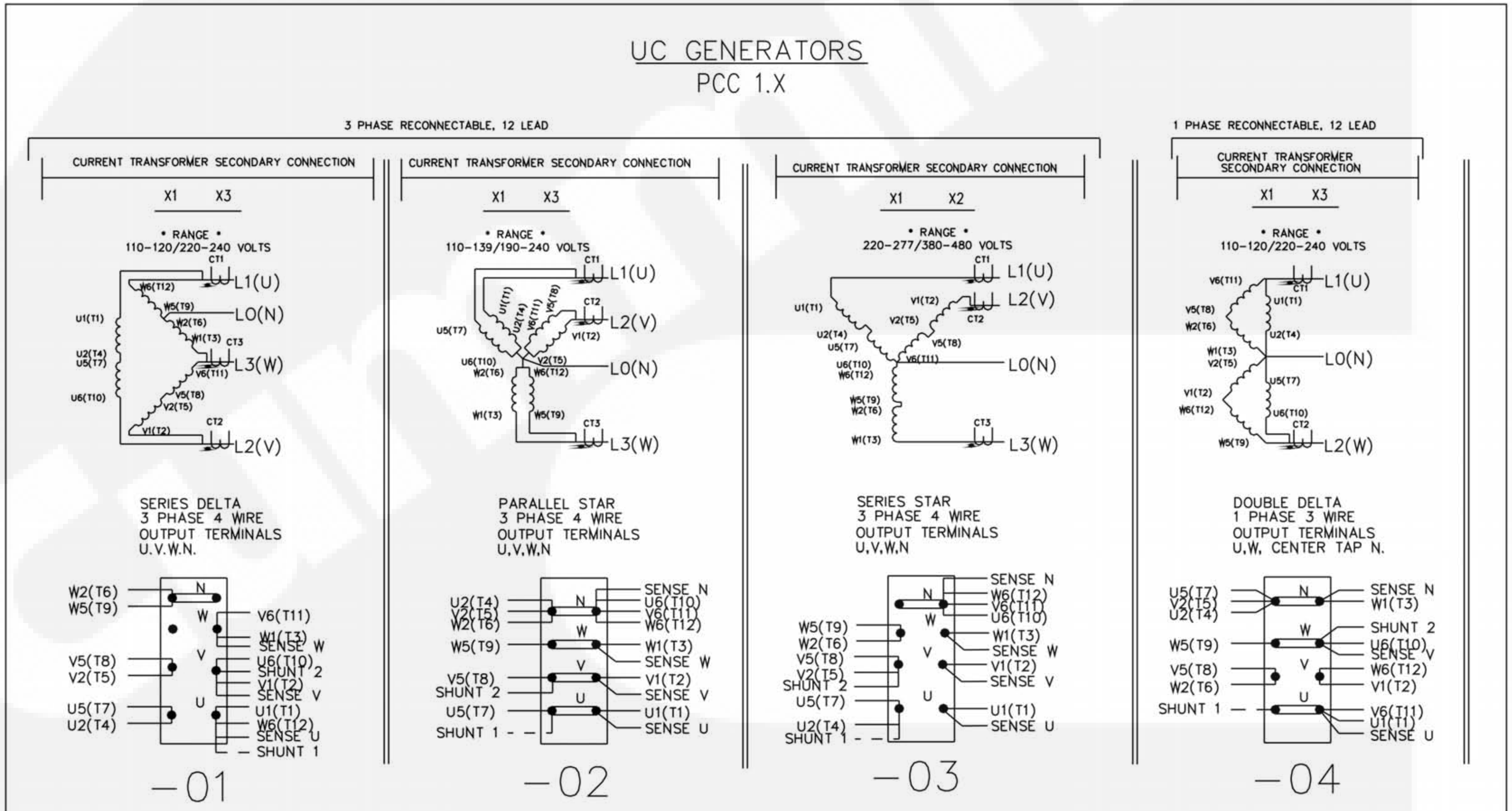
FIGURE 39. EXTERNAL FUEL CONNECTION

Appendix B. Alternator Reconnect Drawing

Table of Contents

The drawings included in this section are representative. For current complete information, refer to the drawing package that was shipped with the unit.

B.2 Reconnect Drawing for Alternator UC



FEATURE CODE	VOLTAGE	50HZ	60HZ	
		WINDING II	WINDING II	WINDING 14
R028	110/220	X	–	X
R071	115/230	X	–	X
R106	120/240	X	X	X

NOTE: SENSE LEAD N IS NOT USED. TAPE END AND TIE BACK.

FEATURE CODE	VOLTAGE	50HZ	60HZ	
		WINDING II	WINDING II	WINDING 14
R004	110/190	X	–	X
R050	115/200	X	–	X
R098	120/208	X	X	X
R020	127/220	X	X	–
R067	139/240	–	X	–

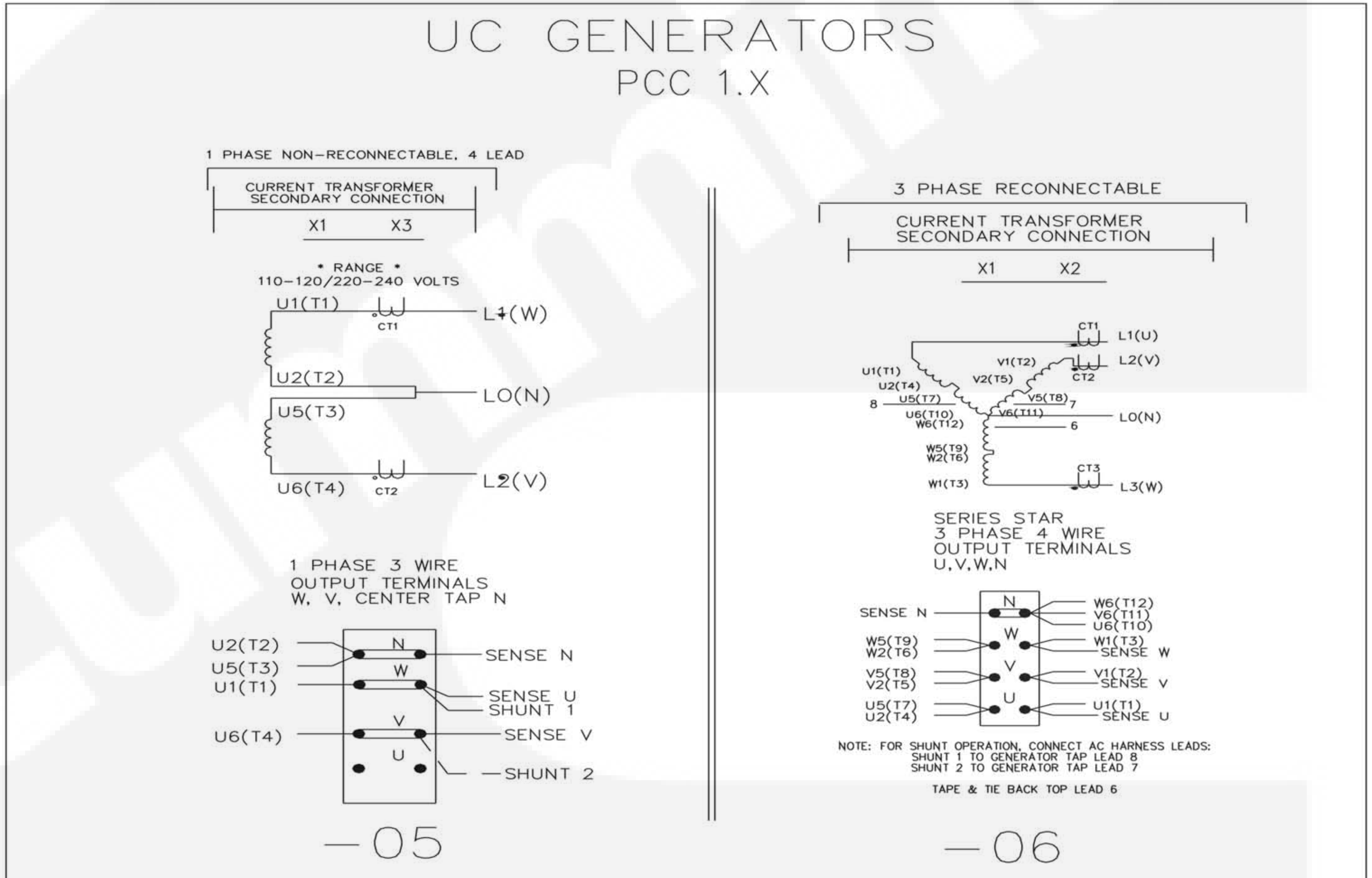
FEATURE CODE	VOLTAGE	50HZ	60HZ	
		WINDING 11	WINDING II	WINDING 14
R099	220/380	X	–	X
R029	230/400	X	–	X
R003	240/416	X	X	X
R023	255/440	X	X	–
R002	277/480	–	X	–

FEATURE CODE	VOLTAGE	50HZ		60HZ			
		WINDING 11		WINDING 11		WINDING 14	
		2/3 OUTPUT	FULL OUTPUT	2/3 OUTPUT	FULL OUTPUT	2/3 OUTPUT	FULL OUTPUT
R046	110/220	X	X	–	–	X	–
R041	115/230	X	X	–	–	X	–
R104	120/240	X	X	X	X	X	–

NOTE: SENSE LEAD W IS NOT USED. TAPE END AND TIE BACK.

0630-3388 Sheet 1

FIGURE 40. 0630-3388 SHEET 1



FEATURE CODE	VOLTAGE	50HZ	60HZ
		–	WINDING 6
R046	110/220	–	X
R041	115/230	–	X
R104	120/240	–	X

FEATURE CODE	VOLTAGE	50HZ	60HZ
R114	600	–	X

NOTE: SENSE LEAD W IS NOT USED.
TAPE END AND TIE BACK.

0630-3388 Sheet 2

FIGURE 41. 0630-3388 SHEET 2