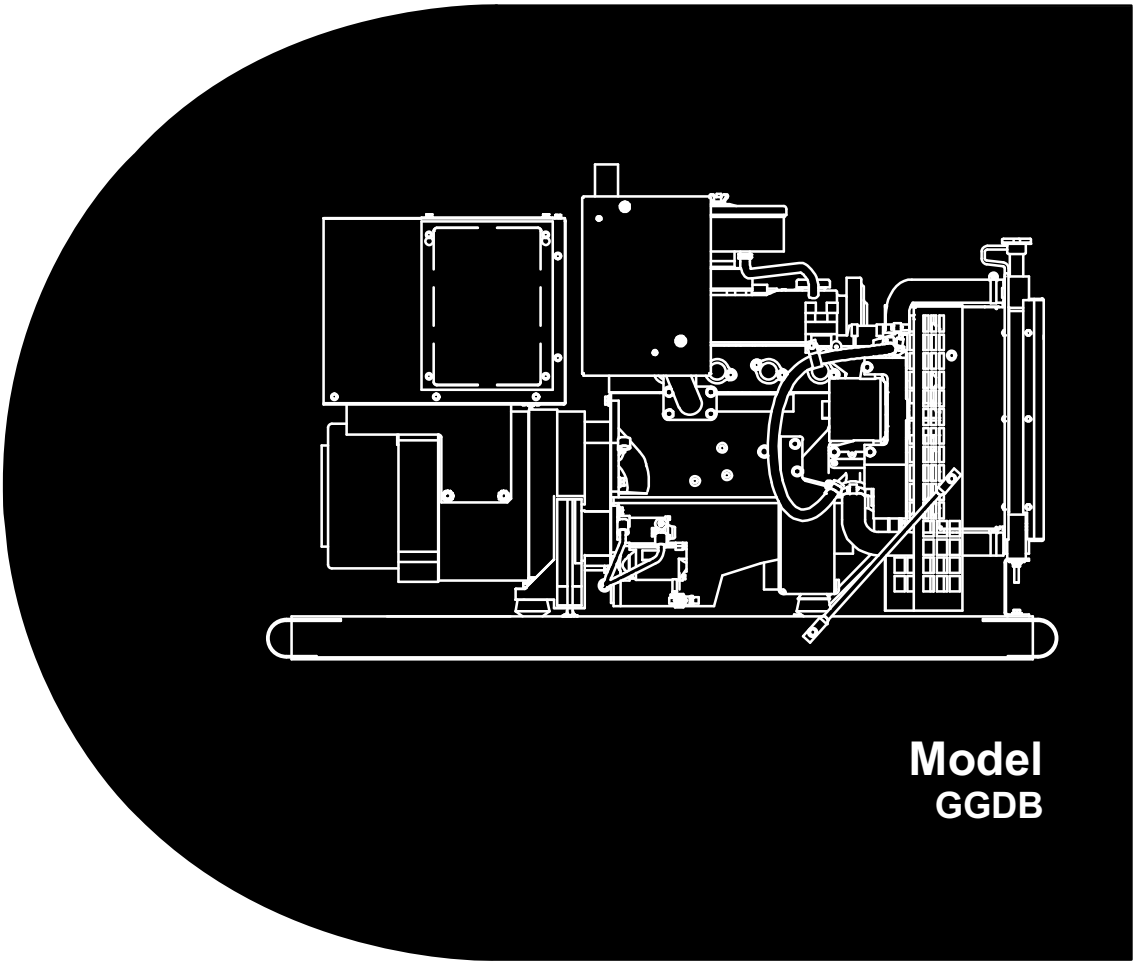
Power Generation

Service Manual

Detector™ /2-Wire Remote Control Generator Sets



Model
GGDB

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⚠ WARNING: ⚠

The engine exhaust from this product contains chemicals known to the State of California to cause cancer, birth defects or other reproductive harm.

IMPORTANT SAFETY INSTRUCTIONS

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

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

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

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

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

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

FUEL AND FUMES ARE FLAMMABLE

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

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

EXHAUST GASES ARE DEADLY

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

MOVING PARTS CAN CAUSE SEVERE PERSONAL INJURY OR DEATH

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

ELECTRICAL SHOCK CAN CAUSE SEVERE PERSONAL INJURY OR DEATH

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

GENERAL SAFETY PRECAUTIONS

- Coolants under pressure have a higher boiling point than water. DO NOT open a radiator or heat exchanger pressure cap while the engine is running. Allow the generator set to cool and bleed the system pressure first.
- Benzene and lead, found in some gasoline, have been identified by some state and federal agencies as causing cancer or reproductive toxicity. When checking, draining or adding gasoline, take care not to ingest, breathe the fumes, or contact gasoline.
- Used engine oils have been identified by some state or federal agencies as causing cancer or reproductive toxicity. When checking or changing engine oil, take care not to ingest, breathe the fumes, or contact used oil.
- Keep multi-class ABC fire extinguishers handy. Class A fires involve ordinary combustible materials such as wood and cloth; Class B fires, combustible and flammable liquid fuels and gaseous fuels; Class C fires, live electrical equipment. (ref. NFPA No. 10).
- Make sure that rags are not left on or near the engine.
- Make sure generator set is mounted in a manner to prevent combustible materials from accumulating under the unit.
- Remove all unnecessary grease and oil from the unit. Accumulated grease and oil can cause overheating and engine damage which present a potential fire hazard.
- Keep the generator set and the surrounding area clean and free from obstructions. Remove any debris from the set and keep the floor clean and dry.
- Do not work on this equipment when mentally or physically fatigued, or after consuming any alcohol or drug that makes the operation of equipment unsafe.
- Substances in exhaust gases have been identified by some state or federal agencies as causing cancer or reproductive toxicity. Take care not to breath or ingest or come into contact with exhaust gases.
- Do not store any flammable liquids, such as fuel, cleaners, oil, etc., near the generator set. A fire or explosion could result.
- Wear hearing protection when going near an operating generator set.
- To prevent serious burns, avoid contact with hot metal parts such as radiator, turbo charger and exhaust system.

KEEP THIS MANUAL NEAR THE GENSET FOR EASY REFERENCE

1. Introduction

ABOUT THIS MANUAL

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

This service manual is for the GGDB generator set (genset). The manual includes engine and generator troubleshooting guides. Engine service instructions are in the applicable engine service manual. Operating and maintenance instructions are in the applicable Operator's Manual.

This manual does not have instructions for servicing printed circuit board assemblies. Always replace a faulty printed circuit board assembly. Attempts to repair a printed circuit board can lead to costly damage to the equipment.

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

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

TEST EQUIPMENT

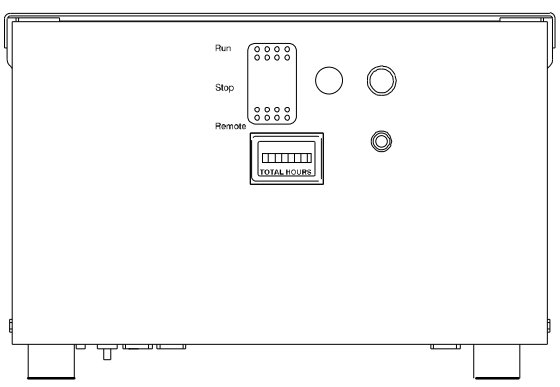
Most of the tests in this manual can be done with an AC-DC multimeter, frequency meter, Wheatstone bridge (0.001 ohm precision is necessary for measuring stator winding resistance) and load test panel.

HOW TO OBTAIN SERVICE

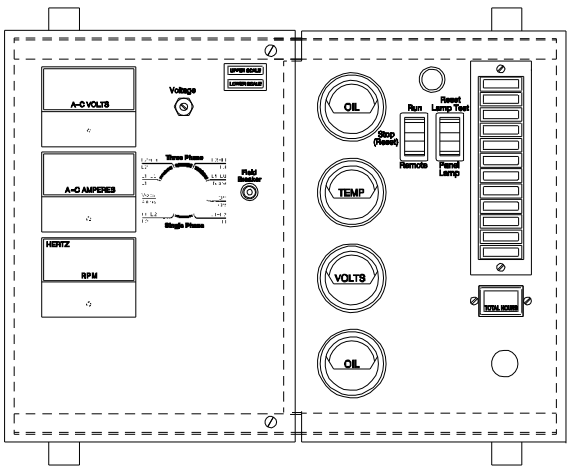
Always give the complete Model, Specification and Serial number of the generator set as shown on the nameplate when seeking additional service information or replacement parts. The nameplate is located on the side of the generator output box.

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

There are separate *Engine Control* and *Troubleshooting* sections for gensets using the 2-Wire Remote control or the Detector control (Figure 1-1). Refer to the *Table of Contents* for specific information relating to your genset control. The remaining sections apply to both controls.



2-Wire Remote Control



Detector 12 Control

FIGURE 1-1. CONTROL PANEL CONFIGURATIONS

2. Voltage Regulator

PRINCIPLE OF GENERATOR OPERATION

Refer to Figure 2-1 while working through the following explanation.

1. The generator field (main rotor) is rotated by the engine to induce output current (AC) in the main stator windings.

2. Generator output current is proportional to field strength, which is varied to match the load. Nominal output voltage and frequency are maintained by the voltage regulator and engine governor, respectively.

3. Generator field strength is proportional to field current, which is supplied by the exciter.

4. The exciter field (stator) induces current in the exciter rotor windings. A full-wave rectifier bridge (rotating rectifiers) mounted on the exciter rotor converts exciter output (3-phase AC) to DC. The exciter rotor is mounted on the main rotor shaft.

5. Exciter output current is proportional to exciter field current.

6. The automatic voltage regulator regulates exciter field current by comparing generator output voltage and frequency with reference values.

7. Exciter field current is supplied by the main stator through the voltage regulator. Residual field magnetism initiates “self-excitation” during startups.

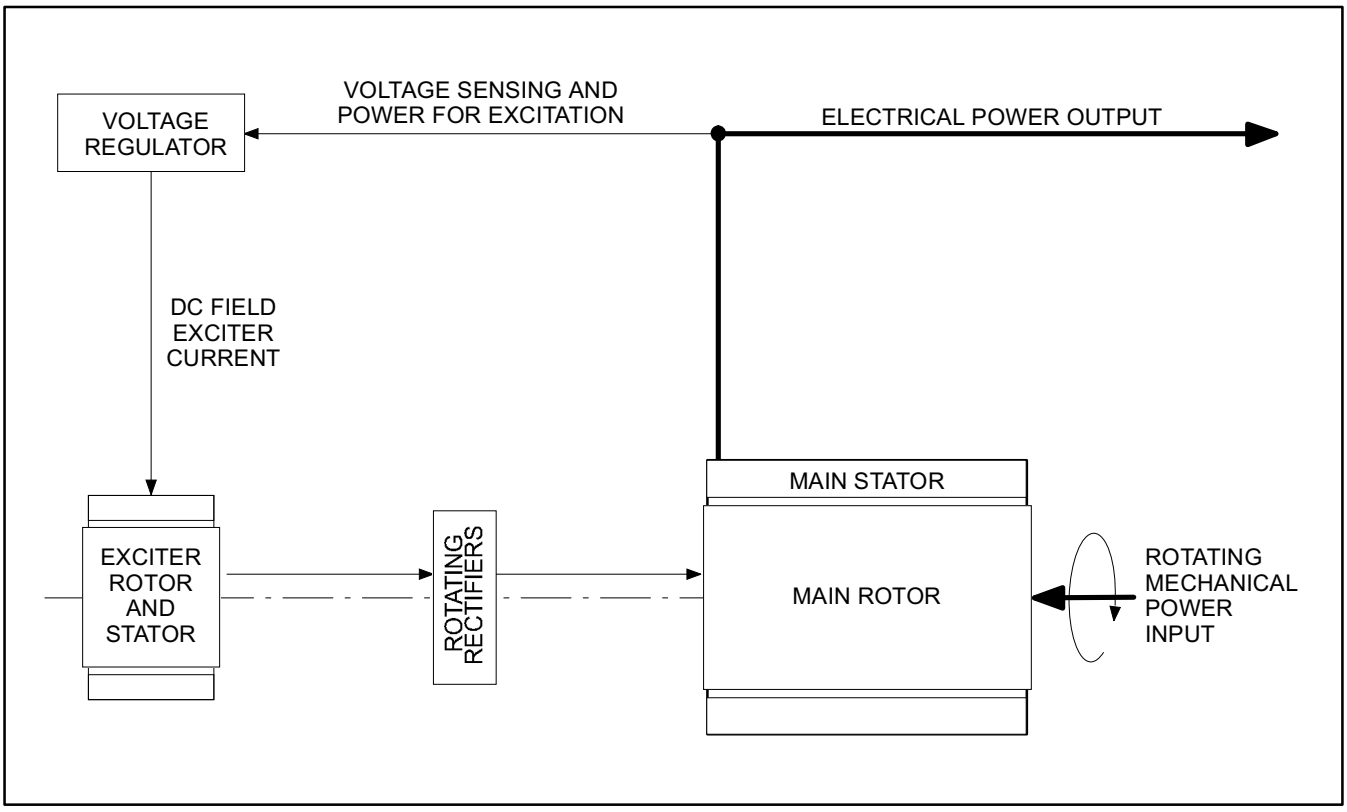


FIGURE 2-1. DIAGRAM OF GENERATOR OPERATION

VOLTAGE REGULATOR

Figures 2-2 and 2-3 illustrate the voltage regulator and its mounting and orientation in the different types of control boxes.

Frequency Selection Jumper

Connect the frequency selection jumper for the application frequency, 50 Hz or 60 Hz.

Voltage Adjustment

Use the control panel mounted voltage trimmer, if provided, for small voltage adjustments. Measure generator output voltage while the set is running without load at the nominal frequency.

If a replacement voltage regulator has been installed, or the voltage trimmer does not provide enough adjustment, adjust voltage as follows:

1. Turn the voltage trimmer (Figure 3-1, Detector control only) to its mid position.
2. Turn the **VOLTS** pot on the voltage regulator fully counterclockwise.
3. Turn the **STABILITY** pot on the voltage regulator to its mid position.
4. Start and operate the generator set at rated frequency and no load. If the **LED** lights, see **UFRO Adjustment**.

5 Slowly turn the **VOLTS** pot clockwise until rated voltage is obtained.

6 See **Stability Adjustment** if voltage is unstable.

Stability Adjustment

If it is necessary to adjust stability, run the generator set at rated frequency and no load. Slowly turn the **STABILITY** pot clockwise until voltage becomes stable and then counterclockwise until it again becomes unstable. Turn the pot slightly clockwise from this position for maximum stability. Readjust voltage after a stability adjustment.

UFRO Adjustment

The **LED** on the voltage regulator indicates that the **UFRO** (under frequency roll off) circuit is in operation. Check first to see that the frequency selection jumper is connected appropriately for the application (50 Hz or 60 Hz).

The **UFRO** pot on the voltage regulator is factory set and sealed. If necessary, adjust it so that the **LED** lights as frequency drops to 47 Hz for a 50 Hz application or 57 Hz for a 60 Hz application. Turn the pot clockwise to reduce the “knee point” frequency.

Field Flashing

If there is no output voltage, flash the field as follows:

1 Assemble a 12 volt battery, 10 ohm resistor, 18 volt voltage suppressor and 12 amp, 300 volt diode as shown in Figure 2-2 or 2-3.

2. While the set is running at nominal frequency, momentarily connect the positive (**+**) side of the circuit to voltage regulator terminal **VR21-F1 (x)** and the negative side (**-**) to voltage regulator terminal **VR21-F2 (xx)**.

   ⚠ CAUTION ***The voltage regulator could be damaged if the flashing circuit is connected for more than 5 seconds.***

3. Check output voltage, shut down the set and restart it. See TROUBLESHOOTING in *Section 7*, if output voltage does not build up without field flashing.

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

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