Operator, Installation, and Service

Cummins **Onan**

Performance you rely on.™

Generator Set

Protec PTO™ Series 12/15 – 30/40 kW

English 8–2009 A028Y570 (Issue 3)

Table of Contents

Safety Precautions

This manual includes the following symbols to indicate potentially dangerous conditions. Read the manual carefully and know when these conditions exist. Then take the necessary steps to protect personnel and the equipment.

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

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

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

Electricity, fuel, exhaust, moving parts and batteries present hazards which can result in severe personal injury or death.

GENERAL SAFETY PRECAUTIONS

Keep ABC fire extinguishers handy.

Remove all unnecessary grease and oil from the unit. Accumulated grease and oil can cause overheating and generator damage, which presents a potential fire hazard.

Do not store anything in the generator compartment such as oil or gas cans, oily rags, chains, wooden blocks, portable propane cylinders, etc. A fire could result or the generator set operation (cooling, noise and vibration) may be adversely affected. Keep the compartment floor clean and dry.

Do not work on this equipment when mentally or physically fatigued, or after consuming any alchohol or drug that makes the operation of equipment unsafe.

ELECTRICAL SHOCK CAN CAUSE SEVERE PERSONAL INJURY OR DEATH

Disconnect starting battery before removing protective shields or touching electrical equiment. 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 surfaces to be damp whenhandling electrical equipment.

Use extreme caution when working on electrical components. High voltages can cause injury or death.

Follow all state and local electrical codes. All electrical installations should be performed by a qualified, licensed electrician. Tag open switches to avoid accidental closure.

Do not connect generator directly to any building electrical system. Hazardous voltages can flow from the generator set into the utility line, which creates a potential for electrocution or property damage. Connect only through an approved device and after building main switch is open. Consult an electrician in regard to emergency power use.

GASOLINE AND LPG FUEL IS FLAMMABLE

Gasoline and LPG fuel may be accidentally ignited by electrical sparks, presenting the hazard of fire or explosion, which can result in severe personal injury or death. When installing the generator set:

Do not tie electrical wiring to fuel lines.

Do not run electrical lines through the same compartment openings.

Keep electrical and fuel lines as far apart as possible.

Place a physical barrier between fuel lines and electrical lines wherever possible.

If electrical and fuel lines must pass through the same compartment opening, make sure that they are physically separated by running them through individual channels, or by passing each line through a separate piece of tubing.

Do not smoke while servicing batteries. Lead acid batteries emit a highly explosive hydrogen gas that can be ignited by electrical arcing or by smoking.

MOVING PARTS CAN CAUSE SEVERE INJURY OR DEATH

Disconnect batteries, (–) cable first, before starting work on the generator. This will prevent accidental arcing.

Keep hands, clothing, hair, and jewelry away from moving parts.

Make sure that fasteners on the generator are secure. Tighten supports and clamps, keep guards in position over fans, drive belts, etc.

Do not wear loose clothing or jewelry while working on generators. 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.

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

RSS-1

1. Introduction

ABOUT THIS MANUAL

This manual covers the operation, installation, maintenance, and service repair of the Cummins Onan PROTEC YD AC PTO generator.

The operator instructions provide typical information on generator start–up, applying electrical loads, routine maintenance, operator–level troubleshooting, and cleaning.

The installation instructions provide procedures for pre-installation and mounting procedures for:

- the AC PTO generator
- the generator display module
- the meter/breaker box and the voltage regulator box
- the splash guard kit.

This manual does not provide the associated components that comprise a complete PTO system (power takeoffs, in-cab control devices, interlock switches, PTO transmissions, etc.). Consult the manufacturer's instructions for details on non-Cummins Onan equipment.

The troubleshooting instructions are for experienced service personnel and cover electrical tests and bearing replacement.

Read this manual carefully, and follow all warnings and cautions. Using the generator properly and following a regular maintenance schedule can result in longer unit life, better performance, and safer operation. The generator must be installed properly to operate safely.

HOW TO OBTAIN SERVICE

When the unit needs service, call an authorized service center and give them the complete model number and serial number listed on the generator nameplate.

Factory-trained parts and service centers can handle your service needs. The Parts and Service Center Directory (publication F-118, included) lists the nearest center.

GENERATOR

The Cummins Onan YD series AC generators are two-bearing, 1500 or 1800 rpm, 50 or 60 hertz units designed for direct drive from a power takeoff unit connected to a vehicle engine.

A centrifugal blower on the front end of the rotor shaft circulates the generator cooling air which is drawn in through the reconnection box, over the rotor, and discharged through the outlet slots at the blower end. See Figure 1-1.

A ball bearing at each end of the generator supports the rotor shaft. The reconnect box, end bell and stator housing are attached by four through-studs which pass through the stator assembly. The brushless exciter stator mounts in the end bell while the exciter rotor and its rotating rectifier assemblies mount on the rotor shaft.

VOLTAGE REGULATOR

The voltage regulator assembly includes the following components:

- Printed circuit board
- Voltage reference transformer
- Commutating reactor assembly
- Field circuit breaker

The voltage regulator is housed in a remote box which may be mounted in any convenient location within a short range of the generator.

LED DISPLAY MODULE

The display module provides the operator with generator output frequency, current readings, and AC voltage. Hours are recorded any time the meter is on.

There are three display modules used with the PROTEC YD AC PTO generators: a single−phase display, a three−phase display for a Star configuration, and a three−phase display for a Delta configuration. Figure 1-2 provides an outline drawing of the single and three−phase displays.

ANALOG METER/BREAKER BOX

The meter/breaker box contains the following components:

- Voltmeter
- Ammeters
- Line circuit breakers
- Marked output terminals
- Conduit connector and hardware
- Current transformers

These components are used to indicate alternator voltage, load current and voltage regulation with a varying load. Circuit breakers protect the generator from overcurrent conditions.

Figures 1-3 and 1-4 illustrate the meter box and its faceplate.

OPERATION

Residual magnetism in the generator rotor and a permanent magnet embedded in one exciter field pole begin the voltage buildup process as the generator starts running. Single-phase AC voltage, taken from one of the stator windings, is fed to the voltage regulator as a reference voltage for maintaining the generator output voltage. The AC reference voltage is converted to DC by a silicon controlled rectifier bridge on the voltage regulator printed circuit board and fed into the exciter field windings. The exciter armature produces three-phase AC voltage that is converted to DC by the rotating rectifier assembly. The resulting DC voltage excites the generator rotor winding to produce the stator output voltage for the AC load.

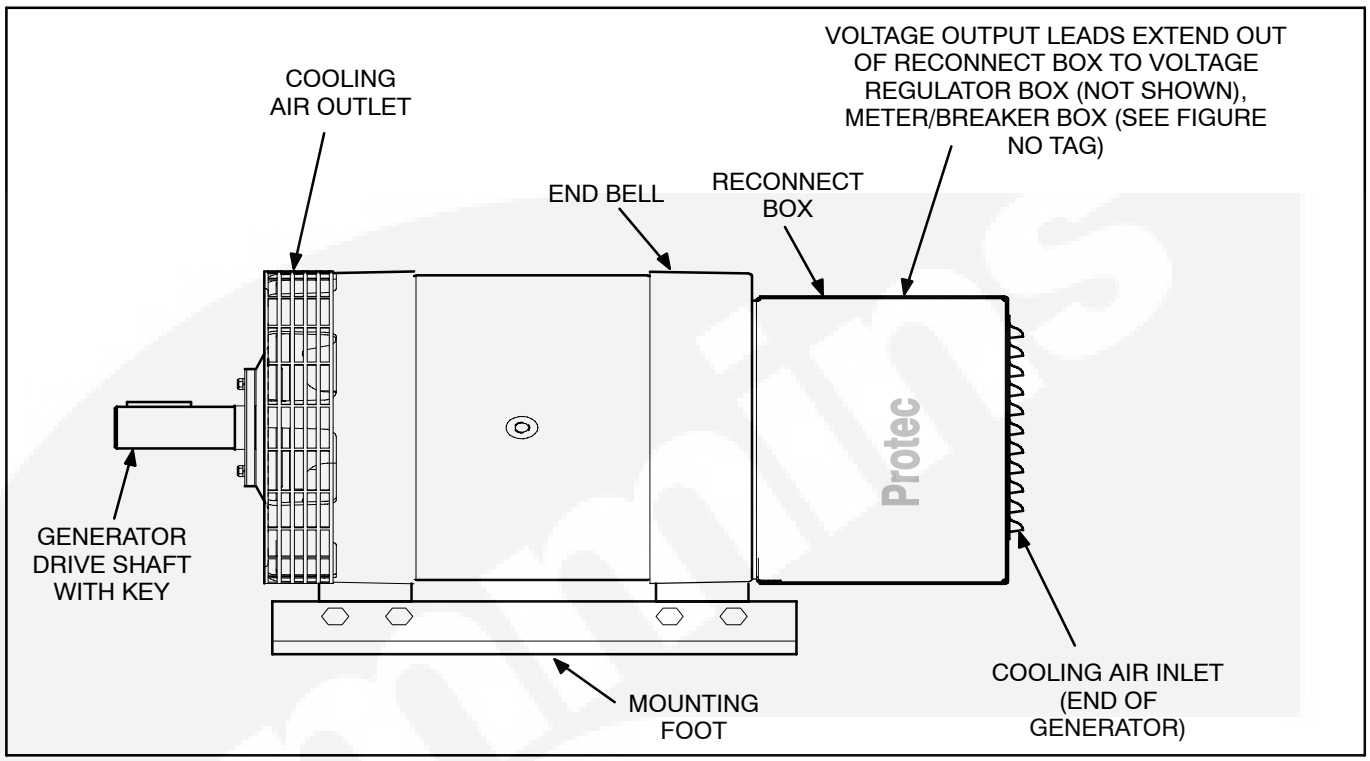


FIGURE 1-1. YD PTO GENERATOR

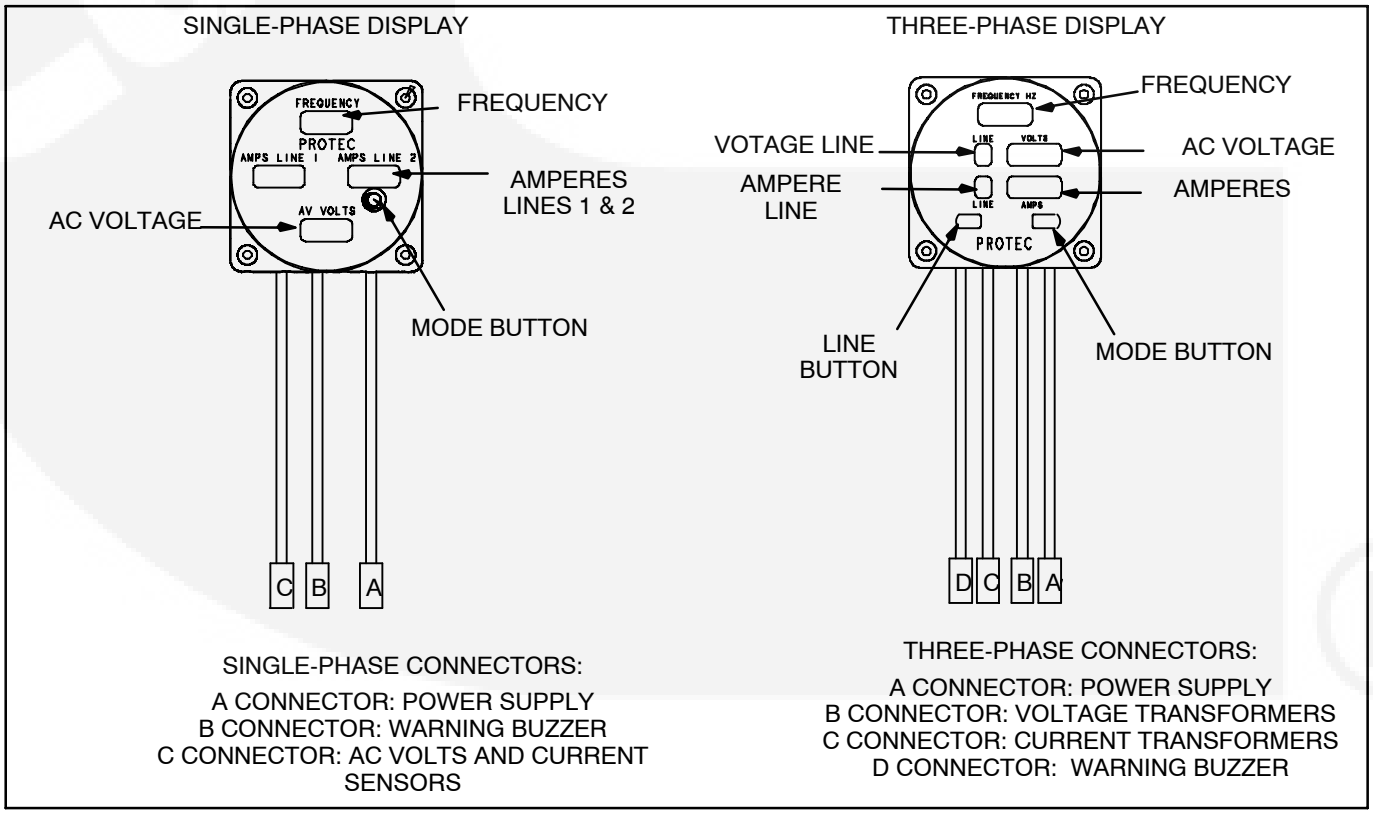


FIGURE 1-2. SINGLE AND THREE-PHASE GENERATOR DISPLAY MODULES

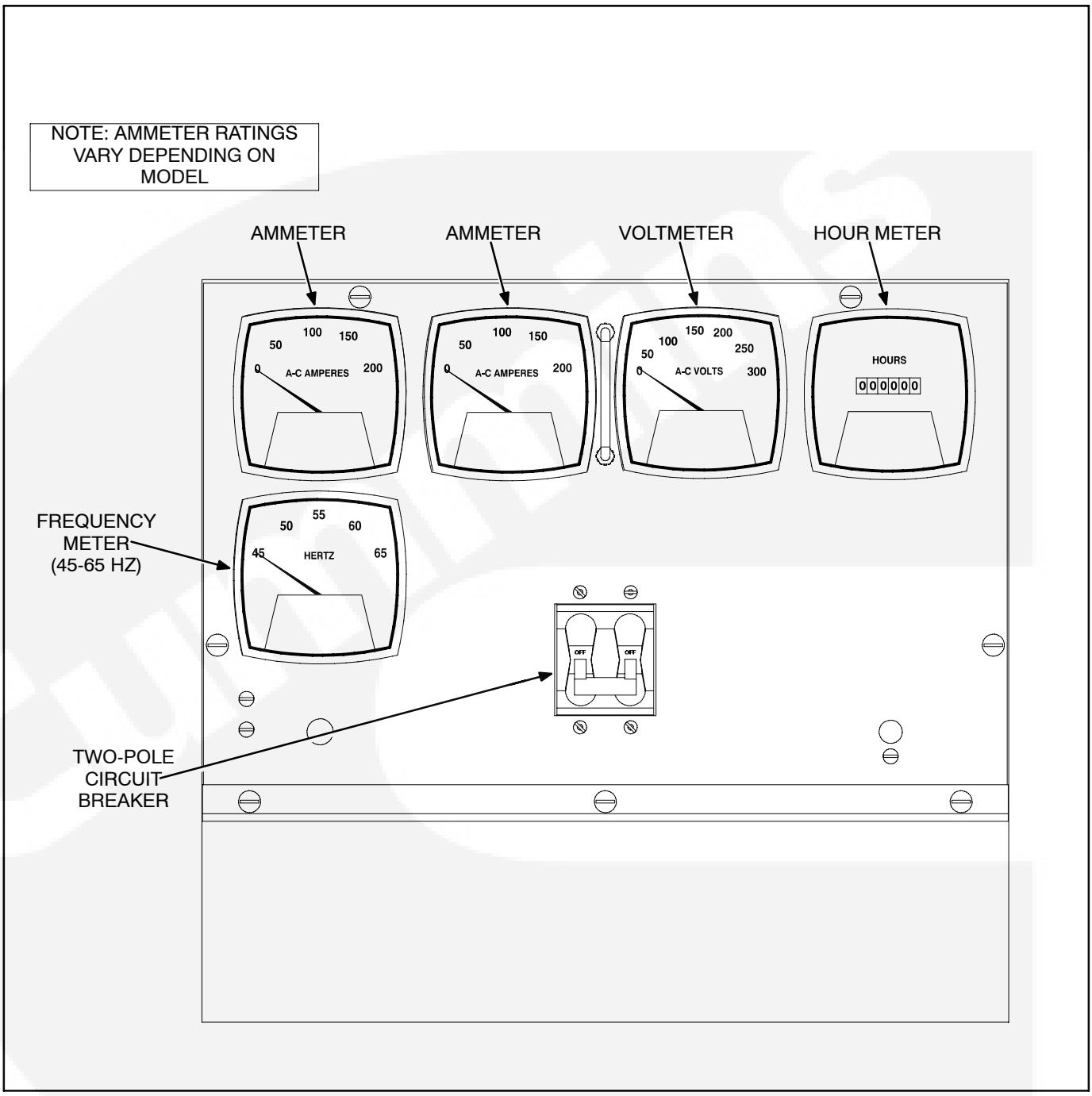
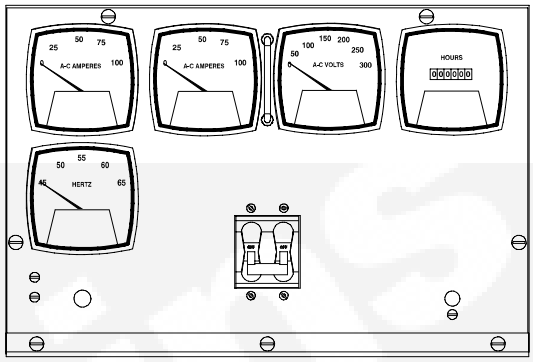
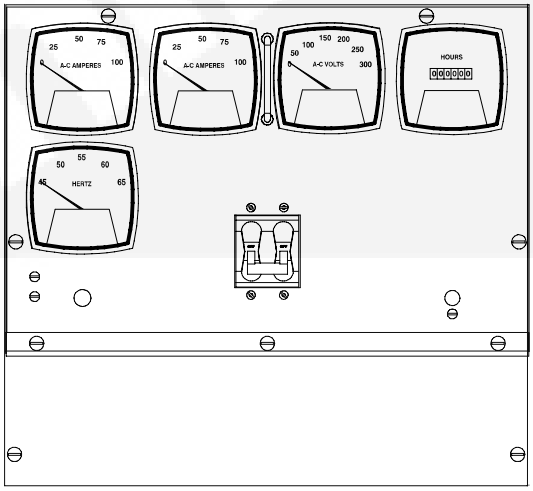


FIGURE 1-3. YD PTO GENERATOR METER/BREAKER BOX (20 KW UNIT SHOWN)

15 KW GENERATOR
METER/BREAKER PANEL



20 KW, 24 KW GENERATOR
METER/BREAKER PANEL
(20 KW PANEL SHOWN)



30 KW, 35 KW GENERATOR
METER/BREAKER PANEL

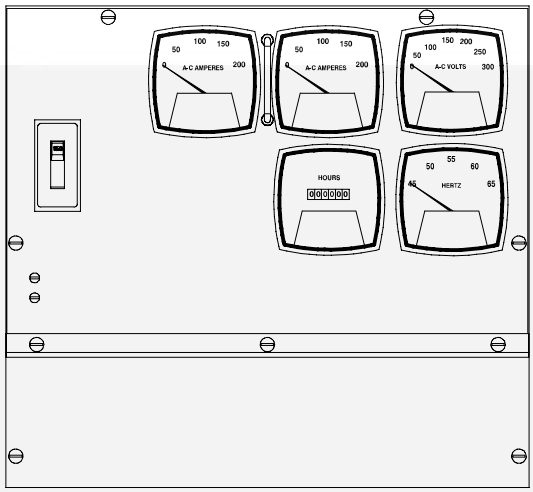


FIGURE 1-4. YD PTO GENERATOR METER/BREAKER PANELS (ALL MODELS SHOWN)

2. Specifications

Design: Revolving field: 4-pole, drip-proof construction. Skewed stator minimizes field heating and voltage harmonics. Stator laminations welded in heavy steel frame. Dynamically balanced rotor. Windings epoxy impregnated and overcoated for environmental protection and improved cooling.

Bearings: Two double sealed, prelubricated ball bearings.

Cooling: Direct-drive centrifugal blower.

Reconnect Box: End mounted. Houses output terminals and conduit connectors.

Exciter System: Brushless, with 8-pole stator mounted in end bell. Rectifier assemblies encapsulated for environmental protection. Permanent magnet in stator field provides reliable voltage build-up.

Voltage Regulator: Components include printed circuit board, voltage reference transformer, commutating reactor, field circuit breaker, voltage adjust rheostat.
Voltage Regulator Dimensions: 8" x 7.75" x 2.75" (203.2 mm x 196.85 mm x 69.85 mm)

Insulation System: Class F, per NEMA MG1-1.65 definition. Insulating varnish conforms with MIL-I-24092, Grade CB, Class 155° C.

Electromagnetic Interference Attenuation: Meets requirements of most industrial and commercial applications.

Configuration: Platform-mounted or side-mounted.

(Optional) Meter/Breaker Box Dimensions, Circuit Breaker Ratings (Single Phase Units Only)

Rating 50/60 (kW)	Circuit Breaker	L x W x H, in. (mm)
12/15	70 A, 2-pole	16.4 (418) x 4.5 (114) x 10.9 (278)
16 20	70 A, 2-pole 85 A, 2-pole	16.4 (418) x 4.5 (114) x 10.9 (278) 16.5 (419) x 10 (254) x 15 (381)
20/25	100 A, 2-pole	16.5 (419) x 10 (254) x 15 (381)
25/30	150 A, 2-pole	16.5 (419) x 10 (254) x 15 (381)
30/35	175 A, 2-pole	16.5 (419) x 10 (254) x 15 (381)

12/15 KW GENERATOR - 1∅

Voltage/Frequency: 115/230 VAC @ 50 Hz 120/240 VAC @ 60 Hz	Input Speed (RPM): 1500 (12 Kw) 1800 (15 Kw)
Phase: One	Height: 19.55 inches
Wires: Four	Width: 15.0 inches
Watts: 12 Kw @ 50 Hz; 15 Kw @ 60 Hz	Length: 21.9 inches
kVA at PF: 12.0/15.0 @ 1.0 power factor	Weight: 306 pounds

16/20 KW GENERATOR - 1∅

Voltage/Frequency: 115/230 VAC @ 50 Hz 120/240 VAC @ 60 Hz	Input Speed (RPM): 1500 (16 Kw) 1800 (20 Kw)
Phase: One	Height: 19.55 inches
Wires: Four	Width: 15.0 inches
Watts: 16 Kw @ 50 Hz; 20 Kw @ 60 Hz	Length: 23.34 inches
kVA at PF: 16.0/20.0 @ 1.0 power factor	Weight: 356 pounds

20/25 KW GENERATOR - 1∅

Voltage/Frequency: 115/230 VAC @ 50 Hz 120/240 VAC @ 60 Hz	Input Speed (RPM): 1500 (20 Kw) 1800 (25 Kw)
Phase: One	Height: 19.55 inches
Wires: Four	Width: 15.0 inches
Watts: 20 Kw @ 50 Hz; 25 Kw @ 60 Hz	Length: 24.59 inches
kVA at PF: 20.0/25.0 @ 1.0 power factor	Weight: 398 pounds

25/30 KW GENERATOR - 1∅

Voltage/Frequency: 115/230 VAC @ 50 Hz 120/240 VAC @ 60 Hz	Input Speed (RPM): 1500 (24 Kw) 1800 (30 Kw)
Phase: One	Height: 19.55 inches
Wires: Four	Width: 15.0 inches
Watts: 24 Kw @ 50 Hz; 30 Kw @ 60 Hz	Length: 26.71 inches
kVA at PF: 24.0/30.0 @ 1.0 power factor	Weight: 453 pounds

30/35 KW GENERATOR - 1∅

Voltage/Frequency: 115/230 VAC @ 50 Hz 120/240 VAC @ 60 Hz	Input Speed (RPM): 1500 (30 Kw) 1800 (35 Kw)
Phase: One	Height: 19.55 inches
Wires: Four	Width: 15.0 inches
Watts: 30 Kw @ 50 Hz; 35 Kw @ 60 Hz	Length: 28.47 inches
kVA at PF: 30.0/35.0 @ 1.0 power factor	Weight: 512 pounds

12/15 KW GENERATOR - 3∅

Voltage/Frequency:
Broad Range Voltages @ 50/60 Hz
Phase: Three
Wires: 12 Lead Reconnectable
Watts: 12 Kw @ 50 Hz; 15 Kw @ 60 Hz
kVA at PF: 12.0/15.0 @ 1.0 power factor

Input Speed (RPM):
1500 (12 Kw)
1800 (15 Kw)
Height: 19.55 inches
Width: 15.0 inches
Length: 21.9 inches
Weight: 306 pounds

16/20 KW GENERATOR - 3∅

Voltage/Frequency:
Broad Range Voltages @ 50/60 Hz
Phase: Three
Wires: 12 Lead Reconnectable
Watts: 16 Kw @ 50 Hz; 20 Kw @ 60 Hz
kVA at PF: 16.0/20.0 @ 1.0 power factor

Input Speed (RPM):
1500 (16 Kw)
1800 (20 Kw)
Height: 19.55 inches
Width: 15.0 inches
Length: 23.34 inches
Weight: 356 pounds

20/25 KW GENERATOR - 3∅

Voltage/Frequency:
Broad Range Voltages @ 50/60 Hz
Phase: Three
Wires: 12 Lead Reconnectable
Watts: 20 Kw @ 50 Hz; 25 Kw @ 60 Hz
kVA at PF: 20.0/25.0 @ 1.0 power factor

Input Speed (RPM):
1500 (20 Kw)
1800 (25 Kw)
Height: 19.55 inches
Width: 15.0 inches
Length: 24.59 inches
Weight: 398 pounds

25/32 KW GENERATOR - 3∅

Voltage/Frequency:
Broad Range Voltages @ 50/60 Hz
Phase: Three
Wires: 12 Lead Reconnectable
Watts: 25 Kw @ 50 Hz; 32 Kw @ 60 Hz
kVA at PF: 25.0/32.0 @ 1.0 power factor

Input Speed (RPM):
1500 (25 Kw)
1800 (32 Kw)
Height: 19.55 inches
Width: 15.0 inches
Length: 26.71 inches
Weight: 453 pounds

30/40 KW GENERATOR - 3∅

Voltage/Frequency:
Broad Range Voltages @ 50/60 Hz
Phase: Three
Wires: 12 Lead Reconnectable
Watts: 30 Kw @ 50 Hz; 40 Kw @ 60 Hz
kVA at PF: 30.0/40.0 @ 1.0 power factor

Input Speed (RPM):
1500 (30 Kw)
1800 (40 Kw)
Height: 19.55 inches
Width: 15.0 inches
Length: 28.47 inches
Weight: 512 pounds

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3. Operation

START-UP CONSIDERATIONS

Components of the Cummins Onan YD AC PTO generator include:

- YD generator with mounting hardware
- Voltage regulator in box
- (Optional) the display module that shows frequency, amperes, voltage, and hours of operation (or meter/breaker box with ammeters, voltmeters, frequency meter, hour meter, and circuit breakers).

These components are not supplied by Cummins Onan:

- Driving source (normally the vehicle propulsion engine)
- External governor unit, dedicated to maintaining 1500 or 1800 rpm from the driving source
- Dedicated power takeoff unit with clutch or transmission to engage the generator
- Remote control unit for the power takeoff unit
- Interlock systems to keep the PTO from being started in the wrong circumstances (vehicle in gear, brakes off, etc.).

TYPICAL START-UP PROCEDURE

⚠WARNING ***If the PTO generator is accessible to the operator or other personnel, guards must be installed around rotating parts to prevent injury or death.***

Although most installations vary, a typical start-up procedure follows. These steps depend on the procedures recommended by the manufacturers of the non-Cummins Onan components of the system: the engine, governor, power takeoff unit and remote control unit. **Consult their instruction manuals before starting the PTO system.**

1. **Engage the vehicle emergency brake.** Most installations will have an interlock that keeps the PTO system from being started unless the brake is engaged and the vehicle is motionless.
2. **Verify that the vehicle transmission is in the NEUTRAL position.** Most installations will have an interlock that prevents the PTO system from being started unless the transmission is in neutral.

   ⚠WARNING ***Emergency brake and/or transmission interlocks must be provided to prevent PTO operation while vehicle is in motion. Do NOT operate generator while vehicle is moving or in gear. Severe equipment damage and personal injury may result.***

3. **Start the vehicle propulsion engine** (if not already running).
4. **Actuate the governor/PTO system.** The engine governor and the geared PTO are actuated, beginning rotation of the YD generator. The engine governor system maintains PTO output speed at 1800 rpm (1500 rpm for 50 Hz system), adjusting engine fuel delivery to compensate for the generator's electrical load. See Figure A and B for examples of PTO control systems.
5. **Verify the output voltage and frequency.** The display module or meter panel provides verification of output voltage and frequency: these should quickly stabilize at 120/240 VAC and 60 Hz (or other voltage/frequency, depending on model).

6. **Close the circuit breakers on the panel (if not already closed).** The breakers on the panel provide system protection from electrical shorts or overloads. Ampere rating of the breakers depends on the size of the generator.
7. **Apply load to the alternator.** External switches or plug connections may be used to apply power to the genset, depending on the application.

Note: Depending on the configuration, the load may be powered by closing the breakers on the panel.

⚠WARNING ***Exhaust gas presents the hazard of severe personal injury or death. Inspect the vehicle exhaust system audibly and visually before operating the PTO. Have any leaks repaired immediately.***

APPLYING ELECTRICAL LOAD

- Allow the driving source to warm up before connecting a heavy load. Continuous generator overloading may cause high operating temperatures that can damage the windings. Although the generator can handle a 20% overload for ten minutes, the breakers supplied by Cummins Onan will not permit it. For normal operation, keep the load within nameplate rating.
- Connect the electrical load after the generator operates correctly at no load. When applying load to electric motors, connect one at a time, allowing each to reach running speed before connecting the next one. Motors require much more current for starting than when running at normal speed. Therefore, if several motors were connected at the same time, the generator could be so overloaded that none of the motors would start.
- If the engine governor does not provide effective regulation, or if the engine is operating at maximum capacity, it may be necessary to manually adjust the engine throttle control in accordance with changes in generator load. With electronically controlled engines ths is not required and is illadvised.

Note: On a brand new installation occasionally the alternator will not produce voltage. The residual magnetism in the alternator may be gone. See section 5–8 for field flash procedure.

DISPLAY MODULE

The display module is available for single and three-phase applications.

Single-Phase Display Module

AC Output. The single-phase display continuously shows AC output frequency, voltage, and current for each leg.

Hour Meter. The display will show the number of hours run if the **Mode** Button is pushed once. The display reverts to AC output after the elapse of a few seconds.

Overcurrent Condition or Voltage Out of Range. Lines 1 or 2 flash for an overcurrent condition, and likewise, the voltage readout flashes if the voltage falls out of range. If installed, an alarm sounds concurrently with either of these conditions. (The alarm is available from sources other than Cummins Onan.)

FIGURE 3-1. SINGLE-PHASE DISPLAY

Three-Phase Display Module

AC Output. The three-phase display continuously shows AC output frequency, voltage, and current. On power–up the line displays default to Auto mode, and continually scroll through the six selectable options, displaying the corresponding voltages and currents as shown in the Line Displays Table. To view a particular line voltage and current, press and hold the **Line** button until the desired selection appears in the windows. During normal operations, the display should be left in Auto mode to monitor all of the line voltages and currents.

Hour Meter. The display will show the number of hours run if the **Mode** Button is pushed once. The display reverts to AC output after the elapse of a few seconds.

Overcurrent Condition or Voltage Out of Range. In an overcurrent condition the current display begins to flash. Since no current reading is shown when lines 4, 5, and 6 are selected, the AMPS window flashes the letters OC for over capacity. Likewise, the voltage readout flashes if the voltage falls out of range, informing the operator that output voltage is at an unsafe operating level. If installed, an alarm sounds concurrently with either of these conditions. (The alarm is available from sources other than Cummins Onan.)

Line Displays

Voltage	Description
Line 1. A – N	Phase A to neutral
Line 2, B – N	Phase B to neutral
Line 3, C – N	Phase C to neutral
Line 4, A – B	Phase A to phase B
Line 5, B - C	Phase B to phase C
Line 6, C – A	Phase C to phase A
Auto	Continuous scroll through all options
Current	
Line 1, A	Phase A current
Line 2, B	Phase B current
Line 3, C	Phase C current
Lines 4, 5, 6	When active the AMPS window shows three dashes.

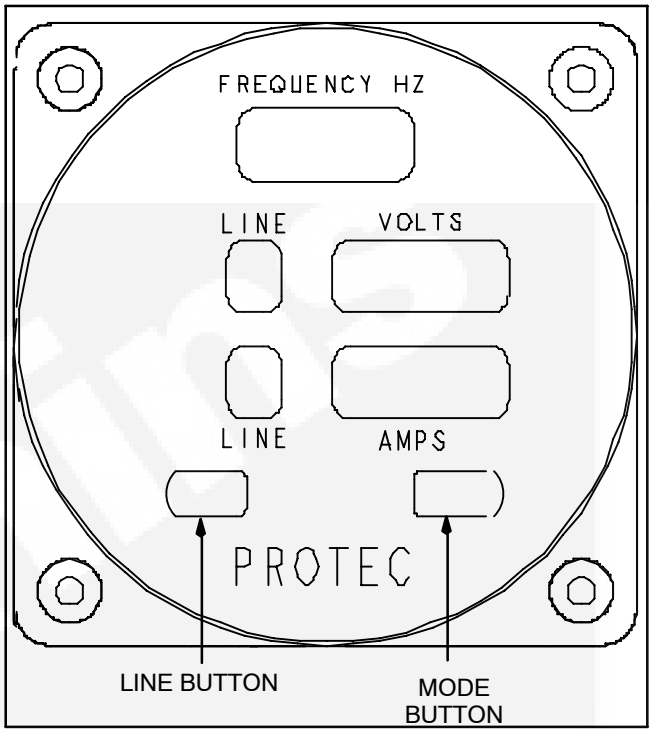

FIGURE 3-2. THREE-PHASE DISPLAY

MAINTENANCE

The YD PTO AC generator is a low-maintenance unit. Only a few principles need to be kept in mind to keep the generator running correctly:

- Keep the generator clean: remove dirt, oil, grease and other foreign substances on a regular basis
- Make certain that the air inlet and outlet to the generator are unobstructed, so that it may be cooled properly
- Inspect the generator regularly. Make a good visual check before, during, and after the generator is operating; look for loose or broken leads and bad connections.
- Check the torque on the generator holddown bolts and retighten if necessary (see Installation Manual for rating).
- If the generator becomes submerged in water, replace the generator bearings. This is far less costly than replacing the entire alternator, and rusty bearings are not covered by the warranty.

CLEANING THE GENERATOR

Clean the generator every six months, or more often in severe conditions. Remove dust with a damp cloth. Use steam to remove tar or other residue (do not steam-clean the generator while it is running). Protect the generator, voltage regulator, display module, and meter/breaker box from cleaning solutions. Do not clean with solvents; they may damage electrical connectors or winding epoxy.

OPERATOR TROUBLESHOOTING

A few simple checks and a proper troubleshooting procedure can locate the probable source of trouble and cut down troubleshooting time.

- Check all modifications, repairs, and replacements performed since last satisfactory operation of the generator, to be sure that connection of the generator leads are correct. A loose wire connection, overlooked when installing a replacement part, could cause problems. An incorrect connection, an opened circuit breaker, or a loose printed circuit board are all potential malfunction areas to be eliminated by a visual check.
- Unless absolutely sure that the panel instruments are accurate, use calibrated or known accurate portable test meters for troubleshooting.
- Visually inspect components inside the voltage regulator box. Look for dirt, dust, moisture, burned resistors, arcing tracks and cracks in the printed circuit conductors.
- Coupling direct drive units have the driving unit and generator shafts in line with each other. If either the driving unit or the generator is loosened from the base, the loosened unit must be properly realigned when reinstalled.

FAULT CODE BLINKING

At fault shutdown, the status indicator light will repeatedly blink sets of 1, 2, 3 or 4 blinks.

- **One blink** indicates shutdown due to high engine coolant temperature.
- **Two blinks** indicate shutdown due to a loss of engine oil pressure.
- **Three blinks** indicate a service fault. Press **Stop** once to cause the two-digit, second-level shutdown code to blink. (Pressing **Stop** again will stop the blinking.) The two-digit code consists of 1, 2, 3, 4 or 5 blinks, a brief pause, and then 1 to 9 blinks. The first set of blinks represents the tens digit and the second set of blinks the units digit of the shutdown code number. For example, **shutdown code No. 36** appears as:

  blink-blink-blink—*pause*—blink-blink-blink-blink-blink-blink—*long pause*—repeat

- **Four blinks** indicate that cranking time exceeded 35 seconds.
- *Fault Code Nos. 1, 2, 3, and 4 are first level faults. Pay close attention to the pause sequence to avoid interpreting first level faults as second-level Fault Codes Nos. 11, 22, 33, or 44.*
- *To avoid the possibility of anyone misinterpreting Code Nos. 3 and 4 as Code Nos. 33 and 44, the latter have not been assigned faults.*

RESTORING FAULT CODE BLINKING

The fault code stops blinking after five minutes. Press **Stop** three times within three seconds to restore fault code blinking.

Note: The last fault logged will blink even though the condition that caused the shutdown may have been corrected.

TROUBLESHOOTING GUIDE

⚠WARNING ***Many troubleshooting procedures present hazards which can result in severe personal injury or death. Only qualified service personnel with knowledge of electricity and machinery hazards should perform service procedures. Review safety precautions on inside cover page.***

	SYMPTOMS	CORRECTIONS
Generator overheats	1. Windings and parts covered with dirt and oil. 2. Air intake is restricted or incoming air is too hot. 3. Overloaded.	1. Disassemble generator and clean. 2. Take necessary steps to allow for proper cooling. 3. Check load.
Noisy generator	1. Generator loose on mounting. 2. Defective bearing.	1. Tighten/replace mounting bolts. 2. Replace. Check alignment (call Cummins service center).
No voltage output	1. Voltage regulator trouble, or open, short or grounded circuit in generator. 2. Generator leads broken or loose. 3. PTO transmission failure.	1. Call Cummins service center. 2. Tighten connections and replace broken leads. 3. Repair/replace PTO.
Low voltage output	1. Speed low because of faulty PTO and/or governor. 2. External short circuit on line. 3. Open circuit to voltage regulator. 4. Short circuit of winding in field or armature.	1. Adjust/repair PTO/governor system as required. 2. Test generator with output leads disconnected. 3. Make proper connections. 4. Call Cummins service center.

TYPICAL IN-CAB PTO CONTROL

SWITCH/METER BOX MOUNTED IN COMPARTMENT BELOW CAB OF TRUCK

METER/BREAKER BOX MOUNTING

PTO ON-OFF SWITCH

FIGURE 3-3. EXAMPLES OF PTO CONTROL SYSTEMS

4. Installation

PRE-INSTALLATION

The following factors should be considered before installing the generator, voltage regulator box and meter/breaker box:

- Location
- Adequate cooling air
- Electrical connections
- Accessibility for operation and service
- Vibration isolation

The PTO system must be designed, configured and installed properly for the Cummins Onan YD PTO AC generator to operate correctly. Each PTO installation is different, depending on the manufacturer's requirements. PTO operating considerations as they affect the Cummins Onan generator are described later in this section.

⚠WARNING ***Incorrect installation, service, or parts replacement can result in severe personal injury, death, and/or equipment damage. Service personnel must be qualified to install electrical and mechanical components.***

Generator Mounting

Generator mounting considerations include:

- **Generator support area:** The mounting framework must be able to support the weight of the generator. Generator weight is found in Section 2–2 of this manual. The vehicle manufacturer and the installer must provide a structurally sound support area.
- **Generator mounting hole configuration:** The mounting area must be able to accept the mounting hole arrangement found on the generator. Generator mounting holes are illustrated in Section 7 of this manual.
- **Generator ventilation:** The mounting area must have sufficient ventilation for the generator's cooling requirements. An area with minimal dust and dirt is preferable. The generator compartment must not admit dirt, rocks, water or slush. The entrance of dust and salt into the compartment must be minimized. Baffles may be needed to protect certain areas.

  NOTE: Avoid recirculation of ventilation air. Configure the generator ventilation so that only fresh air is circulated through the generator.
- **Protection from exhaust heat:** The generator must be protected from excess heat: for this reason, it should not be mounted close to the vehicle muffler or exhaust area unless it is absolutely necessary. Use a heat shield if the muffler and generator are to be mounted close together.
- **Generator mounting hardware:** Along with a mounting framework for the generator, hardware for connecting the generator to the PTO output should be considered. Components that must be selected typically include:
- A keyed coupler to connect the generator shaft to the PTO output
- U-joints for the PTO-generator coupling
- A sliding coupler element to prevent thrust load on the front bearing of the generator
- A shear-limiting coupler to prevent damage to the transmission or generator due to a seized bearing or high starting torque.

Meter/Breaker Box Mounting

Meter/breaker enclosure mounting considerations include:

- **Meter/breaker box mounting hole configuration:** The mounting area must be able to accept the mounting hole arrangement found on the control box. Meter/breaker box mounting is described later in this section.
- **Meter/breaker box vibration mounting:** Rubber/plastic vibration mounts should be used between the box and the mounting framework. The box must be protected from potentially harmful vibration.
- **Meter/breaker box protection:** The box should be mounted in an area that is protected from the elements: rain, dust, etc. can harm electrical components.

Figure 4-1 shows a typical meter/breaker box installation.

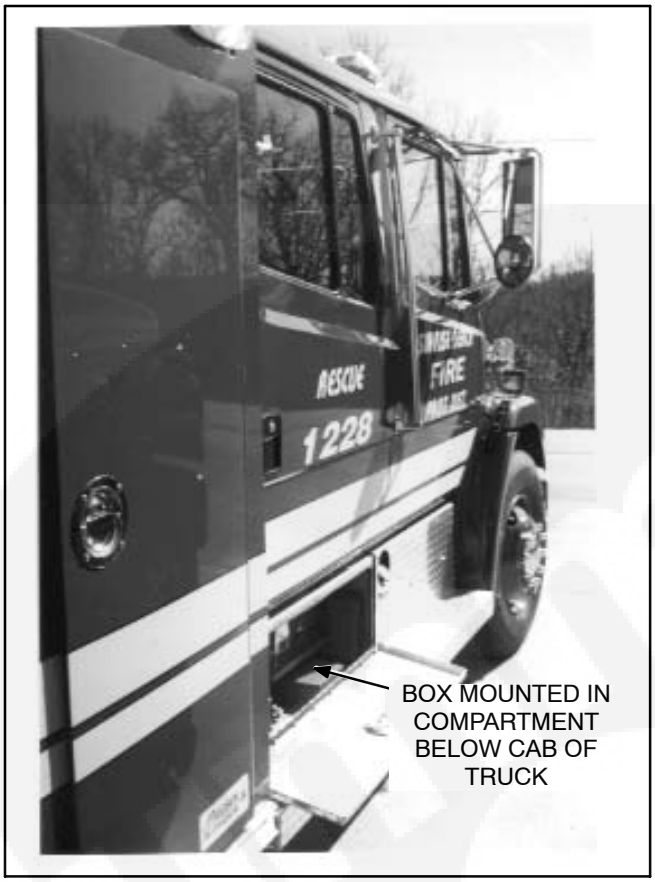

FIGURE 4-1. METER/BREAKER BOX MOUNTING

PTO System Configuration

The installation and operation of a vehicle-mounted PTO system are outside the scope of this manual. However, any PTO system must be configured bearing these considerations in mind:

- **Control System:** The control system can have as many or as few automated elements as is necessary. Controls may be mounted inside or outside the vehicle cab, in any location. Figure 3–3 illustrates some typical control mounting locations.
- **Interlocks:** The PTO control system should have interlocks to keep the PTO from being engaged under the following circumstances:
- When the vehicle is moving (emergency brake interlock)
- When the vehicle is in gear (transmission neutral interlock)
- If the engine speed is higher than the speed required to run the generator (engine governor interlock)

Other interlocks may be necessary depending on the application and the control system selected. Consult the PTO and control systems' manuals for guidelines. Figure 3-3 is a block diagram of a typical PTO/generator system, showing how the Onan components fit into a standard configuration.

⚠WARNING Emergency brake and/or transmission interlocks must be provided to prevent PTO operation while the vehicle is in motion. Do NOT operate generator while vehicle is moving or in gear. Severe equipment and property damage and personal injury may result.

Verify that the engine is running at proper RPM. On most installations, the PTO output will be geared up to provide the 1800 rpm (1500 rpm, 50 Hz units) and 40 horsepower or less that the YD AC generator requires. A typical engine/PTO output ratio might be 1:1.29. This means that the vehicle engine will be running at 1400 rpm to provide 1800 rpm to the generator. (The selected PTO ratio should produce an 1800 rpm output with an engine high idle of 1200 to 1400 rpm to reduce engine wear.) Most installations will have an interlock to keep the PTO from being started at high RPM. Also, a clutch-shift PTO system must always be used. A direct-drive PTO will overspeed the generator when the truck is being driven.

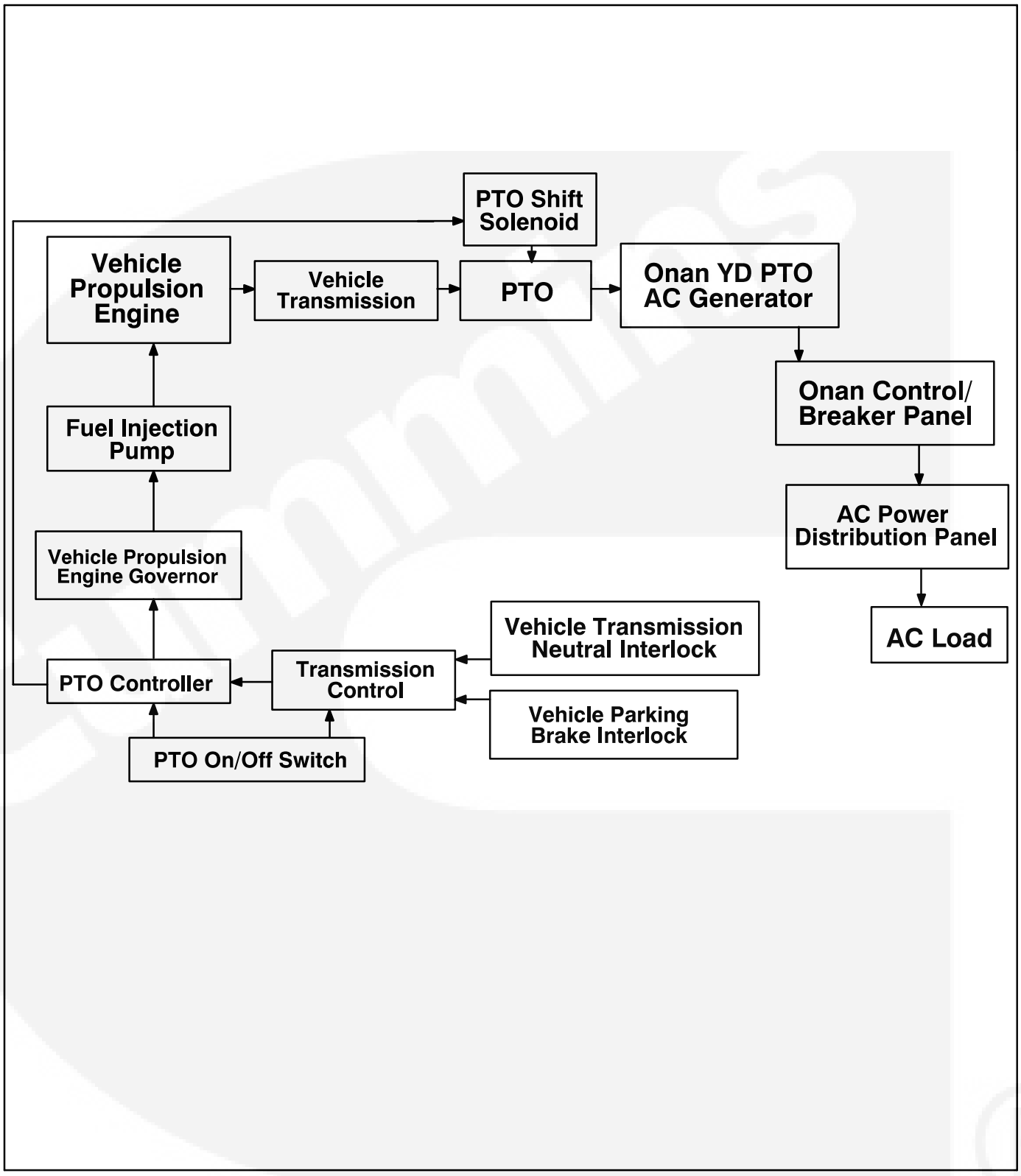

FIGURE 4-2. PTO GENERATOR SYSTEM BLOCK DIAGRAM

GENERATOR MOUNTING

Generator Support Framework

The generator must be mounted on a framework that is capable of supporting its weight subjected to road shocks. Generator weights are listed in Section 2-2 of this manual.

Normally, a framework is constructed underneath the vehicle chassis, located in line with the PTO shaft transmission. A tubular steel framework cradles the PTO generator from the main frame rail at the right hand side of the vehicle.

The generator shaft & PTO shaft should be parallel with no more than 1 degree of missalignment see figure A. The offest of the two shafts should never create a U–Joint angle greater than 10 degrees. The shafts should not be perfectly inline. U joint failure will occure if there is not movement from a perfectly aligned shafts.

Points to consider when constructing such a framework include:

- **Clearance:** Allow as much clearance as possible between the generator framework and the road, especially if travel over rough surfaces or grass and brush is likely.
- **Frame support:** The frame support must be reinforced to avoid system resonances at generator running speed (and multiples of running speed).
- **Frame alignment:** Alignment is critical to generator operation. Side loads due to misalignment could provide a source for system resonance at multiples of running speed.

See page 7-9 of this manual for an outline drawing of the generator showing its mounting holes, dimensions, and air inlet and outlet locations.

Make sure that the air “inlet louvers” of the reconnect box access cover point downward. The access cover can be rotated in any direction to correctly position the inlet louvers to the installed position of the generator.

Note that the standard under-chassis installation described in this manual presents little likelihood of operator contact with the PTO or the generator. However, other applications may mean that the generator is accessible. In such cases, proper guards and barriers to rotating components must be installed. Failure to install adequate guards may lead to severe injury or death from contact with moving parts. Contact Onan application engineers before attempting any other mode of installation than that which is described in this Manual.

⚠WARNING If the PTO generator is accessible to the operator or other personnel, guards must be installed around rotating parts to prevent severe injury or death. Contact Cummins Onan application engineers before attempting any installation other than described in this Manual.

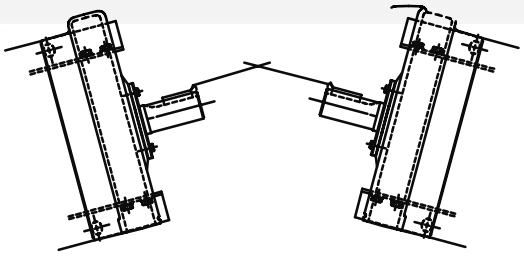

FIGURE A. PTO to GEN CONNECTION 1 DEGREES OR LESS

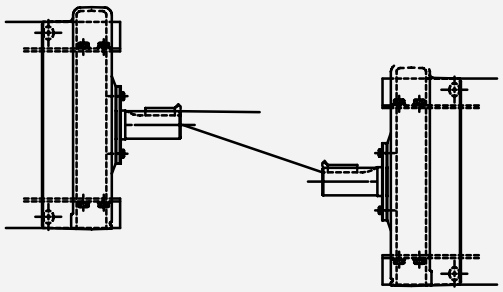

FIGURE B. PTO to GEN CONNECTION 5–10 DEGREES MAX.

Connecting the PTO

A standard keyed coupling should be used to connect the generator driveshaft with the PTO output shaft. The drive shaft yoke is coupled to the generator's straight shaft with a four-bolt steel flange coupling keyed to the shaft. Figure 4-3 shows the generator shaft and key. A full outline drawing of the generator is found in Section 7 of this manual.

Points to consider when connecting the PTO AC generator to the driving source:

- **Generator inertia load:** Note that the entire drive train including the generator shaft must be designed to absorb the starting torque due to the inertia of the generator rotor. A torsional drawing showing the inertia, weight, stiffness and length of each part of the generator rotor is included in Section 7 of this manual.
- **Generator driveshaft takeup section:** Note that the drive shaft should have a slider bar, splined take-up section or other variable-length coupling, to take up slight drive shaft length variances, and to prevent thrust load on the front bearing.
- **Generator driveshaft shear limiter:** A shear limiting device may be needed in the coupling to prevent damage to the transmission or generator due to a seized bearing or high starting torque. At full load a 40 kW alternator requires 230 ft. lbs. of torque. At full load a 20 kW alternator requires 115 ft. lbs. of torque.
- **Driveshaft alignment:** Side loads due to misalignment could provide a source for running speed vibration. Alignment is critical on the YD PTO generator.

  If possible, constant velocity driveshafts should be installed between the generator and PTO. This type of driveline is more tolerant of misalignment and in general reduces vibration.

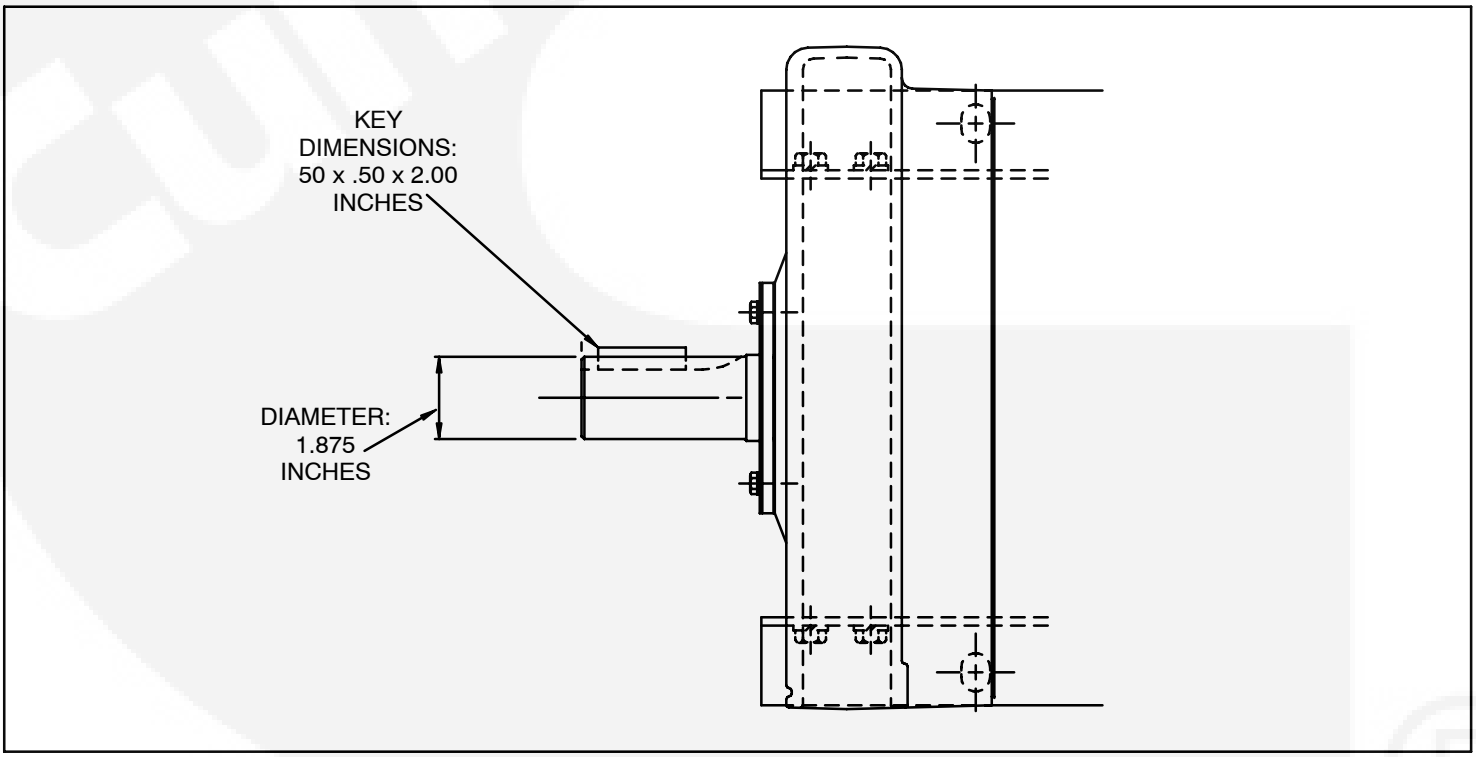

FIGURE 4-3. DETAIL OF GENERATOR SHAFT AND MOUNTING KEY

INSTALLING THE DISPLAY MODULE

Before beginning installation of the display module, make sure it is calibrated to match the rated generator output. If required, use the calibration procedure on next page for the single-phase display.

Mounting the Display Module

- Measure and mark the mounting location for the display module. Refer to page 7-5 for dimensions.

NOTE: Make sure there is clearance behind the mounting location for the display module and cables before cutting the hole.

- Cut–out a mounting hole 3.75 inches square.
- Drill four holes for mounting screws.
- Secure the display module with four 10–32 screws.

INSTALLING THE METER/BREAKER BOX AND VOLTAGE REGULATOR BOX

Mounting the voltage regulator box and the optional meter/breaker box supplied with the YD PTO AC generator is a relatively uncomplicated process. The boxes are bolted to a convenient surface which is:

- Protected from the elements
- Convenient to the electrical load or load panel.

See page 4-1 of this manual (Pre-Installation) for factors regarding the selection of the location for the meter/breaker box.

Mounting the two boxes simply involves:

- Selecting the mounting area
- Measuring the mounting area
- Drilling the mounting holes
- Installing bolts and nuts to hold the box in place.

⚠WARNING ***Before drilling holes, check to make sure no electrical or fuel lines run behind the area. Severe personal injury or death could result.***

See Section 7 of this manual for drawings of the voltage regulator box and of the two sizes of the meter/breaker box, with dimensions and the locations of their mounting holes.

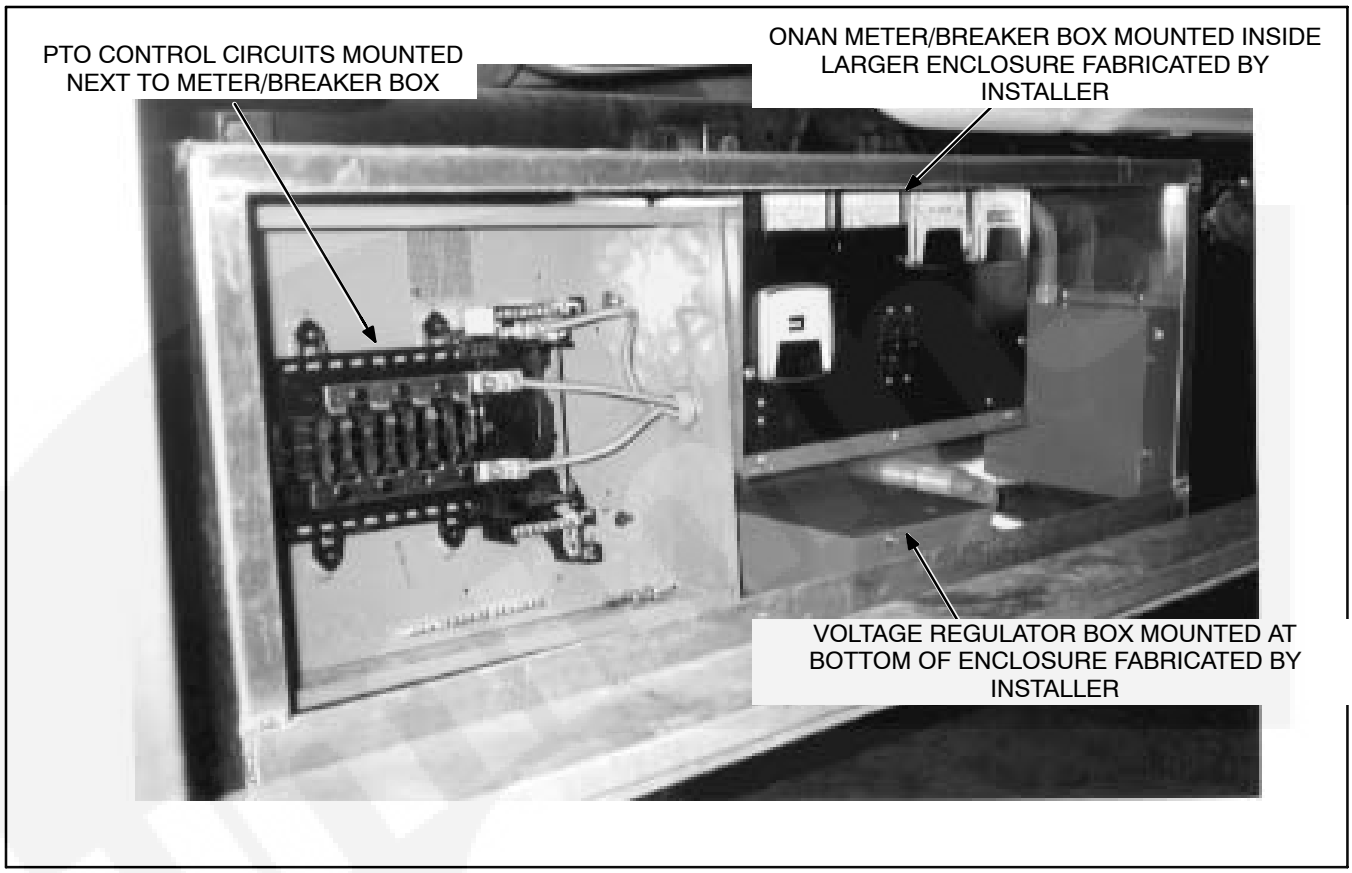

FIGURE 4-4. CUMMINS ONAN METER/BREAKER PANEL MOUNTING

MATCHING THE SINGE-PHASE DISPLAY MODULE WITH THE GENERATOR RATING

If the display module does not match the generator rating (it will flash at a power level below the laternator rating), it will need to be changed using the Mode and hidden Menu buttons for the single-phase display (see Figure 4-5). For the three–phase display, make sure to install the display that is rated for the particular generator:

- Press **Menu** twice, then press **Mode** twice. The display shows the current setting for kilowatts.
- Press **Menu** and repeat to move through the availabe values to the desired kilowatt setting.
- When the desired setting is reached, press and hold **Mode**, then press and hold **Menu** to accept the selection.
- Release both buttons once the display changes to its normal state.

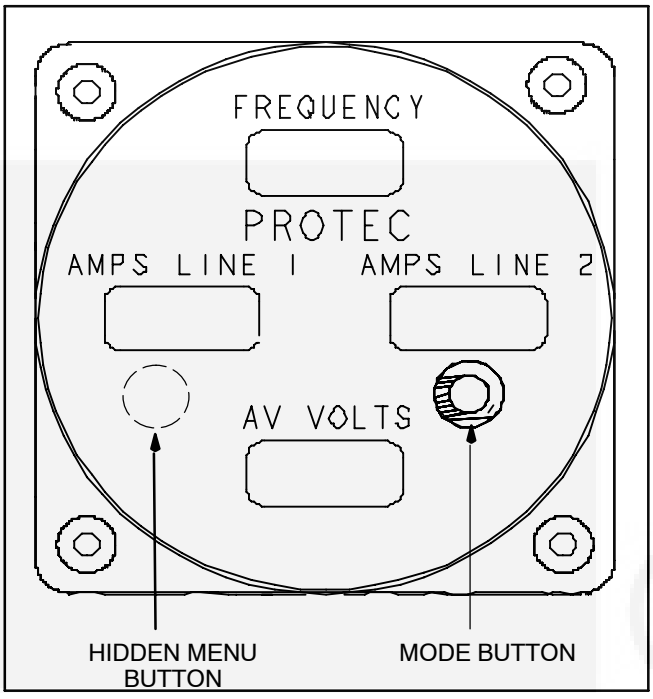

FIGURE 4-5. HIDDEN MENU AND MODE BUTTONS

INSTALLING THE SPLASH SHIELD

A splash shield kit, part number 026−00362, is availabe from Onan Indiana WWW.ONANINDIANA.COM or your distributor. The kit consists of a shield and V-ring seal that provide added protection for the Protec generator from road spray, and is recommended to prevent excessive moisture from damaging the front generator bearing. The splash shield may require modification to fit driveshaft or frame clearances on some installations (see Figure 4-6). The splash guard is installed as follows:

NOTE: The following steps assume that the PTO drive line between the generator and truck transmission is not connected.

- Slide the V−ring seal over the PTO shaft until it is close to the front bearing cover.
- Lubricate the back side of the lip of the bearing cover with a small amount of white grease, vasoline, or light oil.
- Slide the seal until it touches the bearing cover plate, and then slide it in another 1/16 to 1/8 of an inch (see Figure 4-7).
- Remove two of the three mounting screws from the bearing cover.
- Slide the splash shield over the PTO shaft against the face of the bearing cover (see Figure 4-6).
- Note that one of the pre-drilled mounting holes in the splash plate is larger than the other two holes (see Figure 4-8). Place the enlarged hole over the remaining bearing cover mounting screw to help align the shield.
- With the shield in alignment, use the two bearing cover screws that were removed earlier to secure the shield to the bearing cover.
- Remove the third screw from the bearing cover which the oversized hole is designed to allow.
- Reinstall the third screw with a sufficiently large flat washer to complete the installation.

FIGURE 4-6. MODIFIED SPLASH GUARD INSTALLATION

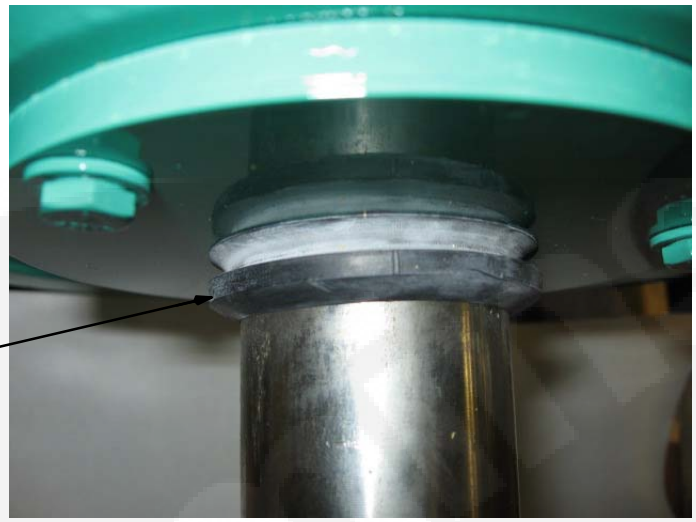

FIGURE 4-7. V–RING SEAL ON PTO SHAFT

FIGURE 4-8. SPLASH SHIELD WITH ENLARGED MOUNTING HOLE

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5. Troubleshooting

The following tests and adjustments can be performed without disassembly of the generator. Figure 5-1 provides a cut-away view of the generator with identification of major components.

Before starting resistance measurements, disconnect the starting battery cables (negative [–] first) to make sure the engine will not start while performing these tests.

⚠WARNING ***Accidental starting of the generator can cause severe personal injury or death. Disconnect the propulsion engine battery cables, negative (–) lead first, before connecting test leads to the controls or generator.***

⚠WARNING ***Contact with high voltage can cause severe personal injury or death. Do not touch any exposed wiring or components with any part of the body, clothing, tool or jewelry. Do not use non-insulated tools inside the control. Stand on an insulating mat or dry wood platform when the control doors are open.***

TROUBLESHOOTING PROCEDURES

Use the following procedures to diagnose the generator set and voltage regulator. Faults are cross referenced with the tests that are in the following section.

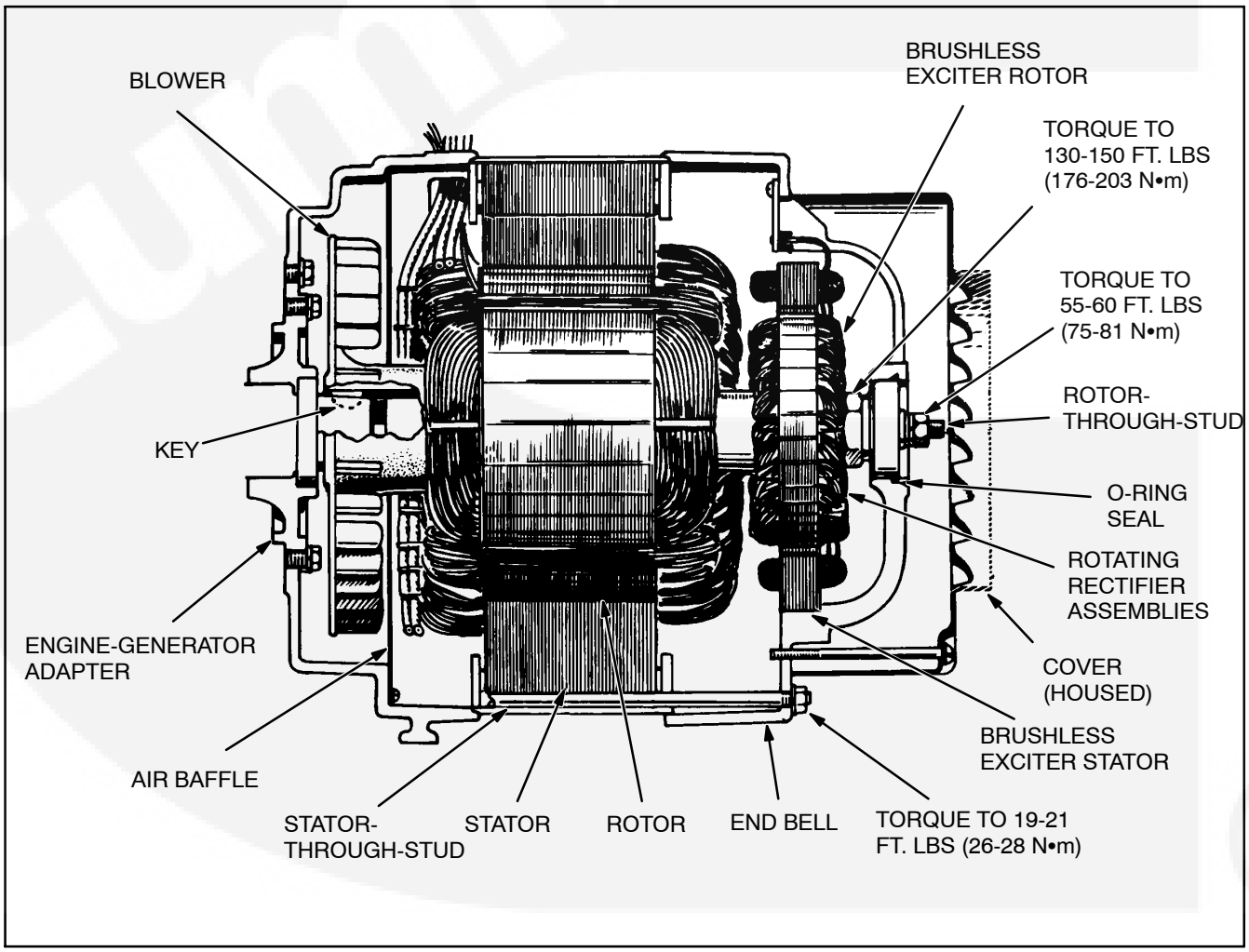


FIGURE 5-1. GENERATOR

⚠WARNING ***Some Generator Set service 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 Generator Set service.***

NO AC OUTPUT VOLTAGE

Logic:

Field voltage is compromised.

Possible Causes:

1. Field circuit breaker CB21 tripped.
2. Commutating reactor CMR21 failed.
3. A failed diode on the rotating rectifier.
4. Rotor failed.
5. Stator failed.
6. Exciter rotor failed.
7. Exciter stator failed.
8. Wire connections.

Diagnosis and Repair:

1. Field circuit breaker CB21:
   A. Check to see if circuit breaker is On.
   B. Check continuity across breaker terminals with one lead disconnected.
   C. Replace if bad.
2. Check voltage across terminals 2 and 3 of VR21:
   A. If voltage is 5 to 10 VAC, go to step 3.
   B. f voltage is less than 5 VAC:
      Flash exciter field. See Test C.
      Check diodes CR1 through CR6 on rotor, and replace if bad. See Test F.
      Check exciter rotor windings, and replace if bad. See Test H.
      Check generator rotor windings, and replace if bad. See Test K.
      Check generator stator windings, and replace if bad. See Test J.
3. Check commutating reactor CMR 21, and replace if bad. See Test B.

⚠WARNING ***Some Generator Set service 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 Generator Set service.***

4. Check voltage across VR21 terminals 4 and 5.
   A. If voltage is 5 VDC or greater, go to step 5.
   B. If voltage is less than 5 VDC:

      Check exciter field winding for shorts, and replace if bad. See Test L.

      Replace the regulator PC board if defective. See Test E.
5. Check exciter field wiring harness, and replace if bad. See Test L.
6. Check exciter field winding, and replace if bad. See Test G.

UNSTABLE VOLTAGE AT RATED, STABLE ENGINE SPEED

Logic:

Generator is directly coupled to engine and requires specific engine speed. Control board provides voltage output control.

Possible Causes:

1. Wiring connections.
2. Control board.

Diagnosis and Repair:

1. Check for broken wires or loose connections on the voltage regulator assembly. Replace broken wires and tighten loose connections.
2. Check wiring harness from regulator assembly to end bell. Repair or replace as necessary. See Test L.
3. If steps 1 and 2 do not solve the problem:

   Dealers contact distributors for technical support.

   Distributors contact factory for technical support.

WARNING ***Some Generator Set service 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 Generator Set service.***

OUTPUT VOLTAGE TOO HIGH OR TOO LOW

Logic:

Generator is directly coupled to engine and requires specific engine speed. Control board provides voltage output control.

Possible Causes:

1. Engine rpm.
2. Voltage Adjust Control.
3. Transformer connections.
4. Generator output leads.

Diagnosis and Repair:

1. Check engine rpm. Set at rated rpm or governor manual.
2. Check that Voltage Adjust Control (if present) on the regulator board is set correctly.
3. Check reference transformer T21 connections on TB1.
4. Check generator output leads for proper connections. See Test N.
5. If steps 1 through 4 do not solve the problem:

   Dealers contact distributors for technical support.

   Distributors contact factory for technical support.

⚠WARNING ***Some Generator Set service 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 Generator Set service.***

FIELD CIRCUIT BREAKER TRIPS

Logic:

Current on the field circuit exceeded breaker rating.

Possible Causes:

1. Circuit breaker.
2. Wiring/connections.
3. Excitor stator.
4. Transformer.
5. Control board.

Diagnosis and Repair:

1. Check current at circuit breaker for 150% of rated amperage before tripping.
2. Check for loose or broken wires or connections on VR21 control board assembly.
3. Check reference transformer T21. See Test E.
4. Check exciter stator winding. See Test G.
5. If steps 1 through 4 do not solve the problem:

   Dealers contact distributors for technical support.

   Distributors contact factory for technical support.

⚠WARNING ***Some Generator Set service 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 Generator Set service.***

UNBALANCED GENERATOR OUTPUT VOLTAGE

Logic:

Current demand or ground circuits are allowing unmatched line−to−line output voltage.

Possible Causes:

Ground connections, or stator windings.

Diagnosis and Repair:

1. Remove loads at generator terminals.
2. Check generator leads for proper grounding and connections
3. Check stator windings. See Test J.
4. Check load for ground faults.

LOW AC VOLTAGE OUTPUT AFTER CONVERSION FROM 60 TO 50 HZ

Logic:

When the jumper between terminals 6 and 7 on the voltage regulator is moved to terminals 7 and 8, the internal ground path for the voltage regulation circuit is removed.

Possible Causes:

Wrong frequency conversion procedure.

Diagnosis and Repair:

1. If AC voltage is low after frequency conversion from 60 to 50 Hz, check jumper wires on voltage regulator terminal block.
2. Retain jumper wire between terminals 6 and 7. Install an additional jumper wire between terminals 7 and 8. Readjust the speed of the generator / PTO from 1800 RPM to 1500 RPM.

TESTS

A - Testing AC Residual Voltage

Test for residual AC voltage if there is no AC power output from the generator.

- Disconnect propulsion engine battery cables, negative (–) lead first, before connecting test leads to generator leads 1 and 2.
- Reconnect battery cables, positive (+) cable first.
- Start the engine, PTO, and generator, and operate at normal speed.
- Check voltage between generator leads 1 and 2 while the set is running. Residual voltage should be 5 to 10 VAC.

B - Testing the Commutating Reactor

The schematic for the commutating reactor is shown in Figure 5-2. It is located within the voltage regulator housing and is designated CMR21 in the schematics.

⚠WARNING ***Accidental starting of the generator can cause severe personal injury or death. Disconnect the propulsion engine battery cables, negative (–) lead first, before connecting test leads to the controls or generator.***

- Disconnect engine battery cables, negative (–) cable first.
- Remove reactor leads from the terminal board for testing.
- Measure the resistance across leads 1 and 2 for a reading of 0.33 to 0.39 ohms at 77° (25° C).
- Measure the resistance across leads 3 and 4 for a reading of 0.38 to 0.46 ohms at 77° (25° C).
- Measure the resistance between the winding and the reactor frame. The reading should be infinity.

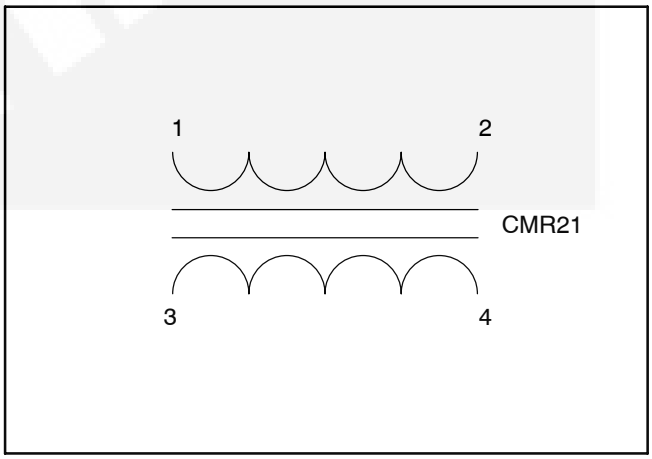


FIGURE 5-2. REACTOR CMR21

C - Flashing the Field

⚠WARNING ***An incorrect flashing procedure can damage the voltage regulator. Do not keep excitation circuitry connected longer than 5 seconds.***

⚠WARNING ***Contact with high voltage can cause severe personal injury or death. Do not touch any exposed wiring or components with any part of the body, clothing, tool or jewelry. Do not use non-insulated tools inside the control. Stand on an insulating mat or dry wood platform when the control doors are open.***

If output voltage does not build up, it may be necessary to restore residual magnetism by flashing the field.

- Assemble a field flashing circuit as shown in Figure 5-3 from a12V storage battery, a10A fuse, a momentary On switch, and a 12V 300A diode.
- Disconnect propulsion engine battery cables, negative (–) lead first, before connecting field flashing leads.
- Connect the positive lead to the F1 (+) exciter stator lead and the negative lead to the F2 (–) exciter lead.
- Reconnect the battery cables, positive (+) cable first, then start the engine, PTO and generator and operate at normal speed.

  Close the switch just long enough for the generator output voltage to build up.

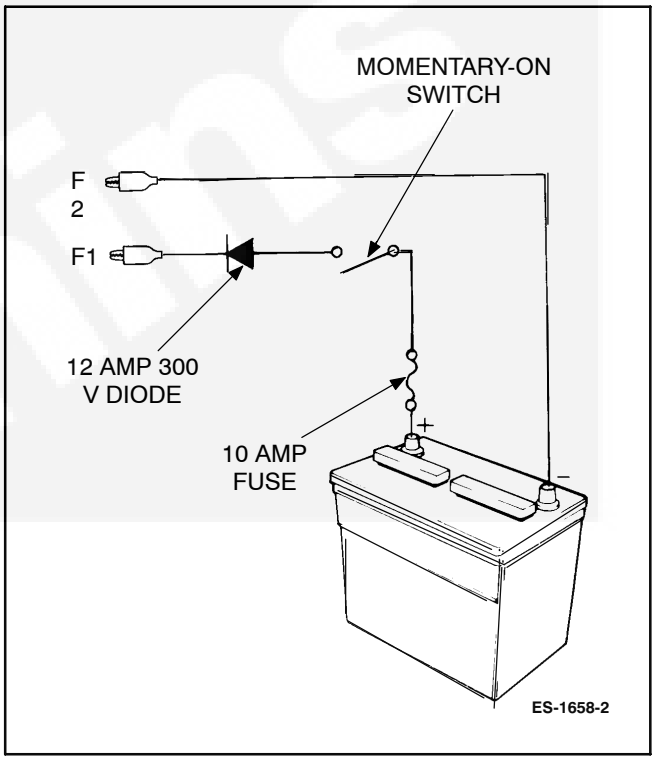


FIGURE 5-3. FIELD FLASHING CIRCUIT

D - Testing Reference Transformer

Reference transformer T21 is located inside of the voltage regulator housing. T21 has four leads: primary leads H1 and H2 and secondary leads X1 and X2 (see Figure 5-4).

- Open the voltage regulator housing.
- Disconnect transformer T21 leads and measure resistance. The resistance of either coil should be 100 ohms ± 10% at 75° (25° C).
- Measure the resistance between the leads and transformer frame. The resistance should be infinity.

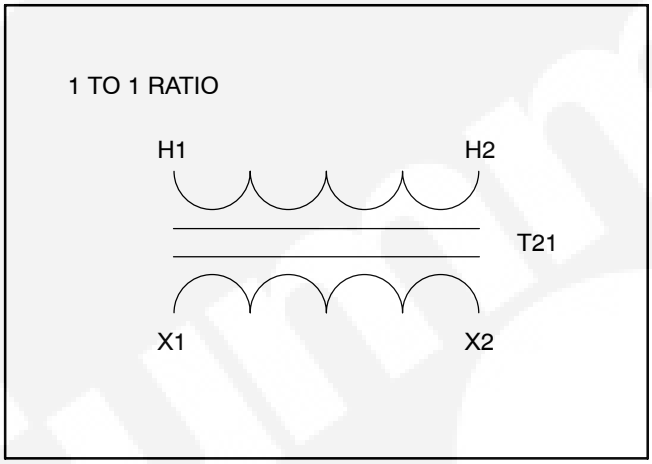


FIGURE 5-4. REFERENCE TRANSFORMER T21

E - Replacing the Voltage Regulator PC board or VR Chassis

Use the following procedure for replacing the voltage regulator PC board or VR chassis.

- Open the voltage regulator housing.
- Disconnect the regulator, and if necessary, label the wires (see Figure 5-5).
- Remove four attaching screws, and remove the faulty PC board.
- Secure the new board with four attaching screws.
- Reconnect the regulator wires to the proper terminals.
- Reconnect the battery cables, positive (+) cable first.
- Start the engine, and set voltage as outlined in test M, Voltage Adjustment.

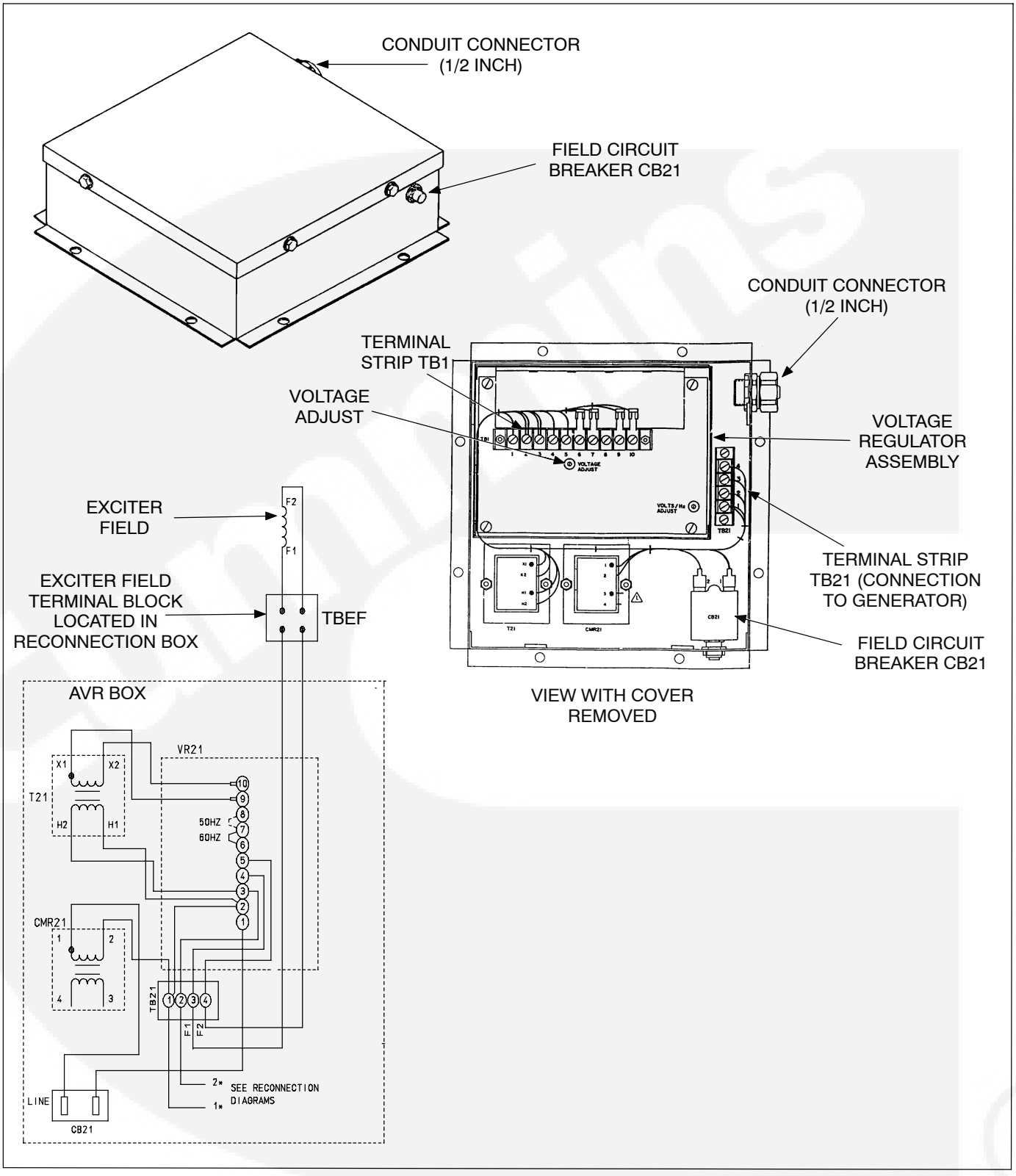


FIGURE 5-5. VOLTAGE REGULATOR BOX

F - Testing Rotating Rectifiers

Two different rectifier assemblies make up the rotating rectifier bridge assembly (see Figure 5-6). Test each diode on the rectifier assemblies with an ohm meter using negative and positive polarities:

- Connect one test lead to the F1+ stud, connect the other lead to diodes CR1, CR2, and CR3 sequentially, and record the resistance value of each rectifier.
- Connect one test lead to the F2– stud, connect the other lead to diodes CR4, CR5, and CR6 sequentially, and measure the resistance value of each rectifier.
- Reverse the ohmmeter leads from the preceding steps, and repeat the resistance measurements: F1+ stud to CR1 through 3, and F2– to CR4 through 6.
- All resistance values should read high for one test and low for the other test. If any reading is high or low for both tests, the rectifier assembly is defective.

NOTE: Use 23 to 26 inch-lbs (2.6 to 2.9 N•m) torque when replacing nuts for F1+ and F2–, and diodes CR1 through CR6.

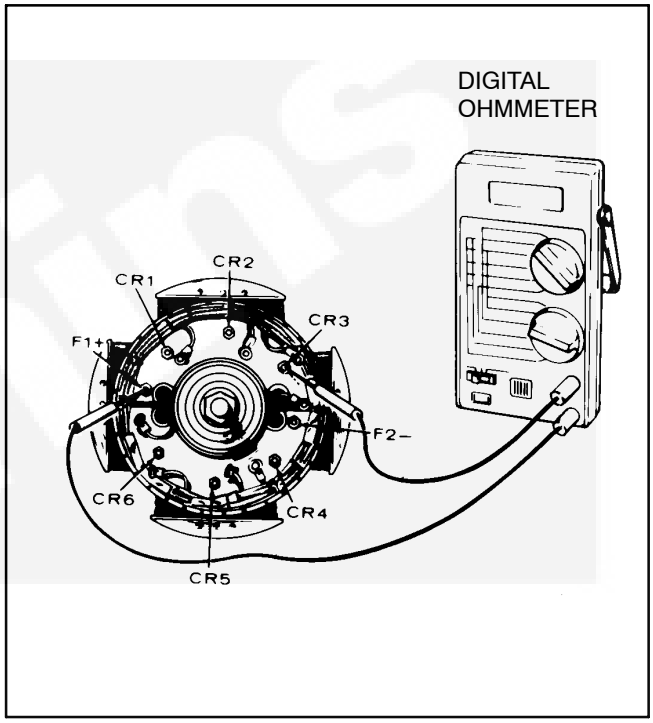


FIGURE 5-6. TESTING ROTATING RECTIFIERS

G - Testing Exciter Stator

Test the exciter stator for open or shorted windings, and grounds, as follows (see Figure 5-7).

Open or shorted windings:

- Disconnect F1+ and F2– exciter field leads from terminal block in generator end bell, and measure the resistance between them. The resistance should measure 12.4 ohms ± 10% at 77° (25° C).

Grounds:

- Connect the ohmmeter between either field lead and exciter stator laminations.
- Set the ohmmeter to the highest resistance range. Resistance must read one megohm or greater.

NOTE: The preferred test is with a megger or insulation resistance meter that applies 500 VDC or more to the test leads. Readings should be 100,000 ohms or greater.

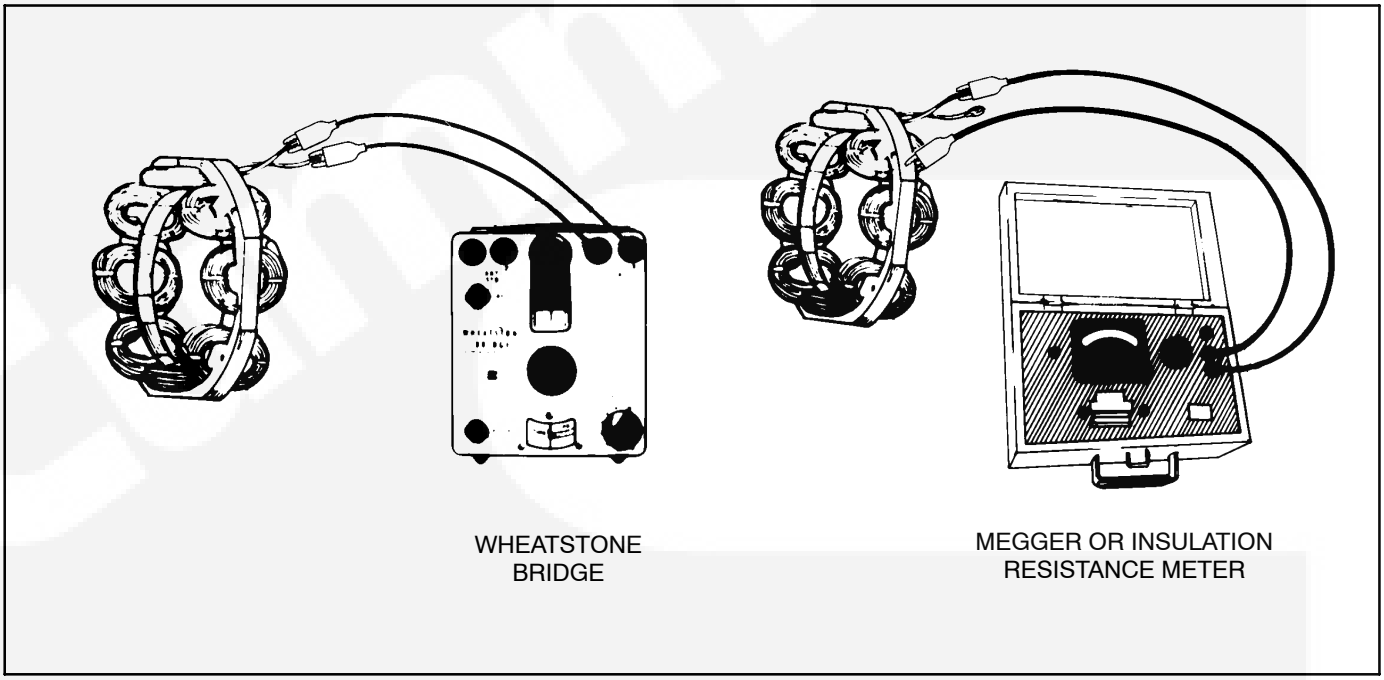


FIGURE 5-7. TESTING WINDINGS RESISTANCE

H - Testing the Exciter Rotor

Test the exciter rotor for open, shorted windings, or grounds (see Figure 5-8):

- Disconnect the main rotor field leads which connect to the rotating rectifier assemblies at F1+ and F2–.
- Disconnect lead wires from diodes CR1 through CR6.
- Using a Wheatstone bridge or digital ohmmeter, measure between exciter lead pairs T1–T2, T2–T3, and T1–T3. Resistance should measure 645 milliohms ± 10% at 77° (25° C).

Test the exciter rotor for grounds.

- With all generator leads disconnected from diodes CR1 through CR6, measure between any diode lead and exciter rotor laminations.
- The reading should be greater than one megohm.
- A reading less than one megohm indicates defective ground insulation.

NOTE: The preferred test is with a Megger or insulation resistance meter that applies 500 VDC or more. Be sure all exciter leads are disconnected from the diodes. Readings should be 100,000 ohms or greater.

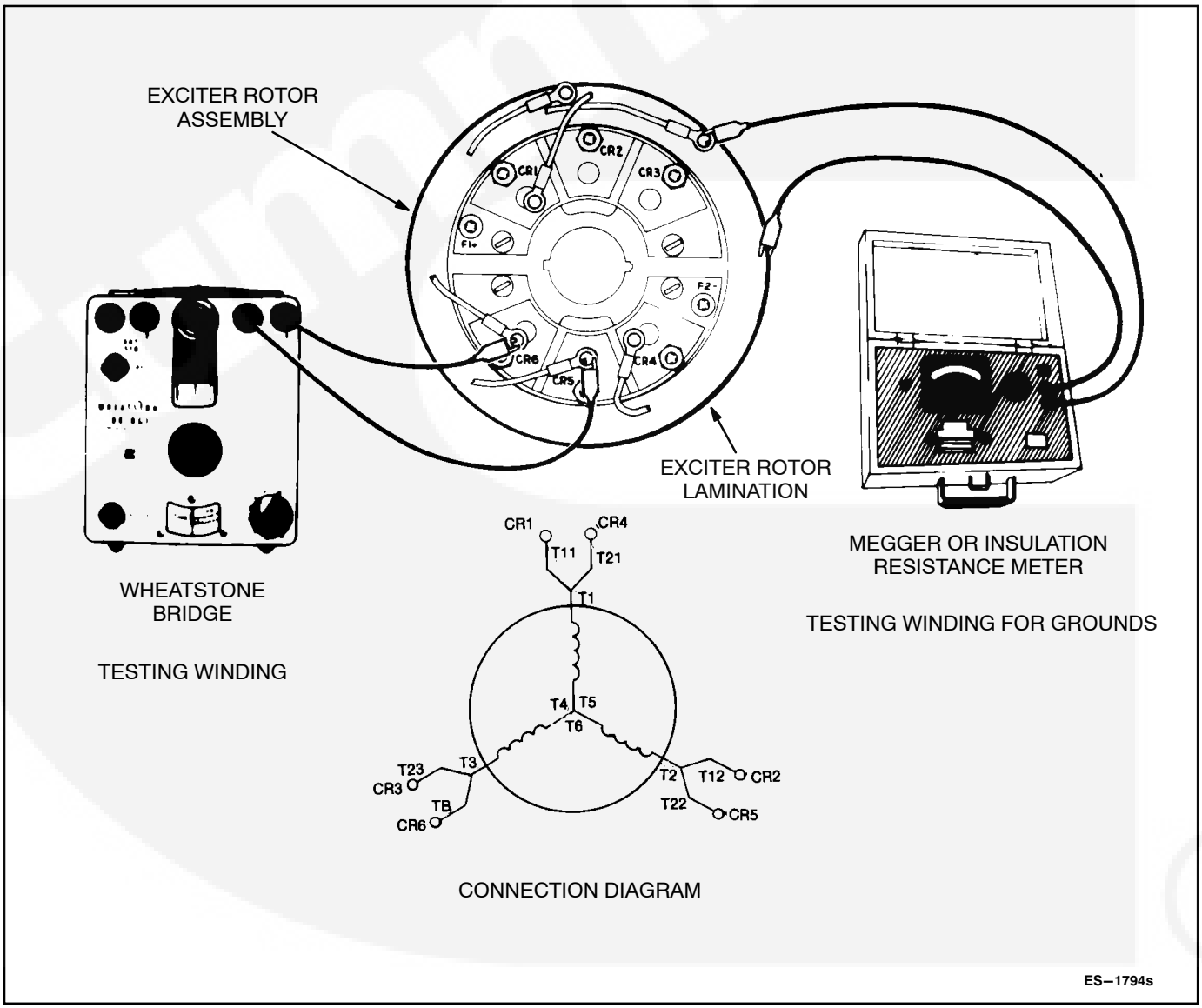


FIGURE 5-8. TESTING THE EXCITER ROTOR

J - Testing the Generator Stator

Using the proper test equipment, test the stator for grounds, opens, and shorts in the windings (Figure 5-9).

Test for grounds:

NOTE: Some generators have ground connections to the frame. Check the wiring diagram. All stator leads must be isolated for testing.

- Use a megger or insulation resistance meter which applies 500 VDC or more to the test leads.
- Test each stator winding for a short to the laminations.
- A reading less than 100,000 ohms indicates a questionable stator.
- Thoroughly dry the stator and retest.

Test the stator for open or shorted windings:

- Use an accurate instrument for this test such as a Kelvin bridge or digital ohmmeter.
- For single-phase stators, measure between T1-T2 and T3-T4.
- For three-phase stators, measure between T1-T4, T2-T5, T3-T6, T7-T10, T8-T11, and T9-T12.
- Resistance values at 77° (25° C) are listed in the Stator Resistance Table (lead length between 0 and 15 feet).
- If any windings are shorted, open, or grounded, replace the stator assembly.
- Before replacing the assembly, check the leads for broken wires or insulation.

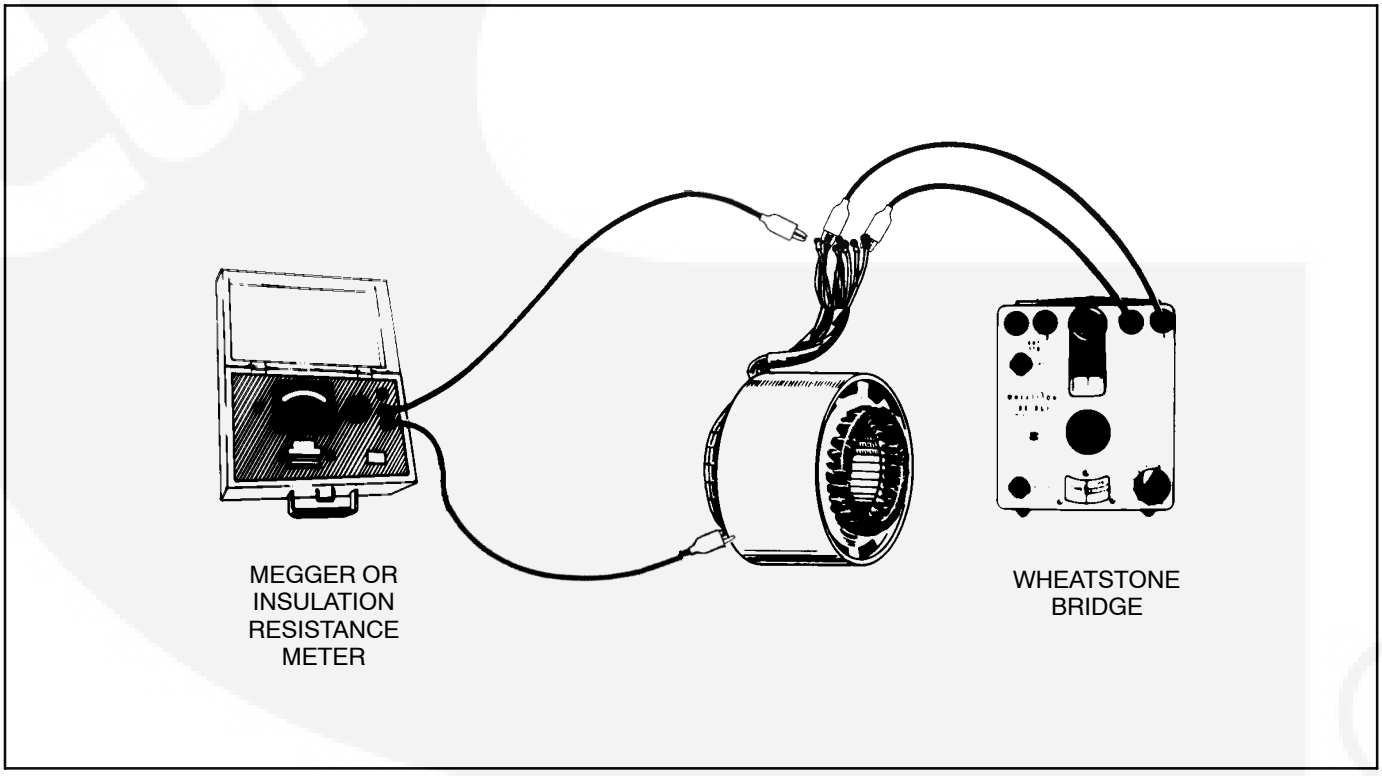


FIGURE 5-9. TESTING THE GENERATOR STATOR

Stator Resistance Values

Single Phase kW Rating	Resistance (Ohms ± 5 %)	Three Phase kW Rating	Resistance (Ohms ± 5 %)
12/15	.122 – .134	12/15	.172 – .191
16/20	.075 – .083	16/20	.105 – .117
20/24	.061 – .067	20/25	.086 – .096
24/30	.040 – .044	25/32	.056 – .062
30/35	.032 – .036	30/40	.048 – .053

K - Testing the Generator Rotor

For these measurements, use a megger or insulation resistance meter which applies 500 VDC or more to the test leads.

Test for grounds (Figure 5-10):

- Remove rotor leads F1+ and F2– from the rotating rectifier assemblies.
- Connect test leads between F1+ and the rotor shaft. Meter should read 100,000 ohms or greater.
- If the measurement value is less than 100,000 ohms, the rotor is questionable.
- Thoroughly dry the rotor and retest.
- Replace a grounded rotor with a new identical part.

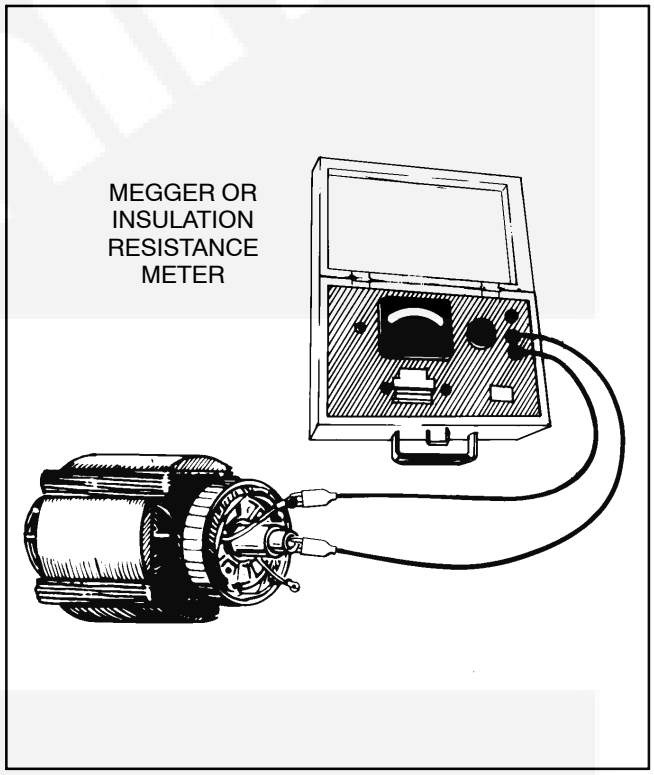


FIGURE 5-10. TESTING WINDINGS RESISTANCE

Test for open or shorted windings:

- Remove rotor leads F1+ and F2– from the rotating rectifier assemblies.
- Using an ohmmeter, measure the resistance between F1+ and F2– (see Figure 5-11).
- Refer to the Rotor Resistance Values Table for the appropriate resistance values at 77° (25° C).
- Replace a defective rotor with a new, identical part.

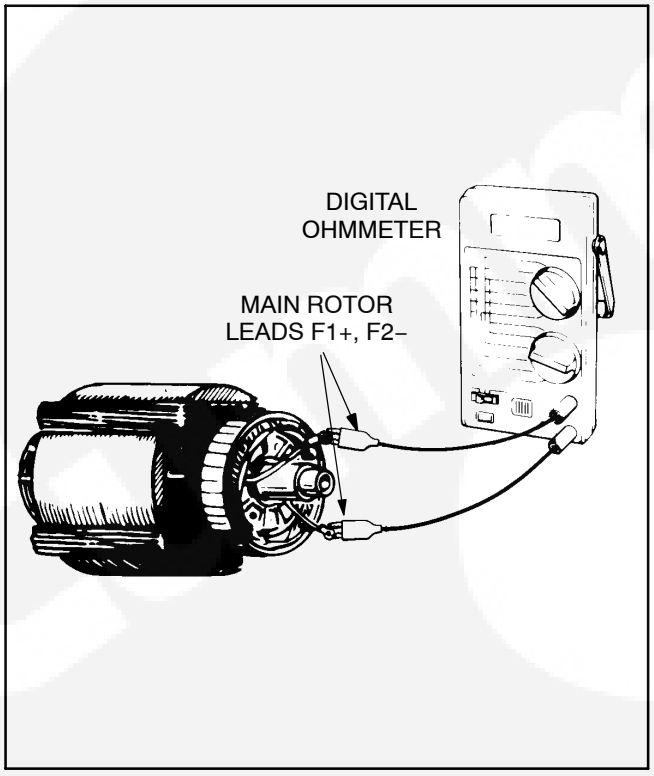


FIGURE 5-11. TESTING WINDINGS RESISTANCE

Single and 3–Phase
Rotor Resistance Values

kW Rating	Resistance (Ohms ± 10%)
12/15	2.35
16/20	2.75
20/24	1.80
24/30	2.24
30/35	2.91

L - Wiring Harness Check

Check the wiring harnesses using the following procedure.

- Inspect all wires for breaks, and loose or reversed connections. See the wiring diagrams on pages 7-10 and 7-11.
- Disconnect all wires at both ends, and check wires for continuity or opens with an ohmmeter.
- Check with an ohmmeter each wire against each of the other wires and to ground for possible shorts or insulation breaks under areas covered by wrapping material.
- Reconnect or replace wires according to the wiring diagram on pages 7-10 and 7-11.

M - Voltage Adjustment

When checking output voltage, make sure that the generator has stabilized and is running at the correct speed (frequency).

⚠WARNING ***Contact with high voltage can cause severe personal injury or death. Do not touch any exposed wiring or components with any part of the body, clothing, tool or jewelry. Do not use non-insulated tools inside the control. Stand on an insulating mat or dry wood platform when the control doors are open.***

With the generator running, set the voltage adjust potentiometer on the regulator board assembly for correct voltage (see Figure 5-12).

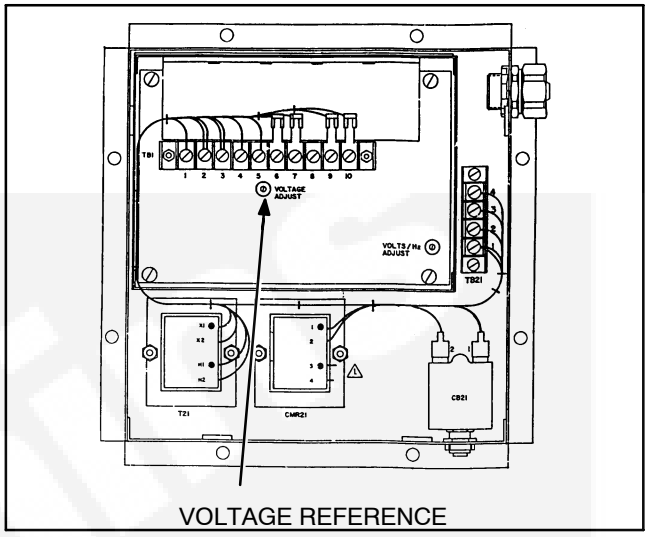


FIGURE 5-12. VOLTAGE REGULATOR BOARD

N - Reconnection

Generator reconnection conforms to AC wiring diagrams supplied in Section 7.

REPLACING THE BEARINGS

The generator is heavy. Use the appropriate tools and procedures to remove it.

⚠WARNING ***Accidentally dropping the generator can damage it and cause severe personal injury and death. The hoist, straps and chains must have sufficient capacity and be attached properly so that the load cannot shift.***

Before starting, disconnect the starting battery cables (negative [–] first) to make sure the set will not start while working on it.

⚠WARNING ***Accidental starting of the generator set while working on it can cause severe personal injury or death. Prevent accidental starting by disconnecting the starting battery cables (negative [–] first).***

Generator Removal

- Disconnect the PTO drive shaft between the generator and the truck's transmission.
- Remove reconnect box cover and disconnect alternator output leads and exciter F1 and F2 leads.
- Remove nuts and washers from through–studs to take off the reconnect box.
- Remove the generator from the truck.

Alternator Disassembly

Position the alternator with the end bell facing up which facilitates a safer and easier assembly and disassembly. Refer to Figure 5–13 for an exploded view of the alternator with parts identification.

- Remove nuts from the rotor through studs.
- Remove the end bell by tapping upward around the joint and separating it from the stator assembly.
- Remove four stator through-studs with a vise grip.
- Using a safe lifting device, stator handling tongs, or chain and lift hooks, lift stator assembly from gear case adapter. If necessary, lift unit off the bench about one inch and tap adapter housing with a soft faced hammer to free stator from adapter.

⚠CAUTION ***Do not set stator down on open end, top or bottom. Stator weight can damage the windings.***

- While stator is still on lift tongs or hooks, revolve stator to horizontal position and set it on its side.
- Remove the air baffle by loosening four locking screws.

NOTE: A rope sling is the most suitable device for handling rotors.

- Remove the rotor and fan by using a soft-faced hammer to tap on the adapter while holding the rotor assembly about one inch above the bench with a hoist and rope sling.

⚠CAUTION ***Use care to prevent damage to the fan blades. Broken blades will throw the fan out of balance and reduce the air flow rate.***

- If it is necessary to replace a damaged fan, support the rotor assembly horizontally and remove the fan from the rotor with a gear puller.
- Hold the rotor in a suitable clamp and loosen the nut on the rotor through-stud bolt.
- If required, remove the bearing with a gear puller and accessory crutch (if available) from the rotor through stud.
- Clamp the alternator rotor in a fixed vertical or horizontal position to remove or install the rotor lock nut. The lock nut is torqued to 130-150 ft. lb. (176-203 N•m).
- If bearing, shaft, or oil seal replacement is required, hold gear case upright and tap drive pinion and shaft through gear case.
- With a vise grips, remove rotor through-stud from the drive pinion shaft.
- Remove the snap ring from the bearing on the drive pinion shaft.
- Press the bearing from the drive pinion shaft if bearing replacement is required.

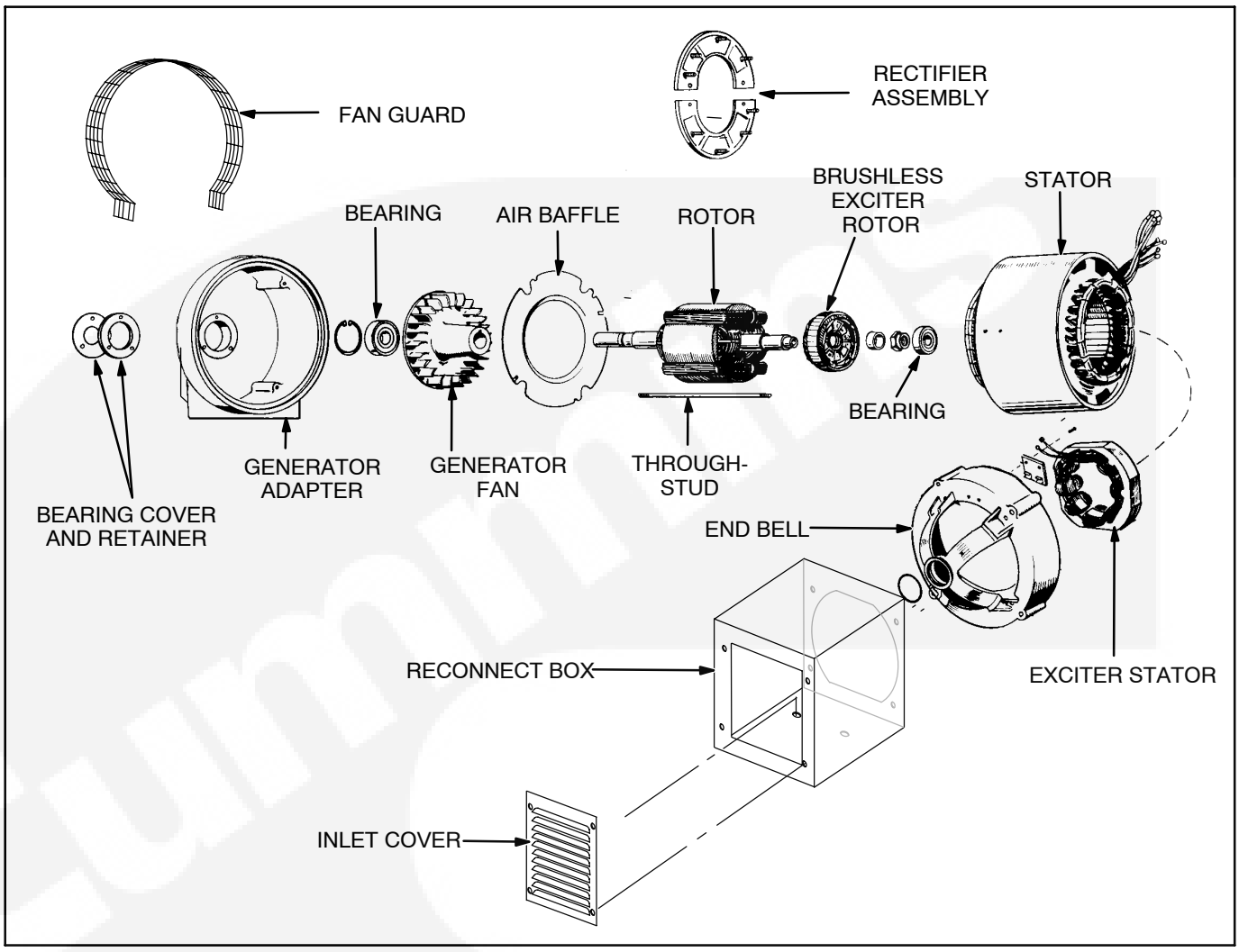


FIGURE 5-13. ALTERNATOR–PARTS IDENTIFICATION

Alternator Assembly

Assemble alternator components in reverse order from disassembly using the following additional instructions.

- Clean and inspect mating surfaces.
- Coat mating area between alternator bearing and end bell bearing hole with a thin film of Molykote or equivalent lubricant.
- Install rotor through-stud in drive pinion shaft, if it was removed.
- Install the rotor and fan assembly on the adapter.
- Guide the key slot in the fan onto the key in the drive pinion shaft. A raised line on the fan body casting indicates the location of the key slot inside. The drive shaft and key can be seen through the air outlet in the adapter.
- If they were removed, install the exciter rotor and shaft bearing.
- Torque the shaft nut against the exciter rotor to 130 to 150 ft. lbs. (176 to 203 N•m).

⚠CAUTION ***Use care to prevent damage to the fan blades. Broken blades will throw the fan out of balance and reduce the air flow rate.***

- Install two stator through-studs in the adapter for aligning the stator assembly over the rotor.
- Install the baffle ring.
- Install the remaining two stator through-studs in the adapter.
- Install the stator and end bell. Torque the nuts on the through-studs to 19 to 21 ft. lbs. (26 to 28 N•m).
- Torque the rotor through-stud nut to 55 to 60 ft. lbs (75 to 81 N•m).
- Install the mounting feet and the control box.
- Connect the alternator output and control leads according to the appropriate wiring diagram.
- Replace the end bell cover.
- Replace the reconnect box cover.

6. System Wiring

GENERAL

This section provides the procedure that is used to connect the AC electrical system of the YD PTO AC generator.

Connecting the generator AC electrical system involves:

- Generator voltage connections
- Load connection
- Wiring of voltage regulator box
- Wiring of the display module, or wiring of the optional meter/breaker box (single- phase, series 3-wire configuration only)

Local regulations often require that wiring connections be made by a licensed electrician, and that the installation be inspected and approved before operation. All connections, wire sizes, materials used, etc. must meet local electrical codes.

⚠WARNING ***Improper wiring can cause a fire or electrocution, resulting in severe personal injury or death and/or property and equipment damage.***

Before using the generator, verify that all electrical connections are secure, and that all wiring is complete. Replace and secure any access panels that have been removed during installation. Check that the load cables from the generator are properly connected.

Wiring methods must be in accordance with applicable codes, such as the National Electrical Code (NFPA No. 70).

AC WIRING

Generator Voltage Connections

The YD PTO AC generator can be configured for the voltages shown in the Reconnection Diagrams in Section 8. Most of these voltages must be reconnected by the installer to give the voltage required by the installation. Before shipping, the factory tests the generator output by connecting the generator to produce a particular test voltage. The generator may be connected at the factory to produce a specified voltage per customer order. The installer must always check the stator lead terminal block connections and perform any necessary reconnect to obtain the voltage desired.

When installing the generator display, connect the cables at the back of the display module (see page 7-7. Two current sensors are supplied for single-phase displays and three sensors for three-phase displays. Mount the sensors in the circuit breaker box (recommended). Run the wires from the generator to the input side of the circuit breaker for the lines to be monitored. The voltage transformer(s) included in the display kit work for 120 and 240 VAC systems. The transformer(s) should be securely attached in the electrical box.

When installing the optional meter/breaker box, the generator leads must be routed through current transformers for proper meter operation. The transformers are labeled CT1 and CT2. Refer to Figures NO TAG and 6–4 to identify the output leads that must be routed through each correct transformer.

Use the electrical schematic supplied with your generator when actually performing load connections.

⚠CAUTION ***Reconnecting factory connected generators to lower voltages can reduce set ratings, and also render line circuit breakers too small. Consult with your distributor before performing reconnection for a different voltage.***

AC Connections

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

See Figures 6–2, NO TAG, and 6–4 for typical connections. Once the generator, voltage regulator box and generator display or control/meter box are mounted, perform the following steps:

1. Cut two holes into the side of the reconnect box, one for the load wires and the other for the voltage regulator leads.
2. Cut and fit flexible watertight conduit between:
   a. The generator and the load panel or the optional control/meter box.
   b. The generator and the voltage regulator box.
3. Pass the load wires and the voltage regulator leads through the conduit and connect to the appropriate terminals. Use 16 gauge (stranded) wire for the voltage regulator circuit.

   Wiring diagrams for the meter/breaker panels, generator, and voltage regulator are found in Section 8.
4. Make sure that all terminal connections are clean and tight.

   To prevent corrosion, cover all terminals with a non-conductive, corrosive protectant sealer.
5. Make sure that the terminals on TB1 are labelled correctly with the number 10 closest to the large electrolytic capacitor to prevent reverse wiring (see Figure 6-1).

Grounding

Typical requirements for bonding and grounding are given in the National Electrical Code, Article 250. All connections, wire sizes, etc. must conform to the requirements of the electrical codes.

⚠WARNING ***Faulty grounding can lead to fire or electrocution and severe personal injury or death. Grounding must be in accordance with applicable codes.***

Load Balancing

Three phase: When connecting loads to three phase generators, balance the loads so the current flow from each line terminal (L1, L2, and L3) is about the same. This is especially important if both single phase and three phase loads are connected. Any combination of single phase and three phase loading can be used as long as each line current is within 10 percent of median value and no line current exceeds the nameplate rating of the generator.

Single phase: For single phase generators connected in a “series 3-wire” configuration, the maximum loading of either branch circuit (L1 - L0 or L2 - L0) should not exceed 50 percent of the generator rated load. In addition, imbalance between branch circuits should not exceed 10 percent of rated load.

LABEL SHOULD BE INSTALLED WITH THE NUMBER 10 CLOSE TO THE LARGE ELECTROLYTIC CAPACITOR

FIGURE 6-1. CORRECT LABELLING OF VOLTAGE REGULAR TB1

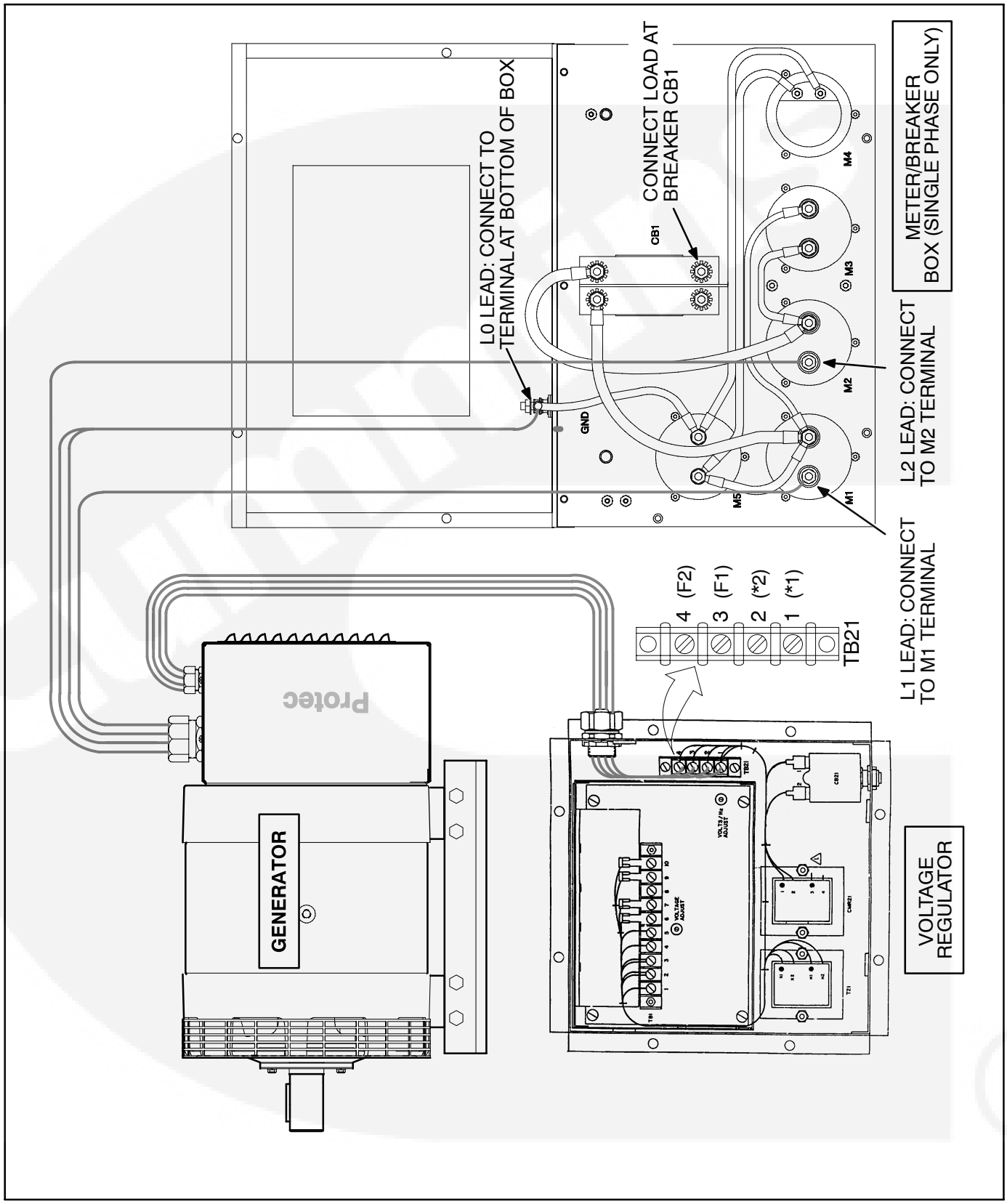


FIGURE 6-2. 15 KW GENERATOR WIRING

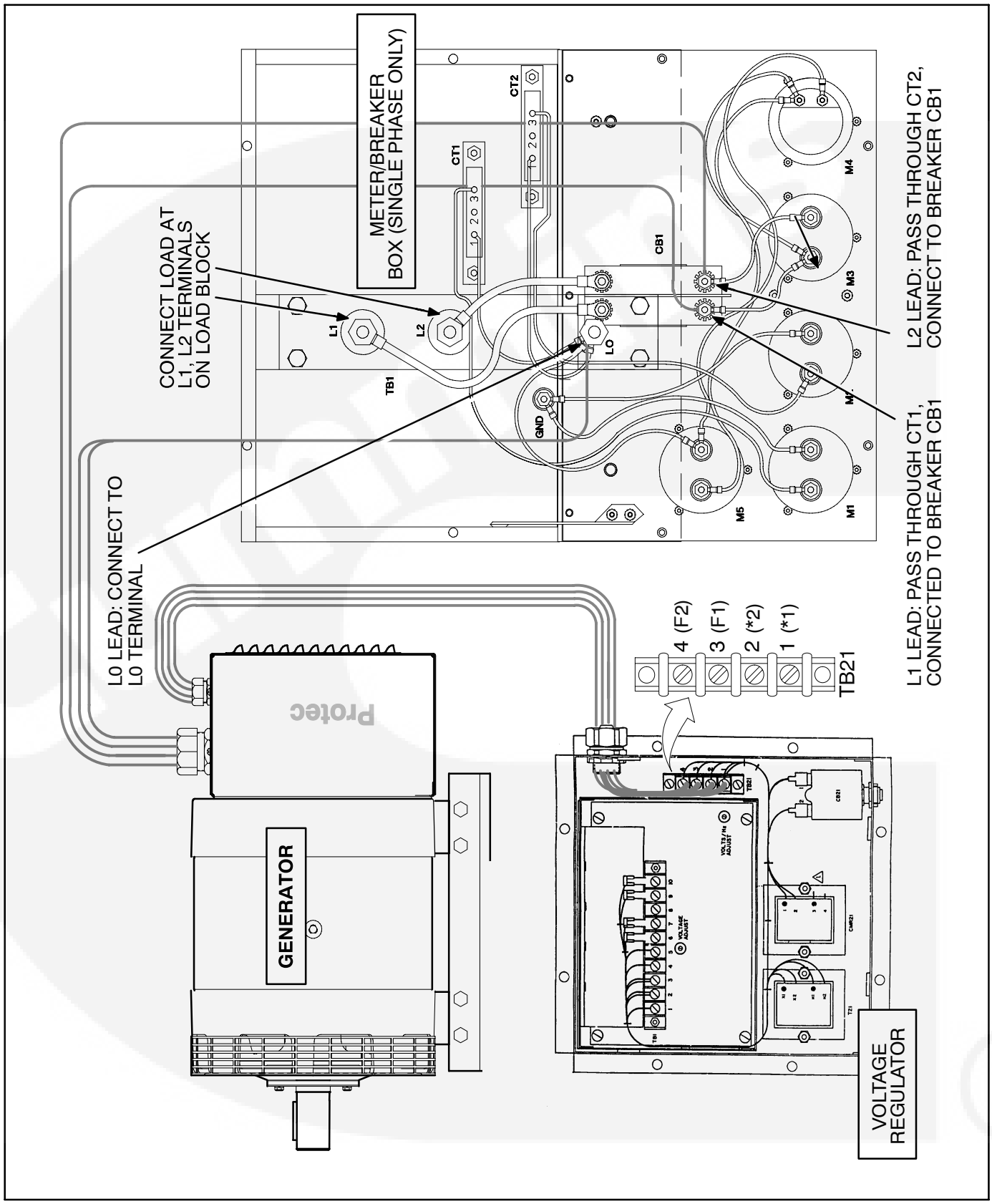


FIGURE 6–3. 20, 24 KW GENERATOR WIRING

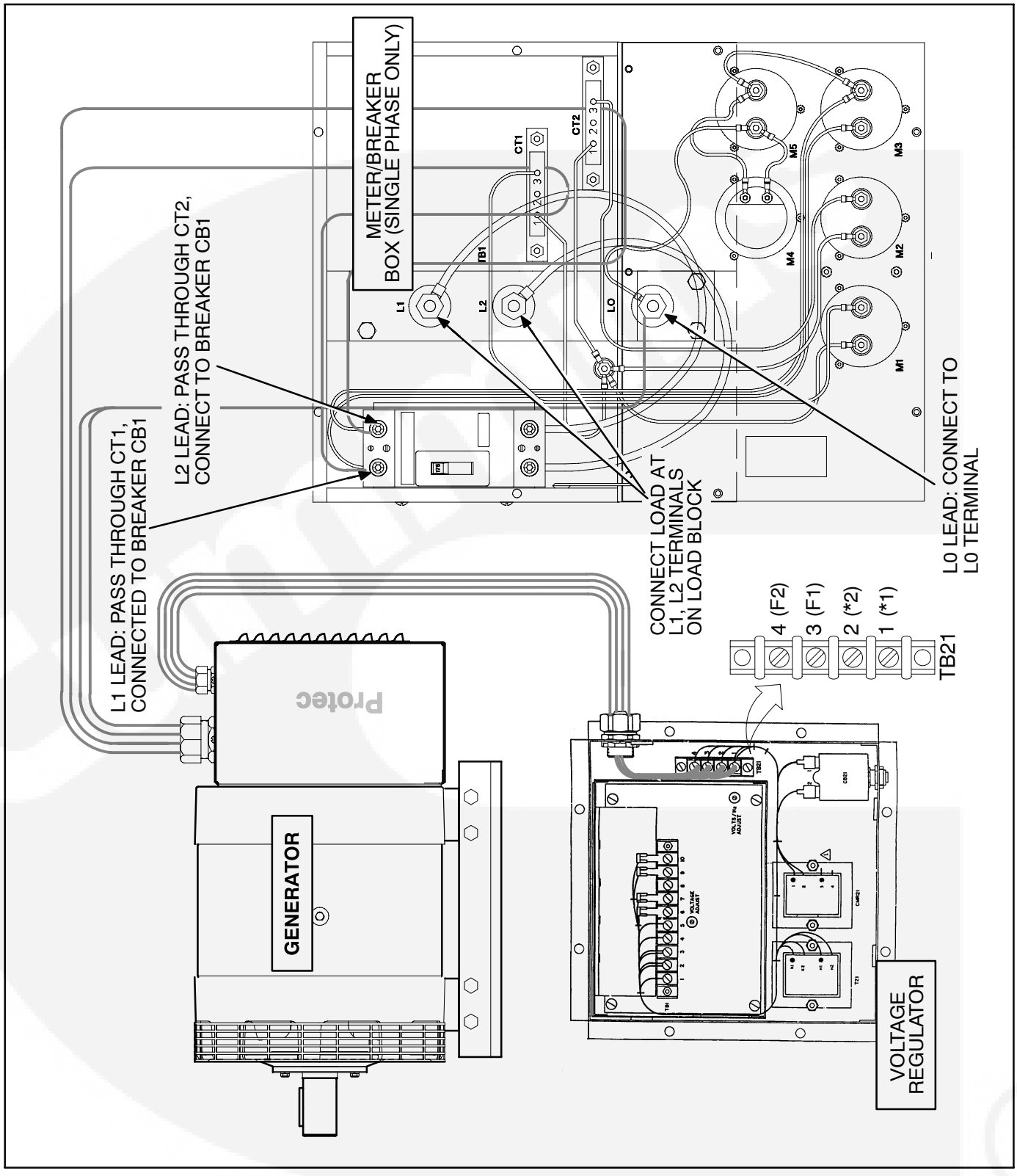


FIGURE 6-3. 30, 35 KW GENERATOR WIRING

OUTPUT VOLTAGE FREQUENCY CONVERSION

⚠WARNING ***Electrical shock can cause severe personal injury or death. Use extreme caution when working on electrical circuitry. Attach and remove jumpers only when generator is not operating.***

⚠CAUTION ⚠CAUTION ***The meter/breaker box for 50 HZ applications is a different component than the meter/breaker box for 60 HZ applications. The two components are <u>not</u> interchangeable: the correct meter/breaker box must be installed for the application.***

The frequency of the voltage output from the YD PTO generator may be converted from 60 HZ to 50 HZ, or from 50 HZ to 60 HZ, by performing the following steps (see Figure 6-4):

1. Stop the generator. Disable the propulsion engine and PTO unit. Remove the propulsion engine battery leads, negative (-) lead first, so that there is no possibility of the engine being started.
2. Remove the cover to the voltage regulator box.
3. Locate terminal block TB1 inside the voltage regulator box.

4a. **60 HZ to 50 HZ conversion:** Retain the jumper between terminals 6 and 7. Install an additional jumper between terminals 7 and 8. Readjust the speed of the generator/PTO from 1800 RPM to 1500 RPM .

NOTE: It is important to note that the unit needs to maintain a steady 1500 RPM for 50 HZ operation. The additional jumper does not prevent the unit from overvoltage and overfrequency.

4b. **50 HZ to 60 HZ conversion:** Remove the jumper between terminals 7 and 8. Readjust the speed of the generator/PTO from 1500 RPM to 1800 RPM.

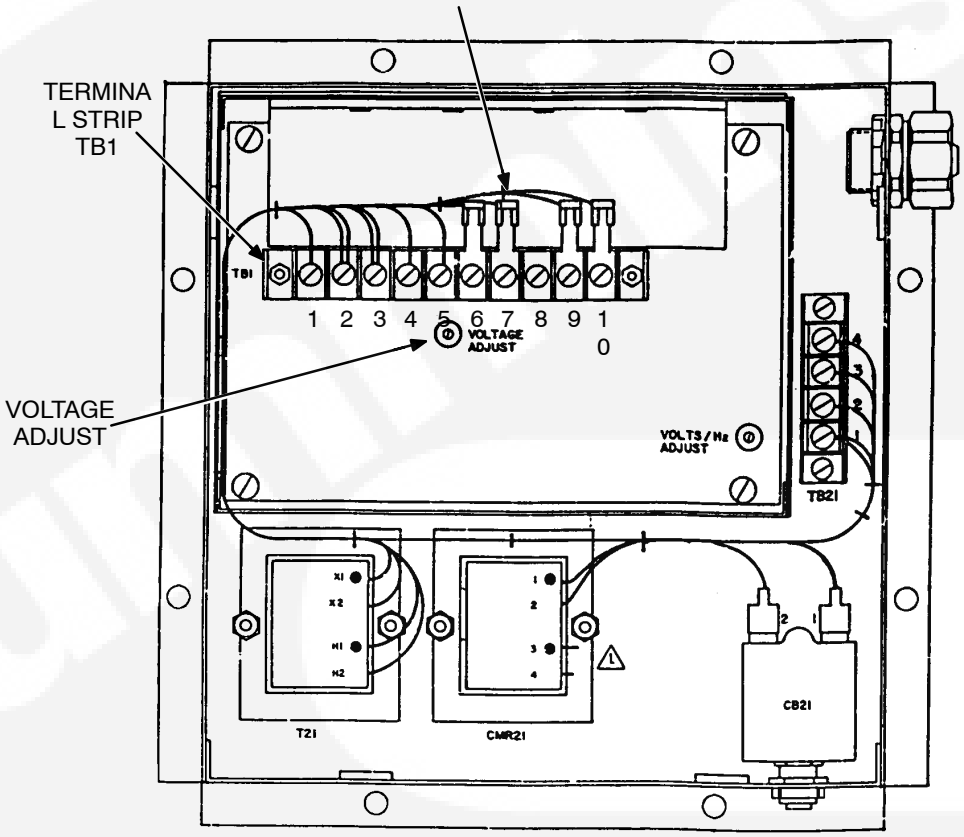
⚠WARNING ***Failure to operate the YD PTO generator at the correct speed may damage or destroy the generator and associated equipment. All governors or speed-regulating systems must be in place, working correctly and activated before the YD PTO generator can be used.***

5. Start the engine/governor/PTO/generator system, recheck output voltage and adjust as necessary using the voltage adjustment on the voltage regulator (see Figure 6-4).

⚠WARNING ***Electrical shock can cause severe personal injury or death. Attach and remove meter leads only when generator is not operating. Do not touch meter or meter leads during testing. Use extreme caution when adjusting output voltage: exposed terminals inside voltage regulator box carry full generator output voltage potential.***

60 HZ TO 50 HZ CONVERSION: RETAIN JUMPER BETWEEN TERMINALS 6 AND 7. INSTALL JUMPER BETWEEN TERMINALS 7 AND 8: OPERATE GENERATOR AT 1500 RPM, READJUST VOLTAGE

50 HZ TO 60 HZ CONVERSION: REMOVE JUMPER BETWEEN TERMINALS 7 AND 8: OPERATE GENERATOR AT 1800 RPM, READJUST VOLTAGE



VOLTAGE REGULATOR BOX SHOWN WITH COVER REMOVED

FIGURE 6-4. GENERATOR OUTPUT VOLTAGE FREQUENCY CONVERSION (50 OR 60 HZ)

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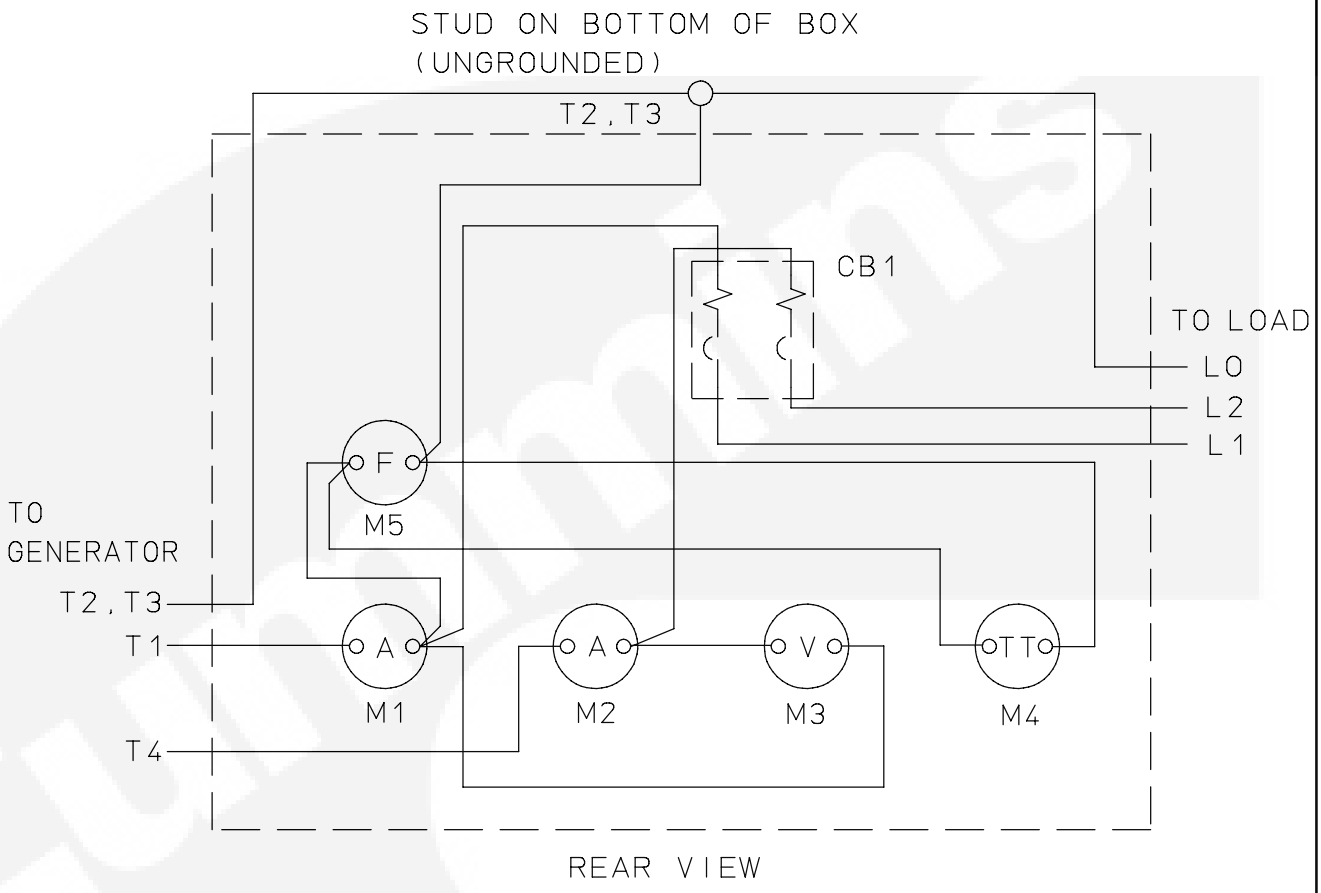
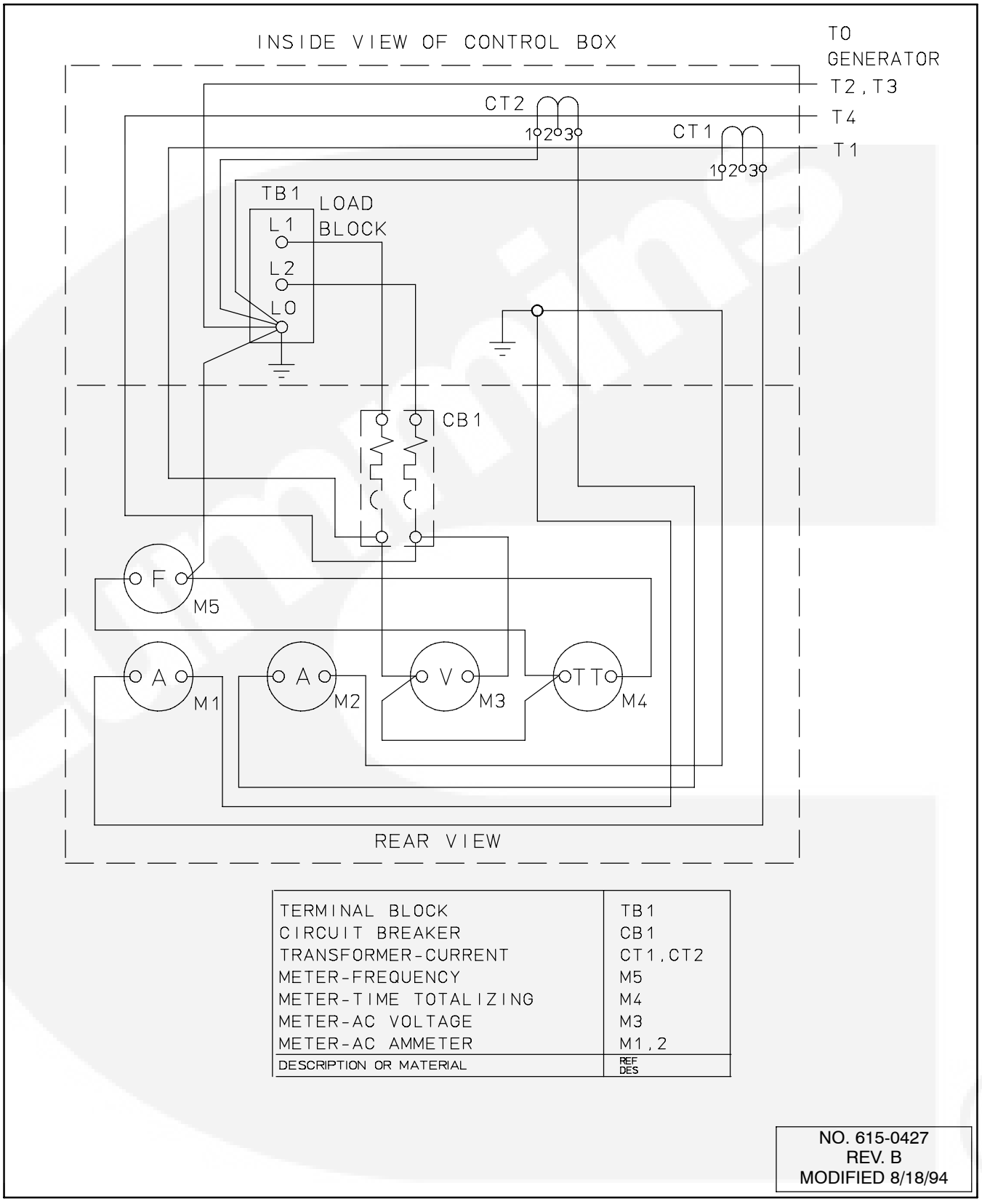
7. Installation and Wiring Diagrams



DESCRIPTION OR MATERIAL	REF DES
CIRCUIT BREAKER	CB1
METER-FREQUENCY	M5
METER-TOTAL TIME	M4
METER-AC VOLT	M3
METER-AC AMMETER	M1, 2
ASSY-SWITCHBOARD	

NO. 615-0426
REV. A
MODIFIED 5/10/94

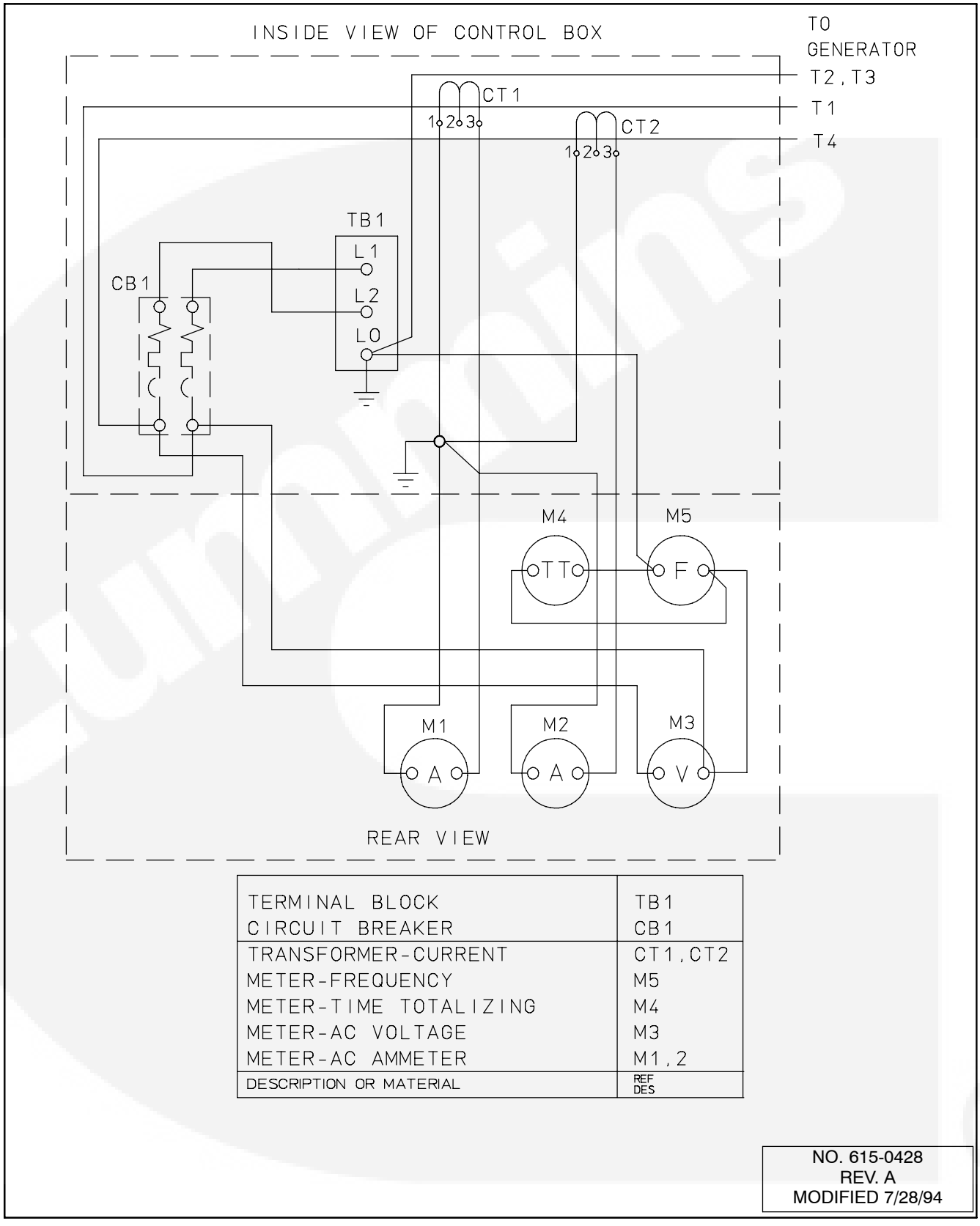
15 KW GENERATOR METER/BREAKER PANEL SCHEMATIC DIAGRAM



DESCRIPTION OR MATERIAL	REF DES
TERMINAL BLOCK	TB1
CIRCUIT BREAKER	CB1
TRANSFORMER-CURRENT	CT1, CT2
METER-FREQUENCY	M5
METER-TIME TOTALIZING	M4
METER-AC VOLTAGE	M3
METER-AC AMMETER	M1, 2

NO. 615-0427
REV. B
MODIFIED 8/18/94

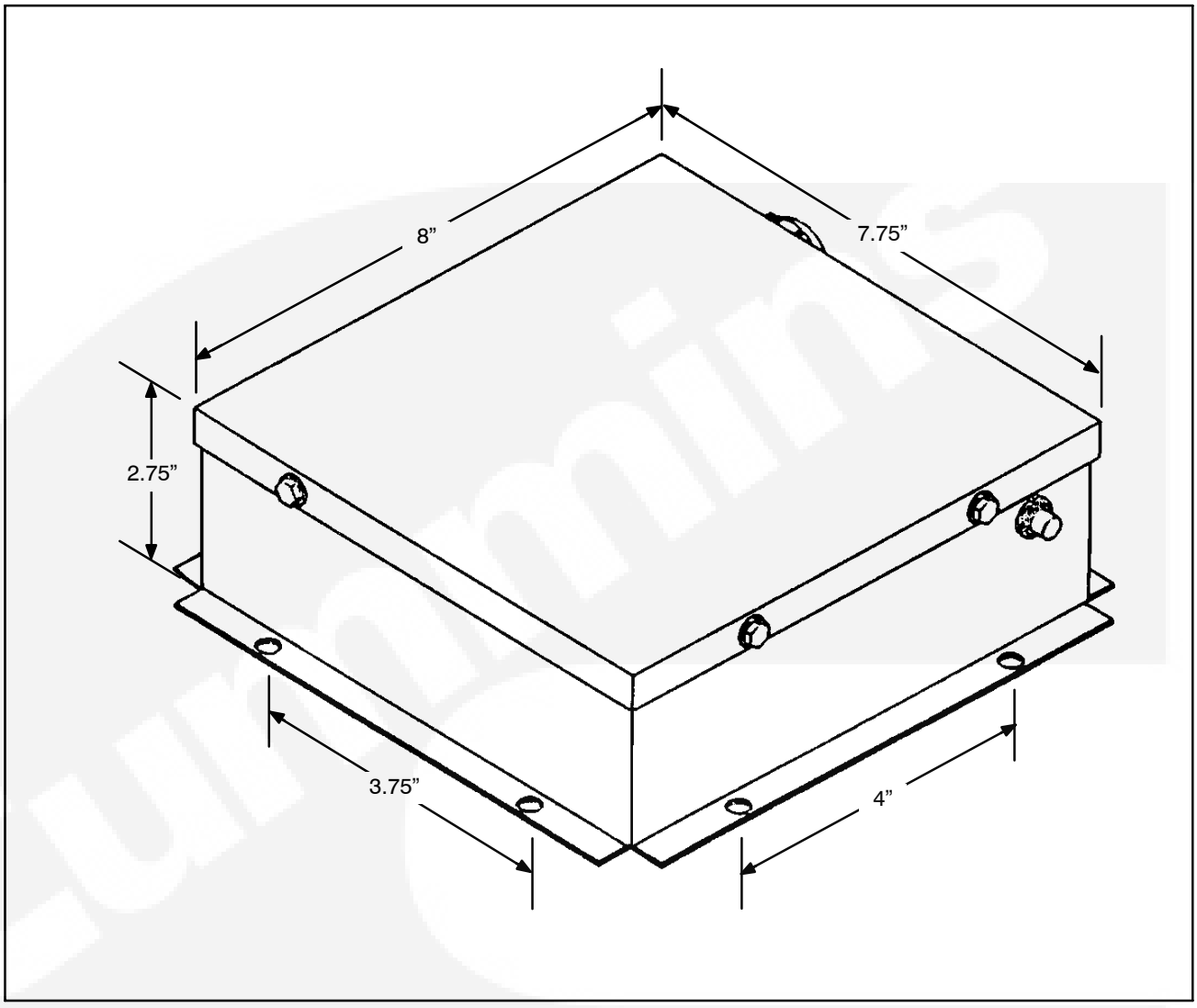
20, 25 KW GENERATOR METER/BREAKER PANEL SCHEMATIC DIAGRAM



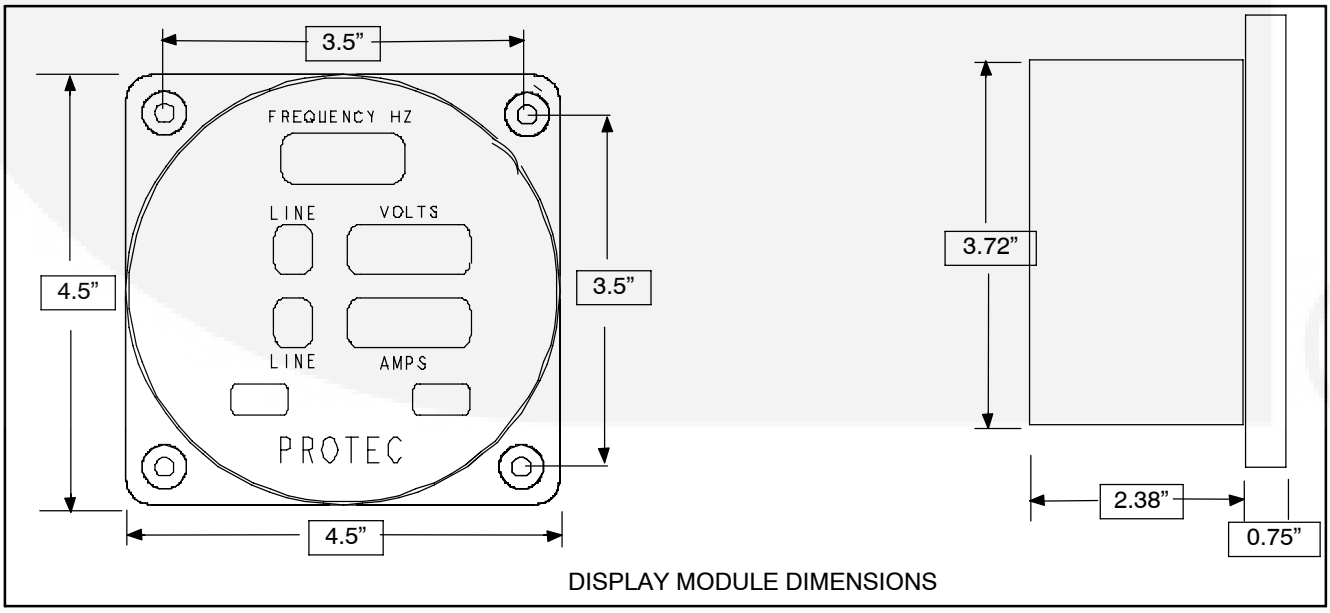
TERMINAL BLOCK	TB1
CIRCUIT BREAKER	CB1
TRANSFORMER-CURRENT	CT1, CT2
METER-FREQUENCY	M5
METER-TIME TOTALIZING	M4
METER-AC VOLTAGE	M3
METER-AC AMMETER	M1, 2
DESCRIPTION OR MATERIAL	REF DES

NO. 615-0428
REV. A
MODIFIED 7/28/94

30, 35 KW GENERATOR METER/BREAKER PANEL SCHEMATIC DIAGRAM



VOLTAGE REGULATOR BOX DIMENSIONS



DISPLAY MODULE DIMENSIONS

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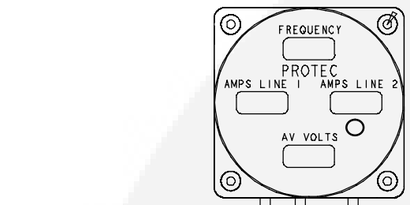
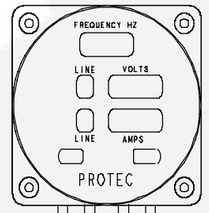


AC VOLTS AND CURRENT SENSORS CABLE CONNECTOR:		
RED	PIN 6	AC1
BLACK	PIN 5	AC2
GREEN	PIN 3	CT1+
BLUE	PIN 1	CT1–
ORANGE	PIN 2	CT2+
BROWN	PIN 4	CT2–

WARNING BUZZER CABLE CONNECTOR:		
RED	PIN 1	+12 V SUPPLY
BLACK	PIN 2	TO BUZZER

POWER SUPPLY CABLE CONNECTOR:		
RED	PIN 1	+12V
BLACK	PIN 2	GND

SINGLE-PHASE GENERATOR DISPLAY



WARNING BUZZER CABLE CONNECTOR:		
RED	PIN 1	+12 V SUPPLY
BLACK	PIN 2	TO BUZZER

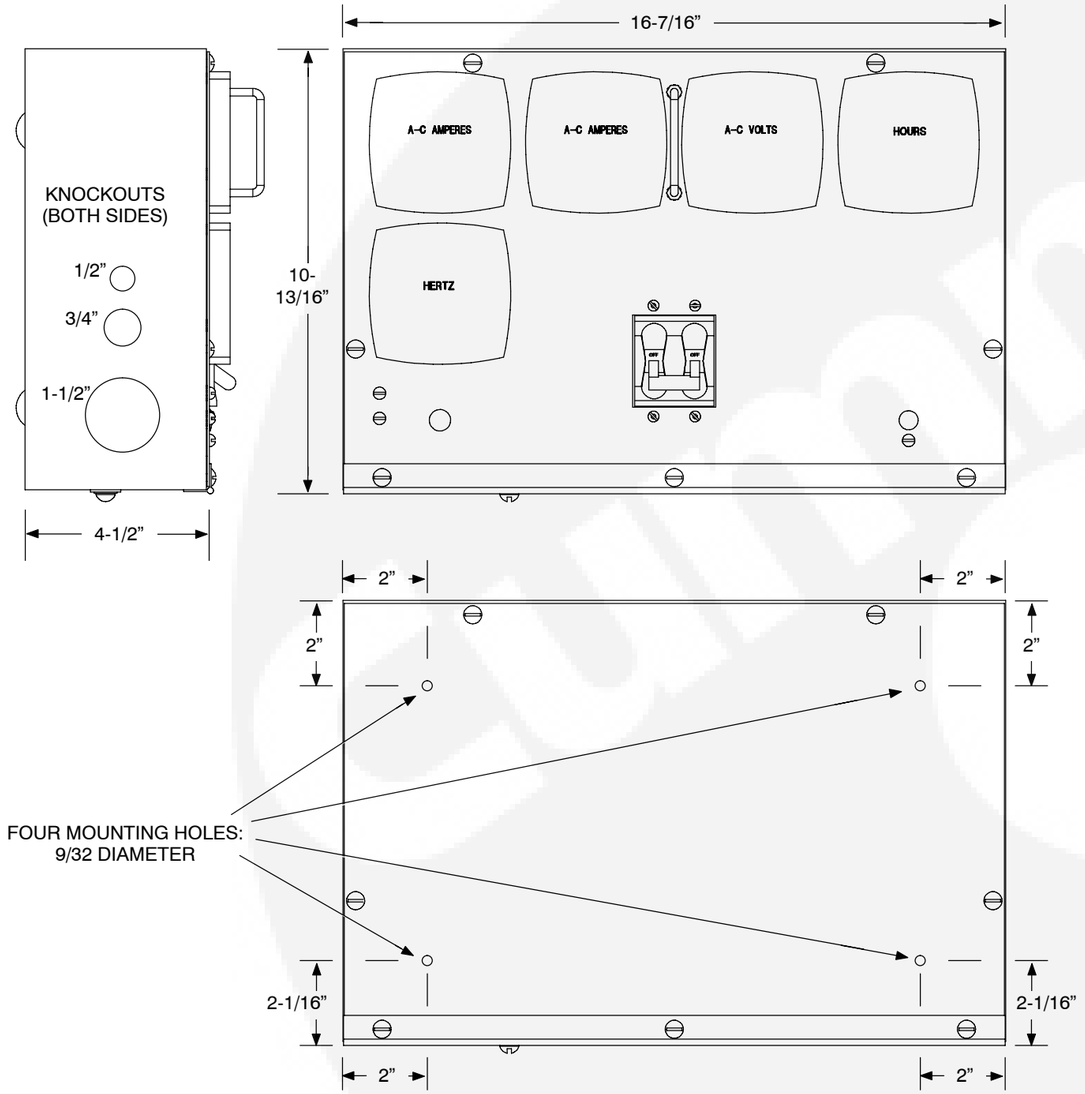
CURRENT SENSOR CABLE CONNECTOR:		
RED	PIN 1	AMP 1 TO WHT, CT1
BLACK	PIN 2	AMP 1 TO BLK, CT1
WHITE	PIN 3	AMP 2 TO WHT, CT2
GREEN	PIN 4	AMP 2 TO BLK, CT2
BLUE	PIN 5	AMP 3 TO WHT, CT3
BROWN	PIN 6	AMP 3 TO BLK, CT3

VOLTAGE TRANSFORMER CABLE CONNECTOR:			
RED	PIN 1	AC1	VT1
BLACK	PIN 2	AC1	VT1
WHITE	PIN 3	AC 2	VT2
GREEN	PIN 4	AC 2	VT2
BLUE	PIN 5	AC 3	VT3
BROWN	PIN 6	AC 3	VT3

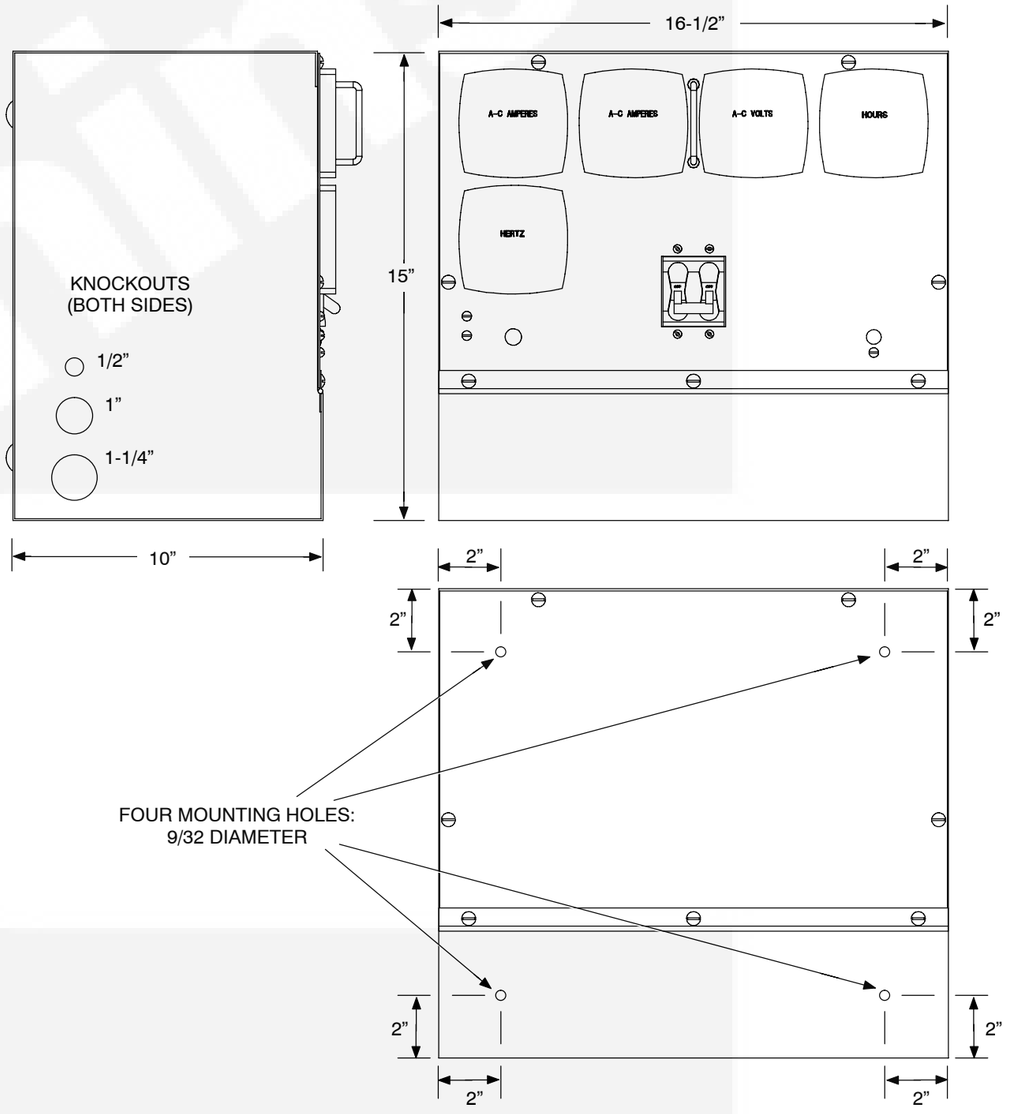
POWER SUPPLY CABLE CONNECTOR:		
RED	PIN 1	+12 V
BLACK	PIN 2	GND

THREE-PHASE GENERATOR DISPLAY

SINGLE AND THREE-PHASE DISPLAY MODULE– WIRING DIAGRAM

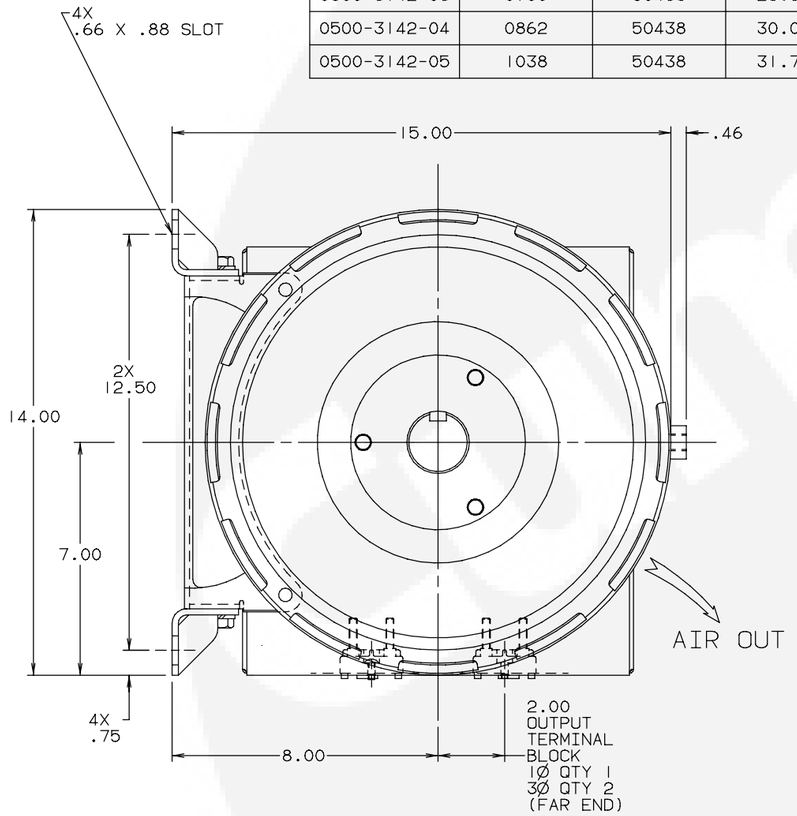


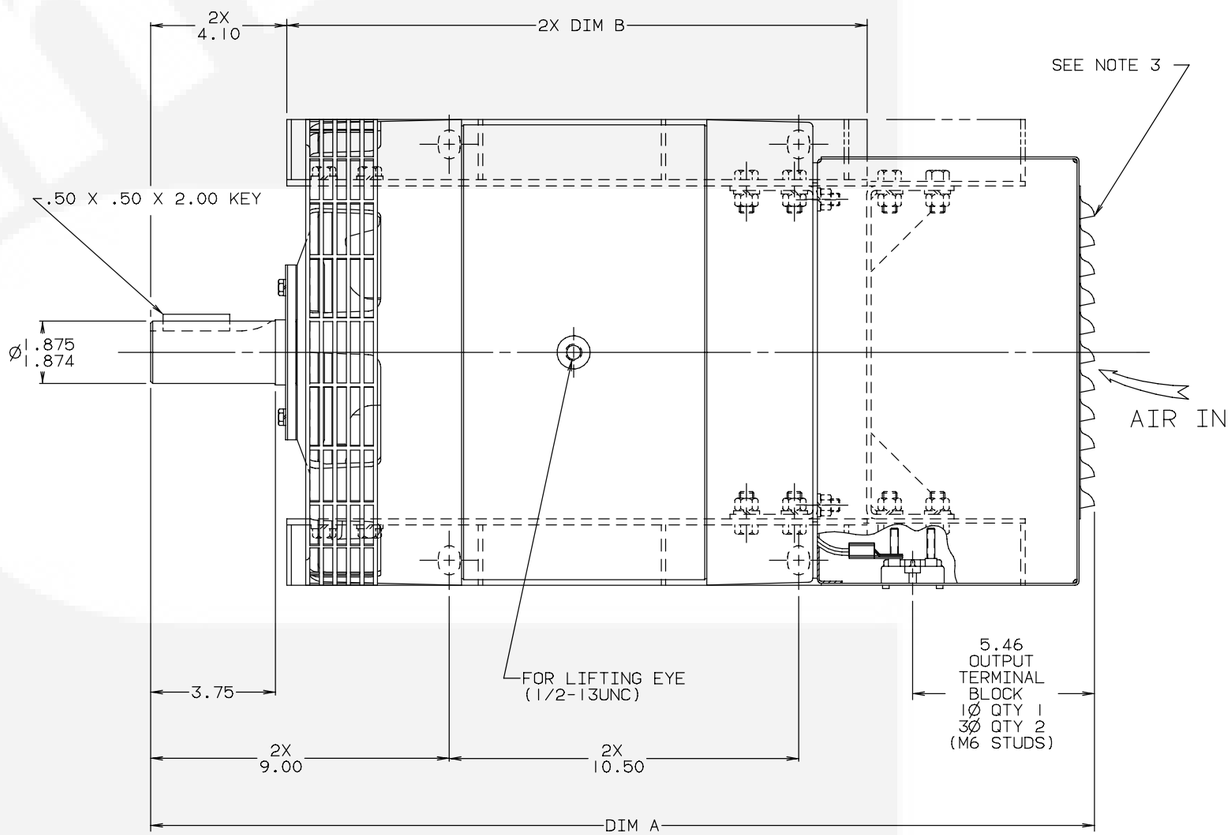
15 KW YD PTO GENERATOR METER/BREAKER PANEL DIMENSIONS, MOUNTING HOLES, AND CONDUIT OPENINGS



20 THROUGH 35 KW YD PTO GENERATOR METER/BREAKER PANEL DIMENSIONS, MOUNTING HOLES, AND CONDUIT OPENINGS

TABULATION					
OUTLINE-GEN	FRAME DESIGNATION CODE	CURRENT ER NO.	DIM A	DIM B	APPROX WEIGHT (LBS)
0500-3142-01	0431	50438	25.68	17.44	301
0500-3142-02	0575	50438	27.12	17.44	351
0500-3142-03	0700	50438	28.37	17.44	393
0500-3142-04	0862	50438	30.00	22.19	448
0500-3142-05	1038	50438	31.75	22.19	507





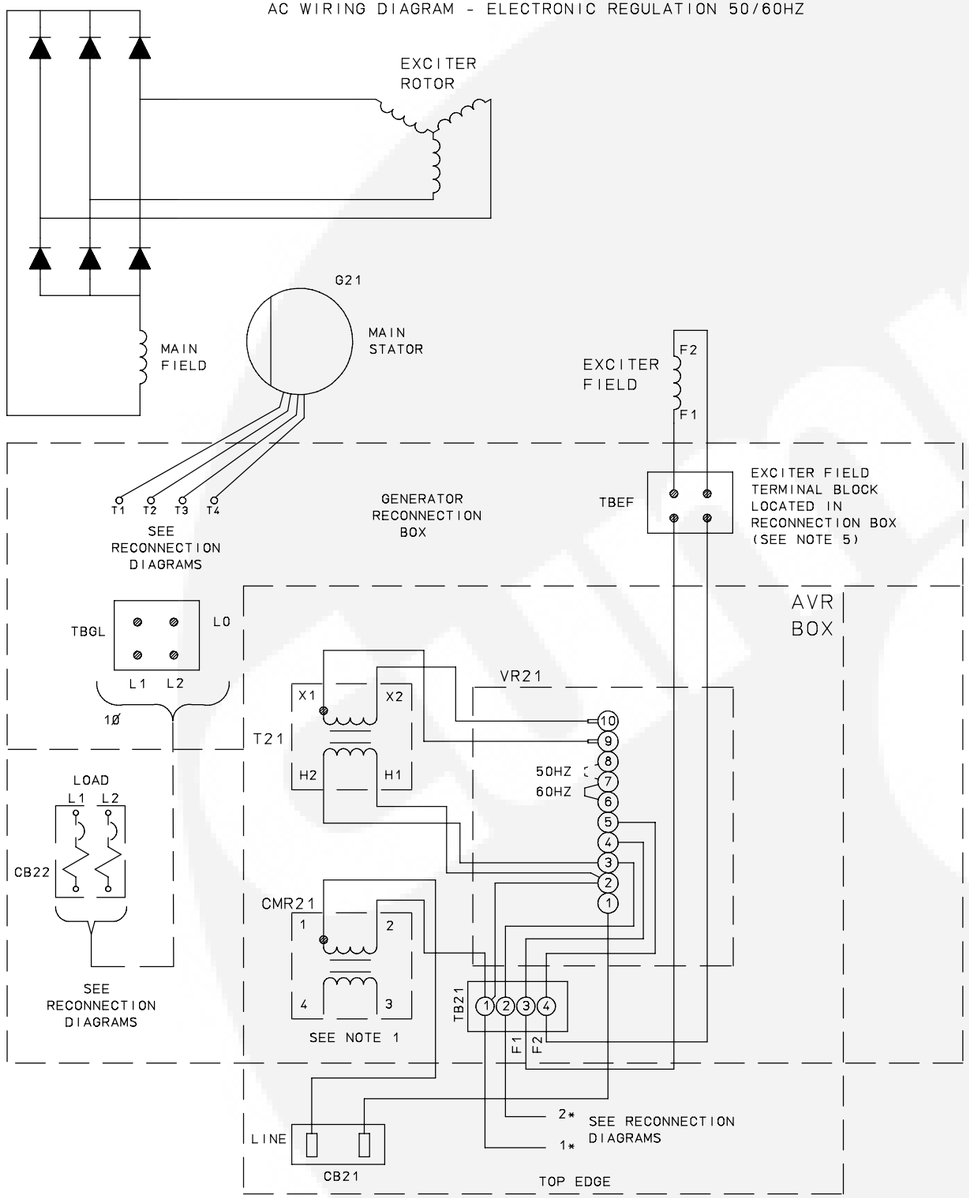
NOTES:

1. NEMA FRAME DESIGNATION-324TS
2. SHAFT SPEED:
   1800 RPM, 60HZ
   1500 RPM, 50HZ
3. RE-POSITION OUTPUT BOX COVER (LOUVERS) TO MATCH PEDESTAL MOUNT CONFIGURATION. SIDE MOUNT SHOWN.

YD PTO AC GENERATOR DIMENSIONAL DRAWING

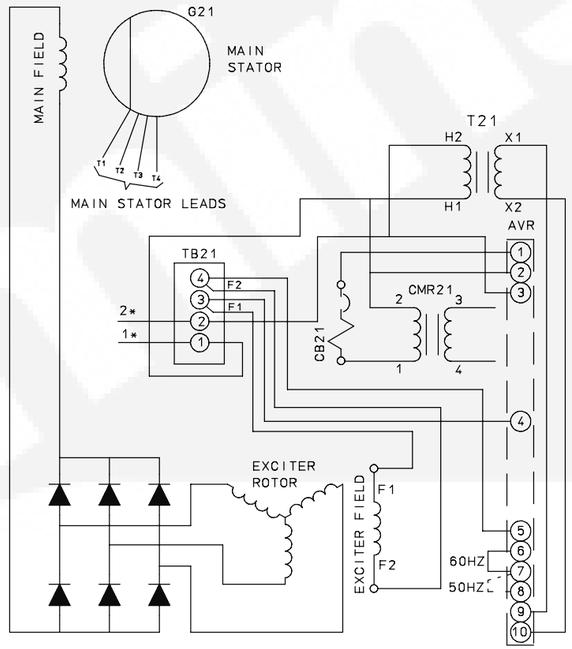
NO.500-3142 SH 1 OF 1
REV. A SYS: CADAM
MODIFIED 8/7/96

AC WIRING DIAGRAM - ELECTRONIC REGULATION 50/60HZ



FRONT PANEL (REAR VIEW)

AC SCHEMATIC - ELECTRONIC REG 50/60HZ

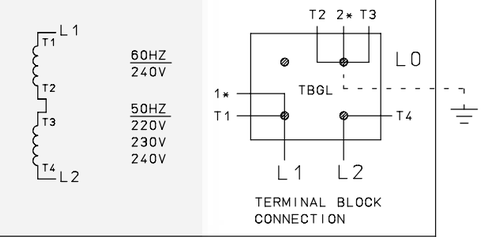


NOTES:

1. CUT LEADS 3 & 4 ON CMR21 THESE LEADS ARE NOT USED.
2. UNLESS OTHERWISE NOTED. ALL COMPONENTS ARE SHOWN IN DE-ENERGIZED POSITION
3. DASHED LINES INDICATE CONNECTIONS WHEN USED.
4. TERMINAL BLOCK TBGL FOR GENERATOR LEADS AND LOAD LEADS IS LOCATED IN THE GENERATOR RECONNECTION BOX. CUSTOMER TO SUPPLY L1, L2, LO, 1*, 2* LEADS SHOWN IN RECONNECTION DIAGRAMS.
5. CUSTOMER TO SUPPLY LEADS FROM F1 AND F2 (TERMINAL BLOCK TBEF) TO REGULATOR (TERMINAL BLOCK TB21)
6. ADD JUMPER FOR 50 HZ.

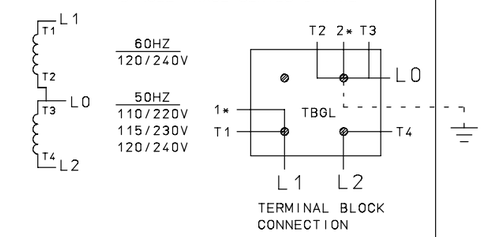
RECONNECTION DIAGRAMS
(SEE NOTE 4)

SINGLE PHASE SERIES 2-WIRE



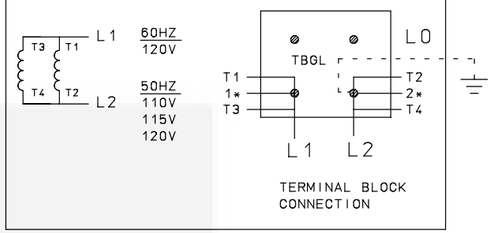
TERMINAL BLOCK CONNECTION

SINGLE PHASE SERIES 3-WIRE



TERMINAL BLOCK CONNECTION

SINGLE PHASE PARALLEL 2-WIRE



TERMINAL BLOCK CONNECTION

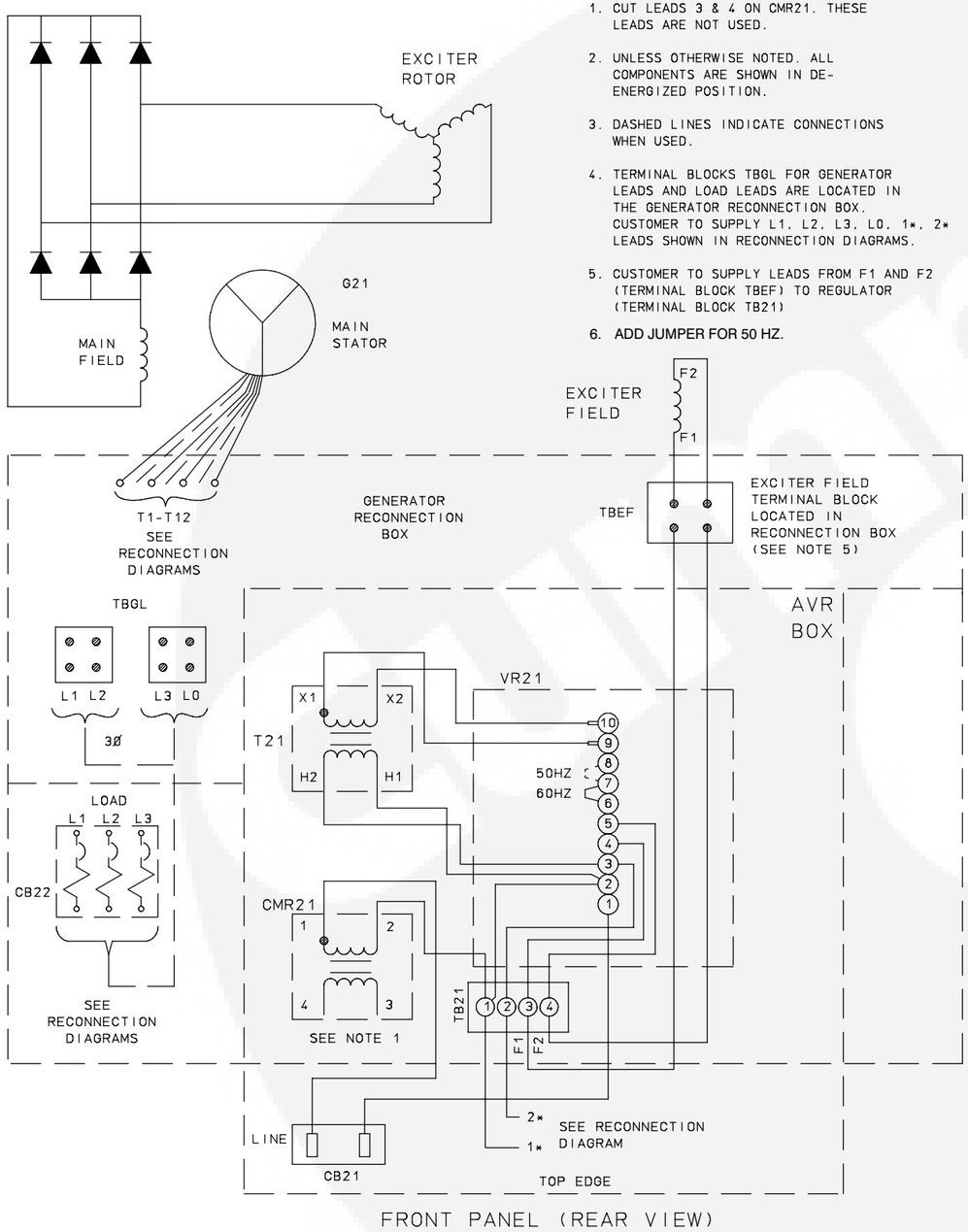
TBGL LEADS	TERMINAL BLOCK GEN AND LOAD
TBEF	TERMINAL BLOCK EXCITER FIELD
T21	TRANSFORMER-VOLT REF
CMR21	REACTOR ASSEMBLY-LOAD
G21	GENERATOR (AC)
CB22	CIRCUIT BREAKER-LOAD
CB21	CIRCUIT BREAKER-MAG 3A
VR21	REGULATOR-ASSEMBLY VOLT

NO. 612-6715 SH 1 OF 1
REV. C SYS: HP
MODIFIED 4/18/97

WIRING DIAGRAM, YD PTO AC GENERATOR (SINGLE PHASE)

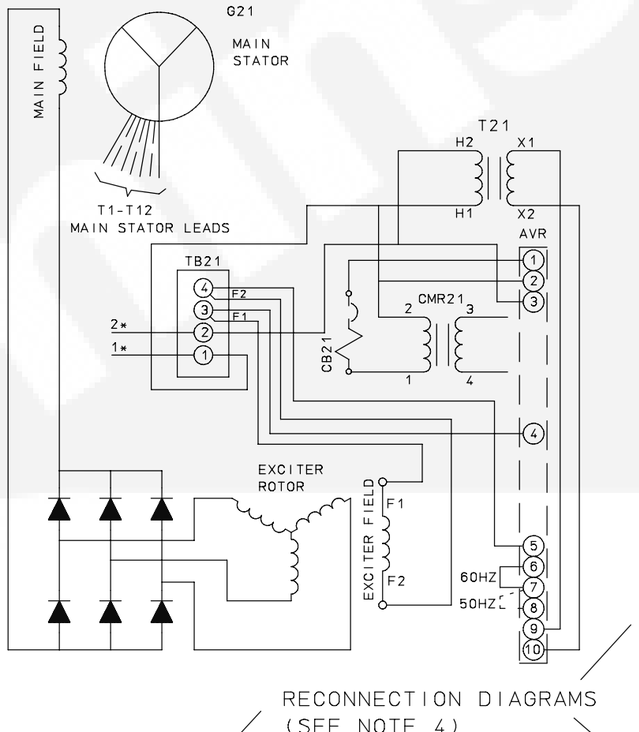
NOTES:

1. CUT LEADS 3 & 4 ON CMR21. THESE LEADS ARE NOT USED.
2. UNLESS OTHERWISE NOTED. ALL COMPONENTS ARE SHOWN IN DE-ENERGIZED POSITION.
3. DASHED LINES INDICATE CONNECTIONS WHEN USED.
4. TERMINAL BLOCKS TBGL FOR GENERATOR LEADS AND LOAD LEADS ARE LOCATED IN THE GENERATOR RECONNECTION BOX. CUSTOMER TO SUPPLY L1, L2, L3, L0, 1*, 2* LEADS SHOWN IN RECONNECTION DIAGRAMS.
5. CUSTOMER TO SUPPLY LEADS FROM F1 AND F2 (TERMINAL BLOCK TBEF) TO REGULATOR (TERMINAL BLOCK TB21)
6. ADD JUMPER FOR 50 HZ.

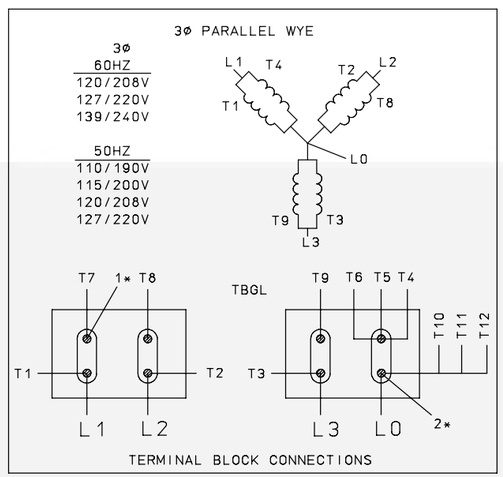


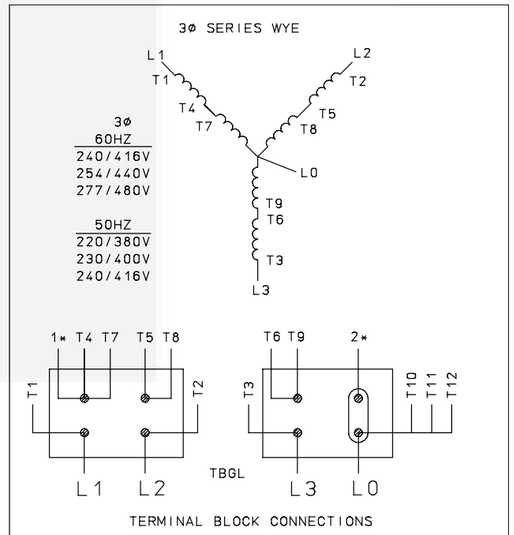
FRONT PANEL (REAR VIEW)

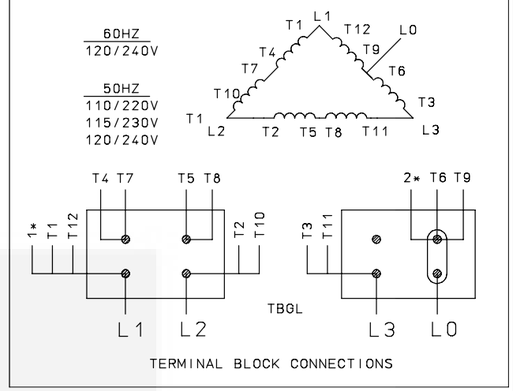
AC SCHEMATIC - ELECTRONIC REG 50/60HZ



RECONNECTION DIAGRAMS
(SEE NOTE 4)







TBGL LEADS	TERMINAL BLOCK GEN AND LOAD
TBEF	TERMINAL BLOCK EXCITER FIELD
T21	TRANSFORMER-VOLT REF
CMR21	REACTOR ASSEMBLY-LOAD
G21	GENERATOR (AC)
CB22	CIRCUIT BREAKER-LOAD
CB21	CIRCUIT BREAKER-MAG 3A
VR21	REGULATOR-ASSEMBLY VOLT

NO. 612-6716 SH 1 OF 1
REV. C SYS: HP
MODIFIED 4/18/97

WIRING DIAGRAM, YD PTO AC GENERATOR (THREE PHASE)

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Cummins **Onan**

Cummins Power Generation
1400 73rd Ave. NE
Minneapolis, MN 55432 USA

Phone 1 763 574 5000
Toll-free 1 800 888 6626
Fax 1 763 574 5298
Email www.cumminsonan.com/contact
www.cumminsonan.com