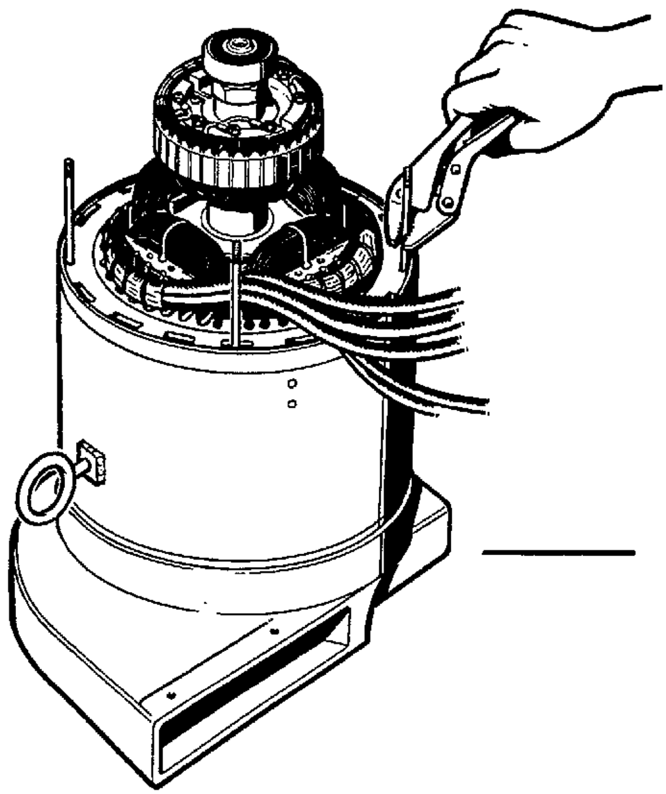
Caution: This document contains mixed page sizes (8.5 x 11 or 11 x 17), which may affect printing. Please adjust your printer settings according to the size of each page you wish to print.

Cummins Power Generation

Onan

Service Manual

YD Generators and Controls



4.5 to 30.0 kW

USED ON:

- J-SERIES SETS
- SK AND DTA SERIES SETS
- PTO ALTERNATORS
- TWO BEARING ALTERNATORS

900-0184
Reprinted 11-83
Printed in U.S.A.

Cummins Power Generation

SAFETY PRECAUTIONS

The following symbols in this manual highlight conditions potentially dangerous to service personnel, or equipment. Read this manual carefully. Know when these conditions can exist. Then take necessary steps to protect personnel as well as equipment.

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

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

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

PROTECT AGAINST MOVING PARTS

Avoid moving parts of the unit. Avoid use of loose jackets, shirts or sleeves due to danger of becoming caught in moving parts.

Make sure all nuts and bolts are secure. Keep power shields and guards in position.

If you must make adjustments while the unit is running, use extreme caution around hot manifolds, moving parts, etc.

Do not work on this equipment when mentally or physically fatigued.

GUARD AGAINST ELECTRIC SHOCK

Disconnect 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 surfaces to be damp when handling electrical equipment.

Disconnect batteries to prevent accidental engine start. Jewelry is a good conductor of electricity and should be removed before working on electrical equipment.

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

Follow all state and local codes. To avoid possible personal injury or equipment damage, a qualified electrician or an authorized service representative must perform installation and all service.

⚠WARNING

EXHAUST GAS IS DEADLY!

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

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

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

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

1-P/EM

Supplement 900-1002
Date: 12-94
Insert with-
Title: YD Generators and Controls Service Manual
Number: 900-0184 **Date:** 11-83

This supplement to the YD Service Manual adds information specific to the Onan PROTEC series of YD PTO AC generator/voltage regulator systems.

NOTE: The YD PTO product referred to in the YD Service Manual is an earlier Onan product, no longer being manufactured.

CONTENTS OF SUPPLEMENT

TITLE **PAGE**

GENERATOR/VOLTAGE REGULATOR TROUBLESHOOTING

This section contains troubleshooting information for the generator and its electronic voltage regulator. Determine the problem and then refer to the appropriate flow chart (A, B, C, D, or E) for troubleshooting procedures.

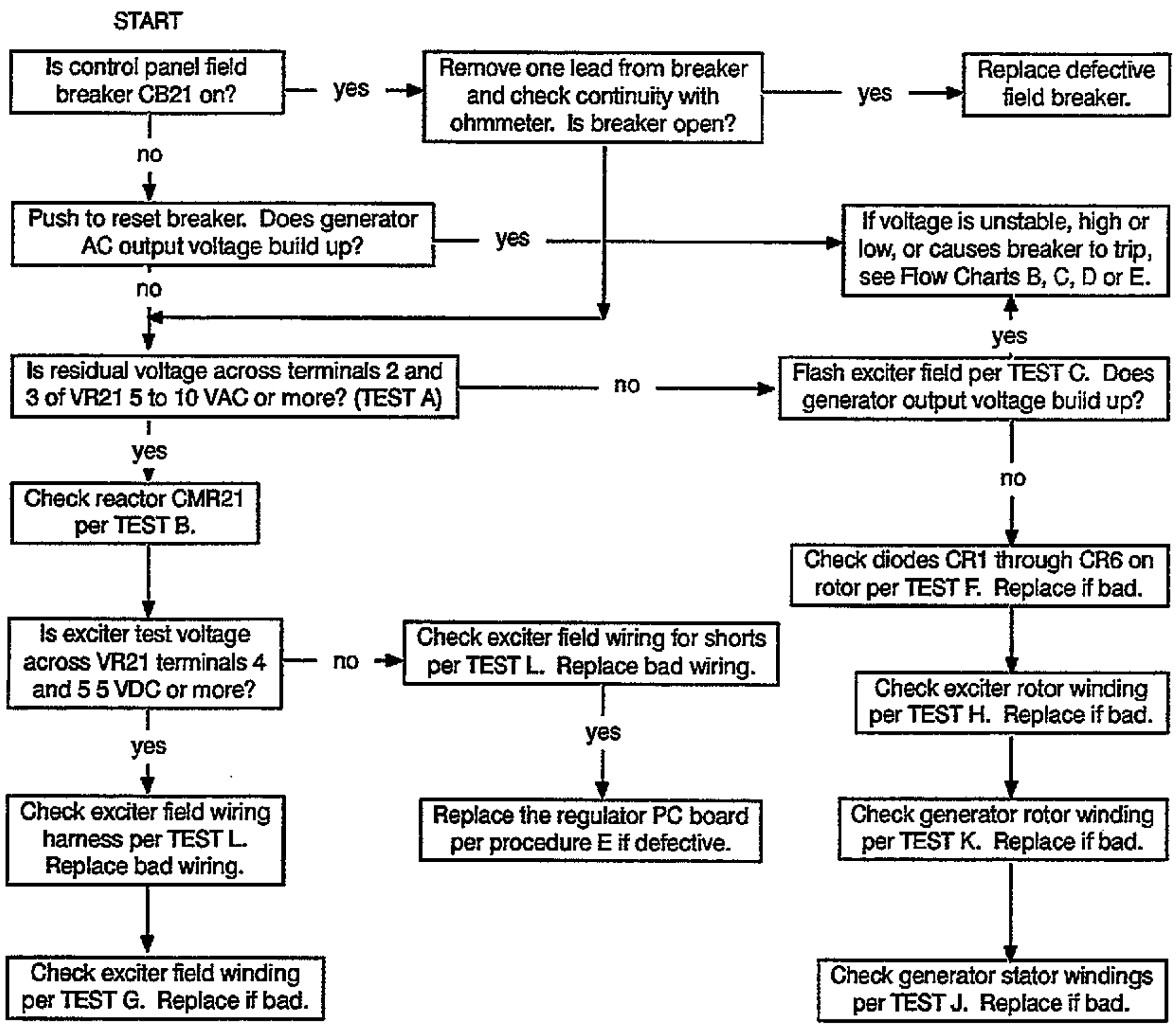
A. NO AC OUTPUT VOLTAGE AT RATED RPM.
B. UNSTABLE OUTPUT VOLTAGE, ENGINE SPEED STABLE.
C. OUTPUT VOLTAGE TOO HIGH OR LOW
D. EXCITER FIELD BREAKER TRIPS
E. UNBALANCED GENERATOR OUTPUT VOLTAGE

To troubleshoot a problem, start at upper left corner of the chart related to the problem, and answer all questions either YES or NO. Follow the chart until the problem is found, performing referenced Adjustment and Test procedures following the Flow Charts.

Referenced components in the Flow Charts and Adjustment and Test procedures can be found on the schematic and wiring diagrams found in this supplement, and in the assembly drawings found in the Installation Manual.

NOTE: Generator disassembly/assembly procedures and PROTEC series YD PTO generator configurations may be found in the YD Service Manual (900-0184) and in the PROTEC Operator's Manual (929-0100) and Installation Manual (929-0600).

FLOW CHART A. NO AC OUTPUT VOLTAGE AT RATED ENGINE RPM



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.***

CAUTION ***A new printed circuit board can be damaged by malfunctioning components within the control. Do not install the new PC board until all other problems have been located and corrected.***

FLOW CHART B. UNSTABLE VOLTAGE, ENGINE SPEED STABLE

START

- Are there any broken wires or loose connections on the voltage regulator assembly? — **yes** → Repair as required.
- **no** ↓
- Check wiring harness from regulator assembly to end bell per TEST L. Check okay? — **no** → Repair wiring or replace as required.
- **yes** ↓
- Replace the regulator PC board per procedure E.

⚠CAUTION ***A new printed circuit board can be damaged by malfunctioning components within the control. Do not install the new PC board until all other problems have been located and corrected.***

⚠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.***

FLOW CHART C. OUTPUT VOLTAGE TOO HIGH OR LOW

START

- Is engine running at correct RPM? — **no** → Set RPM per instructions in appropriate engine and/or governor manual.
- **yes** ↓
- Does adjustment of Voltage Adjust control on the regulator board result in correct output voltage? — **yes** → Set control per Voltage Adjustment (M).
- **no** ↓
- Are reference transformer T21 connections correct and secure on TB1? — **yes** → Are generator output leads properly connected? See TEST N.
  - **yes** ↓
  - Replace the regulator PC board per procedure E.

⚠CAUTION ***A new printed circuit board can be damaged by malfunctioning components within the control. Do not install the new PC board until all other problems have been located and corrected.***

⚠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.***

FLOW CHART D. FIELD BREAKER TRIPS

START

- Does AC output voltage build up to 150% or more of rated voltage before breaker trips?
  - yes → Check for any loose or broken wires or connections on VR21 assembly. → Check reference transformer T21 per TEST E.
  - no → Check exciter stator winding per TEST G. Replace if bad. → Replace the regulator PC board per Procedure E.

⚠CAUTION ***A new printed circuit board can be damaged by malfunctioning components within the control. Do not install the new PC board until all other problems have been located and corrected.***

⚠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.***

FLOW CHART E. UNBALANCED GENERATOR OUTPUT VOLTAGE

START

- Remove load at generator terminals. Is output still unbalanced?
  - no → Check for correct grounding of generator and load.
  - yes ↓
- Are generator leads connected and grounded properly? See Procedure N.
  - no → Correct as necessary.
  - yes ↓
- Are generator stator windings continuous per TEST J?
  - no → Replace stator assembly.
  - yes → Check load for ground faults and correct as necessary.

⚠CAUTION ***A new printed circuit board can be damaged by malfunctioning components within the control. Do not install the new PC board until all other problems have been located and corrected.***

⚠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.***

GENERATOR/REGULATOR TESTS

General

All the following adjustments and tests can be performed without disassembling the generator. They should be used for testing generator regulator components in conjunction with the troubleshooting flow charts earlier in this supplement.

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.

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.***

Check voltage between generator leads 1 and 2 while the set is running (see the schematic diagram included later in this supplement). **Use extreme caution when performing this test** (see warning, below). Residual voltage should be 5 to 10 VAC.

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.***

B - Testing Commutating Reactor

WARNING ***Accidental starting of the generator can cause severe personal injury or death. Disconnect the propulsion engine battery cables, negative (-) lead first, before beginning this test.***

The commutating reactor is shown in Figure 1. It is called CMR21 on the schematics, and is located inside the voltage regulator housing (mounted near the generator; see Installation and Operator's Manuals). Only one winding of the reactor (leads 1 and 2) is used on this model. Disconnect propulsion engine battery cables, negative (-) lead first. Then remove reactor leads from the terminal board for testing.

Resistance across leads 1 and 2 should be **330 to 390 milliohms** at 77° F (25° C). Resistance between the winding and the reactor frame should be infinity.

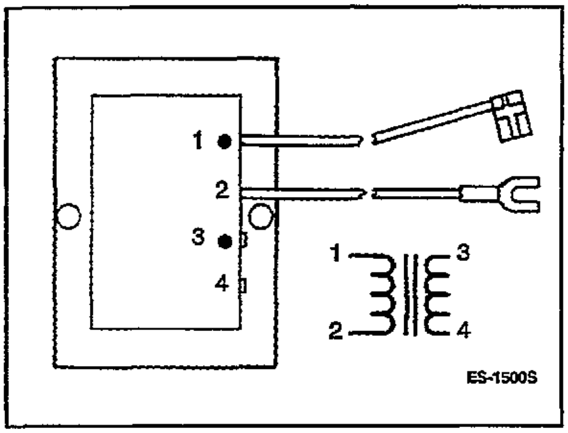


FIGURE 1. COMMUTATING REACTOR

C - Flashing the Field

If output voltage does not build up, it may be necessary to restore residual magnetism by flashing the field. Assemble a 12 volt storage battery, 10 amp fuse, momentary-on switch, and diode as shown in Figure 2.

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 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.

CAUTION ***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.***

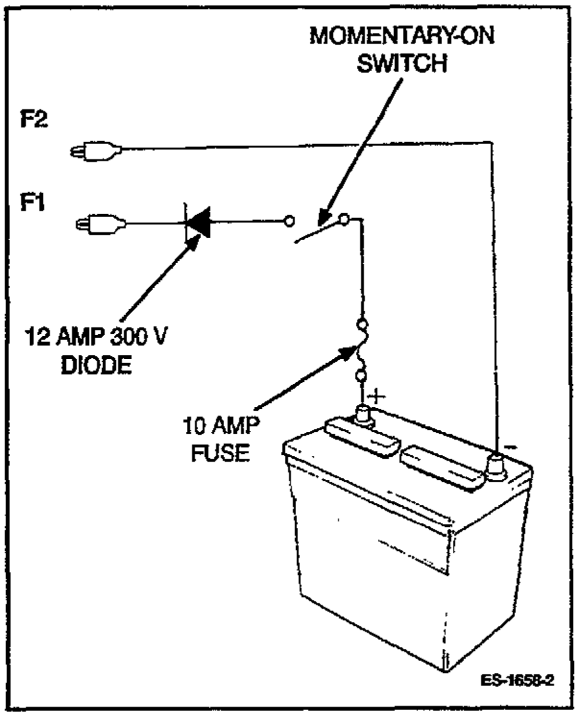


FIGURE 2. FIELD FLASHING CIRCUIT

D - Testing Reference Transformer

Reference transformer T21 is located inside the voltage regulator housing, mounted near the generator. T21 has four leads; two primary leads marked H1 and H2 and two secondary leads marked X1 and X2. See Figure 3.

Stop the engine and PTO unit. Disconnect leads to engine starting battery, negative (-) lead first. Disconnect transformer T21 leads and make resistance readings. The resistance of either coil should be **100 ohms** ± 10% at 75° F (25° C). Resistance between leads and transformer frame should be infinity.

⚠WARNING ***Accidental starting of the generator can cause severe personal injury or death. Disconnect the propulsion engine battery cables, negative (-) lead first, before disconnecting the reference transformer for resistance testing.***

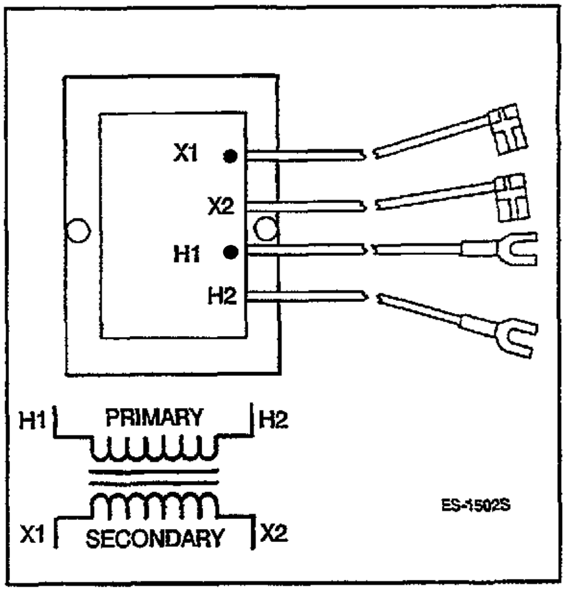


FIGURE 3. REFERENCE TRANSFORMER

E - VR21 Replacement

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

1. Stop engine and PTO unit. Disconnect leads to engine starting battery, negative (-) lead first.

   ⚠WARNING ***Accidental starting of the generator can cause severe personal injury or death. Disconnect the propulsion engine battery cables, negative (-) lead first, before continuing with this PC board replacement procedure.***

2. Open the voltage regulator housing. Disconnect the regulator and if necessary, label wires. Refer to the AC control wiring diagram included later in this supplement.
3. Remove four screws at corners of the PC board to remove it.
4. Install new PC board; secure with four screws.
5. Reconnect wires removed in step 2 at proper terminals.

6. Reconnect battery cables, positive (+) cable first. Start the engine and PTO and set voltage as outlined in test (M), Voltage Adjustment.

F - Testing Rotating Rectifiers

Two different rectifier assemblies make up the rotating rectifier bridge assembly, Figure 4. Using an accurate ohmmeter, test each CR using negative and positive polarities. Test rectifiers as follows:

1. Stop engine and PTO unit. Disconnect leads to engine starting battery, negative (-) lead first.

   WARNING ***Accidental starting of the generator can cause severe personal injury or death. Disconnect the propulsion engine battery cables, negative (-) lead first, before continuing with this test procedure.***

2. Disconnect all leads from assembly to be tested.
3. Connect one test lead to F1+ stud and connect other lead to CR1, CR2, and CR3 in turn; record resistance value of each rectifier.
4. Connect one lead to F2- stud and connect other lead to CR4, CR5 and CR6 in turn; record resistance value of each rectifier.
5. Reverse ohmmeter leads from steps 2 and 3 and record resistance value of each rectifier F1+ to CR1, CR2, and CR3 and F2- to CR4, CR5, and CR6.
6. All the resistance readings should be high in one test and low in the other test. If any reading is high or low in both tests, rectifier assembly is defective.

Use 23 to 26 inch-lbs (2.6 to 2.9 N•m) torque when replacing nuts of F1+ and F2-, CR1, CR2, CR3, CR4, CR5 and CR6.

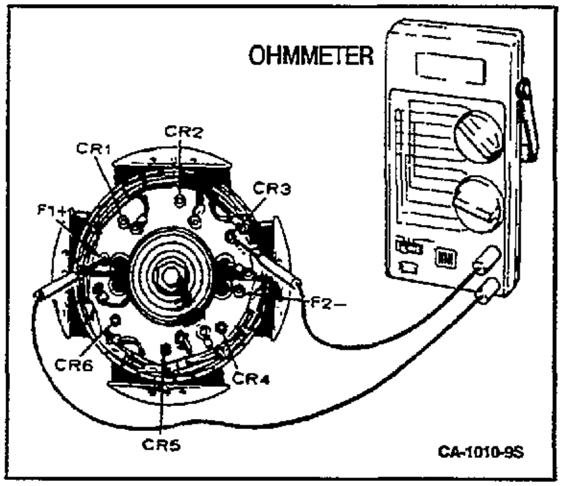


FIGURE 4. TESTING ROTATING RECTIFIERS

G - Testing Exciter Stator

Test the exciter stator (Figure 5) for open or shorted windings and grounds as follows:

Testing for Open or Shorted Windings: Stop engine and PTO unit. Disconnect leads to engine starting battery, negative (-) lead first.

WARNING ***Accidental starting of the generator can cause severe personal injury or death. Disconnect the propulsion engine battery cables, negative (-) lead first, before continuing with this test procedure.***

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

Testing for Grounds: Stop engine and PTO unit. Disconnect leads to engine starting battery, negative (-) lead first.

WARNING ***Accidental starting of the generator can cause severe personal injury or death. Disconnect the propulsion engine battery cables, negative (-) lead first, before continuing with this test procedure.***

Connect ohmmeter between either field lead and exciter stator laminations. Use ohmmeter set at the highest resistance range. Resistance must be one megohm (1,000,000 ohms) or greater.

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.

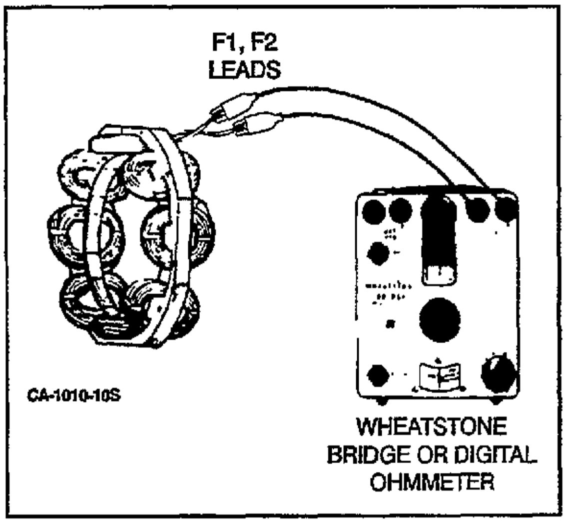


FIGURE 5. MEASURING EXCITER STATOR RESISTANCE

H - Testing Exciter Rotor

Stop engine and PTO unit. Disconnect leads to engine starting battery, negative (-) lead first.

WARNING ***Accidental starting of the generator can cause severe personal injury or death. Disconnect the propulsion engine battery cables, negative (-) lead first, before continuing with these test procedure.***

Test the exciter rotor (Figure 6) for open or shorted windings or grounds as follows:

Testing for Open or Shorted Windings: Use a wheatstone bridge or digital VOM for this test. Disconnect main rotor field leads which connect to rotating rectifier assemblies at F1+ and F2-. Disconnect lead wires from diodes CR1, CR2, CR3, CR4, CR5 and CR6. Test between exciter lead pairs T1-T2, T2-T3, and T1-T3. Resistance at 77° F (25° C) should be **645 milliohms** ± 10%.

Testing for Grounds: Connect leads of ohmmeter between any CR lead and exciter rotor laminations. Use an ohmmeter set at the highest resistance range. An ohmmeter reading less than one megohm (1,000,000 ohms) indicates defective ground insulation.

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

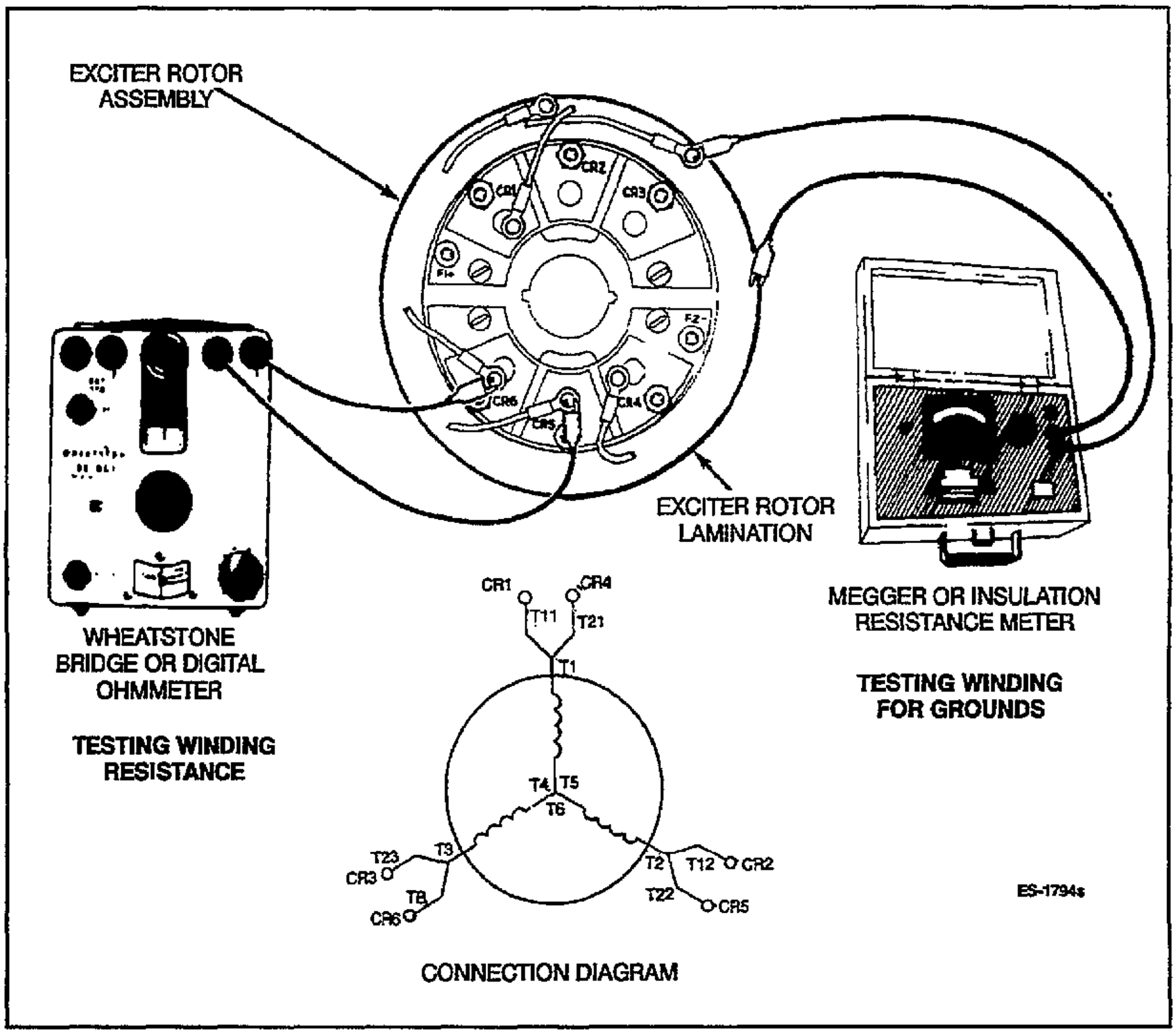


FIGURE 6. TESTING EXCITER ROTOR

J - Testing Generator Stator

Stop engine and PTO unit. Disconnect leads to engine starting battery, negative (-) lead first.

WARNING ***Accidental starting of the generator can cause severe personal injury or death. Disconnect the propulsion engine battery cables, negative (-) lead first, before continuing with these test procedure.***

Using proper test equipment, check the stator for grounds, opens, and shorts in the windings.

Testing for Grounds: Some generators have ground connections to the frame. Check 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.

Testing for Open or Shorted Windings: Test for continuity between coil leads shown in Figure 7: wire pairs T1-T2 and T3-T4 should have equal resistance. Use an accurate instrument for this test such as a Kelvin bridge or digital ohmmeter. Resistance values at 77° F (25° C) are given in Table 1 (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.

TABLE 1. STATOR RESISTANCE VALUES IN OHMS, ±10%

kW RATING	RESISTANCE
12/15	.115 - .147
16/20	.069 - .091
20/24	.054 - .072
24/30	.033 - .043
30/35	.029 - .038

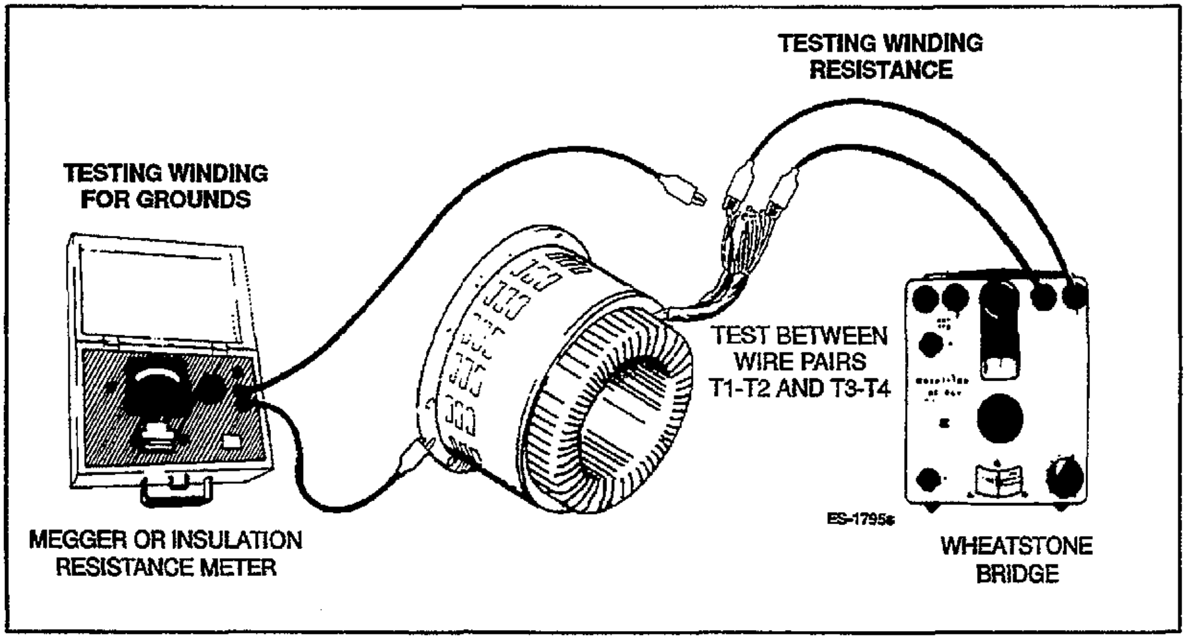


FIGURE 7. TESTING STATOR WINDINGS

K - Testing Generator Rotor

Stop engine and PTO unit. Disconnect leads to engine starting battery, negative (-) lead first.

⚠WARNING ***Accidental starting of the generator can cause severe personal injury or death. Disconnect the propulsion engine battery cables, negative (-) lead first, before continuing with these test procedure.***

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

Testing for Grounds: Check for grounds between each rotor lead and the rotor shaft, Figure 8. Perform tests as follows:

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

Testing for Open or Shorted Windings: Perform tests as follows:

1. Remove rotor leads F1+ and F2- from rotating rectifier assemblies.
2. Using ohmmeter, check resistance between F1 and F2 leads, Figure 9.

The resistance values at 77° F (25° C) should be as shown in Table 2. If not, replace defective rotor with new, identical part.

TABLE 2. ROTOR RESISTANCE VALUES IN OHMS, ±10%

kW RATING	RESISTANCE (ohms)
12/15	2.35
16/20	2.75
20/24	1.80
24/30	2.24
30/35	2.91

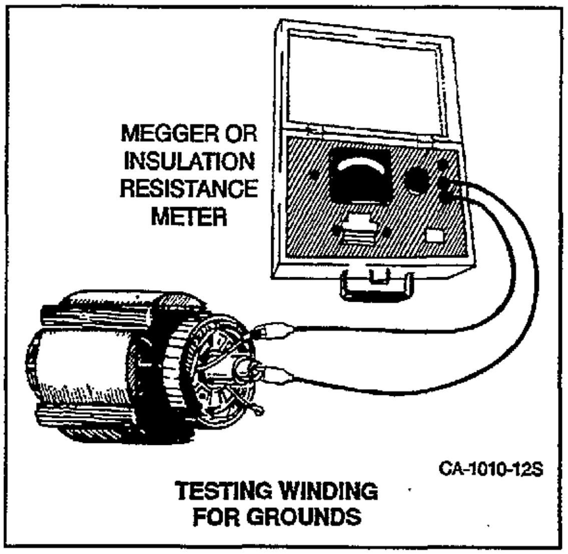


FIGURE 8. TESTING ROTOR FOR GROUNDS

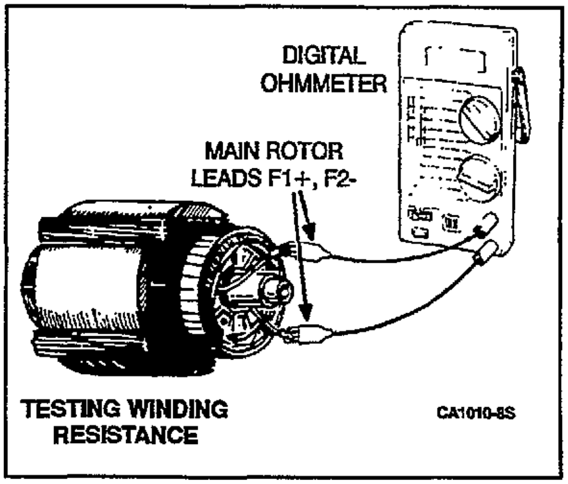


FIGURE 9. TESTING ROTOR FOR AN OPEN CIRCUIT

L - Wiring Harness Check

Stop engine and PTO unit. Disconnect leads to engine starting battery, negative (-) lead first.

⚠WARNING ***Accidental starting of the generator can cause severe personal injury or death. Disconnect the propulsion engine battery cables, negative (-) lead first, before continuing with these test procedure.***

Carefully check wiring harnesses as follows:

1. Inspect all wires for breaks, loose connections, and reversed connections. Refer to the wiring diagrams at the end of this supplement.
2. Remove wires from terminals at each end and using an ohmmeter, check each wire end to end for continuity or opens.
3. Using an ohmmeter, check each wire against each of the other wires and to ground for possible shorts or insulation breaks under areas covered by wrapping material.
4. Reconnect or replace wires according to the wiring diagrams at the end of this supplement.

M - Voltage Adjustment

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

⚠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.***

With the generator running, set the voltage adjust potentiometer on the regulator board assembly for correct voltage. See Figure 10.

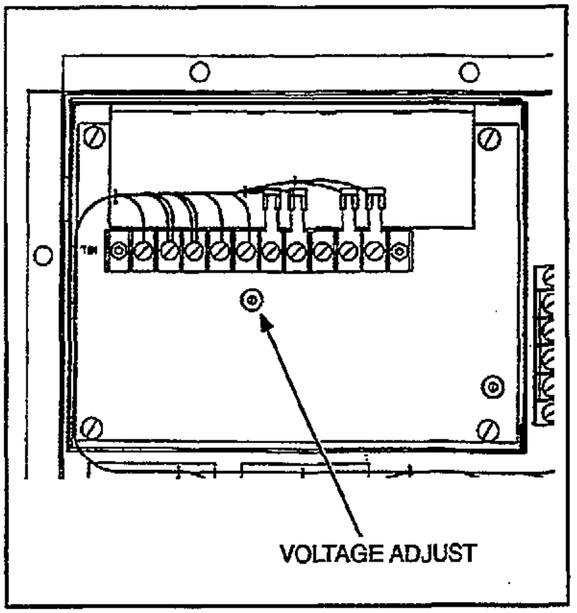
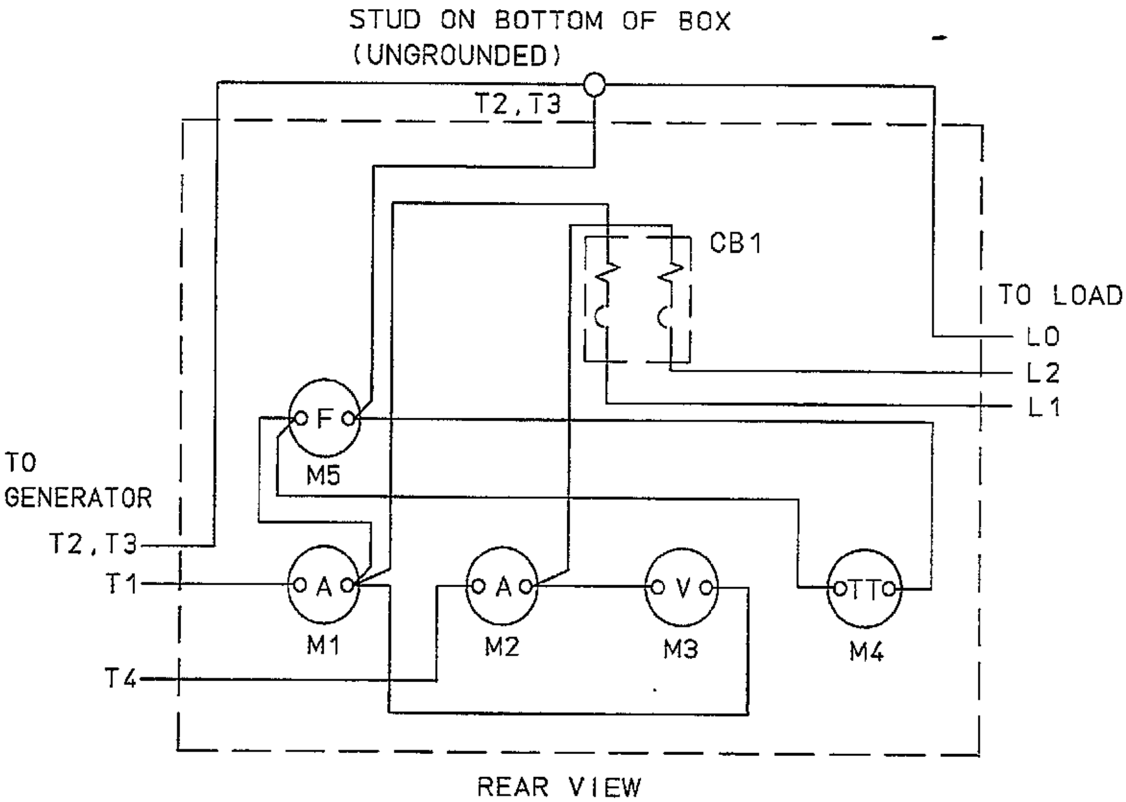


FIGURE 10. VOLTAGE REGULATOR BOARD INSIDE CONTROL BOX

N - Reconnection

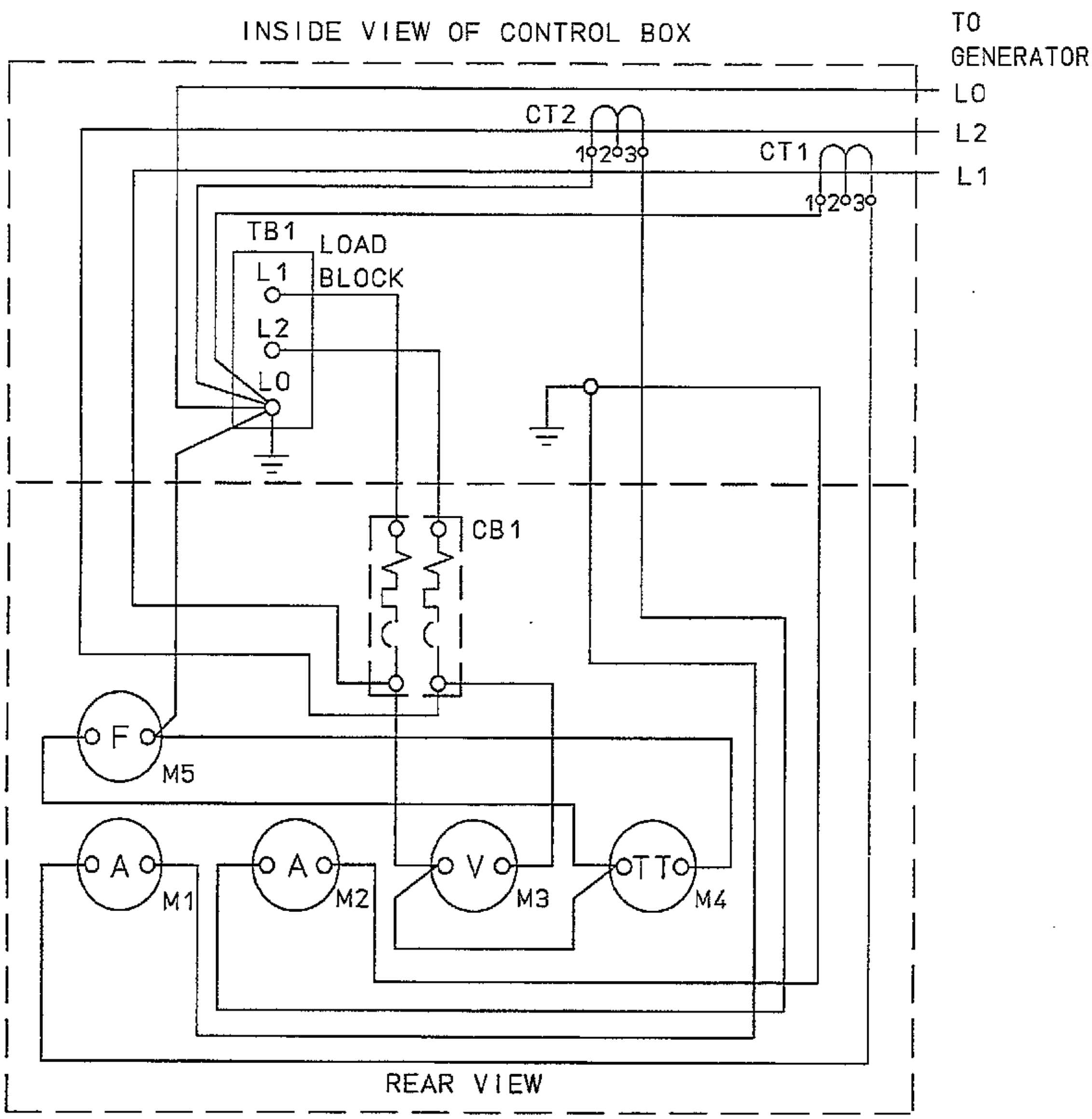
Generator reconnection conforms to AC wiring diagram 612-6678, supplied in this supplement. Also see the Installation Manual for output connection and generator reconnection guidelines.



5	METER-FREQUENCY	M5
4	METER-TOTAL TIME	M4
3	METER-AC VOLT	M3
2	METER-AC AMMETER	M1,2
1	ASSY-SWITCHBOARD	
ITEM	DESCRIPTION OR MATERIAL	REF DES

12/15 KW GENERATOR METER/BREAKER PANEL SCHEMATIC DIAGRAM

NO. 615-0426
REV. A
MODIFIED



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

16/20, 20/24 KW GENERATOR METER/BREAKER PANEL SCHEMATIC DIAGRAM

NO. 615-0427
REV. A
MODIFIED

TABLE OF CONTENTS

WARNING

TO AVOID POSSIBLE PERSONAL INJURY OR EQUIPMENT DAMAGE, A QUALIFIED ELECTRICIAN OR AN AUTHORIZED SERVICE REPRESENTATIVE MUST PERFORM INSTALLATION AND ALL SERVICE.

INTRODUCTION

GENERAL

This manual contains troubleshooting and repair procedures for the YD generators and controls. Engine information is in the applicable engine manual. Three systems which could cause the electric generating set to malfunction are the generator, the control and the engine.

The YD generator information includes description, troubleshooting, adjustments and tests for repairing the generator, exciter and voltage regulator.

The major section of this manual applies to most, but not all, YD generators. In the development of larger capacity generators in the YD family, Onan has included some modifications so that the generator would have adequate motor-starting capability.

These modifications involve two basic areas:

1. The rotating exciter (rotor and stator) is about 1/2 inch thicker than standard. This results in the winding resistances being different from the majority of generators.
2. The "UR" regulation system is used rather than the standard YD regulator.

The generator set models affected by the above modifications include:

- 25 kW MDTA/DTA generator sets
- 30 kW SK generator sets
- 30 kW YD PTO generators

Separate sections of this manual should be referred to for information on these models which is different from that provided in the main body of the manual.

The *Control* system information includes description and troubleshooting procedures for repairing the set if the trouble is in starting, stopping, or if the set shuts down because of an emergency condition.

MANUAL REFERENCE FOR YD GENERATOR SETS AND ALTERNATORS

GENERATOR SET	kW		STATOR STACK LENGTH	PARTS CATALOG	OPERATOR'S MANUAL
	60 Hz	**50 Hz**			
JB	7.5	6.0	2.88	967-0223	967-0123
JC	12.5		4.31	967-0220	967-0120
MJC	10.0		3.44	968-0340	968-0340
RJC	12.5	10.0	4.31	974-0220	974-0120
JC	15.0	12.5	5.00	967-0220	967-0120
MJC	15.0		5.00	968-0340	968-0340
RJC	15.0	12.5	4.31	974-0220	974-0120
SK	30.0	25.0	7.00-10.38	946-0220	946-0120
Diesel					
DJB	6.0	4.5	2.19	967-0221	967-0121
DJE	6.0	4.5	2.19	967-0225	967-0125
MDJE	7.5	6.0	2.88	968-0224	968-0120
DJC	12.0	9.0	4.31	967-0222	967-0122
MDJC	12.0	10.0	4.31	968-0222	968-0122
RDJC	15.0	12.5	5.00	974-0221	974-0121
MDJF	15.0	12.0	5.00	968-0221	968-0121
RDJF	17.5	14.5	5.75	974-0222	974-0122
MDTA	25.0		8.62	961-0222	961-0122
DTA	25.0		8.62	961-0220	961-0120
YD PTO Alternator	15.0-30.0	15.0-30.0	5.00-8.62	929-0002	929-0002
YD Two Bearing	5.0-20.0	5.0-16.0	2.19-7.00	929-0004	929-0004

Typical wiring diagrams are included at the end of this manual to help personnel trace or isolate problems. Onan suggests, however, that service personnel use the wiring diagrams shipped with the units.

Repair information is not extensive because the solid-state printed circuit boards lend themselves more to replacement that repair. ONAN *does not* recommend repair of the printed circuit boards, except at the factory and has initiated a return/exchange service obtainable through distributors, whereby faulty printed circuit boards can be returned and exchanged for good units. For more information, contact your Onan distributor.

Application of meters or high heat soldering irons to printed circuit boards by other than qualified personnel can result in unnecessary and expensive damage.

CAUTION **High voltage testing or high potential (or Megger) testing of generator windings can cause damage to solid state components. Isolate these components before testing.**

TEST EQUIPMENT

Most of the test procedures in this manual can be performed with an AC-DC multimeter such as a Simpson Model 260 VOM. Some other instruments to have available are:

- Onan Multitester
- Wheatstone Bridge
- Kelvin Bridge
- Jumper Leads
- Onan Load Test Panel
- Variac
- AC Voltmeter
- DC Voltmeter

See Tool Catalog 900-0019.

GENERATOR DESCRIPTION

The YD generators (Figure 1) are four-pole, revolving field, brushless exciter, reconnectible models of drip-proof construction. Design includes both single and three-phase, 60 and 50 hertz type generators. The generator rotor connects directly to the engine crankshaft with a tapered shaft and key. It is fastened by the rotor-through-stud which passes through the rotor shaft and a nut on the outside of the end bell. A centrifugal blower, on the front end of the rotor shaft, circulates the generator cooling air which is drawn in through the end bell cover and discharged through an outlet at the blower end.

A ball bearing in the end bell supports the outer end of the rotor shaft. The end bell and generator stator housing are attached by four-through-studs which pass through the stator assembly to the engine-

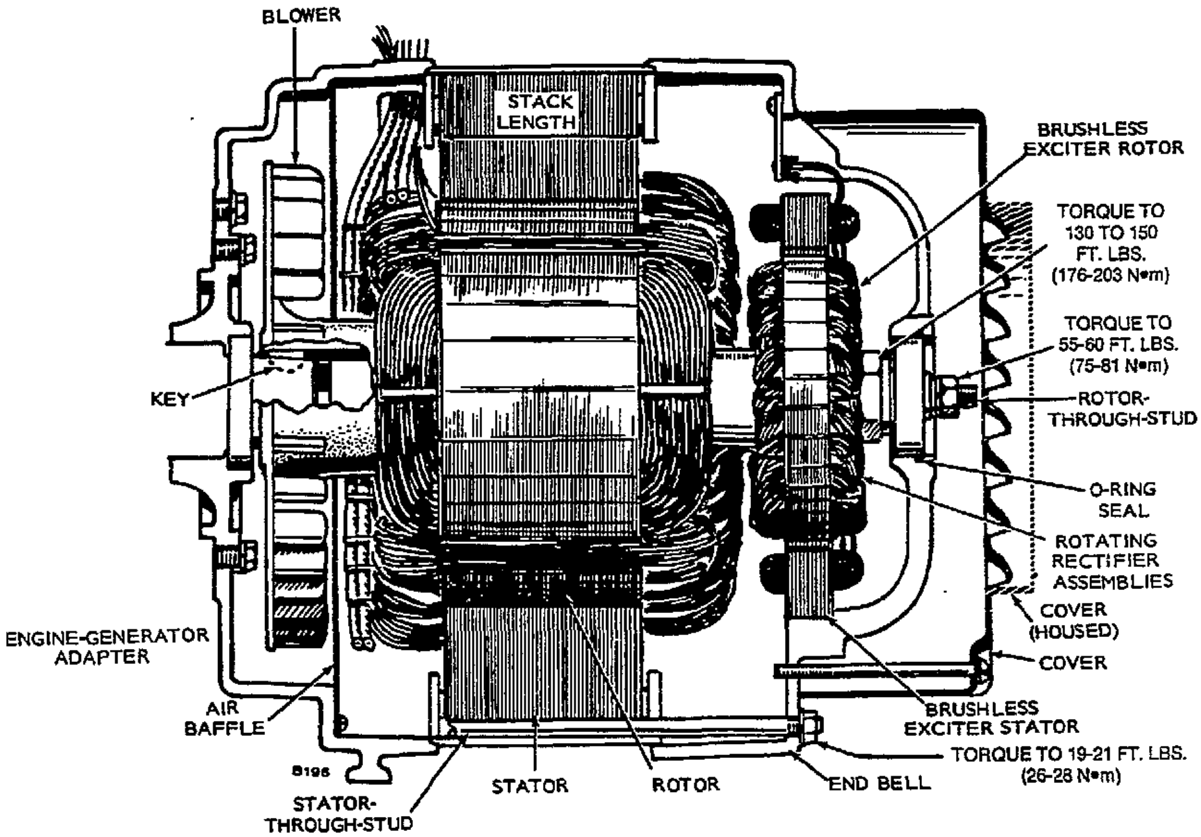


FIGURE 1. TYPICAL YD J-SERIES GENERATOR (SECTIONAL VIEW)

generator adapter. The brushless exciter stator mounts in the end bell while the exciter rotor and its rotating rectifier assemblies mount on the generator rotor shaft.

All generators have four wires extending from the stator housing in addition to the AC output leads, Figure 2. Lead B^2 is from the battery charge winding and connects to terminal 7 of the engine control. Lead $F^{1}+$ and $F^{2}-$ are from the exciter field winding and are connected to the output terminals of the voltage regulator. Leads 1 and 2 are connected to the stator windings and provide reference voltage and input power to the voltage regulator. These four leads are connected at the factory.

Figure 2 is a composite illustration showing four output leads for single-phase units, 12 output leads for 3-phase broad range units, and four output leads for code 9X 3-phase 347/600 volt generators.

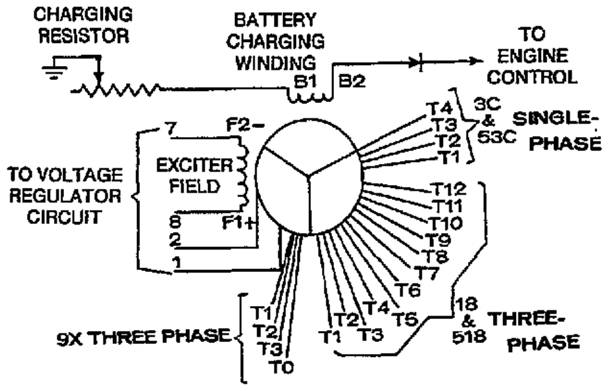


FIGURE 2. SINGLE AND THREE PHASE GENERATOR SCHEMATIC (COMPOSITE)

GENERATOR OPERATION

Operation of the generator involves the stator, voltage regulator, exciter field and armature, a full wave bridge rectifier, and the generator rotor, Figure 3. Residual magnetism in the generator rotor and a permanent magnet embedded in one exciter field pole begin the voltage build-up process as the generator set starts. Single-phase AC voltage, taken from one of the stator windings, is fed to the voltage regulator as a reference for maintaining the generator output voltage. AC 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 resultant DC voltage excites the generator rotor winding to produce the stator output voltage for the AC load.

The generator rotor also produces AC voltage in the charging winding of the stator which is converted to direct current for battery charging.

Generator sets without a control panel or switchboard containing AC instruments such as voltmeters, ammeters, running time meter, frequency meters, and line circuit breakers are shipped from the factory with the AC output leads separated in the output box. On generator sets with switchboards containing AC instruments, the AC output leads are wired as specified on the customer's purchase order to deliver only the voltage specified.

VOLTAGE RECONNECTION WITH OPTIONAL INSTRUMENTS

The optional AC instruments on the control panel (such as voltmeters, ammeters, transformers, and running time meters) are intended for use with specific nameplate voltages. Control components may have to be changed to match new current ratings when field reconnection for other voltage codes or voltages are made.

CAUTION **To prevent instrument damage contact the Onan factory for required instrument changes, new wiring diagrams, new plant nameplate with proper specification number and voltage before attempting to reconnect a generator with instruments on the control panel.**

Under no circumstances shall the generator be connected in any other manner than shown in the applicable wiring and reconnection diagrams.

Severe damage will result if leads are incorrectly connected or improperly insulated. Use extreme care in checking leads to assure proper connections.

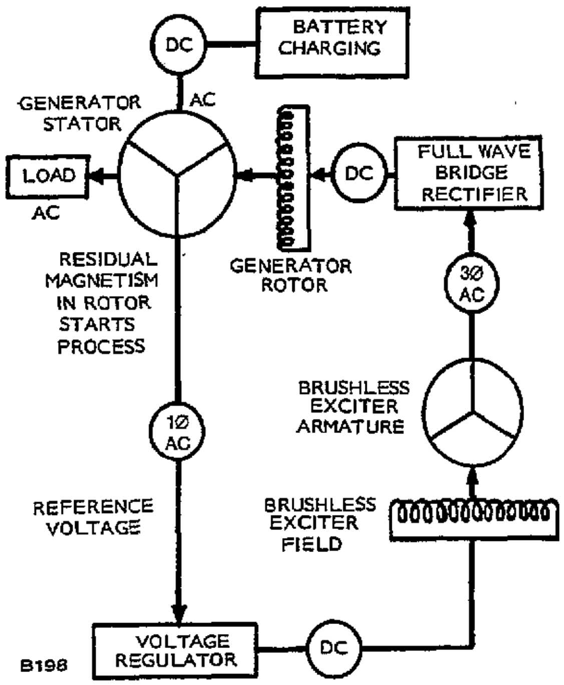


FIGURE 3. EXCITATION BLOCK DIAGRAM

GENERATOR TROUBLESHOOTING

PREPARATION

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

- Check all modifications, repairs, replacements performed since last satisfactory operation of set to ensure that connection of 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 connection on printed circuit board are all potential malfunction areas to be eliminated by a visual check.
- Unless absolutely sure that panel instruments are accurate, use portable test meters for troubleshooting.
- Visually inspect components on VR21. Look for dirt, dust, or moisture and cracks in the printed solder conductors. Burned resistors, arcing tracks are all identifiable. Do not mark on printed circuit boards with a pencil. Graphite lines are conductive and can cause leakage or short circuits between components.

The PART I TROUBLESHOOTING PROCEDURES are for YD generators in the 4.5 to 25 kW size range using the standard YD regulator and generator.

The PART II TROUBLESHOOTING PROCEDURES (page 21) are for YD generators in the 25 to 30 kW size range. These units have thicker exciters and use the UR type regulation system.

PART I TROUBLESHOOTING PROCEDURES

(STANDARD YD GENERATOR AND REGULATOR)

The information in this section is divided into Flow Charts A, B, C, D, and E as follows:

A. NO AC OUTPUT VOLTAGE AT RATED ENGINE RPM.

B. UNSTABLE OUTPUT VOLTAGE, ENGINE SPEED STABLE 1800 RPM.

C. OUTPUT VOLTAGE TOO HIGH OR LOW.

D. EXCITER FIELD BREAKER TRIPS.

E. UNBALANCED GENERATOR OUTPUT VOLTAGE.

To troubleshoot a problem, start at upper-left corner of the chart related to problem, and answer all questions either YES or NO. Follow the chart until the problem is found, performing referenced Adjustment and Test procedures following the Flow Charts.

Referenced components in the Flow Charts and Adjustment and Test procedures can be found on the electrical schematic Figure 4, and on assembly drawings and wiring diagrams on pages 18-20.

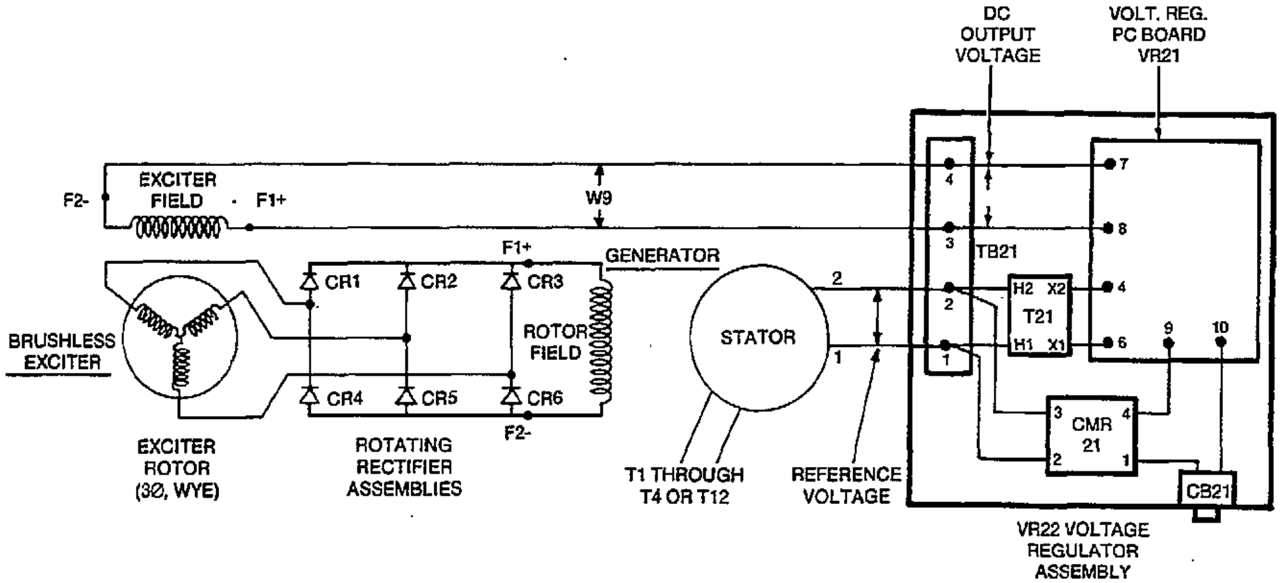
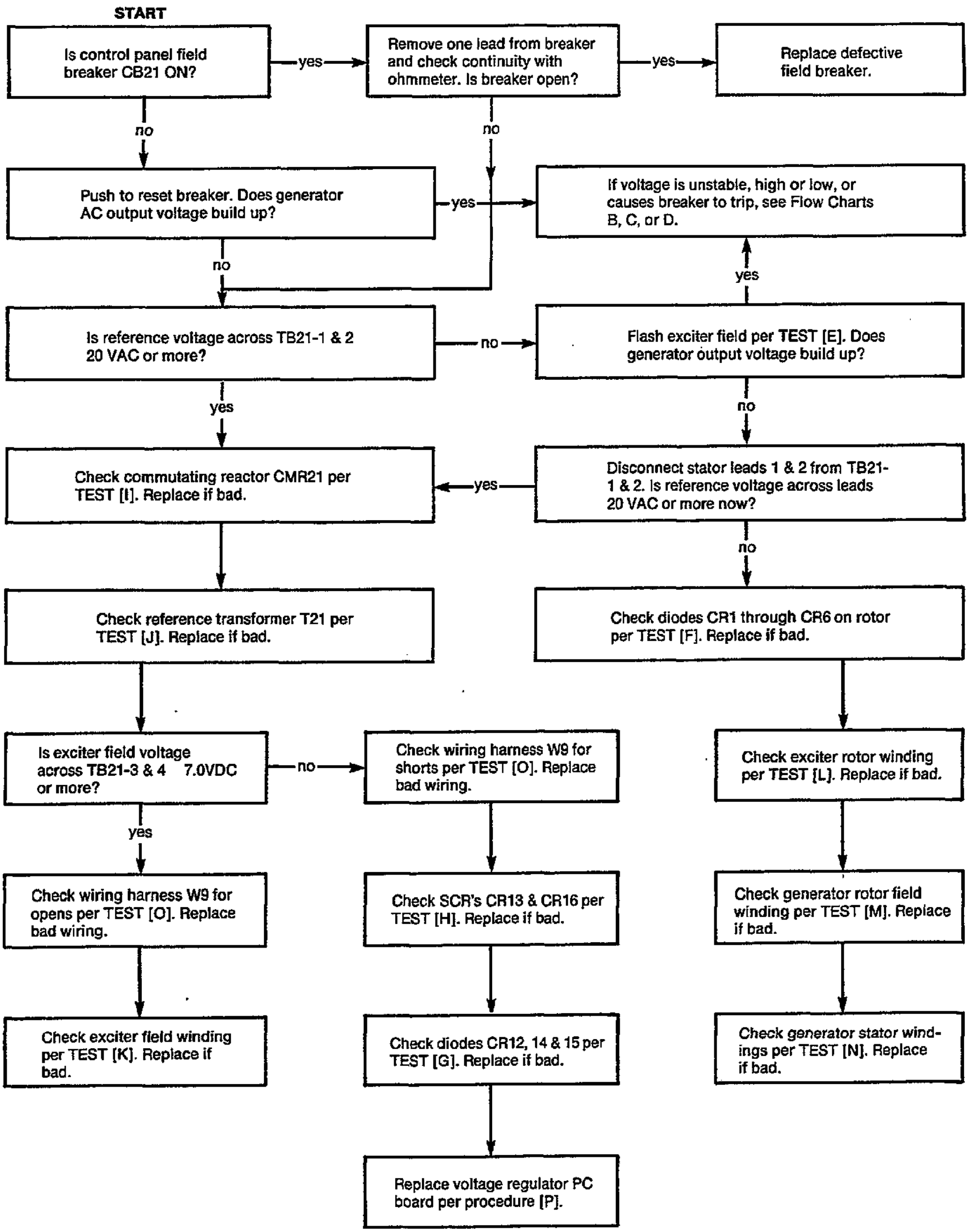


FIGURE 4. ELECTRICAL SCHEMATIC, STANDARD YD GENERATOR AND REGULATOR

FLOW CHART A. NO BUILD UP OF AC OUTPUT VOLTAGE



CAUTION **Do not replace the printed circuit board until the trouble not on the PC board has been located and corrected to avoid damage to new PC board.**

FLOW CHART B. AC OUTPUT VOLTAGE BUILDS UP, BUT IS UNSTABLE

START

Are there any broken wires or loose connections on voltage regulator assembly VR22? — yes → Repair as required.

no ↓

Check wiring harness from VR22 to end bell per TEST [O]. Check OK? — no → Repair wiring or replace as required.

yes ↓

Does adjustment of Dampening Control R27 on VR21 per adjustment [B] result in stable voltage? — yes → Is voltage stable within spec at no load to full load range of generator set?

no ↓

Replace voltage regulator PC board per procedure [P].

CAUTION **Do not replace the printed circuit board until the trouble not on the PC board has been located and corrected to avoid damage to new PC board.**

FLOW CHART C. AC OUTPUT VOLTAGE BUILDS UP, BUT IS HIGH OR LOW

START

Is engine running at correct RPM? — no → Set RPM per instructions in appropriate engine manual.

yes ↓

Does adjustment of Voltage Adjust control R22 on VR22 result in correct output voltage? — yes → Set control per Voltage Calibration Adjustment [A].

no ↓

Does adjustment of control R26 on VR21 result in correct output voltage? — yes → Set per Voltage Calibration Adjustment [A].

no ↓

Is jumper wire W10 connected correctly on VR21 for desired voltage? See Figure 19 on page 20 and correct if needed. → Are generator output leads properly connected? See Figure 19 and correct if needed.

↓

Replace voltage regulator PC board VR21 per procedure [P].

CAUTION **Do not replace the printed circuit board until the trouble not on the PC board has been located and corrected to avoid damage to new PC board.**

FLOW CHART D. AC OUTPUT VOLTAGE BUILDS UP, BUT FIELD BREAKER TRIPS

START

Does AC output voltage build up to 140% or more of rated voltage before breaker trips?

no →

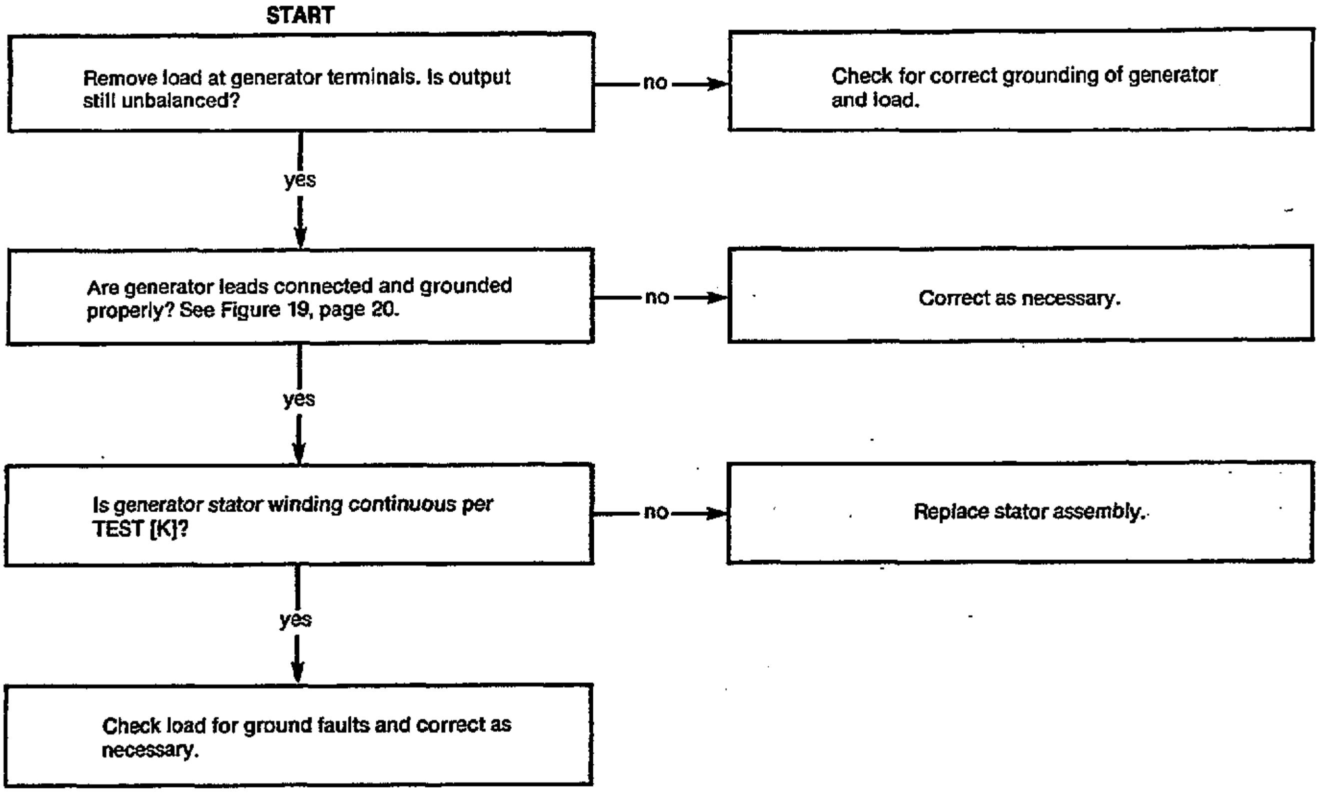
1. Check diodes CR1,2,3,4,5 and 6 in rotor assembly per TEST [F]. Replace if bad.
2. Check exciter stator winding per TEST [K]. Replace if bad.
3. Check exciter rotor winding per TEST [L]. Replace if bad.
4. Check generator rotor field winding per TEST [M]. Replace if bad. → (go to: Check generator stator windings per TEST [N])

yes →

1. Check for any loose or broken wires or connections on VR22 assembly.
2. Check diode CR15 on VR21 per TEST [G]. Replace if bad.
3. Check reference transformer T21 and connections per TEST [J]. Replace if bad.
4. Check generator stator leads for proper connection. See Figure 19, page 20.
5. Check generator stator windings per TEST [N]. Replace if bad.
6. Replace voltage regulator PC board VR21 per procedure [P].

CAUTION Do not replace the printed circuit board until the trouble not on the PC board has been located and corrected to avoid damage to new PC board.

FLOW CHART E. UNBALANCED GENERATOR OUTPUT VOLTAGE



ADJUSTMENTS AND TESTS
(STANDARD YD GENERATOR AND REGULATOR)

GENERAL

All of the following Adjustments and Tests can be performed without disassembly of the generator. They should be used for testing generator and regulator components in conjunction with the troubleshooting flow charts.

[A]

VOLTAGE CALIBRATION ADJUSTMENT

The calibration adjustment is made using an accurate AC voltmeter to observe generator output voltage and to set the correct no load voltage. If voltage regulator VR21 printed circuit board has been replaced, it may be necessary to make a calibration adjustment. To obtain the correct output voltage, proceed as follows:

1. If set has a voltage adjust potentiometer (R22) on the meter panel, set pointer halfway between minimum and maximum positions.
2. With unit running at no load, turn generator voltage potentiometer R26 on VR21 (Figure 5) clockwise to increase output voltage; turn R26 counterclockwise to decrease output voltage.

[B]

VOLTAGE STABILITY ADJUSTMENT

Voltage stability is set at the factory, but if printed circuit board VR21 has been replaced or if damping potentiometer R27 has been unnecessarily adjusted it may be necessary to reset stability. Set stability as follows:

1. With generator set running at no load, turn potentiometer R27 (Figure 5) to a position where voltage tends to be unstable or hunt.
2. Turn R27 clockwise slowly until voltage first stabilizes. This setting will result in stable voltage under all conditions in maximum voltage regulator response time.

[C]

BATTERY CHARGE RATE ADJUSTMENT

One generator winding supplies current for the battery charging circuit. The current flows through diode CR11, ammeter M11, to the battery, and to the ignition-fuel solenoid circuits.

1. The slide tap on adjustable resistor R21, located in the generator air outlet, should be set to give about 2 amperes charging rate, Figure 2. For applications requiring frequent starts, check battery charge condition (specific gravity) periodically and if necessary, increase charging rate slightly (slide tap nearer ungrounded lead) until it keeps battery charged. Having engine stopped when readjusting avoids accidental shorts. Avoid overcharging.
2. If charge winding AC output is below:
   a. 19 volts on 12 volt battery charge models,
   b. 38 volts on 24 volt battery charge models,
   c. 50 volts on 32 volt battery charge models,

   test the charging circuit for opens or grounds in the leads and charging winding. If leads are defective, replace them. If winding is defective, replace generator stator.
3. If a separate automatic demand control for starting and stopping is used, adjust charge rate for maximum 4.5 amperes. This normally keeps battery charged even if starts occur as often as 15 minutes apart.

[D]

VOLTAGE REGULATOR CHECKOUT

The solid state voltage regulators (VR21) can be checked out on the bench for proper operation or location of faulty components. The following test equipment (one-each) is required for a proper checkout.

REF. DESIGNATION	TEST EQUIPMENT
S	Switch
CMR21	Reactor
F	Fuse, 5 Amps
T1	Transformer, Variable 2 Amp 0-150V
V2	Voltmeter, DC ± 2% of Full Scale 3, Scale 0-50 and 0-150V and 0-10V
V1	Voltmeter, AC ± 2% @ 10VAC, 1% @ 150V
R1	Resistor, 100-Ohm 400 W
T21	Transformer, Input 315-0386

Transformer T21 and reactor CMR21 are a part of the voltage regulator assembly (VR22 or VR23); these are the only parts obtainable with an Onan part number. The big 100-ohm 400 watt resistor (R1) serves as the field during checkout.

Bench Check:

1. Remove voltage regulator from unit according to procedure given for voltage regulator replacement.
2. Referring to Figure 5 and Table 1, connect test equipment to the printed circuit board VR21 terminals as follows:

CONNECT	FROM	TO
Jumper	VR21-V1	VR21-V4
Jumper	VR21-1	VR21-2
Lead	CMR21-1	VR21-10
Lead	CMR21-4	VR21-9
Lead	T21-X1	VR21-6
Lead	T21-X2	VR21-4
AC Voltmeter	Across	T21-H1 & H2
DC Voltmeter	Across	VR21-7 & 8
VARIAC	Across	T21-H1 (fused) and H2
R1	Across	VR21-7 & 8

3. Open switch in 120 VAC supply to VARIAC.
4. Plug VARIAC into 120 VAC source.
5. Proceed with checkout according to steps in Table 1.

[E]

FLASHING THE FIELD

The following procedure is used for momentarily flashing the exciter field with a low voltage which restores the residual magnetism in the alternator rotor. Flashing the field is usually necessary when installing a new brushless exciter stator wound assembly, but seldom is necessary under other circumstances. Always check generator residual voltage at terminals 1 and 2 to be certain whether or not flashing the field is necessary. Generator residual

TABLE 1. VOLTAGE REGULATOR CHECKOUT

V_1 AC INPUT VOLTAGE
V_2 DC OUTPUT VOLTAGE

(<= LESS THAN) (>= MORE THAN)

STEP NO.	TEST NAME	PROCEDURE	REQUIREMENTS
1	BUILD UP	SET V_1 TO 25 VAC	V_2 SHALL BE > 12 VDC
2	CALIBRATION	SET V_1 TO 120 VAC	SET POT R26 TO HOLD V_2 BETWEEN 50–70 VDC
3	RANGE	A. SET V_1 TO 123 VAC B. SET V_1 TO 125 VAC	V_2 SHALL BE < 30 VDC V_2 SHALL BE < 10 VDC
4	RANGE	A. SET V_1 TO 115 VAC B. SET V_1 TO 117 VAC	V_2 SHALL BE > 85 VDC V_2 SHALL BE > 80 VDC
5	MAX VOLTAGE	SET V1 TO 150 V	V_2 < 10 VOLTS
6	DAMPING	SET V1 TO 120 VAC. DECREASE R27 UNTIL INSTABILITY IN V1 AND V2 OCCURS. INCREASE R27 TO STABILITY IN V1 AND V2.	V1 AND V2 SHALL REMAIN STABLE AFTER APPLICATION AND REMOVAL OF GENERATOR LOAD.

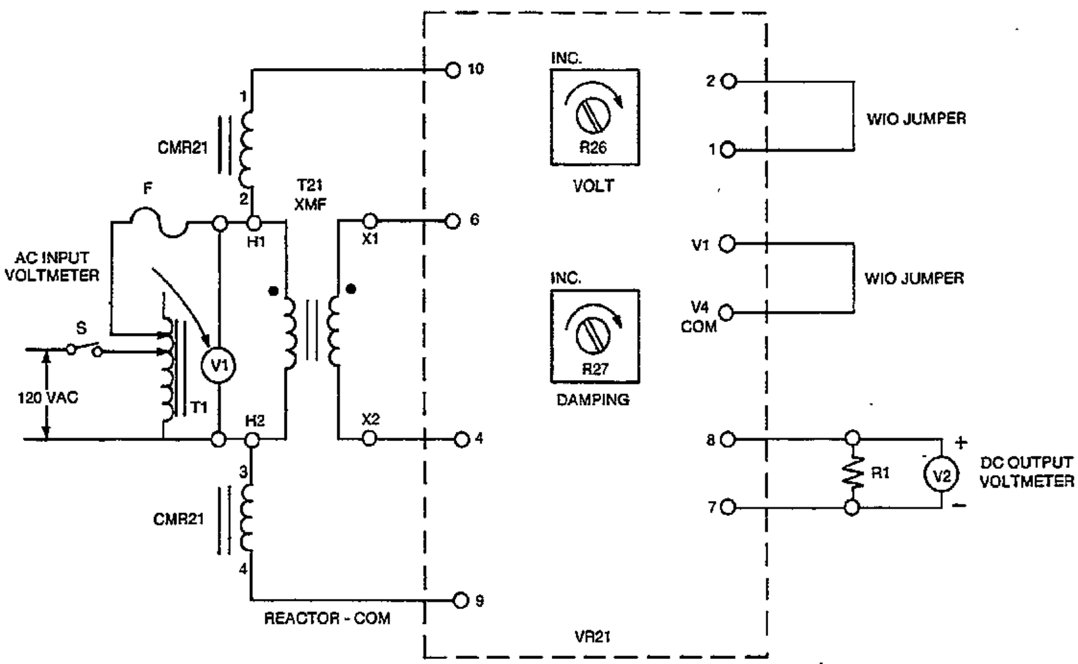


FIGURE 5. VOLTAGE REGULATOR CHECKOUT TEST EQUIPMENT CONNECTIONS

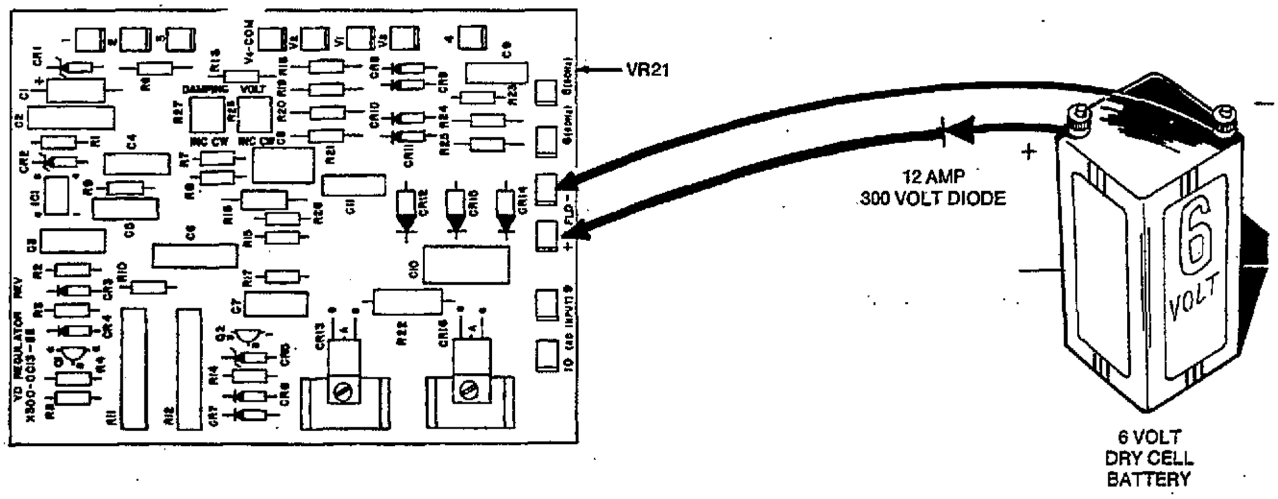


FIGURE 6. FLASHING THE FIELD

voltage should be at least 20 VAC at rated speed. If residual is too low and the output voltage will not build up, flash the field as follows:

1. Locate terminals 7(-) and 8(+) on voltage regulator printed circuit board (VR21).
2. Use a six volt dry cell battery with two clip leads and a 12 amp, 300 volt diode as shown in Figure 6. If a six volt battery is not available, a 12 volt automotive battery can be used by adding a 20-ohm resistor in series; or a 24 volt automotive battery can be used by increasing the resistance to 40-ohms.
3. After starting engine, touch positive (+) battery lead to the +8, and negative (-) lead to -7 terminals just long enough until voltage starts to build up or damage may occur to exciter-regulator system.

WARNING **Be cautious when working on a generator that is running to avoid electrical shocks.**

TEST PROCEDURES

All of the following tests can be performed without disassembly of the generator. Use the following test procedures for testing generator components in conjunction with the troubleshooting charts.

[F]

TESTING ROTATING RECTIFIERS

Two different rectifier assemblies make up the rotating rectifier bridge assembly, Figure 7. Using an accurate ohmmeter, test each CR using negative and positive polarities. Test rectifiers as follows:

1. Disconnect all leads from assembly to be tested.
2. Connect one test lead to F1+ stud and connect other lead to CR1, CR2, and CR3 in turn; record resistance value of each rectifier.
3. Connect one lead to F2- stud and connect other lead to CR3, CR4 and CR5 in turn; record resistance value of each rectifier.
4. Reverse ohmmeter leads from step 2 and record resistance value of each rectifier F1+ to CR1, CR2, and CR3 and F2- to CR4, CR5, and CR6.
5. All three resistance readings should be high in one test and low in the other test. If any reading is high or low in both tests, rectifier assembly is defective.
6. Replace defective rectifier assembly with new, identical part.

Use 24 lbs-in. (2.7 N•m) torque when tightening nuts on F1+ and F2-, CR1, CR2, CR3, CR4, CR5, and CR6.

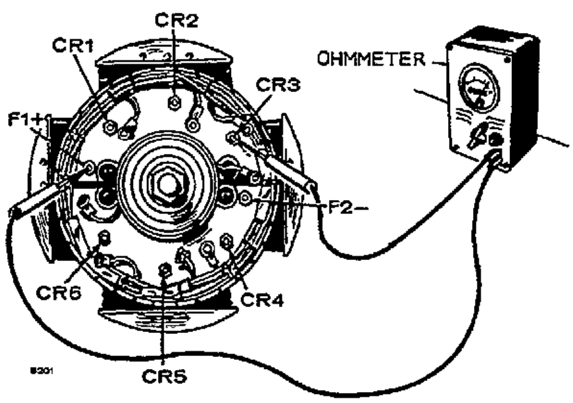


FIGURE 7. TESTING ROTATING RECTIFIERS

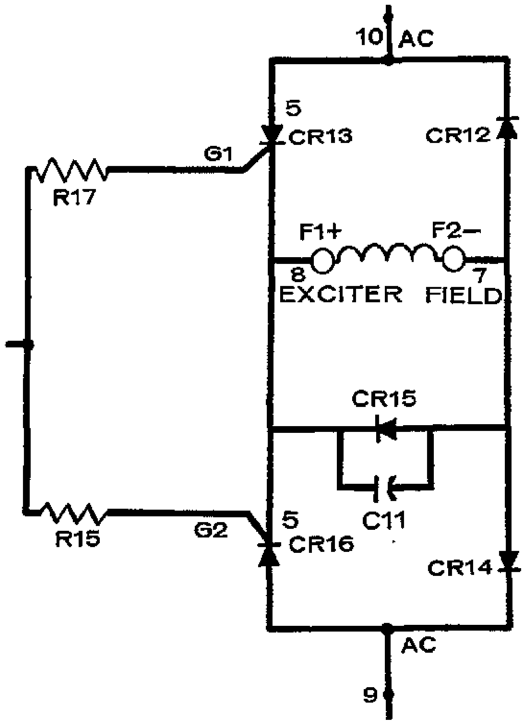


FIGURE 8. SILICON CONTROLLED RECTIFIER BRIDGE

[G]

TESTING OUTPUT BRIDGE DIODES

The output bridge rectifier diodes (Figure 8), CR12, CR14, and CR15, are located on the voltage regulator printed circuit board. Using an accurate ohmmeter, test diodes CR12, CR14, and CR15 as follows:

1. Connect one ohmmeter lead to each end of diode and observe resistance reading, Figure 9.
2. Reverse ohmmeter leads and again observe resistance readings.

A good diode has a higher reading in one direction than the other. If both readings are high, or low, diode is defective.

3. Replace defective diodes with new, identical parts.

[H]

TESTING SCR'S

Two identical silicon controlled rectifiers (SCR's), CR13 and CR16, control the DC output voltage to the exciter field. These SCR's are mounted in heat sinks on the voltage regulator and are tested as follows:

1. Using high scale on ohmmeter, connect ohmmeter leads to anode and cathode of the SCR as shown in Figure 10. The resistance reading should be one megohm or greater. Reverse ohmmeter leads to anode and cathode; resistance should again be one megohm or greater.

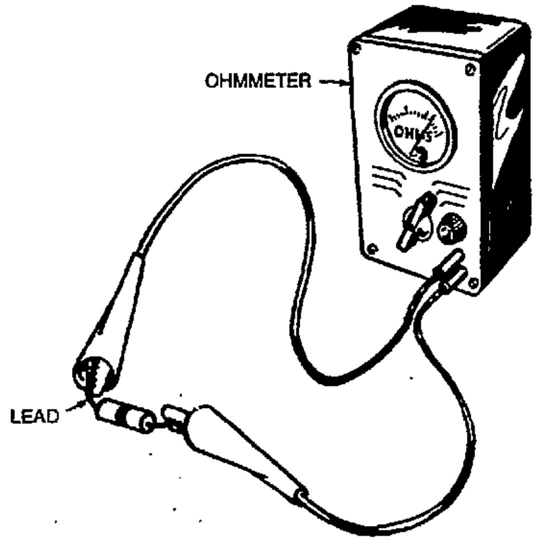


FIGURE 9. TESTING DIODES

2. Using a 6-volt dry cell battery and a 200-ohm series resistor, observe correct polarity and connect battery leads to anode and cathode as shown in Figure 11. Observe polarity and connect a DC voltmeter across the 200 ohm resistor. The voltmeter should now read zero. Jumper anode to gate; voltmeter should now read 6-volts. Remove jumper; voltmeter should still read 6-volts because the SCR remains turned on until voltage is removed from anode to cathode.
3. If the SCR does not pass either test, it is defective. Replace defective SCR with a new, identical part.

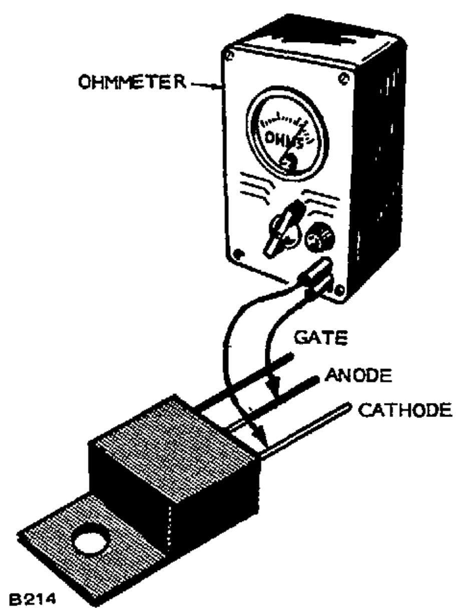


FIGURE 10. SCR RESISTANCE TEST

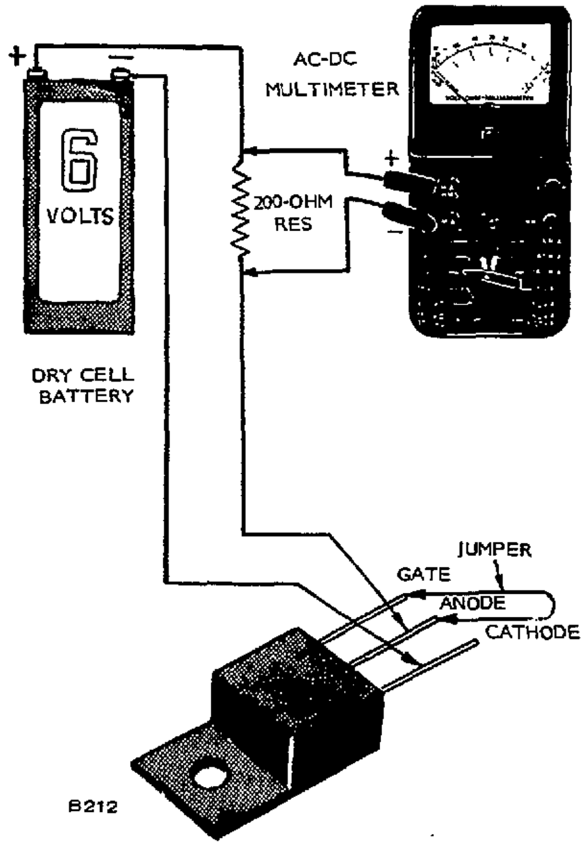
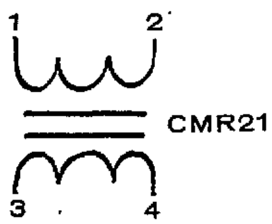


FIGURE 11. SCR VOLTAGE TEST

[I]

TESTING REACTOR

The reactor assembly CMR21 leads are marked 1, 2, 3 and 4. Wires 1-2 and 3-4 are wound on the same iron core.

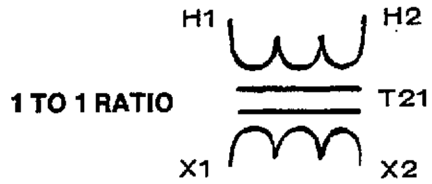


Resistance between 1-2 and 3-4 should be 0.33 to 0.39 ohms and 0.38 to 0.46 ohms respectively at 77°F (25°C). Resistance between coils (e.g. 1-3) and from any terminal to reactor frame should be infinity.

[J]

TESTING REFERENCE TRANSFORMER

The transformer T21 has four leads marked H1, H2, X1, and X2. H1-H2 are the primary leads. X1-X2 are the secondary leads.



Resistance between H1-H2 should be 113 to 139 ohms, between X1-X2 133 to 163 ohms at 77°F (25°C). Resistance between coils and from any terminal to transformer frame should be infinity.

[K]

TESTING BRUSHLESS EXCITER STATOR

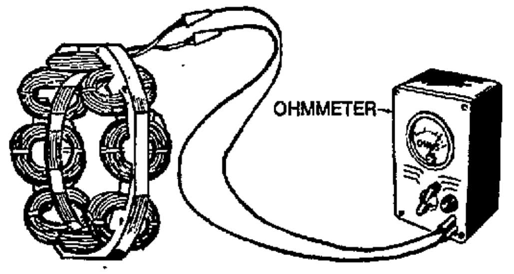
Like the generator, the brushless exciter stator (Figure 12) can be tested for open or shorted windings and grounds.

Testing for Open or Shorted Windings:

Disconnect F1+ and F2- exciter field leads from terminal block in generator end bell. The resistance between field leads should be 10.98 to 13.42 ohms at 68°F (20°C).

Testing for Grounds:

Connect ohmmeter between either field lead and exciter stator laminations. Use ohmmeter set at RX 100 scale. An ohmmeter reading of less than infinity (∞) indicates defective ground insulation.



OHMMETER RESISTANCE BETWEEN F1 AND F2 SHOULD BE 10.98 TO 13.42 OHMS

FIGURE 12. TESTING EXCITER FIELD

[L]

TESTING BRUSHLESS EXCITER ROTOR (ARMATURE)

The brushless exciter rotor (Figure 13), can be tested for open or shorted windings, or grounds.

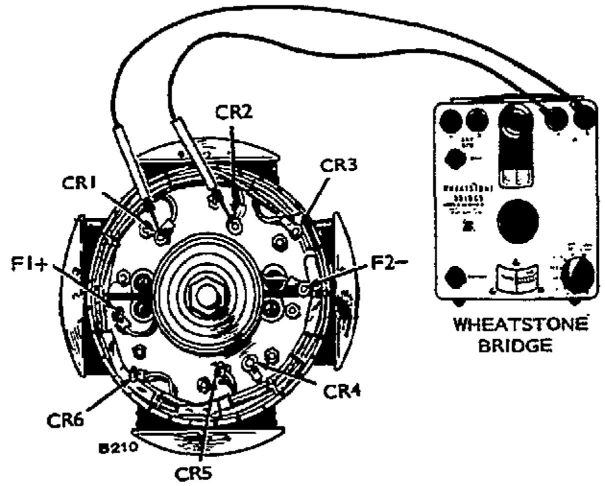


FIGURE 13. TESTING EXCITER ARMATURE

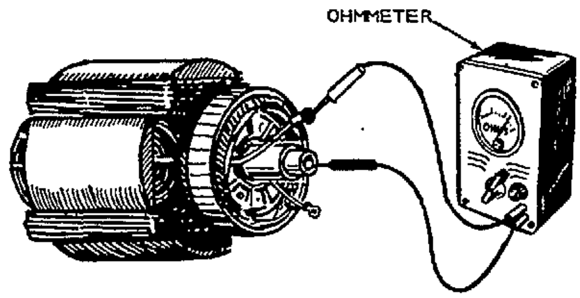


FIGURE 14. TESTING ROTOR FOR GROUNDS

Testing for Open or Shorted Windings:

Use a Wheatstone Bridge for this test. Disconnect main rotor field leads which connect to rotating rectifier assemblies at F1+ and F2-. Disconnect lead wires from diodes CR1, CR2, CR3, CR4, CR5 and CR6. Test between exciter lead pairs T1-T2, T2-T3 and T1-T3. Resistance should be 0.5 to 0.6 ohms at 68° F (20° C).

Testing for Grounds:

Connect leads of ohmmeter between each CR lead and exciter rotor laminations; use RX 100 scale on ohmmeter. An ohmmeter reading less than infinity (∞) indicates defective ground insulation.

[M]

TESTING GENERATOR ROTOR

For these tests, use an ohmmeter on RX 100 scale.

Testing for Grounds:

On brushless type generators, check for grounds between each rotor lead and the rotor shaft, Figure 14. Perform tests as follows:

1. Remove rotor leads F1+ and F2- from rotating rectifier assemblies.
2. Connect ohmmeter leads between F1+ and rotor shaft and between F2- and rotor shaft. Meter should not register.
3. If meter registers, rotor is grounded.
4. Replace grounded rotor with new, identical part.

Testing for Open or Shorted Winding:

All resistance values should be within ±10% of values specified in Tables 2 and 4 at 77° F (25° C). Perform tests as follows:

1. Remove rotor leads F1+ and F2- from rotating rectifier assemblies.
2. Using ohmmeter, check resistance between F1 and F2 leads, Figure 15.

If resistance is low, there are shorted turns. If resistance is high, rotor winding is open. In either case, rotor must be replaced.

3. Replace defective rotor with new, identical part.

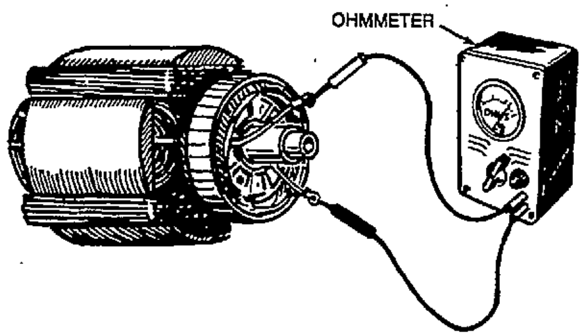


FIGURE 15. TESTING ROTOR FOR AN OPEN CIRCUIT

TABLE 2. RESISTANCE VALUES FOR ROTORS

kW RATING AND MODEL		RESISTANCE
50 HERTZ	60 HERTZ	OHMS @ 25° C (77° F)
4.5 DJB	6.0 DJB	2.45 - 2.50
4.5 DJE	6.0 DJE	2.45 - 2.50
6.0 JB	7.5 JB	2.76 - 2.82
6.0 MDJE	7.5 MDJE	2.76 - 2.82
—	10.0 MJC	2.05 - 2.09
—	12.5 JC	2.30 - 2.35
—	12.5 RJC	2.30 - 2.35
9.0 DJC	12.0 DJC	2.30 - 2.35
10.0 MDJC	12.0 MDJC	2.30 - 2.35
12.5 JC	15.0 JC	2.50 - 2.55
—	15.0 MJC	2.50 - 2.55
12.5 RJC	15.0 RJC	2.50 - 2.55
12.5 RDJC	15.0 RDJC	2.50 - 2.55
12.0 MDJF	15.0 MDJF	2.50 - 2.55
14.5 RDJF	17.5 RDJF	2.70 - 2.75

[N]

TESTING GENERATOR STATOR

Using proper test equipment, check the stator for grounds, opens, and shorts in the windings.

Testing for Grounds:

Some generators have ground connections to the frame. Check wiring diagram.

Using an ohmmeter set at RX 100, test each stator winding for shorts to laminations. A reading less than one megohm indicates a ground.

Testing for Open or Shorted Windings:

Test for continuity between coil leads shown in Figure 16; all parts should have equal resistance. Use an accurate instrument for this test such as a Kelvin Bridge. The proper resistance values for J-Series sets are given in Table 3 according to kW ratings and voltage codes. All resistances should be ± 10% of value shown at 68° F (20° C). Table 4 has resistance values for PTO alternators in the 15-25 kW size range. If any windings are shorted, open or grounded, replace the stator assembly. Before replacing the assembly, check the leads for broken wires or insulation.

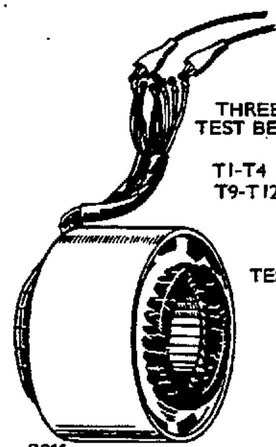


FIGURE 16. TESTING STATOR WINDINGS

TABLE 3. RESISTANCE VALUES FOR STATORS

kW RATING AND MODEL		VOLTAGE CODE			
50 Hertz	60 Hertz	18	518	3C	53C
4.5 DJB	6.0 DJB	.695	.761	.360	.485
4.5 DJE	6.0 DJE	.695	.761	.360	.485
6.0 JB	7.5 JB	.460	.498	.224	.294
6.0 MDJE	7.5 MDJE	.460	.498	.224	.294
	10.0 MJC	.340	—	.172	—
	12.5 JC	.303	—	.120	—
	12.5 RJC	.303	—	.120	—
9.0 DJC	12.0 DJC	.303	.260	.120	.153
10.0 MDJC	12.0 MDJC	.303	.260	.120	.153
12.5 JC	15.0 JC	.220	.198	.087	.110
	15.0 MJC	.220	—	.087	—
12.5 RJC	15.0 RJC	.220	.198	.087	.110
12.0 RDJC	15.0 RDJC	.220	.198	.087	.110
12.0 MDJF	15.0 MDJF	.220	.198	.087	.110
14.5 RDJF	12.5 RDJF	.162	.143	.066	.089

[O]

WIRING HARNESS CHECK

Carefully check wiring harnesses as follows:

1. Inspect all wires for breaks, loose connections, and reversed connections. Refer to applicable wiring diagram.
2. Remove wires from terminals at each end and using an ohmmeter, check each wire end to end for continuity or opens.
3. Using an ohmmeter, check each wire against each of the other wires for possible shorts or insulation breaks under areas covered by wrapping material.
4. Reconnect or replace wires according to applicable wiring diagram.

[P]

VR21 REPLACEMENT

Use the following procedure for replacing the voltage regulator PC board.

1. Stop engine.
2. Disconnect and if necessary, label the following wires: 3, 4, 5 or 6, 7, 8, 9, and 10.
3. Remove four screws at corners.
4. Remove used PC board.
5. Install new PC board; secure with four screws.
6. Reconnect wires removed in step 2 at the proper terminals.
7. Place jumper W10 at proper terminals for your particular voltage code and voltage connection. See Figures 17 and 19.
8. Perform Voltage Calibration and Stability Adjustment procedures [A] and [B] to obtain the correct generator output voltage and stability with new PC board in set.

TABLE 4. RESISTANCE VALUES FOR PTO ALTERNATORS

PTO MODELS	VOLTAGE CODE	OHMS @ 77°F (25°C)	
		ROTOR	STATOR
15.0 kW 1-Phase	3C	2.77 - 2.35	0.095
20.0 kW 1-Phase	3C	2.70 - 2.75	.063 - .076
20.0 kW 3-Phase	5D	2.70 - 2.75	.219 T1-T2, T2-T3, T1-T3 .142 T1-T0, T2-T0 .248 T3-T0
25.0 kW 1-Phase	3C	1.800 —	0.095
25.0 kW 3-Phase	5D	1.800 —	0.170 T1-T2, T2-T3, T3-T1 0.106 T1-T0, T2-T0 0.192 T2-T0

VOLTAGE REGULATOR

The line-voltage regulator assemblies VR22 and VR23 on the J-Series generator sets are solid state devices. Basic components are:

- Printed circuit board VR21
- Voltage reference transformer T21
- Commutating reactor CMR21
- Field circuit breaker CB21
- Voltage adjust rheostat R22 (Optional)

Figure 17 shows the above components for typical control boxes. The electrical schematic and printed circuit board are shown in Figure 18.

The voltage adjust control R22 is optional on either VR22 or VR23 voltage regulator. When R22 is used, it is connected between VR21-1 and VR21-3 (Figure 17) and the jumper between VR21-1 and VR21-2 is removed.

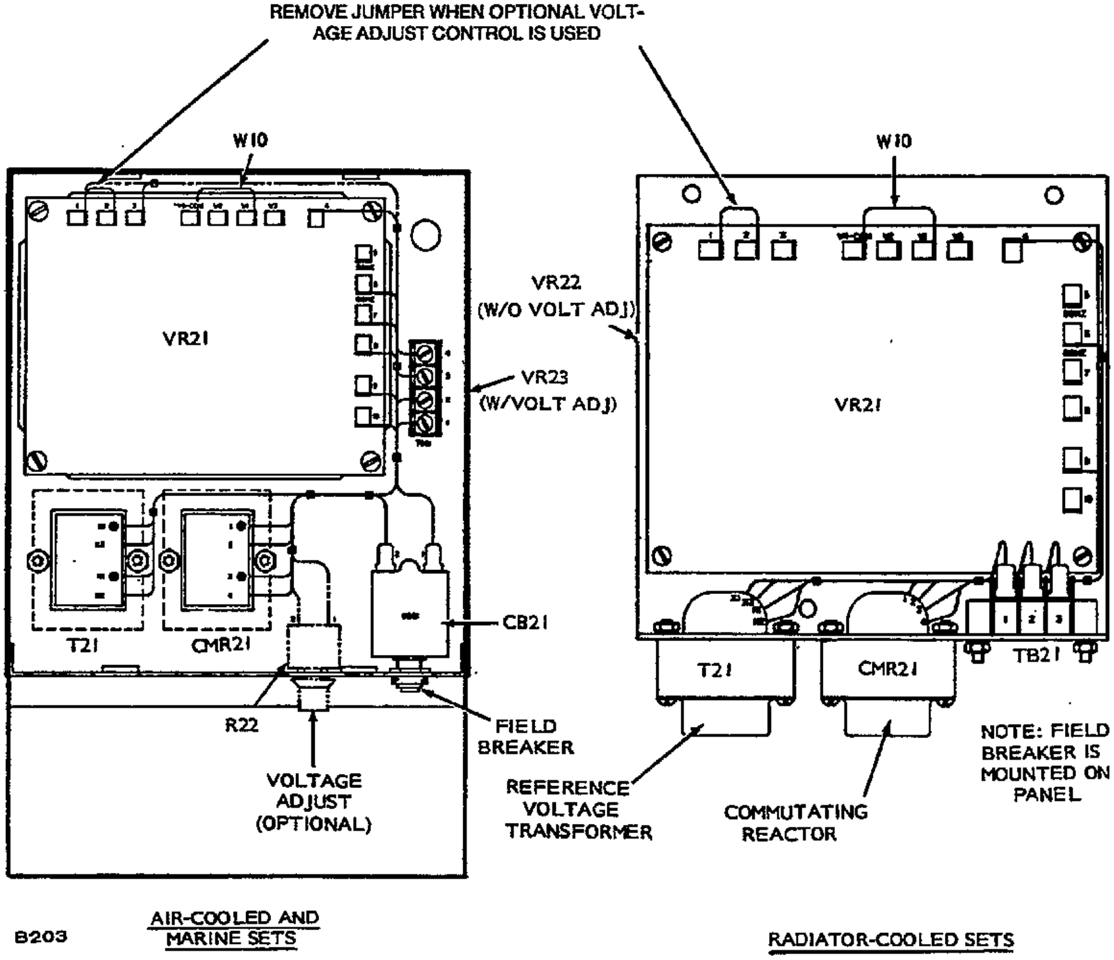
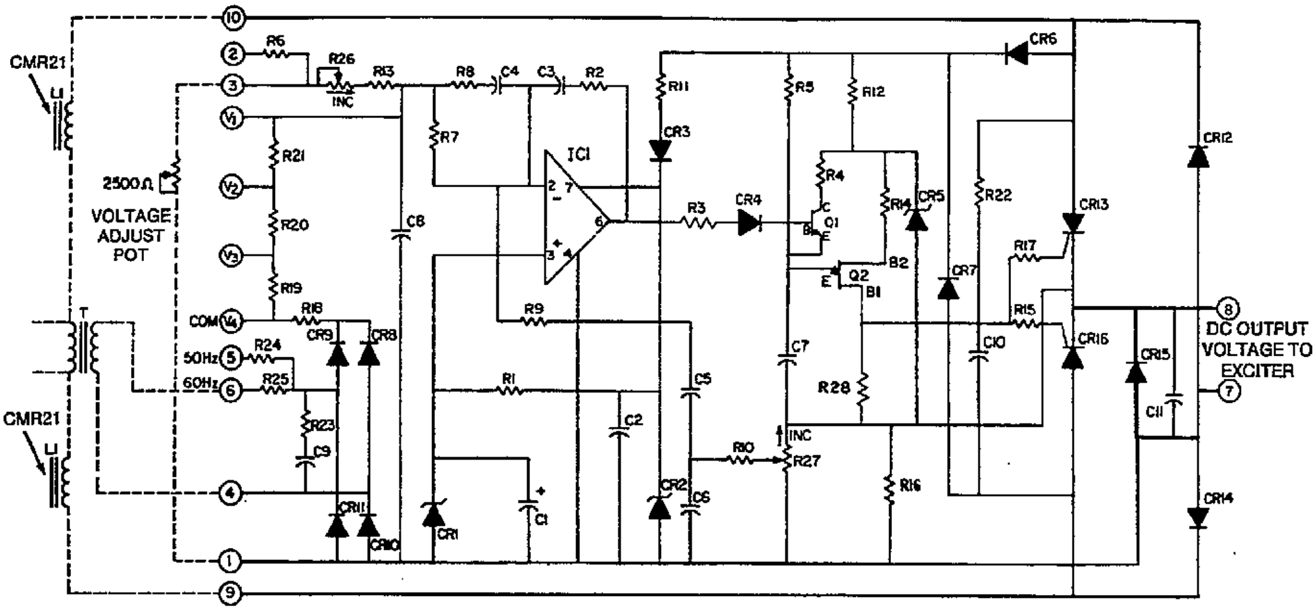
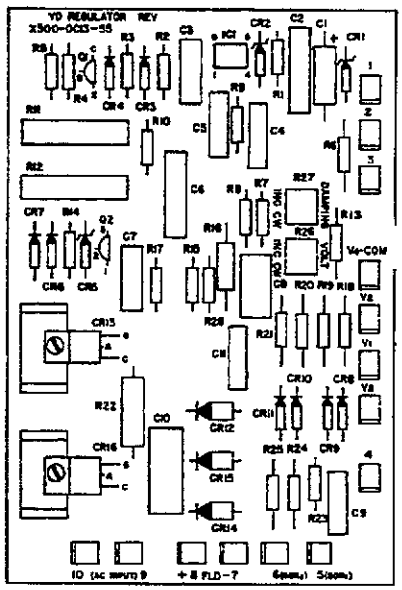


FIGURE 17. STANDARD YD VOLTAGE REGULATOR ASSEMBLIES



REGULATOR SCHEMATIC

REF. DES.	DESCRIPTION
T21	Transformer, Ref Voltage
CMR21	Commutating Reactor
IC1	INTEGRATED CIRCUIT
Q1	TRANSISTOR-NPN
R28	RESISTOR 47Ω 1/2W
R27	POTENTIOMETER 100KΩ
R26	" " 5.0KΩ
R25	RESISTOR-FILM 42.2KΩ, 1/4W
R24	" " 48.4KΩ, 1/4W
R23	RESISTOR 10Ω, 1/2W
R22	RESISTOR 270Ω, 2W
R21	RESISTOR-FILM 2 67K 1/4W
R20	" " 1.53K 1/4W
R19	RESISTOR-FILM 3.01K, 1/4W
R18	RESISTOR FILM 28.0K, 1/4W
R16	RESISTOR 18KΩ 1W
R15 17	" 33Ω, 1/2W
R14	RESISTOR 100Ω, 1/2W
R13	RESISTOR-FILM 11.0KΩ, 1/4W
R11,12	RESISTOR-WIRE WOUND 4KΩ, 5W
R9	RESISTOR 1 MEGΩ, 1/2W
R8 10	RESISTOR 100KΩ, 1/4W
R7	" 270KΩ, 1/2W
R6	RESISTOR-FILM 1.24KΩ, 1/4W
R5	RESISTOR 2 MEGΩ, 1/2W
R4	RESISTOR 3KΩ, 1/2W
R3	" 330KΩ, 1/2W
R2	" 220KΩ, 1/2W
R1	" 33KΩ, 1/2W
Q2	TRANSISTOR-UNIJUNCTION
CR13,16	RECTIFIER-GATE CONT
CR12,14,15	RECTIFIER-DIODE
CR5	DIODE-ZENER 10V
CR3,4,6-11	RECTIFIER-DIODE 1A 400V
CR2	DIODE-ZENER 20V
CR1	" 5.6V
C10	CAPACITOR .47MFD 400V
C9	CAPACITOR .39MFD 250WK
C8	" 1MFD 250WK
C4,C5 C11	" .1MFD 250WK
C3,C7	" .22MFD 250WK
C2,C6	CAPACITOR .47MFD 250WK
C1	CAPACITOR-ELECTROLYTIC 100MFD 10V



PRINTED CIRCUIT BOARD, VR21

NOTE: The 2500 ohm external voltage adjust potentiometer connects between pin 1 and pin 3. See regulator schematic. If your set does not have an external voltage adjust potentiometer, pin 1 is jumpered to pin 2.

FIGURE 18. STANDARD YD REGULATOR PC BOARD 300-1540

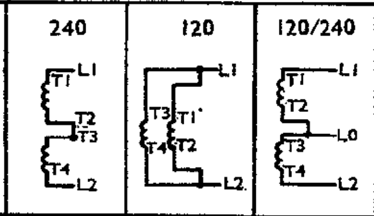
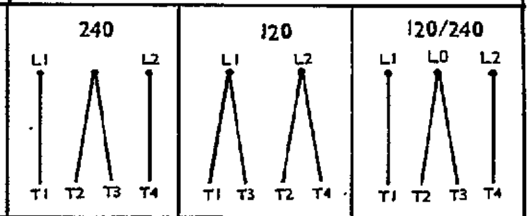
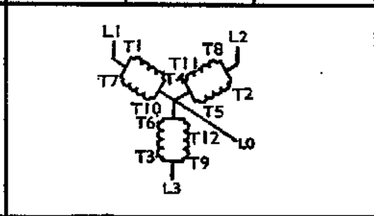
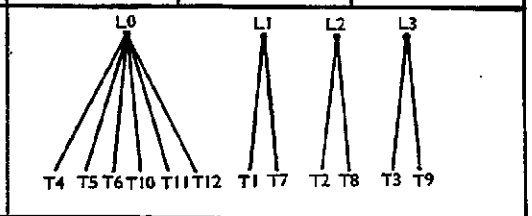
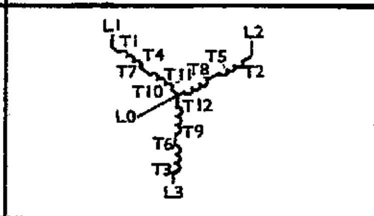
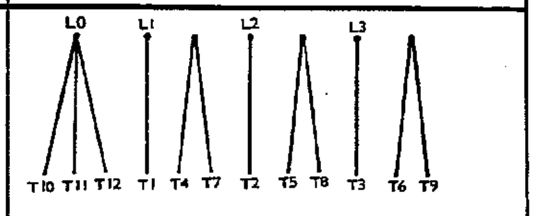
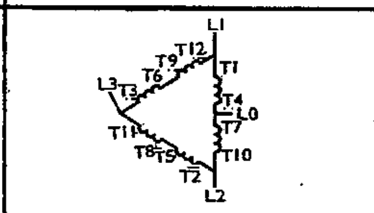
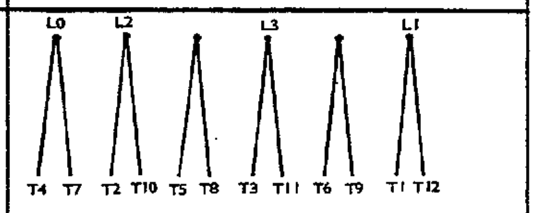
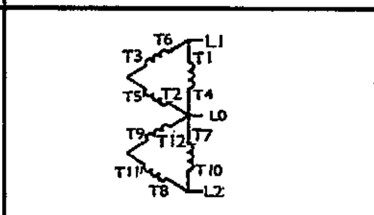
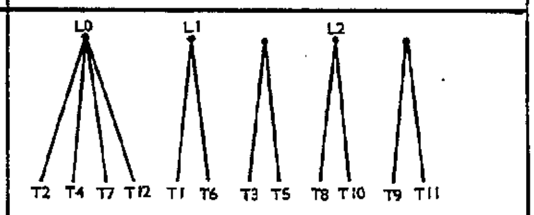
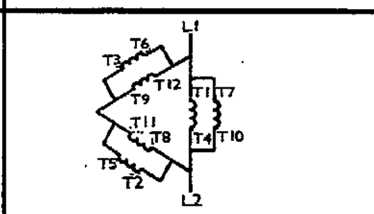
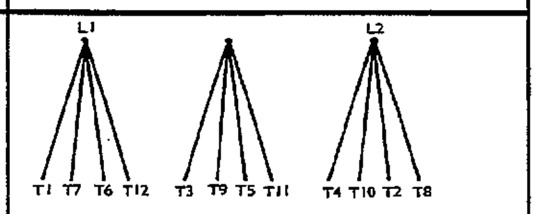
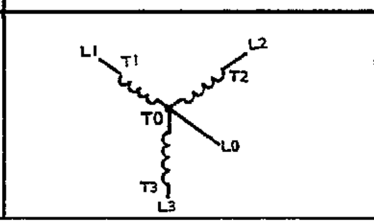
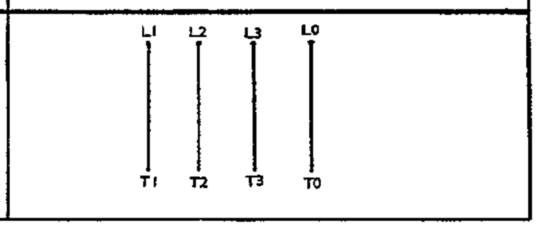
NAMEPLATE VOLTAGE CODE	VOLTAGE	PHASE	FREQUENCY	CONNECT W10 JUMPER WIRE FROM V4 TO:	GENERATOR CONNECTION	GENERATOR CONNECTION SCHEMATIC DIAGRAM	LOAD TO GENERATOR CONNECTION WIRING DIAGRAM — CONNECT X1 TO VR21-5 FOR 50 HERTZ: CONNECT X1 TO VR21-6 FOR 60 HERTZ GENERATORS.
3C	120/240	1	60	V1			
53C	120/240	1	50	V3			
	115/230	1	50	V2			
	110/220	1	50	V1			
18	120/208	3	60	V1	PARALLEL WYE		
	127/220	3	60	V2			
	139/240	3	60	V4			
518	110/190	3	50	V1			
	115/200	3	50	V2			
	120/208	3	50	V3			
	127/220	3	50	V4			
18	240/416	3	60	V1	SERIES WYE		
	254/440	3	60	V2			
	277/480	3	60	V4			
518	220/380	3	50	V1			
	230/400	3	50	V2			
	240/416	3	50	V3			
	254/440	3	50	V4			
18	120/240	3	60	V1	SERIES DELTA		
518	110/220	3	50	V1			
	115/230	3	50	V2			
	120/240	3	50	V3			
18	120/240	1	60	V1	DOUBLE DELTA		
518	110/220	1	50	V1			
	115/230	1	50	V2			
	120/240	1	50	V3			
18	120	1	60	V1	PARALLEL DELTA		
518	110	1	50	V1			
	115	1	50	V2			
	120	1	50	V3			
9X	347/600	3	60	V4	WYE		
B200							

FIGURE 19. GENERATOR WIRING AND RECONNECTION DIAGRAMS 4.5 - 25 kW (CODE 5D PTO UNITS SEE PAGE 34)

PART II
TROUBLESHOOTING PROCEDURES
(YD GENERATORS USING UR REGULATOR)

The information in this section is for generators used on 25DTA/MDTA series sets and the 30kW PTO and SK sets. Information is divided into Flow Charts, A, B, C, D and E as follows:

A. NO AC OUTPUT VOLTAGE AT RATED ENGINE RPM.
B. UNSTABLE OUTPUT VOLTAGE, ENGINE SPEED STABLE 1800 RPM.
C. OUTPUT VOLTAGE TOO HIGH OR LOW.
D. EXCITER FIELD BREAKER TRIPS.
E. UNBALANCED GENERATOR OUTPUT VOLTAGE.

To troubleshoot a problem, start at upper-left corner of the chart related to problem, and answer all questions either YES or NO. Follow the chart until the problem is found, performing referenced Adjustment and Test procedures following the Flow Charts.

Referenced components in the Flow Charts and Adjustment and Test procedures can be found on the electrical schematic Figure 20, and on assembly drawings and wiring diagrams on pages 32-34.

GENERATOR OPERATION

The basic operation of the generator and AC controls involves the stator, voltage regulator, exciter field and armature, a full wave bridge rectifier, and the generator rotor, Figure 20. Residual magnetism in the generator rotor and a permanent magnet embedded in one exciter field pole begin the voltage build-up process as the generator set starts running. Single-phase AC voltage, taken from 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 (SCR) bridge 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 resultant DC voltage excites the generator rotor winding to produce the stator output voltage for the AC load.

The SCR bridge is encapsulated in a hermetically sealed block. Therefore, if any diode or silicon controlled rectifier fails, the entire bridge has to be replaced.

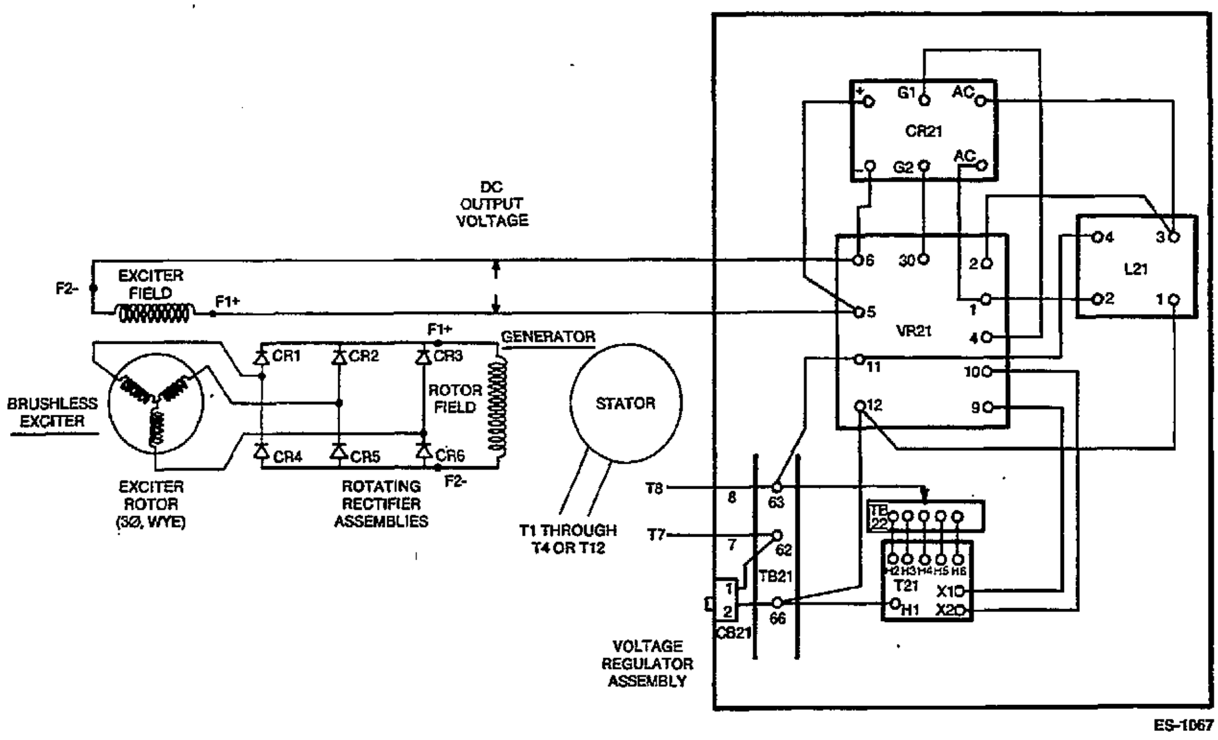
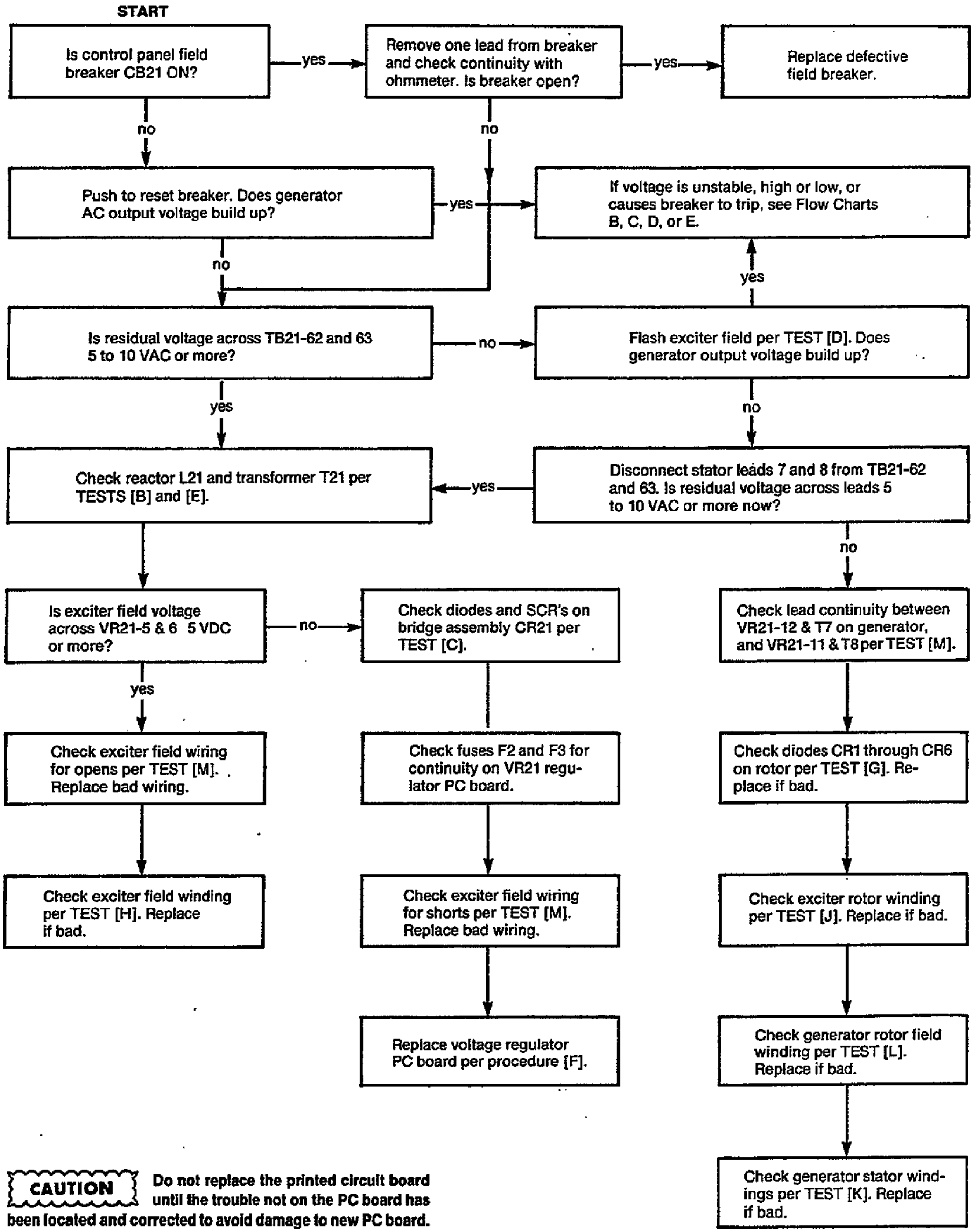


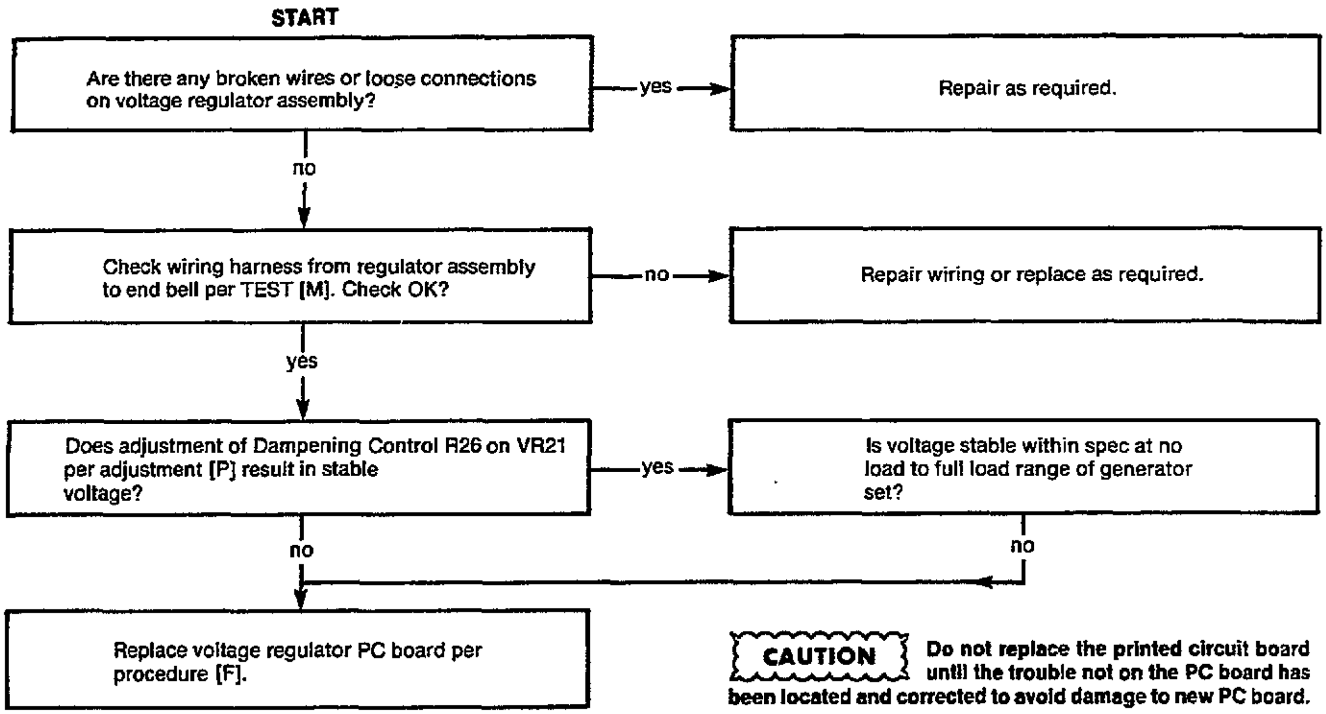
FIGURE 20. ELECTRICAL SCHEMATIC, YD GENERATOR WITH TYPE UR REGULATOR

FLOW CHART A. NO AC OUTPUT VOLTAGE AT RATED ENGINE RPM

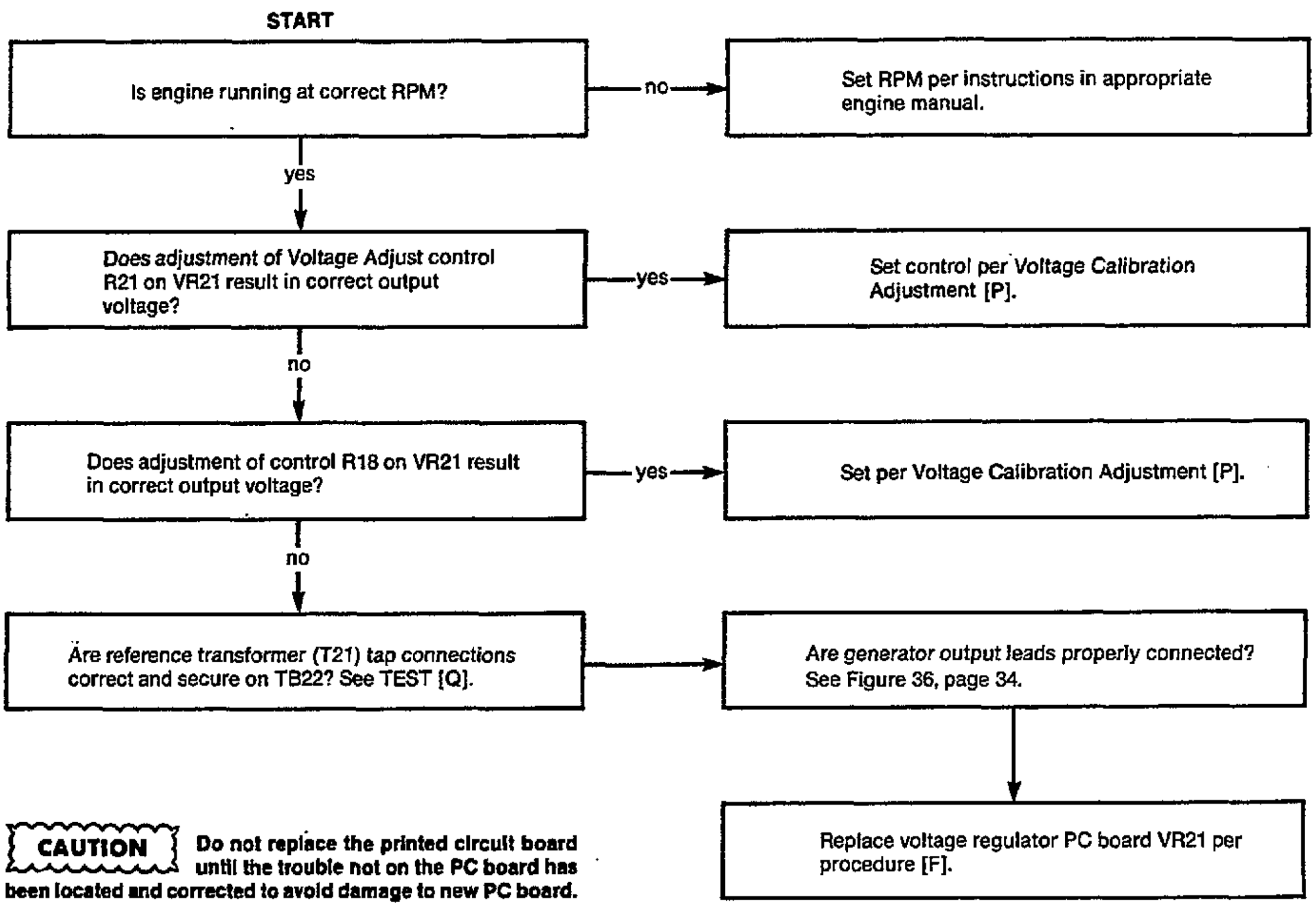


CAUTION Do not replace the printed circuit board until the trouble not on the PC board has been located and corrected to avoid damage to new PC board.

FLOW CHART B. UNSTABLE VOLTAGE, ENGINE SPEED STABLE 1800 RPM



FLOW CHART C. OUTPUT VOLTAGE TOO HIGH OR LOW



FLOW CHART D. EXCITER FIELD BREAKER TRIPS

START

Does AC output voltage build up to 150% or more of rated voltage before breaker trips?

yes → Check for any loose or broken wires or connections on VR21 assembly.

↓

Check diodes and SCR's in bridge assembly CR21 per TEST [C].

↓

Check generator stator leads for proper connection. See Figure 36, page 34.

no ↓

Check diodes CR1,2,3,4,5 and 6 in rotor assembly per TEST [G]. Replace if bad.

↓

Check exciter stator winding per TEST [H]. Replace if bad.

↓

Check exciter rotor winding per TEST [J]. Replace if bad.

↓

Check generator rotor field winding per TEST [L]. Replace if bad.

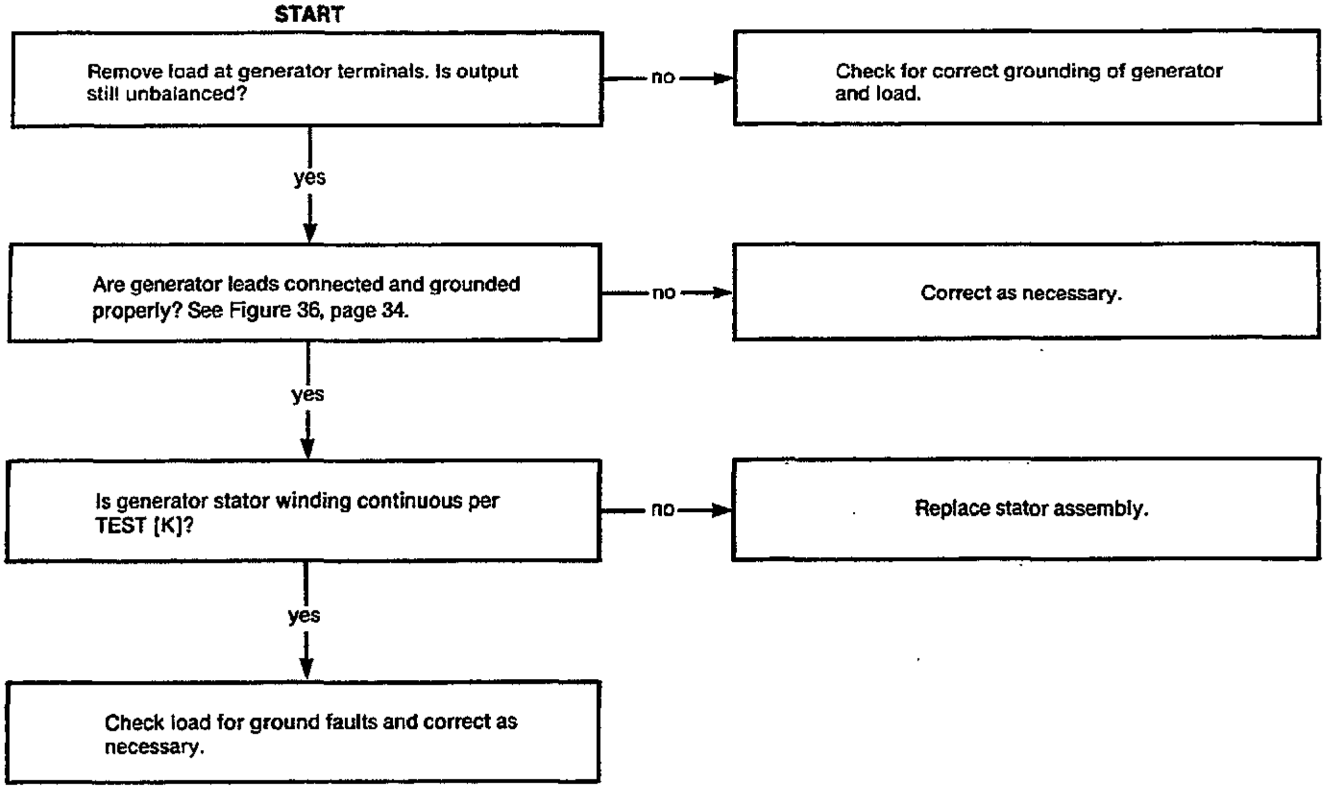
→ Check generator stator windings per TEST [K]. Replace if bad.

↓

Replace voltage regulator PC board VR21 per procedure [F].

CAUTION **Do not replace the printed circuit board until the trouble not on the PC board has been located and corrected to avoid damage to new PC board.**

FLOW CHART E. UNBALANCED GENERATOR OUTPUT VOLTAGE



ADJUSTMENTS AND TESTS
(YD GENERATORS USING UR TYPE REGULATORS)

GENERAL
All of the following Adjustments and Tests can be performed without disassembly of the generator. They should be used for testing generator and regulator components in conjunction with the trouble-shooting flow charts.

[A]

TESTING AC RESIDUAL VOLTAGE
Generator residual AC voltage should be checked first if there is no AC power output. A quick place to check is at TB21 across terminals 62 and 63 (see Figure 20). Residual voltage should be 5-10 VAC. If none, flash field per Test [D].

If residual voltage is present at TB21, then check circuit breaker CB21. If CB21 is OK, proceed to VR21 PC board and check for residual voltage between connector numbers 11 & 12, 1 & 2, and 9 & 10. If none, check continuity between these points with the gen set shut down. If voltage is low, check L21 reactor (Test [B] and T21 transformer (Test [E]).

[B]

TESTING L21 REACTOR
The L21 commutating reactor (Figure 21) mounts inside the control box.

The coils 1-2 and 3-4 are wound on the same core. Resistance between 1-2 and 3-4 should be .031 to .037 and .037 to .046 ohms respectively at 77° F (25°). Resistance between coils and from any terminal to frame of the reactor should be infinity.

[C]

TESTING RECTIFIER BRIDGE ASSEMBLY (CR21)
The rectifier bridge located within the control cabinet, contains 3 diodes, CR1, CR2 and CR3, and two silicon controlled rectifiers, SCR1 and SCR2. The components are encapsulated within a hermetically sealed block, therefore failure of any diode or SCR means the entire unit has to be replaced. See Figure 22.

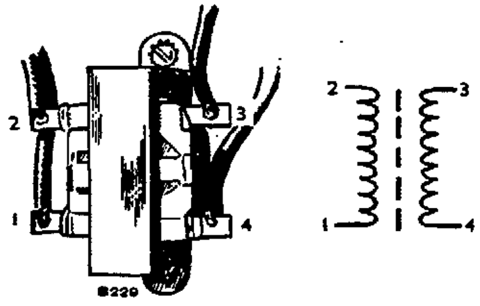


FIGURE 21. L21 REACTOR

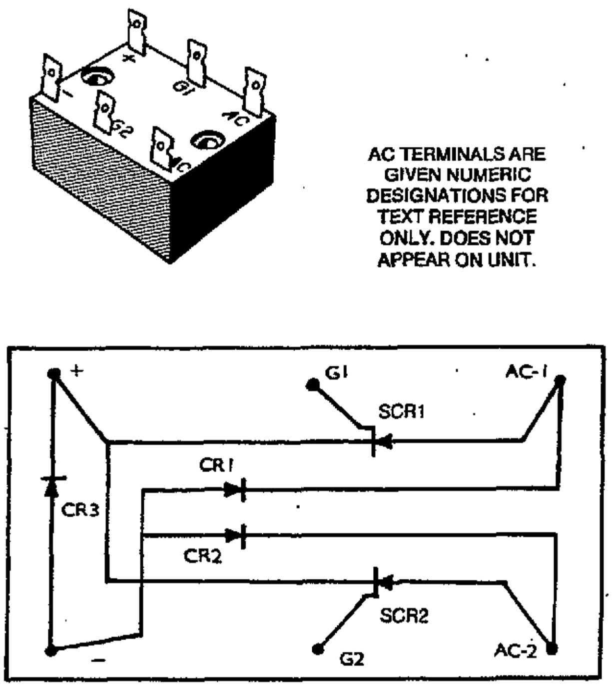


FIGURE 22. RECTIFIER BRIDGE ASSEMBLY

Disconnect wires from rectifier unit prior to testing. Test unit in order shown in Table 5. Refer to Figure 23 for SCR1 and SCR2 test circuit. When test is complete and satisfactory, reconnect unit observing correct wiring hook-up.

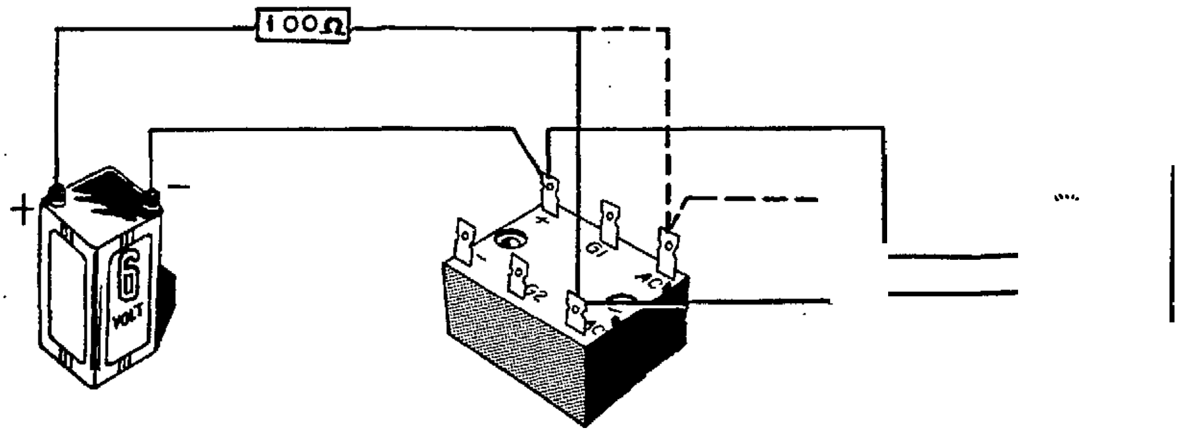


FIGURE 23. TESTING SCR

TABLE 5. TESTING RECTIFIER BRIDGE ASSEMBLY CR21

TEST	OHMMETER LEAD +	OHMMETER LEAD -	RECTIFIER TERMINALS	TESTING CR	TESTING SCR	REMARKS		METER SCALE
1	X	X	+	CR3		Infinity		RX10K
2	X	X	- +	CR3		6- to 50-Ohms		R X 1
3	X	X	+ AC1		SCR1	Infinity		RX10K
4	X	X	AC1 -			Infinity		RX10K
5	X	X	- AC1	CR1		6- to 50-Ohms		RX1
6	X	X	+ AC2		SCR2	Infinity		RX10K
7	X	X	AC2 -	CR2		Infinity		RX10K
8	X	X	- AC2	CR2		6- to 50-Ohms		R X 1
	6 V Battery with Resistor +	-				DC Voltmeter lead +		DC Voltmeter Reading less than
9*	AC1	+			SCR1	AC1	+	3 Volts
10**	AC2	+			SCR2	AC2	+	3 Volts

[D]

FLASHING THE FIELD

If output voltage does not build up it may be necessary to restore residual magnetism by flashing the field. Assemble a 6-volt battery and diode as shown in Figure 24.

If a 6-volt lantern battery is not available, a 12-volt or 24-volt generator set battery can be used. However, a 20-ohm or a 40-ohm, 2 watt resistor must be used in series respectively with the 12 amp 300 V diode. Start the generator set and operate at normal rpm. Touch positive lead to + terminal on rectifier bridge, and negative lead to the - terminal. Hold leads on terminals just long enough for voltage to build up.

CAUTION **Do not keep excitation circuitry connected longer than 5 seconds, or damage may occur to the exciter regulator.**

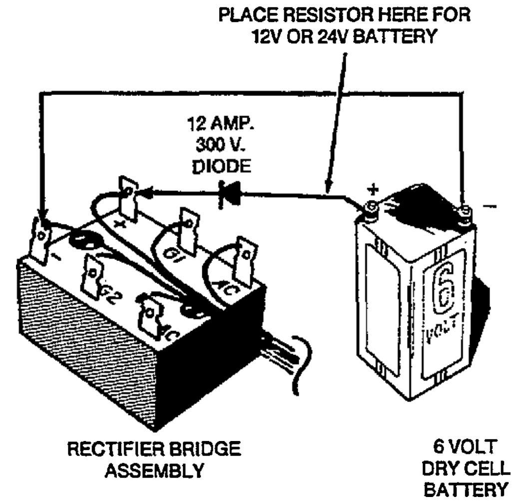


FIGURE 24. FIELD FLASHING CIRCUIT

[E]

TESTING REFERENCE TRANSFORMER T21

Transformer T21 has eight leads; six are primary leads marked H1 through H6, two are secondary leads marked X1 and X2.

The winding schematic (Figure 25) shows the resistance values for the individual coils in ohms. Resistance between any primary and secondary leads and from any lead to transformer frame should be infinity.

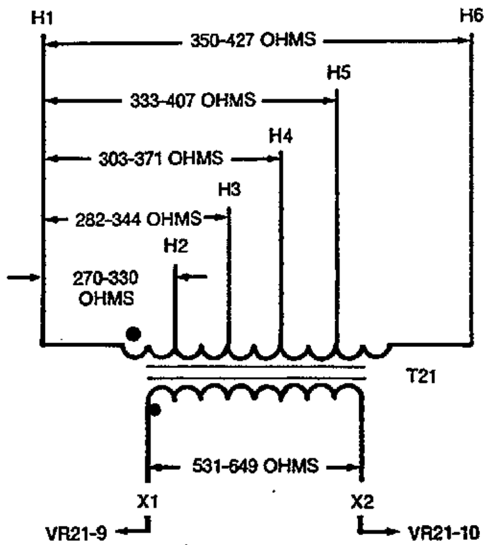


FIGURE 25. T21 WINDING SCHEMATIC

[F]

VR21 REPLACEMENT

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

1. Stop engine.
2. Disconnect and if necessary, label wires; VR21-1 through VR21-12. Refer to AC control wiring diagram.
3. Remove four screws at corners.
4. Remove old PC board.
5. Install new PC board; secure with four screws.
6. Reconnect wires removed in step 2 at proper terminals.
7. Place jumper W12 at proper terminals for your particular voltage code and voltage connection. See Test Procedure [Q].
8. Perform voltage calibration and stability adjustment procedures to obtain the correct generator output voltage and stability with new PC board in set.

[G]

TESTING ROTATING RECTIFIERS

Two different rectifier assemblies make up the rotating rectifier bridge assembly, Figure 26. Using an accurate ohmmeter, test each CR using negative and positive polarities. Test rectifiers as follows:

1. Disconnect all leads from assembly to be tested.
2. Connect one test lead to F1+ stud and connect other lead to CR1, CR2, and CR3 in turn; record resistance value of each rectifier.
3. Connect one lead to F2- stud and connect other lead to CR3, CR4 and CR5 in turn; record resistance value of each rectifier.
4. Reverse ohmmeter leads from step 2 and record resistance value of each rectifier F1+ to CR1, CR2, and CR3 and F2- to CR4, CR5, and CR6.
5. All three resistance readings should be high in one test and low in the other test. If any reading is high or low in both tests, rectifier assembly is defective.
6. Replace defective rectifier assembly with new, identical part.

Use 24 lbs-in. (2.7 N•m) torque when replacing nuts of F1+ and F2-, CR1, CR2, CR3, CR4, CR5, and CR6.

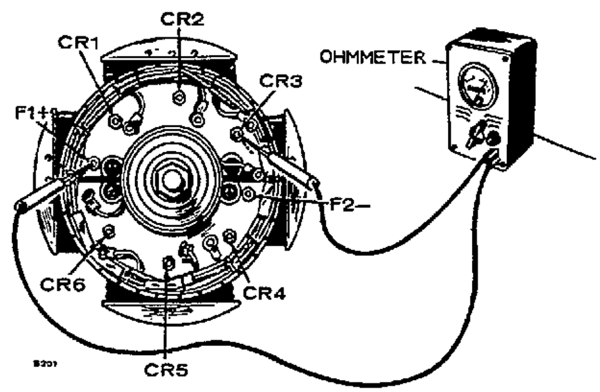


FIGURE 26. TESTING ROTATING RECTIFIERS

[H]

TESTING EXCITER STATOR

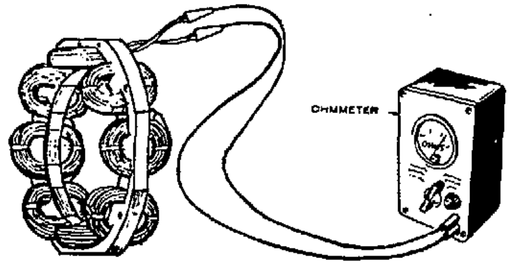
Test the exciter stator (Figure 27) for open or shorted windings and grounds as follows:

Testing for Open or Shorted Windings:

Disconnect F1+ and F2- exciter field leads from terminal block in generator end bell. The resistance between field leads should be 13.05 to 15.95 ohms at 77° F (25° C).

Testing for Grounds:

Connect ohmmeter between either field lead and exciter stator laminations. Use ohmmeter set at RX 100 scale. An ohmmeter reading of less than infinity (∞) indicates defective ground insulation.



OHMMETER RESISTANCE BETWEEN
F1 AND F2 SHOULD BE
13.05 TO 15.95 OHMS AT 77°F (25°C)

FIGURE 27. TESTING EXCITER FIELD

[J]

TESTING EXCITER ROTOR

Test the exciter rotor (Figure 28) for open or shorted windings or grounds as follows:

Testing for Open or Shorted Windings:

Use a Wheatstone Bridge for this test. Disconnect *main rotor field leads which connect to rotating rectifier* assemblies at F1+ and F2-. Disconnect lead wires from diodes CR1, CR2, CR3, CR4, CR5 and CR6. Test between exciter lead pairs T1-T2, T2-T3 and T1-T3. Resistance should be 0.6 to 0.7 ohms at 68° F (20° C).

Testing for Grounds:

Connect leads of ohmmeter between each CR lead and exciter rotor laminations; use RX 100 scale on ohmmeter. An ohmmeter reading less than infinity (∞) indicates defective ground insulation.

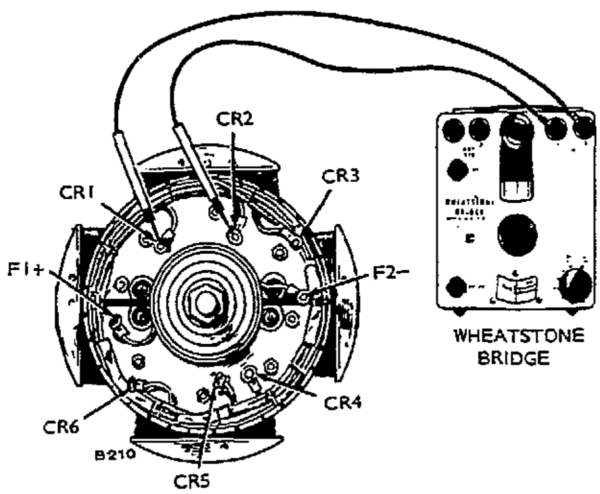


FIGURE 28. TESTING EXCITER ROTOR

[K]

TESTING GENERATOR STATOR

Using proper test equipment, check the stator for grounds, opens, and shorts in the windings.

Testing for Grounds:

Some generators have ground connections to the frame. Check wiring diagram.

Using an ohmmeter set at RX 100, test each stator winding for shorts to laminations. A reading less than one megohm indicates a ground.

Testing for Open or Shorted Windings:

Test for continuity between coil leads shown in Figure 29; all pairs should have equal resistance. Use an accurate instrument for this test such as a Kelvin Bridge. Resistance values at 77° F (25° C) are given in Table 6.

If any windings are shorted, open or grounded, replace the stator assembly. Before replacing the assembly, check the leads for broken wires or insulation.

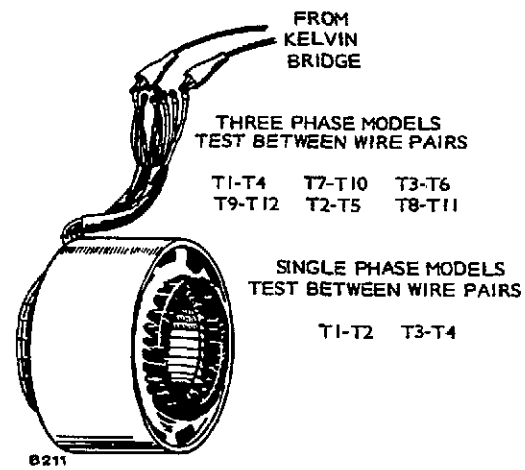
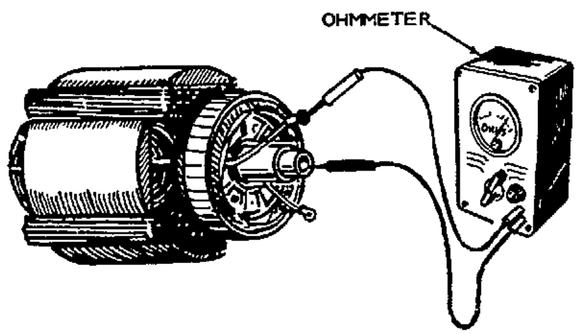


FIGURE 29. TESTING STATOR WINDINGS

TABLE 6. RESISTANCE VALUES FOR STATORS

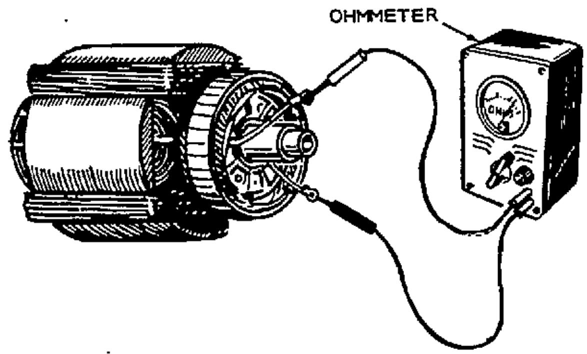
kW RATING 60 Hertz	VOLTAGE CODE	
	15	3C
DTA/MDTA 25.0 kW	.066 to .081 Ohms	.031 to .038 Ohms
SK 30.0 kW	.099 to .121 Ohms	.027 to .033 Ohms
PTO 30.0 kW	Code 5D T1-T2, T2-T3, T3-T1 .149 to .183 Ohms	.032 to .039 Ohms



CONTACT ONE PROD TO EACH OF THE FIELD LEADS AND OTHER PROD TO ROTOR SHAFT. IF ROTOR IS GOOD, THERE WILL BE NO READING ON OHMMETER.

B215

FIGURE 30. TESTING ROTOR FOR GROUNDS



CONTACT ONE PROD TO EACH FIELD LEAD

B213

FIGURE 31. TESTING ROTOR FOR AN OPEN CIRCUIT

[L]

TESTING GENERATOR ROTOR

For these tests, use an ohmmeter on RX 100 scale.

Testing for Grounds:

On brushless type generators, check for grounds between each rotor lead and the rotor shaft, Figure 30. Perform tests as follows:

1. Remove rotor leads F1+ and F2- from rotating rectifier assemblies.
2. Connect ohmmeter leads between F1+ and rotor shaft and between F2- and rotor shaft. Meter should not register.
3. If meter registers, rotor is grounded.
4. Replace grounded rotor with new, identical part.

Testing for Open or Shorted Winding:

Perform tests as follows:

1. Remove rotor leads F1+ and F2- from rotating rectifier assemblies.
2. Using ohmmeter, check resistance between F1 and F2 leads, Figure 31.

   The resistance values at 68° F (20° C) should be as follows:

   - 1.84 to 2.24 ohms for 25DTA/MDTA and 30 kW PTO models.
   - 1.62 to 1.98 ohms for 30 kW SK models.

   If resistance is low, there are shorted turns. If resistance is high, rotor winding is open. In either case, rotor must be replaced.

3. Replace defective rotor with new, identical part.

[M]

WIRING HARNESS CHECK

Carefully check wiring harnesses as follows:

1. Inspect all wires for breaks, loose connections, and reversed connections. Refer to applicable wiring diagram.
2. Remove wires from terminals at each end and using an ohmmeter, check each wire end to end for continuity or opens.
3. Using an ohmmeter, check each wire against each of the other wires for possible shorts or insulation breaks under areas covered by wrapping material.
4. Reconnect or replace wires according to applicable wiring diagram.

[N]

SENSITIVITY REFERENCE CIRCUIT

Three types of frequency sensitivity reference voltage are possible with voltage regulator VR21.

1. *Frequency sensitive*—voltage output reduces in direct proportion to the engine speed.
2. *Non-frequency sensitive*—voltage output does not decrease when engine speed decreases.

   A temporary overload with a non-frequency sensitive reference could cause the engine to reduce speed, and then require a 50- to 60-percent load reduction before it could return to rated speed.

3. *Semi-frequency sensitive* — voltage output decreases as engine speed decreases, but not as

severely as in the "frequency sensitive" mode. Unless otherwise requested by the purchaser, Onan sets are connected at the factory for semi-frequency sensitive voltage regulation because a decrease in voltage output reduces the effective load on the engine, permitting the set to return to its rated voltage and frequency when the overload is removed.

CHANGING SENSITIVITY REFERENCE

The sensitivity reference can be changed if necessary, by unsoldering W1 on VR21 at "S" (semi-frequency sensitive) and resoldering it to hole "F" (for frequency sensitive) or to hole "N" (for non-frequency sensitive) voltage regulation. See Figure 32.

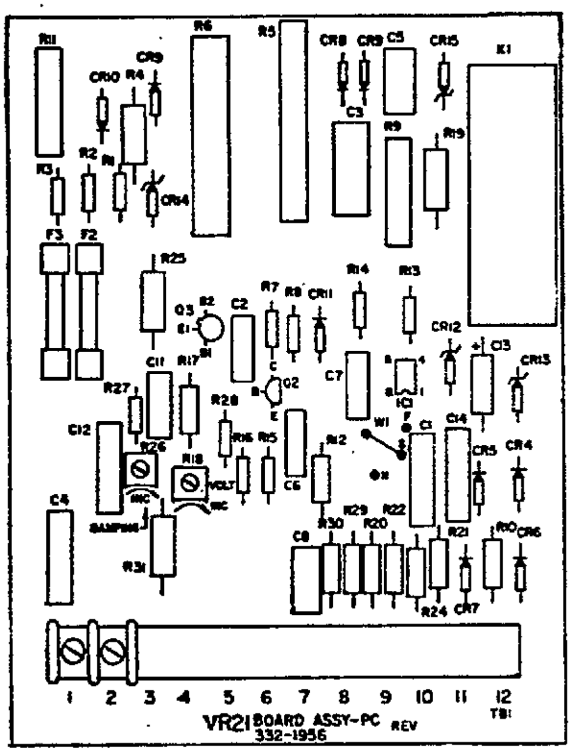


FIGURE 32. REGULATOR CIRCUIT BOARD

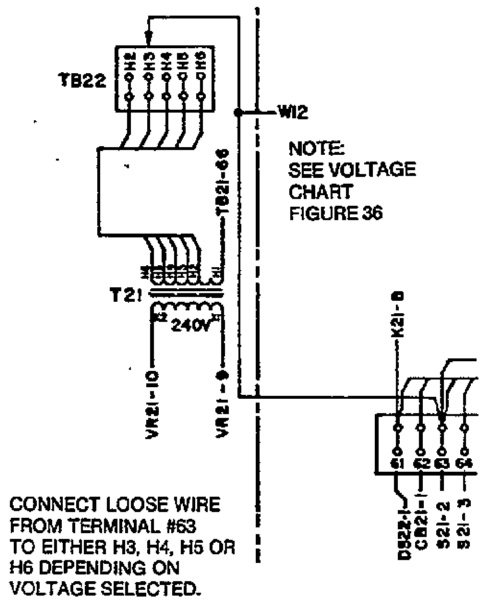
[P]

VOLTAGE ADJUSTMENT

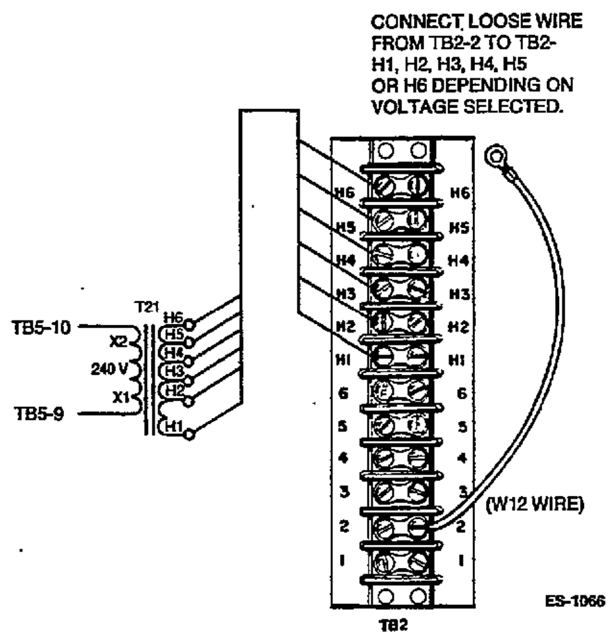
After replacement of the regulator printed circuit board (VR21), voltage adjustment is performed as follows (see Figure 32):

1. Center the voltage adjust knob so pointer is in a vertical position.
2. Start unit and operate at correct rpm.
3. Using a screwdriver, turn R18 potentiometer on printed circuit board VR21 counterclockwise to decrease the voltage or clockwise to increase the voltage. Observe voltmeter on meter panel while making adjustment. Set voltage with no load connected to generator. (Example:For a 120/240 volt connection, set at no-load voltage or approximately 246 volts.)

If voltage is unstable or tends to hunt, turn R26 potentiometer on VR21 in the direction shown on printed circuit board to increase voltage sensitivity.



30 kW PTO AND SK SETS



25 kW DTA SETS

FIGURE 33. CONNECTING LOOSE WIRE W12

[Q]

RECONNECTION WIRE W12

Figure 36 shows reconnection possibilities for the generator. When reconnecting for a different voltage, be sure to also reconnect lead W12 (inside control box) to the proper H terminal as shown in Figure 33.

VOLTAGE REGULATOR

The voltage regulator assembly (Figure 34) controls the generator AC output. Basic components of the regulator are:

- Printed circuit board VR21
- Voltage reference transformer T21
- Commutating reactor L21
- SCR bridge rectifier CR21

On the SK series generator sets, T21, CR21 and L21 are mounted to the control box inside panels close to the VR21 printed circuit board.

The voltage regulator printed circuit board and schematic diagram are shown in Figure 35.

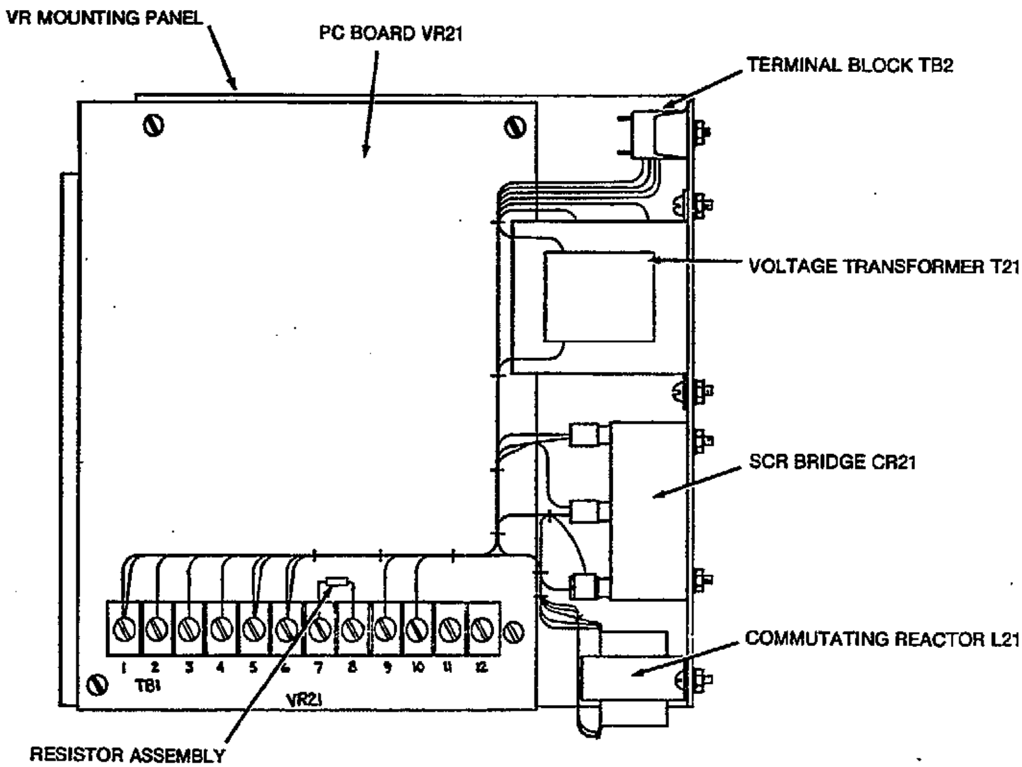
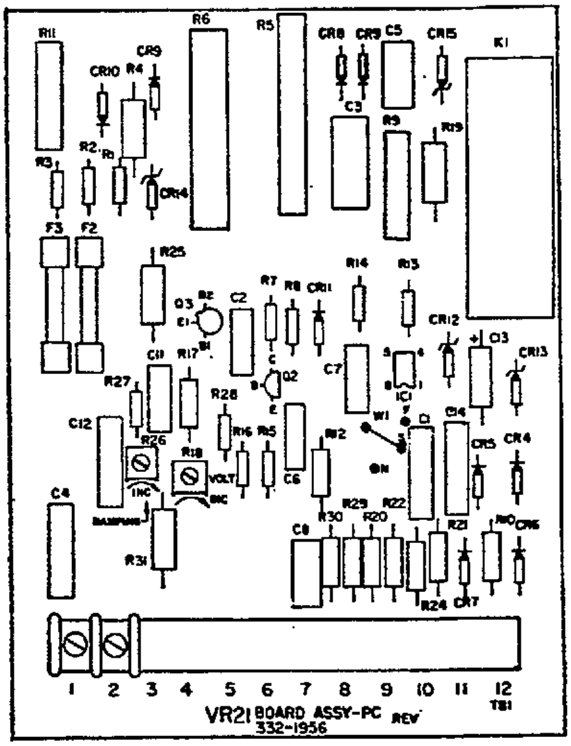


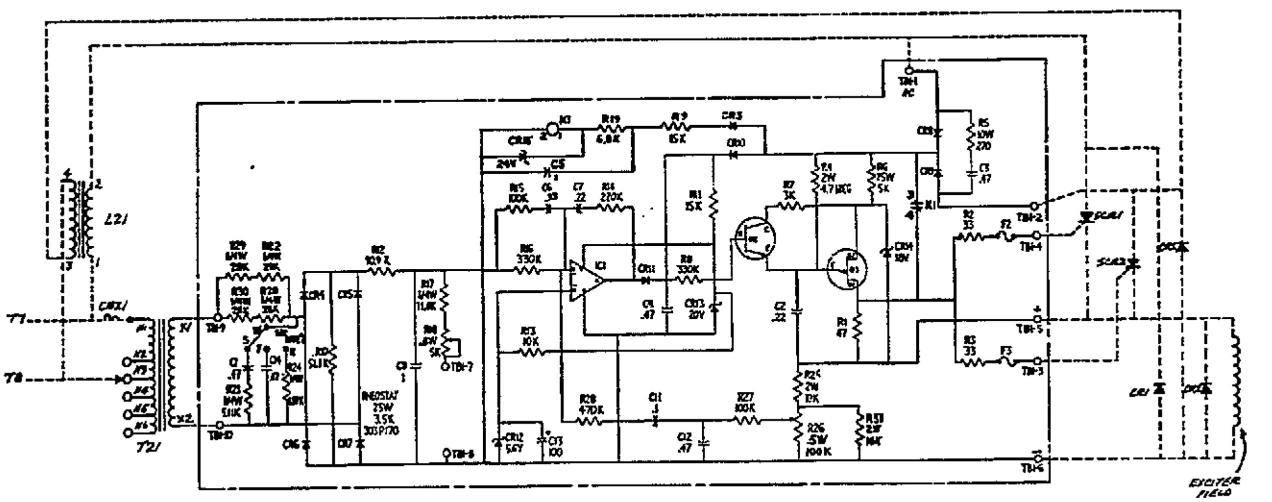
FIGURE 34. VOLTAGE REGULATOR ASSEMBLY 305-0579

REF. NO.	PART DESCRIPTION
	Board Assembly, Printed - Complete
C1,14	Capacitor - .47 Mfd, 250 Volt
C2, C7	Capacitor -.22 Mfd, 250 Volt
C3	Capacitor -.47 Mfd, 400 Volt
C4, C12	Capacitor - .47 Mfd, 250 Volt
C5, C8	Capacitor - 1 Mfd, 100 Volt
C6	Capacitor - .33 Mfd, 250 Volt
C11	Capacitor - .1 Mfd, 400 Volt
C13	Capacitor - Electrolytic 100 Mfd, 10 Volt
CR3 Thru 11	Rectifier - Silicon
CR12	Diode - Zener 5.6 Volt
CR13	Diode - Zener 20 Volt
CR14	Diode - Zener 18 Volt
F2, F3	Fuse 1/4 Amp
1C1	Integrated Circuit
Q2	Transistor - Silicon NPN
Q3	Transistor - Unijunction
R1	Resistor - 1/2 Watt, 47-Ohm
R2, R3	Resistor - 1/2 Watt, 33-Ohm
R4	Resistor - 2 Watt, 4.7 Meg-Ohm
R5	Resistor - Fixed 10 Watt, 270-Ohm
R6	Resistor - Fixed 15 Watt, 5,000-Ohm
R7	Resistor - 1/2 Watt, 3,000-Ohm
R8, R16	Resistor - 1/2 Watt, 330,000-Ohm
R10	Resistor - 1/2 Watt, 51,100-Ohm
R11 R9	Resistor - Fixed 5 Watt, 15,000-Ohm
R12	Resistor - 1/2 Watt, 90,900-Ohm
R13	Resistor - 1/2 Watt, 10,000-Ohm
R14	Resistor - 1/2 Watt, 220,000-Ohm
R15, R27	Resistor - 1/2 Watt, 100,000-Ohm
R17	Resistor, Metal Film - 1/4 Watt, 11,000-Ohm
R18	Potentiometer - 5,000-Ohm, 1/2 Watt
R20, 22 29 & 30	Resistor - 1/4 Watt, 28,000-Ohm
R21	Resistor - Metal Film - 1/4 Watt, 5,110-Ohm
R24	Resistor - Metal Film - 1/4 Watt, 8,870-Ohm

REF. NO.	PART DESCRIPTION
R25, R31	Resistor - 2 Watt, 10,000-Ohm
R26	Potentiometer - 1/2 Watt, 100,000-Ohm
R28	Resistor - 1/2 Watt .47 Meg-Ohm
TB1	Terminal Block
CR15	Diode - Zener - 24 Volt
	Clip - Fuse
K1	Relay, Magnetic Reed
R19	Resistor - 2 Watt, 6,800-Ohm



PC BOARD ASSEMBLY

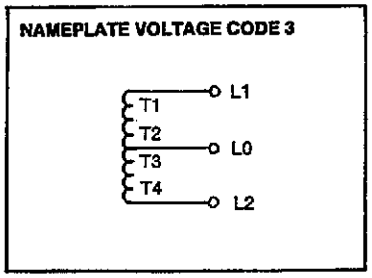


SCHEMATIC

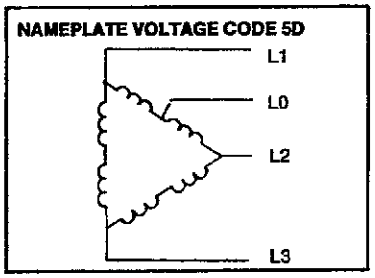
ES-1068

FIGURE 35. UR VOLTAGE REGULATOR PC BOARD 332-1956

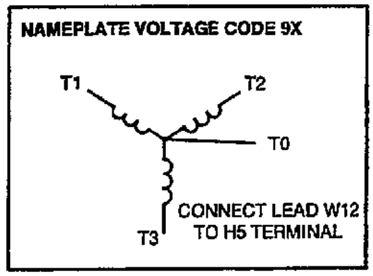
120/240 VOLT, 1 PHASE, 60 HERTZ



120/240 VOLT, DELTA 3 PHASE, 60 HERTZ



347/600 VOLT, 3 PHASE, 60 HERTZ



THIS DIAGRAM APPLIES TO 12 LEAD GENERATORS ONLY

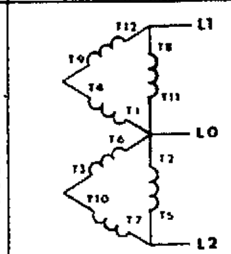
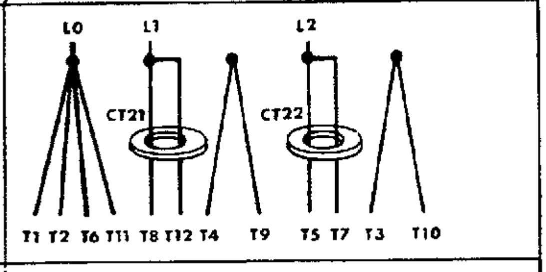
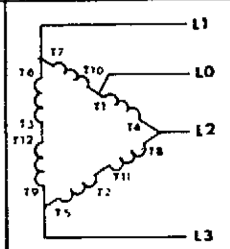
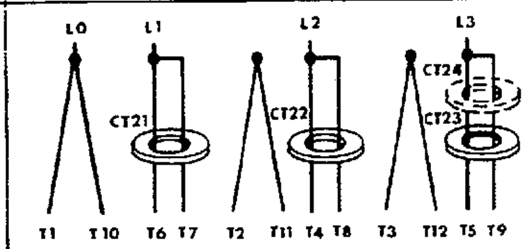
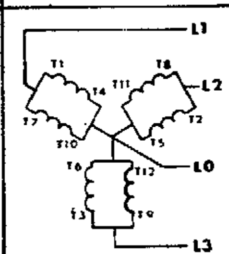
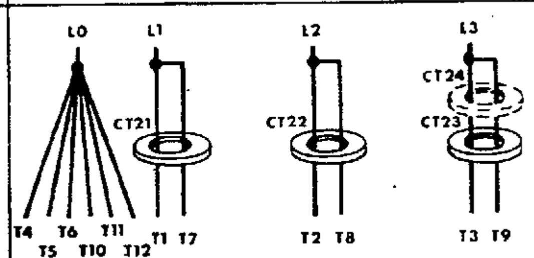
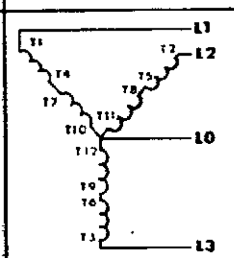
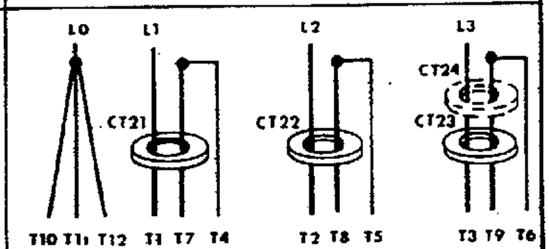
NAMEPLATE VOLTAGE CODE	VOLTAGE	PHASES	HERTZ	CONNECT LEAD W12 TO TERMINAL:	GENERATOR CONNECTION	GENERATOR CONNECTION SCHEMATIC DIAGRAM	GENERATOR CONNECTION WIRING DIAGRAM (WITH CURRENT TRANSFORMERS WHEN USED)
15	120/240	1	60	H5	DOUBLE DELTA		
15	120/240	3	60	H5	SERIES DELTA		
15	120/208	3	60	H3	PARALLEL WYE		
	127/220	3	60	H4			
	139/240	3	60	H5			
15	240/416	3	60	H3	SERIES WYE		
	254/440	3	60	H4			
	277/480	3	60	H5			

FIGURE 36. GENERATOR WIRING AND RECONNECTION DIAGRAMS (25DTA/MDTA, 30 kW PTO AND SK SERIES)

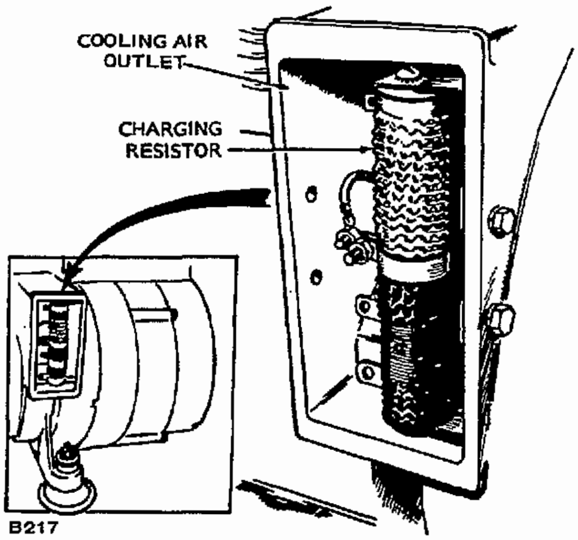


FIGURE 37. GENERATOR AIR OUTLET

DISASSEMBLY

1. Disconnect battery to prevent accidental starting of engine.
2. Remove end bell cover to reveal rotor-through-stud nut.
3. Remove B1 lead from tapped adjustable resistor in generator air outlet opening, Figure 37.
4. Remove leads from control box to ignition system, choke, start disconnect switch, etc., on engine.
5. Remove stator-through-stud nuts, end bell, and stator assembly, Figure 38. Screwdriver slots in adapter provide a means for prying stator loose. Be careful not to let stator touch or drag on rotor.
6. Remove air baffle from adapter. Turn rotor-through-stud nut to end of stud. While pulling rotor outward with one hand, strike nut a sharp blow. Support rotor with hoist and sling to avoid bending rotor-through-stud, Figure 39. Use a heavy, soft faced hammer to loosen the rotor from its tapered shaft fit. If rotor does not come loose, strike it a sharp downward blow in center of lamination stack. Rotate rotor and repeat until it comes loose. Be careful not to hit bearing or windings.
7. After disassembly, all parts should be wiped clean and visually inspected.

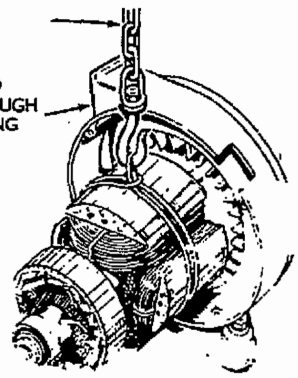


FIGURE 39. ROTOR REMOVAL

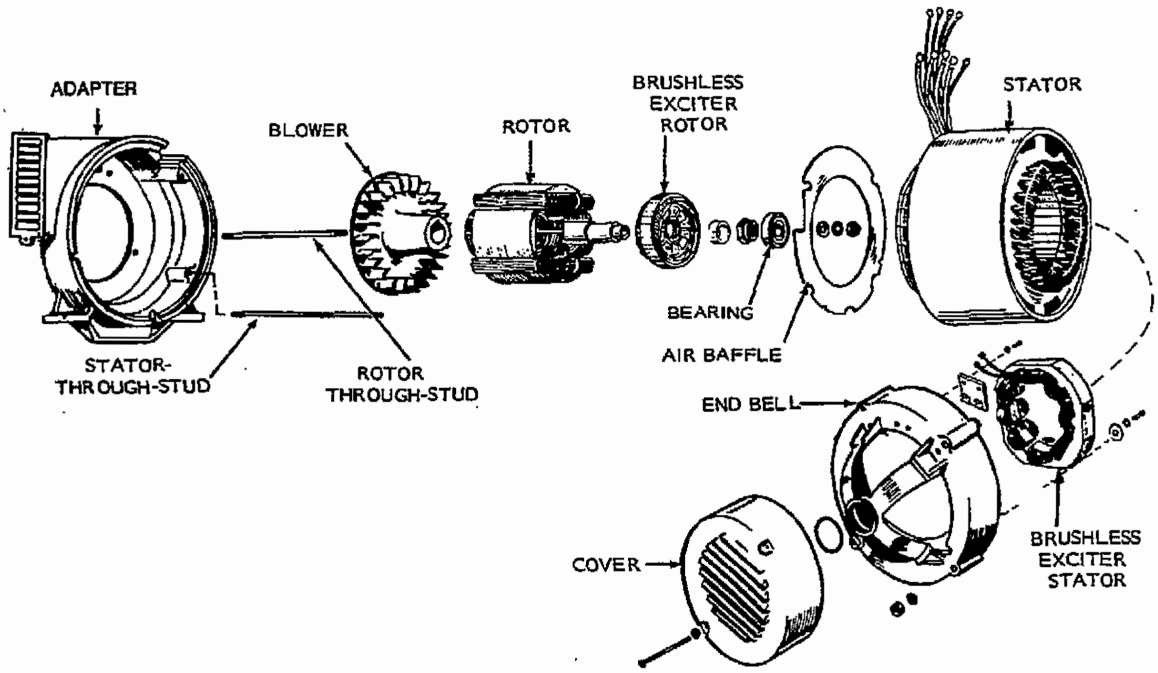


FIGURE 38. GENERATOR DISASSEMBLY

ASSEMBLY

1. Clean and inspect all mating surfaces.
2. Coat mating area between generator bearing and end bell bearing hole with a thin film of Molykote or equal.
3. Install rotor-through-stud in engine crankshaft.
4. Install key in the crankshaft.
5. Slide rotor over through-stud and onto crankshaft. Be careful not to let weight of rotor rest on or bend the through-stud.
6. Install baffle ring.
7. Install stator through-studs in adapter.
8. Install stator and end bell. Torque nuts on through-studs to 19 to 21 ft-lbs (26 to 28 N•m).

   Make certain the B1 lead is placed through the grommet in the baffle ring and out the air discharge opening in the adapter.

9. Torque down rotor-through-stud nut 55-60 ft. lb (75-81 N•m). The rotor and stator are automatically aligned because stator and bearing support were tightened in step 8.
10. Tap end bell to align at horizontal and vertical plane; use a lead hammer to relieve stresses on components (recheck torque).
11. Reconnect leads to preheater, centrifugal switch and governor solenoid.
12. Install lead B1 on adjustable resistor, R21.

CAUTION **Check B1 lead to see that it is short and is kept away from the blower. If necessary when installing a new stator or leads, cut B1 lead shorter and reinstall the connector.**

13. Install end bell cover.

PTO ALTERNATORS

ALTERNATOR DESCRIPTION

The 15 kW through 30 kW alternators are four-pole, revolving field, brushless exciter, 1800 rpm models of drip-proof construction. Alternator design includes both single and three-phase, 60 hertz type alternators. The alternator rotor is fastened to the gear case by the rotor through-stud which passes through the rotor shaft, Figure 40.

The end bell and stator housing are attached by four through-studs which pass through the stator assembly to the gear case alternator adapter. The brushless exciter stator mounts in the end bell while the exciter rotor and its rotating rectifier assemblies mount on the alternator rotor shaft. The shaft is supported at both ends by lubricated ball bearings. A centrifugal blower on the drive end of the alternator draws air through the alternator for cooling.

The complete alternator includes a built-in exciter and voltage regulator, mounting feet, lifting eye, mounted gear box and splined driveshaft and control box, which includes voltmeter and a full output load plug.

Control Box

The control box includes the voltage regulator, voltmeter, 15 amp duplex receptacle with circuit breaker, 50 amp welder receptacle with circuit breakers, a full output load connector with load circuit breakers, and a field circuit breaker. The load circuit breakers can be used as an on-off switch. Alternator power must feed into the farm electrical system through an approved double throw load transfer switch.

Gear Box

The gear box and alternator adapter contain two helical gears supported by heavy duty ball bearings. The bearings and gears are lubricated by the gear box oil. The gear box requires 1.0-pint (.47 litre) of SAE 90 EP (extreme pressure) gear lubricant.

ORIGINAL EQUIPMENT MANUFACTURER'S PRODUCTS

Onan manufactures several versions of YD PTO alternators which are sold nationally under other brand names. The major difference in these units are location of control components and the form of mounting hardware.

SPECIFICATIONS

SINGLE PHASE ALTERNATORS

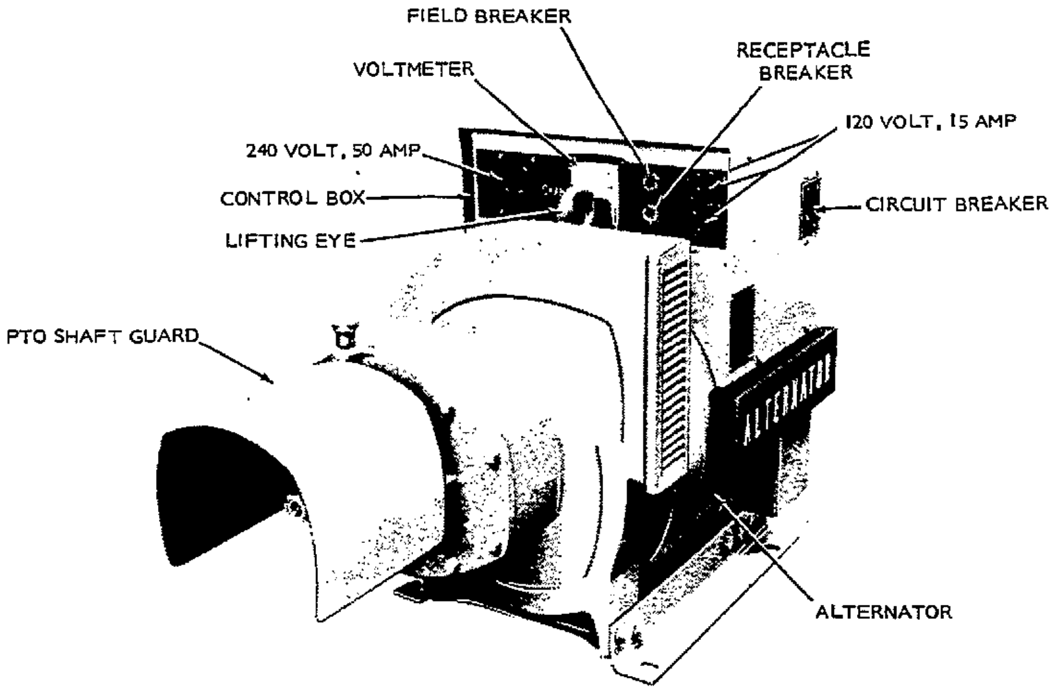
	15.0YD-3G	20.0YD-3G	25.0YD-3G	30.0YD-3G
Starting Watts	37,500	52,000	62,500	80,000
Running Watts	15,000	20,000	25,000	30,000
Volts	120/240	120/240	120/240	120/240
Phase	1	1	1	1
Hertz	60	60	60	60
Current (Amperes)	62.5	83.3	104.2	125
Power Factor	1.0	1.0	1.0	1.0
Wire	4	4	4	4
Brushless	Yes	Yes	Yes	Yes
Alternator Speed (Nominal)	1800	1800	1800	1800
Tractor Speed (Nominal)	540	540	540	540
Minimum Horsepower Required Driving Source	30	35	45	55
Gear Box Oil Capacity, Pints	1.0 Pt (0.47 litre)	1.0 Pt (0.47 litre)	1.0 Pt (0.47 litre)	1.0 Pt (0.47 litre)
Gear Lubricant	SAE 90 EP	SAE 90 EP	SAE 90 EP	SAE 90 EP
Weight	354 lbs. (161 kg)	398 lbs. (181 kg)	438 lbs. (198 kg)	483 lbs. (219 kg)

THREE PHASE ALTERNATORS*

	20.0YD-5DG	25.0YD-5DG	30.0YD-5DG
Starting Watts	57,500	70,000	95,000
Running Watts	20,000	25,000	30,000
Volts	120/240	120/240	120/240
Phase	3	3	3
Hertz	60	60	60
Current (Amperes)	60.2	75.4	90.5
Power Factor	0.8	0.8	0.8
Wire	4	4	4
Brushless	Yes	Yes	Yes
Alternator Speed (Nominal)	1800	1800	1800
Tractor Speed (Nominal)	540	540	540
Minimum Horsepower Required, Driving Source	35	45	55
Gear Box Oil Capacity, Pints	1.0 Pt (0.47 litre)	1.0 Pt (0.47 litre)	1.0 Pt (0.47 litre)
Recommended Gear Lubricant	SAE 90 EP	SAE 90 EP	SAE 90 EP
Weight	423 lbs. (192 kg)	438 lbs. (198 kg)	512 lbs. (232 kg)

All models are CSA Certified.

*Delta wound, one phase center-tapped to deliver 120/240 volt, single-phase power in capacities to 2/3 of rated 3-phase kVA.



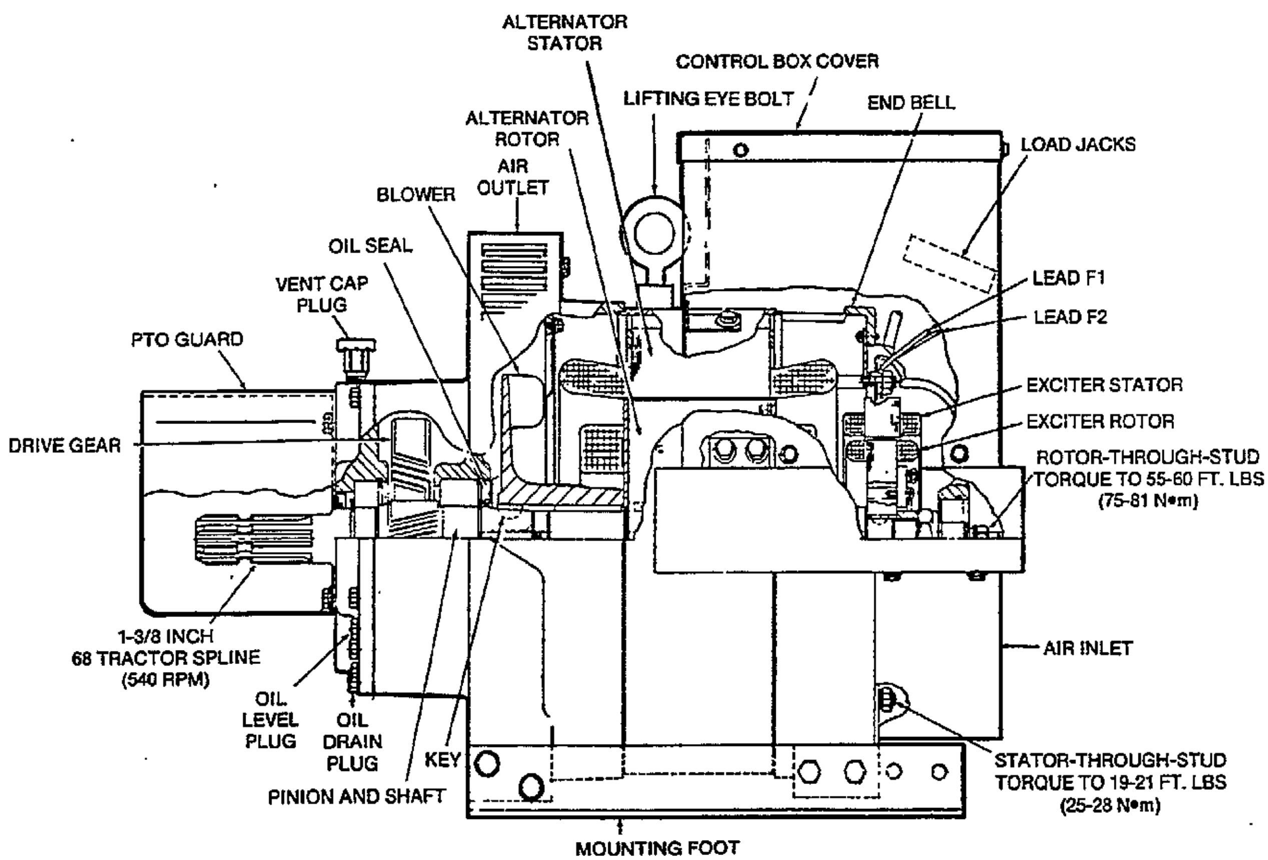


FIGURE 40. YD TRACTOR DRIVE ALTERNATOR

WIRING CONNECTIONS, 15-25 kW

SINGLE PHASE ALTERNATORS

The most popular single phase connection is the 120/240 combination. With this connection either 120 or 240 volts can be used alone or at the same time (Figure 41).

Refer to page 87 for wiring connections of 30 kW units using the UR control.

THREE PHASE ALTERNATORS

Three phase alternators are connected as shown in Figure 42. The three load wires are connected to T1, T2 and T3. Single phase (240 volts) can be obtained between any two three-phase terminals. Single phase (120 volts) can be obtained between T1 and T0 or T2 and T0. T0 is the grounded terminal for 120 volts.

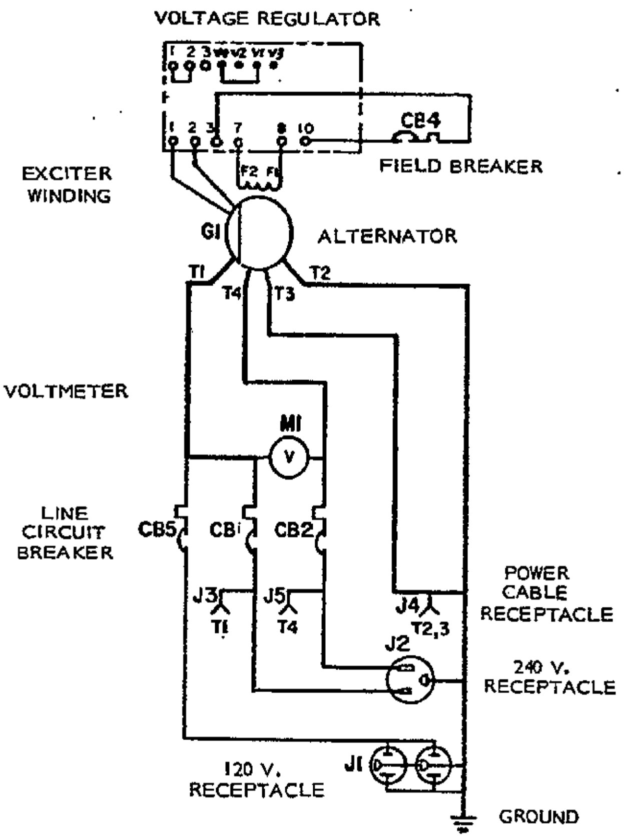


FIGURE 41. 120/240 VOLT, SINGLE PHASE CONNECTION

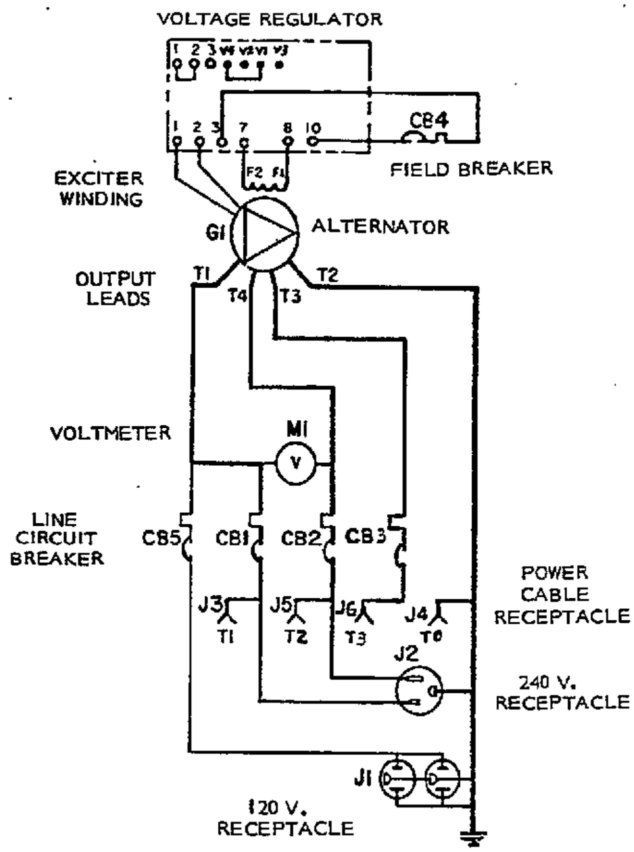


FIGURE 42. THREE PHASE 240 VOLT DELTA CONNECTIONS

TROUBLESHOOTING

NOTE: For detailed troubleshooting information refer to GENERATOR and CONTROL TROUBLESHOOTING procedures and tests.

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

1. Check all modifications, repairs, and replacements performed since last satisfactory operation of set to be sure that connection of 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.
2. Unless absolutely sure that panel instruments are accurate, use portable test meters for troubleshooting.
3. Visually inspect components on voltage regulator. Look for dirt, dust, moisture and cracks in the printed solder conductors. Burned resistors, arcing tracks are all identifiable. Do not mark on printed circuit boards with a pencil. Graphite lines are conductive and can cause short circuits between components.

TABLE 7. TROUBLESHOOTING

NATURE OF TROUBLE	POSSIBLE CAUSE	REMEDY
Alternator Overheats	1. Windings and parts covered with dirt and oil.	1. Disassemble alternator and clean.
	2. Air intake is restricted or incoming air too hot.	2. Clean alternator air intake and outlet areas.
	3. Overloaded.	3. Remove part of load.
Noisy Alternator	1. Alternator loose on base.	1. Tighten mounting bolts.
	2. Defective bearing.	2. Replace. Check alignment.
Low Voltage Output of Alternator	1. External short circuit on line.	1. Test alternator with line wires disconnected.
	2. Incorrect PTO speed.	2. Readjust PTO speed to 540 to 600 rpm.
No Voltage Output, or Voltage Builds Up But Is High, Low, Unstable, Trips Field Breaker.	Refer to GENERATOR TROUBLESHOOTING, Page 5.	Refer to GENERATOR TROUBLESHOOTING, Page 5.

PERIODIC SERVICE AND INSPECTION

Follow a regular schedule of inspection and servicing. Make a good visual check before, while, and after alternator is operating; look for loose or broken leads and bad connections.

GEAR BOX LUBRICATION

Use only SAE 90 EP multi-purpose gear lubricant. Drain the gear box after the first 100 hours of operation and refill with fresh lubricant of the recommended grade. Repeat this procedure each year thereafter, or every 250 hours of operation, whichever occurs first. Maintain the proper oil level between changes.

CAUTION **Overfilling will cause foaming, which can lead to an oil leak.**

Remove oil fill plug at top of the case and oil level plug from the face of the gear case, Figure 43. Fill case until oil flows from the oil level plug hole. Gear box holds 1 pint (0.47 litre) U.S. measure. Replace both plugs.

PTO SHAFT LUBRICATION

Grease the universal joints and telescoping shafts on the PTO shaft at least every 25 operating hours. Under adverse conditions, grease the joints as required, possibly every 4 to 8 hours.

WARNING **Never operate the alternator with the protective guards removed from the PTO shaft. Personal injury or death may otherwise result.**

BEARINGS

The ball-type bearing on the cover end is double sealed and lubricated for life. If this bearing becomes noisy, worn, or otherwise defective, replace it. Remove the old bearing with a gear puller and drive or press new ones into place. The bearing on the gear box end is lubricated by the gear box lubricant (SAE 90 EP). For disassembly and repair see Alternator Repair section on page 47.

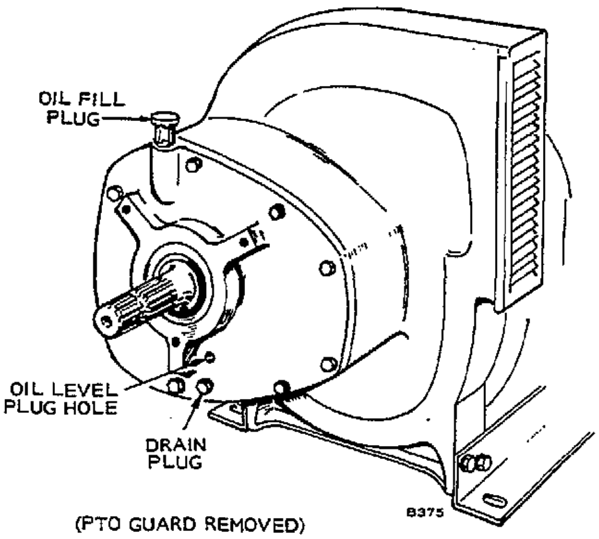


FIGURE 43. GEAR BOX LUBRICATION

TWO BEARING ALTERNATORS

GENERAL

Onan YD two bearing alternators 5.0 through 20.0 kW are 50 and 60 hertz units designed for belt and pulley or direct coupling to a separate prime mover.

A centrifugal blower on the front end of the rotor shaft circulates the alternator cooling air. The air is drawn in through the end bell cover, over the rotor, and discharged through an outlet at the blower end, Figure 44.

A ball bearing at each end supports the rotor shaft. The 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 line voltage regulator is an all solid state device. Basic components of the voltage regulator are:

- Printed circuit board
- Voltage reference transformer T21
- Commutating reactor CMR21
- Field circuit breaker
- Voltage adjust rheostat (optional)

Figure 45 shows the above components in a typical control on standard units.

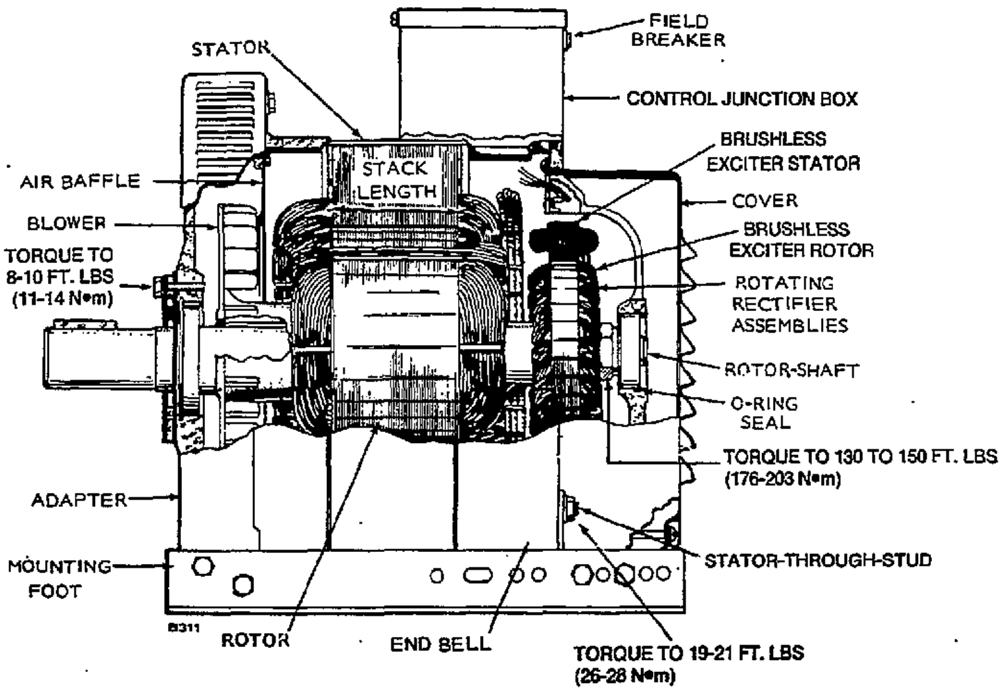
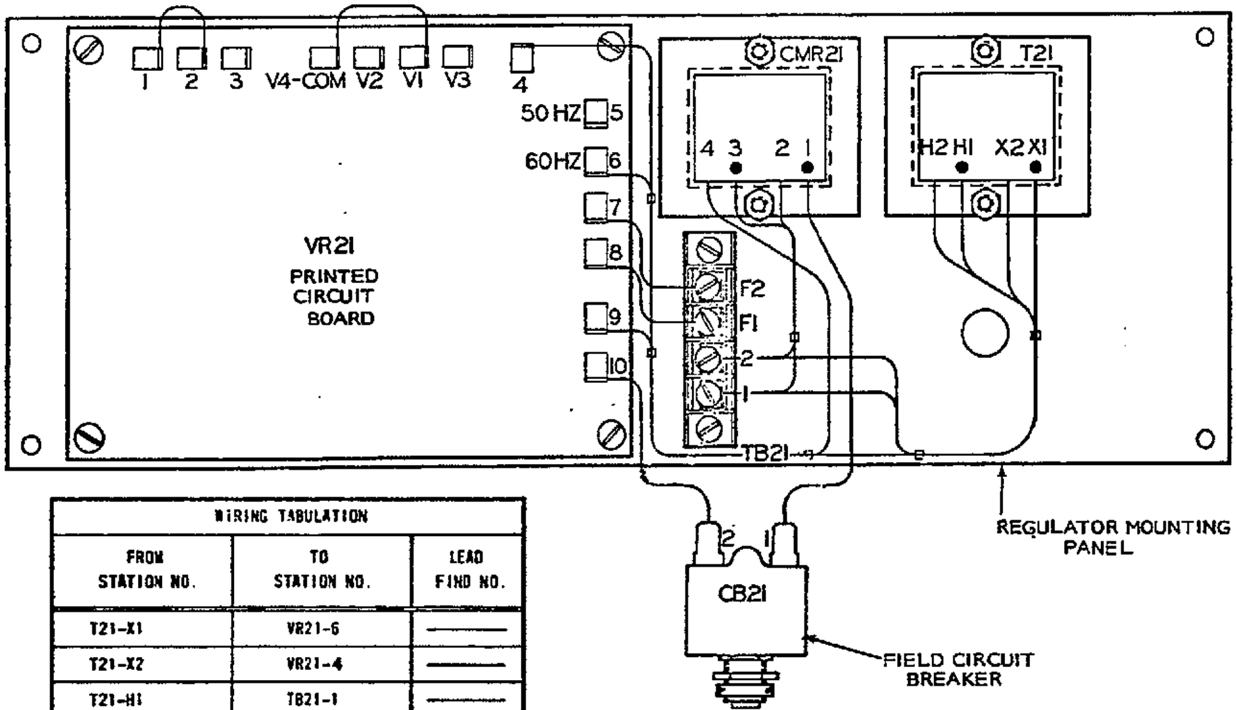


FIGURE 44. GENERATOR (CUTAWAY VIEW)



WIRING TABULATION		
FROM STATION NO.	TO STATION NO.	LEAD FIND NO.
T21-X1	VR21-6	———
T21-X2	VR21-4	———
T21-H1	TB21-1	———
T21-H2	TB21-2	———
CVP21-1	CB21-1	———
CMR21-2	TB21-1	———
CMR21-3	TB21-2	———
CMR21-4	VR21-9	———
CB21-2	VR21-10	13
TB21-F1	VR21-8	14
TB21-F2	VR21-7	14
VR21-V4 COM.	VR21-V1	15
VR21-1	VR21-2	15

FIGURE 45. VOLTAGE REGULATOR ASSEMBLY

CONTROL BOX

The control box (on top of the alternator) contains the voltage regulator and the lower portion of the junction box for making alternator to load line connections.

The generator output leads are accessible by removing the control box cover.

OPTIONAL SWITCHBOARDS

Switchboards (Figure 46) are optional equipment which can be purchased at added cost. They contain a voltmeter, ammeters, line circuit breakers and marked terminals. The switchboard is used to check alternator voltage, load current and voltage regulation with a varying load.

When ordering parts for switchboards, obtain part numbers and description of part from the wiring diagram supplied with the switchboard.

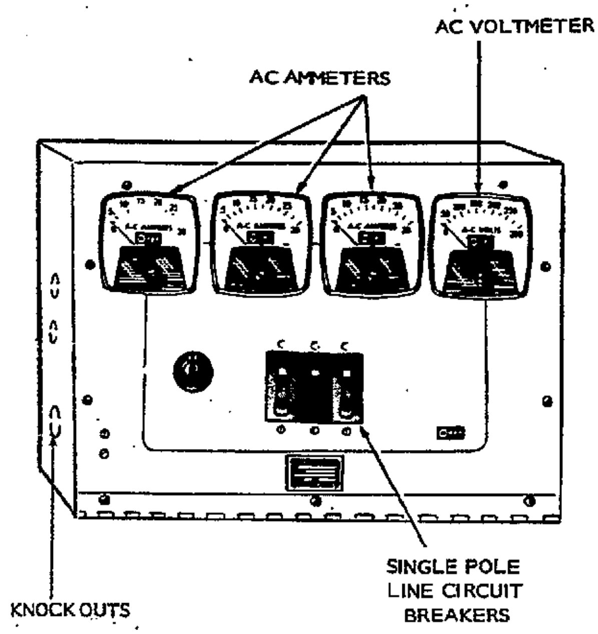


FIGURE 46. TYPICAL WALL MOUNTING "SB" SWITCHBOARD - 3 PHASE, 120/208 VOLTS

SPECIFICATIONS

TWO BEARING ALTERNATORS

MODEL NO. AND KW RATING	ELECTRICAL DETAILS			GENERAL UTILITY RATING				
	Frequency In Hertz	Phase	Wires	Watts	kVA at PF	Amps 240 V	Weight Lbs.	(Approx.) kg
6.0-3CS/	60	1	4	6000	6.0 @ 1.0	25.0	235	106.6
7.5-3CS/	60	1	4	7500	7.5 @ 1.0	31.3	259	117.5
10.0-3CS/	60	1	4	10,000	10.0 @ 1.0	41.7	278	126.1
12.5-3CS/	60	1	4	12,500	12.5 @ 1.0	52.0	306	138.8
15.0-3CS/	60	1	4	15,000	15.0 @ 1.0	62.5	331	150.1
17.5-3CS/	60	1	4	17,500	17.5 @ 1.0	72.9	356	161.5
20.0-3CS/	60	1	4	20,000	20.0 @ 1.0	83.3	398	180.5
5.0-53CS/	50	1	4	5000	5.0 @ 1.0	20.8	235	106.6
6.0-53CS/	50	1	4	6000	6.0 @ 1.0	25.0	259	117.5
8.0-53CS/	50	1	4	8000	8.0 @ 1.0	33.3	278	126.1
10.0-53CS/	50	1	4	10,000	10.0 @ 1.0	41.7	306	138.8
12.5-53CS/	50	1	4	12,500	12.5 @ 1.0	52.0	331	150.1
14.5-53CS/	50	1	4	14,500	14.5 @ 1.0	60.4	356	161.5
16.0-53CS/	50	1	4	16,000	16.0 @ 1.0	66.7	398	180.5
6.0-18S/	60	3	12	6000	7.5 @ 0.8		235	106.6
7.5-18S/	60	3	12	7500	9.4 @ 0.8		259	117.5
10.0-18S/	60	3	12	10,000	12.5 @ 0.8		278	126.1
12.5-18S/	60	3	12	12,500	15.6 @ 0.8		306	138.8
15.0-18S/	60	3	12	15,000	18.75 @ 0.8		331	150.1
17.5-18S/	60	3	12	17,500	21.9 @ 0.8		356	161.5
20.0-18S/	60	3	12	20,000	25.0 @ 0.8		398	180.5
5.0-518S/	50	3	12	5000	6.25 @ 0.8		235	106.6
6.0-518S/	50	3	12	6000	7.5 @ 0.8		259	117.5
8.0-518S/	50	3	12	8000	10.0 @ 0.8		278	126.1
10.0-518S/	50	3	12	10,000	12.5 @ 0.8		306	138.8
12.5-518/	50	3	12	12,500	15.6 @ 0.8		331	150.1
14.5-518S/	50	3	12	14,500	18.1 @ 0.8		356	161.5
16.0-518S/	50	3	12	16,000	20.0 @ 0.8		398	180.5

NOTE: *All units are two-bearing alternators designed for clockwise rotation with belt and pulley drive or direct drive coupled to a separate prime mover. The direction of rotation is clockwise only; it is determined when facing the drive shaft end. The 60 hertz units operate at 1800 rpm while the 50 hertz units operate at 1500 rpm.*

NOTE: *The 3CS/ and 53CS/ models are 120/240 volt single phase units. The 18S/ and 518S/ models are three phase broad range reconnectible units.*

See Figure 19, page 20, for voltage codes, wiring diagram, and connection diagrams.

TROUBLESHOOTING

NOTE: For detailed troubleshooting information refer to GENERATOR and CONTROL TROUBLESHOOTING procedures and tests.

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

1. Check all modifications, repairs, replacements performed since last satisfactory operation of set to be sure that connection of 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.
2. Unless absolutely sure that panel instruments are accurate, use portable test meters for troubleshooting.
3. Visually inspect components on voltage regulator. Look for dirt, dust, or moisture and cracks in the printed solder conductors. Burned resistors, arcing tracks are all identifiable. Do not mark on printed circuit boards with a pencil. Graphite lines are conductive and can cause short circuits between components.

TABLE 7. TROUBLESHOOTING

NATURE OF TROUBLE	POSSIBLE CAUSE	REMEDY
Alternator Overheats	1. Windings and parts covered with dirt and oil.	1. Disassemble alternator and clean.
	2. Drive belt slipping.	2. Adjust tension or replace.
	3. Air intake is restricted or incoming air too hot.	3. Take necessary steps to allow for proper cooling.
	4. Overloaded.	4. Check load.
Noisy Alternator	1. Alternator loose on base.	1. Tighten mounting bolts.
	2. Defective bearing.	2. Replace. Check alignment.
No Voltage Output	1. Voltage regulator trouble, or open, short or grounded circuit in alternator.	1. Refer to GENERATOR TROUBLESHOOTING, Page 5.
	2. Alternator leads broken or loose.	2. Tighten connections and replace broken leads.
	3. Broken drive belt.	3. Install new belt and adjust tension (readjust after one hour of operation).
Low Voltage Output of Alternator	1. Speed low because of loose, slipping belts.	1. Adjust belt tension.
	2. External short circuit on line.	2. Test alternator with line wires disconnected.
	3. Open circuit of shunt field winding.	3. Make proper connections.
	4. Short circuit of winding in the field or armature.	4. Refer to GENERATOR TROUBLESHOOTING, Page 5.

ALTERNATOR REPAIR

GENERAL

Disassembly and reassembly of the PTO and two bearing alternators are nearly identical. The difference involves the drive end and the controls. Use the appropriate Parts Catalog and Wiring Diagrams as aids in re-assembling the control box hardware and the alternator output and control leads.

The following items require disconnecting and removal before disassembly of gear case and alternator:

- Disconnect engine PTO shaft.
- Remove control box cover.
- Disconnect alternator output leads from control components.
- Disconnect exciter leads F1 and F2 at printed circuit board.
- Remove control box from alternator.

GEAR CASE DISASSEMBLY

The gear case cover is drained of oil and removed from the unit for two purposes: (a) gear, bearing, or shaft replacement; and (b) to provide a flat end for supporting the alternator during disassembly and reassembly.

1. Remove PTO guard by loosening three 5/16 x 1/2-inch locking screws, Figure 47.
2. Remove gear case drain plug and allow oil to drain, Figure 48.

Use a new gasket when replacing gear case cover.

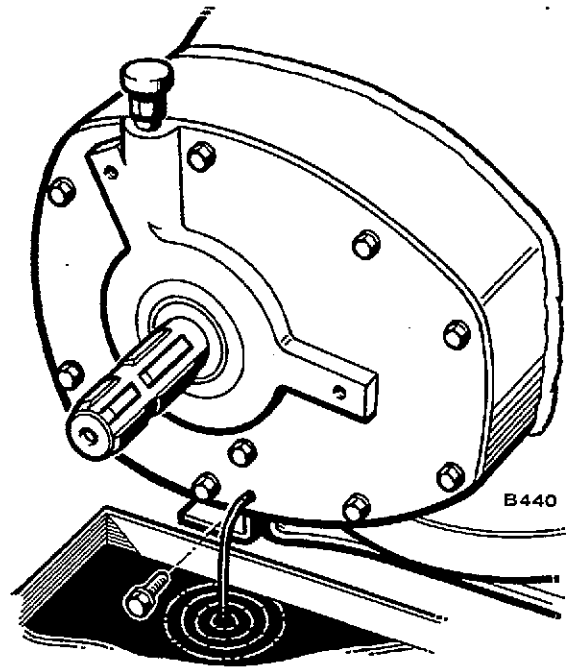


FIGURE 48. DRAINING GEAR CASE

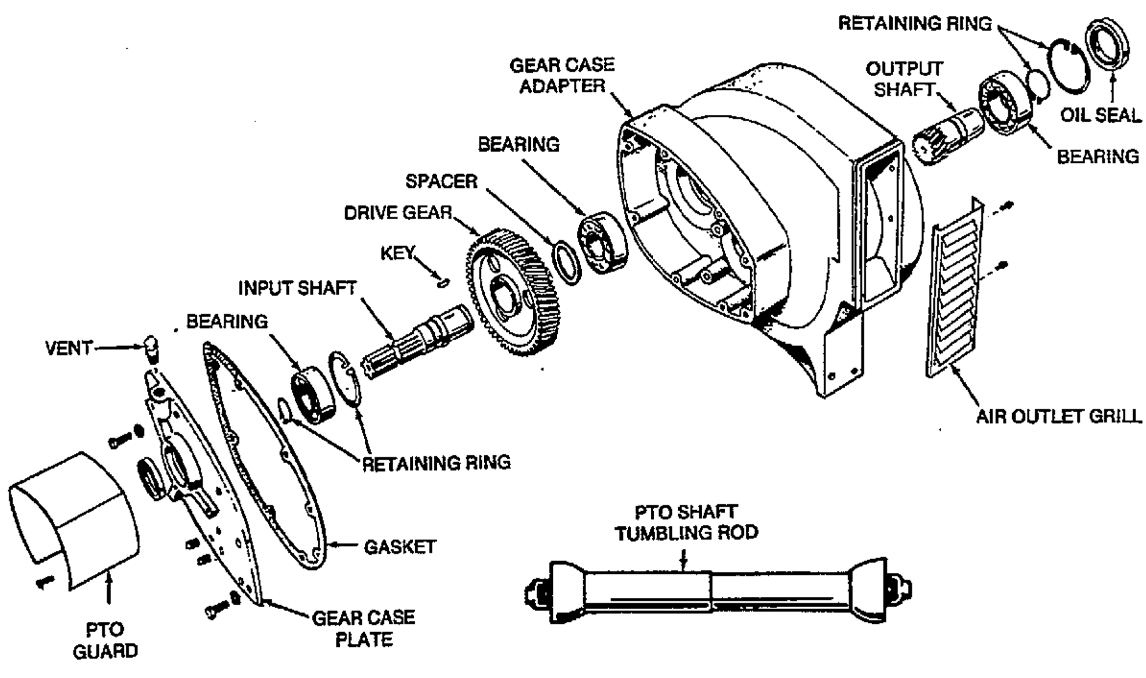


FIGURE 47. GEAR CASE ASSEMBLY

3. Remove six 5/16 x 1-inch cap screws and two 5/16 - 1-1/4-inch cap screws and gear case plate, Figure 49.

To assure a good seal always use a new gear case gasket when gear case plate is assembled.

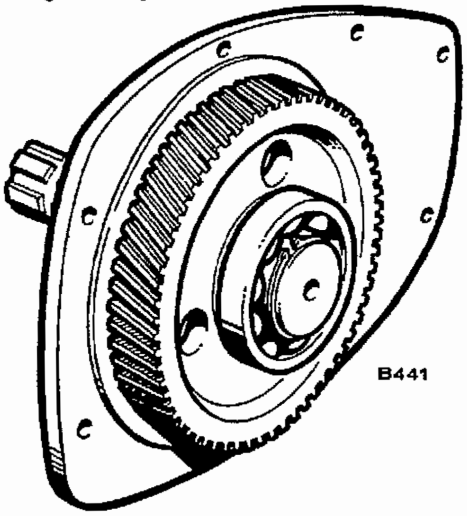


FIGURE 49. GEAR CASE PLATE REMOVED

4. If necessary, remove seal and snap ring from around input shaft, Figure 50.

Old seal must be replaced with a new seal when reassembled.

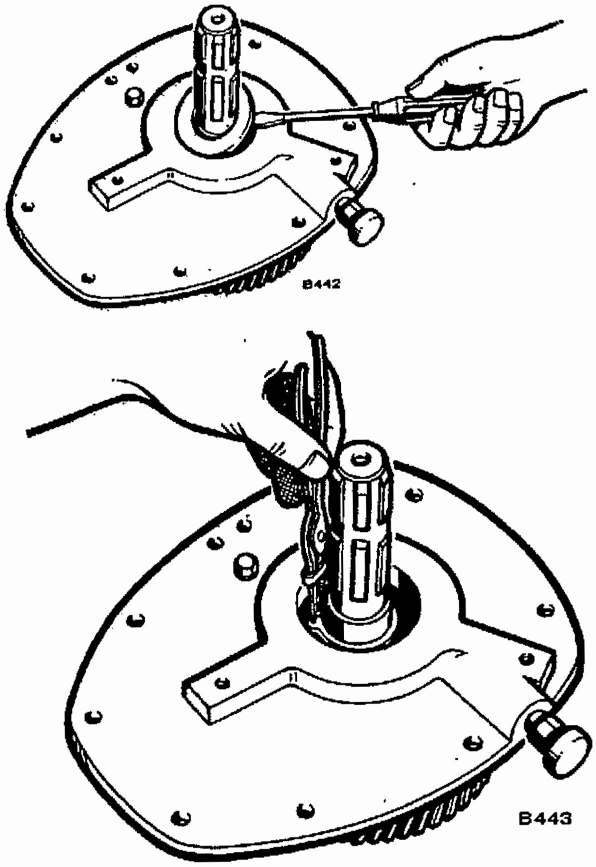


FIGURE 50. INPUT SHAFT SEAL AND SNAP RING REMOVAL

5. Block up gear case plate as shown in Figure 51 and tap PTO shaft out of plate.

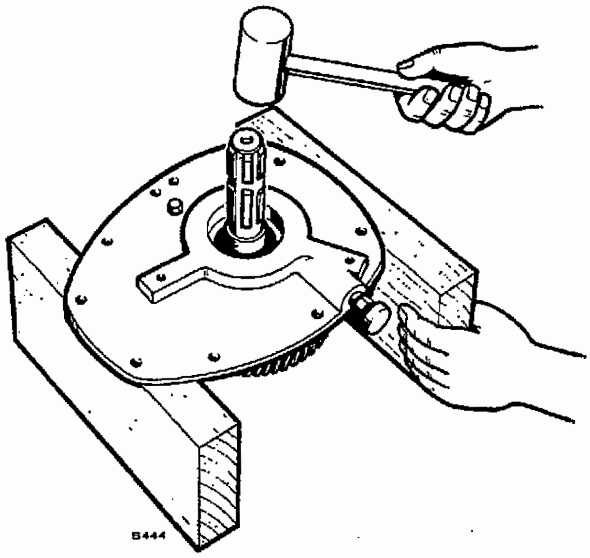


FIGURE 51. REMOVAL OF PTO SHAFT FROM GEAR CASE PLATE

6. Remove snap ring and tap bearing through gear box plate, Figure 52.

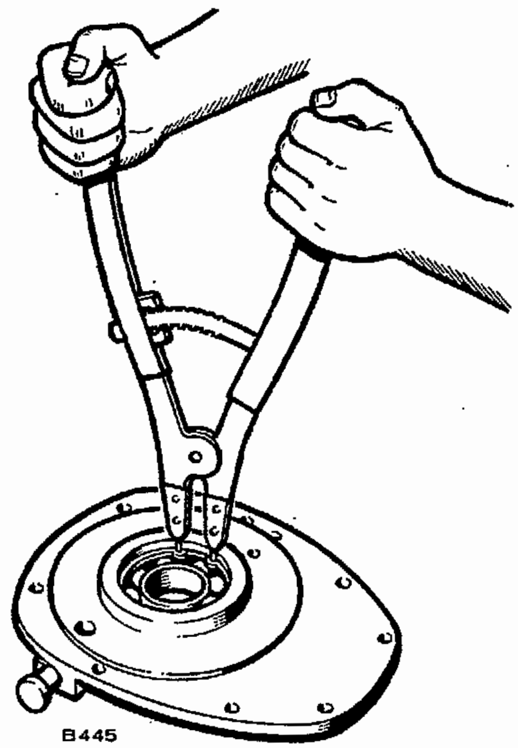


FIGURE 52. GEAR PLATE BEARING REMOVAL

The drive gear and inner end bearing are pressed on the input shaft and held in place by a key and a retaining ring, Figure 53. Use a suitable press when it is necessary to replace the bearing, gear or shaft.

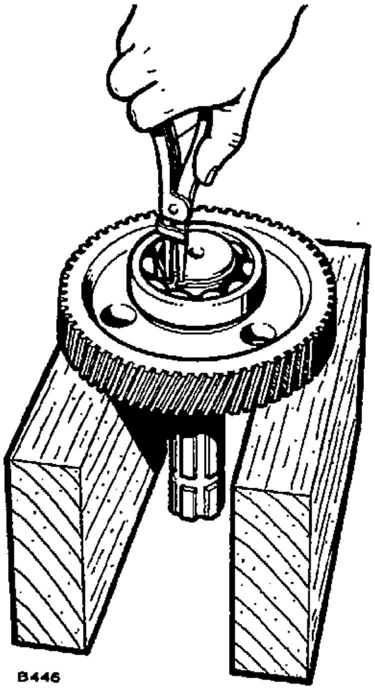


FIGURE 53. INSTALLING SNAP RING BEHIND DRIVE GEAR BEARING

ALTERNATOR DISASSEMBLY

The alternator disassembly and reassembly is safer and easier with the alternator in the vertical position as shown in following sequence of illustrations. Alternator components are heavy, so use a hoist and rope sling and stator tongs for handling and separating the components, Figure 54.

On two bearing alternators, remove drive end bearing plate and shaft key before upending the unit for disassembly.

1. Use a hoist and rope sling to raise the end bell end up to a vertical position.
2. Support unit on drive end and use special blocks to protect drive shaft. This step isn't necessary on PTO units if the gear case cover and shaft are removed first.
3. Remove four nuts from rotor-through-studs, Figure 55.

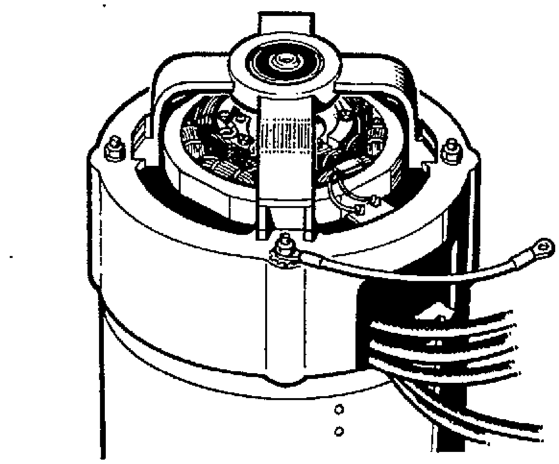


FIGURE 55. END BELL REMOVAL

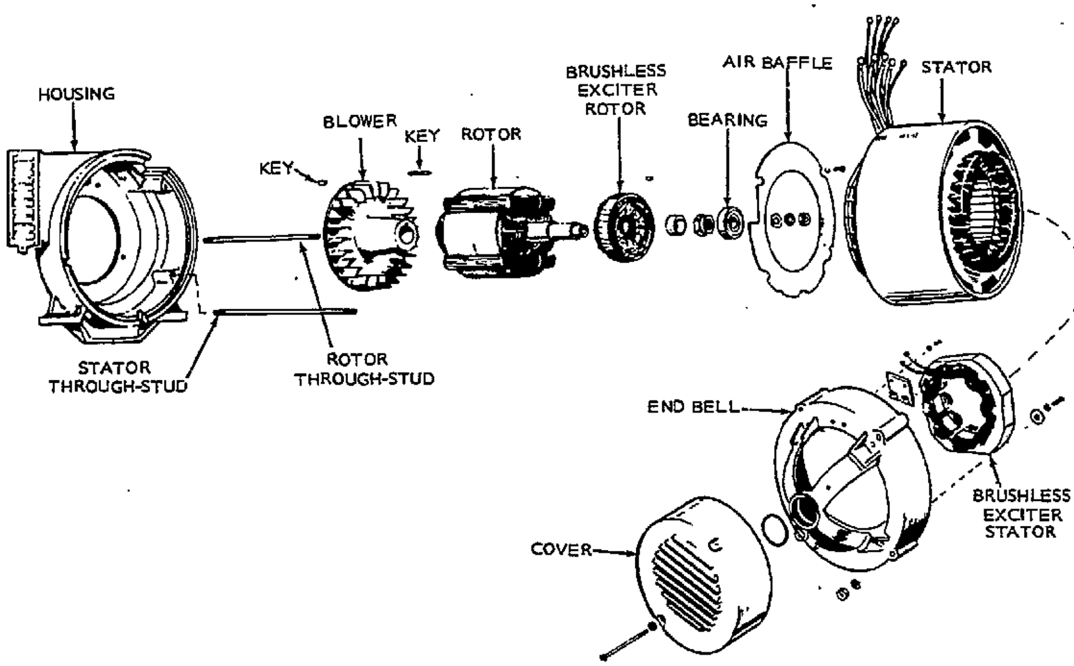


FIGURE 54. ALTERNATOR DISASSEMBLY

4. Remove end bell by tapping upward around joint and separating it from stator assembly, Figure 56.

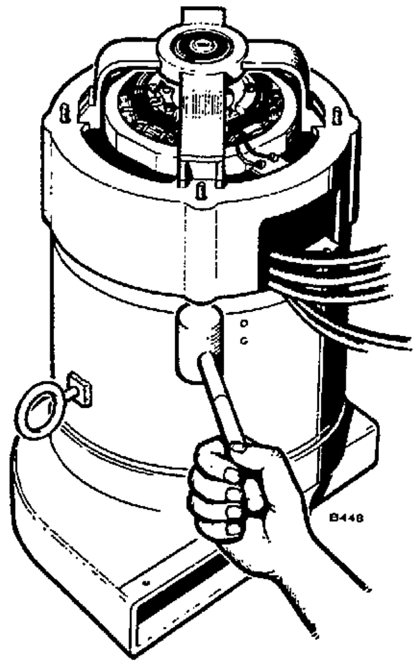


FIGURE 56. FREEING END BELL FROM STATOR

5. Remove four stator through-studs with vise grip pliers as shown in Figure 57. Reinstall two studs during reassembly for aligning and guiding the stator over the rotor.

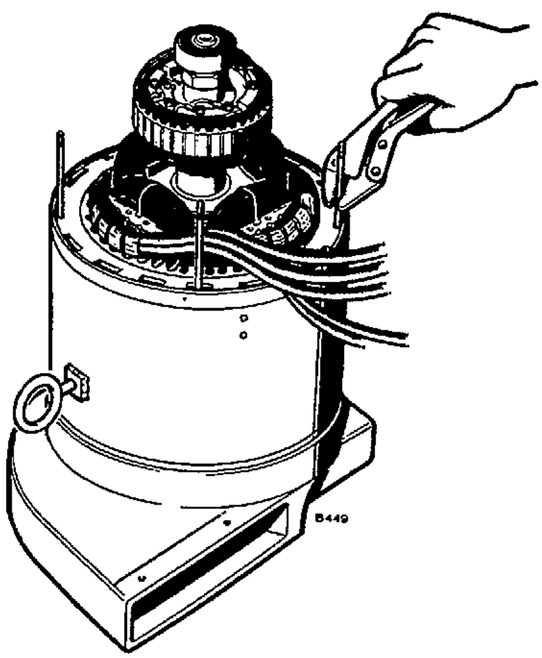


FIGURE 57. STATOR THROUGH-STUD BOLT REMOVAL

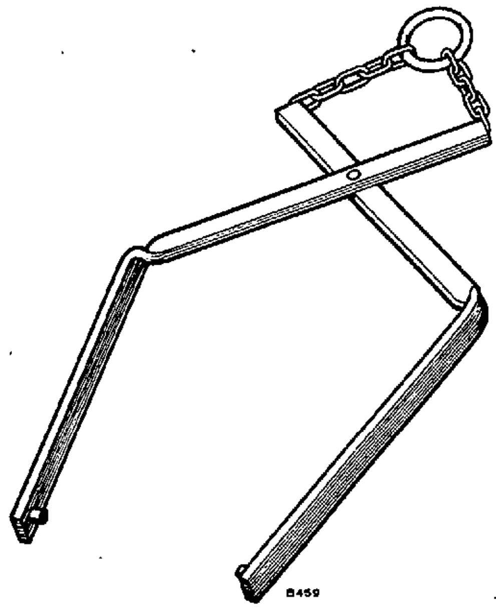


FIGURE 58. STATOR HANDLING TONGS

A pair of tongs is the most suitable device for handling stators, Figure 58.

The tongs shown were made from one inch steel bar stock. The tongs should be a suitable size for handling several different size stators.

6. 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 bench about one inch and tap adapter housing with a soft faced hammer to free stator from adapter, Figure 59.

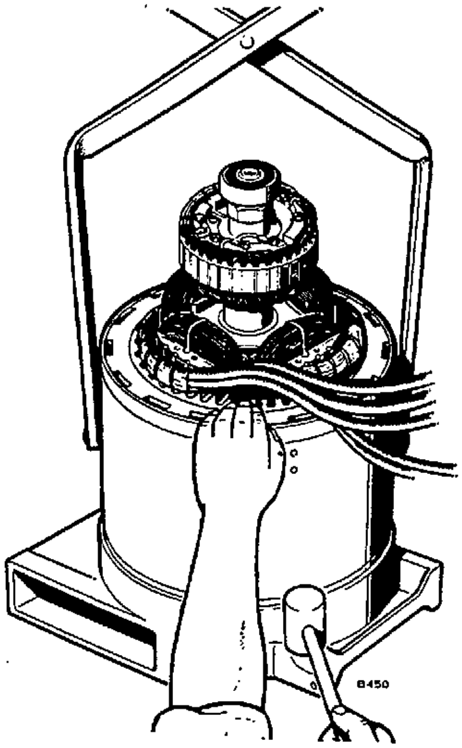


FIGURE 59. STATOR REMOVAL

7. While stator is still on lift tongs or hooks, revolve stator to horizontal position and set it down on its side, Figure 60.

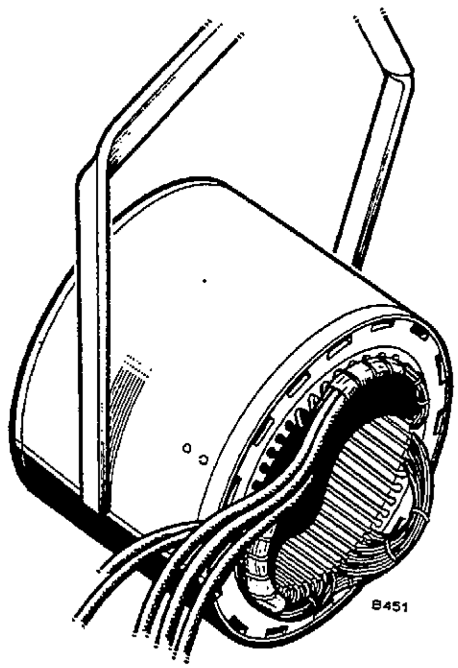


FIGURE 60. REVOLVING STATOR FOR REPAIRS

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

8. Remove air baffle by loosening four locking screws, Figure 61.

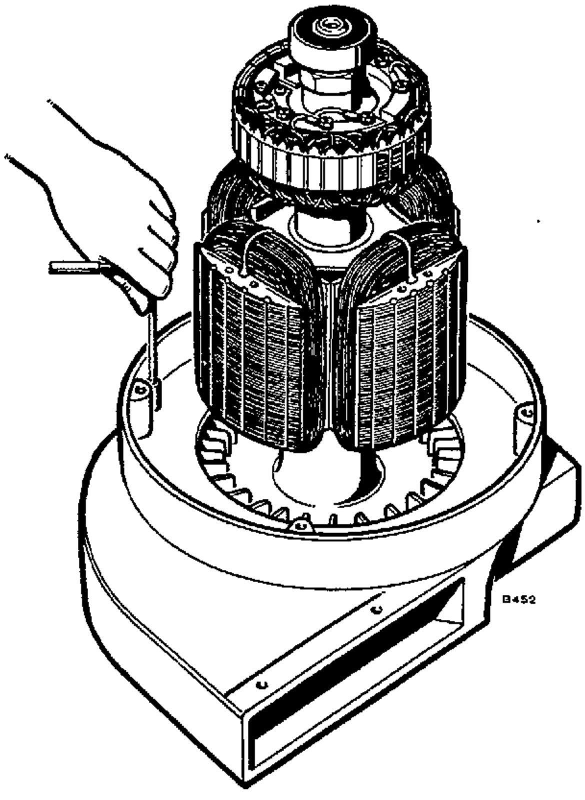


FIGURE 61. AIR BAFFLE REMOVAL

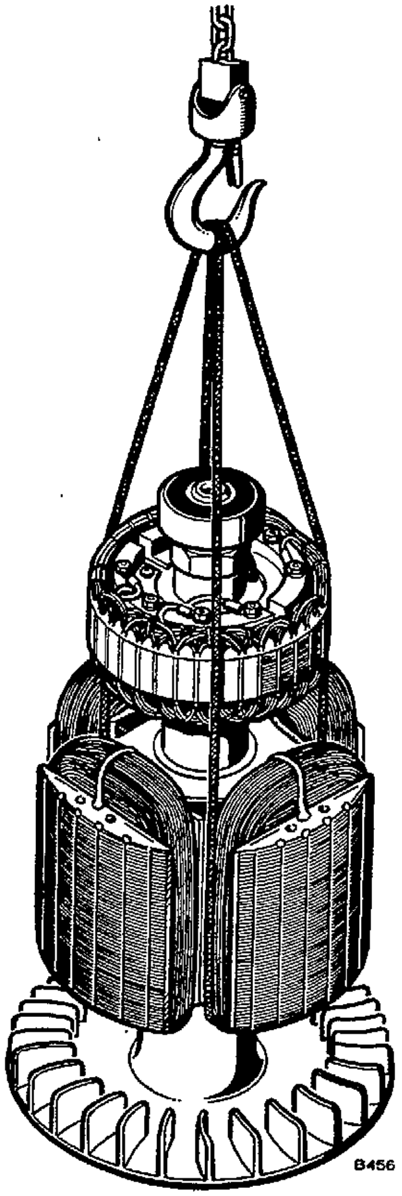


FIGURE 62. ROTOR HANDLING SLING

A rope sling is the most suitable device for handling rotors, Figure 62.

9. Remove rotor and fan by using a soft-faced hammer to tap on the adapter while holding the rotor assembly about one inch above bench with a hoist and rope sling, Figure 63.

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.

10. If it is necessary to replace a damaged fan, support rotor assembly horizontally and remove fan from rotor with a gear puller. Use the holes provided in fan to attach gear puller tongs.

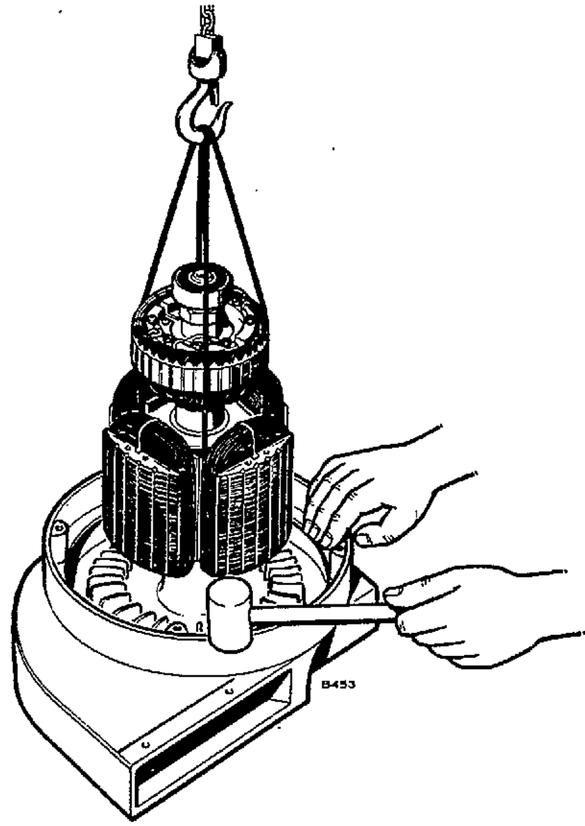


FIGURE 63. ROTOR AND FAN REMOVAL

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.

11. Hold rotor in a suitable clamp and loosen nut on rotor-through-stud bolt as shown in Figure 64.

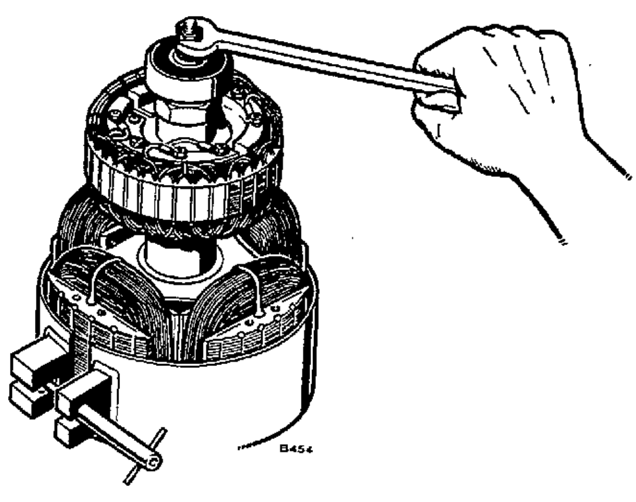


FIGURE 64. ROTOR THROUGH-STUD NUT REMOVAL

12. If required, remove bearing with a gear puller and accessory crutch (if available) from rotor through stud, Figure 65.

13. Clamp alternator rotor in a fixed vertical or horizontal position to remove or install the rotor lock nut, Figure 66. Lock nut is torqued to 130-150 ft. lb. (176-203 N•m).

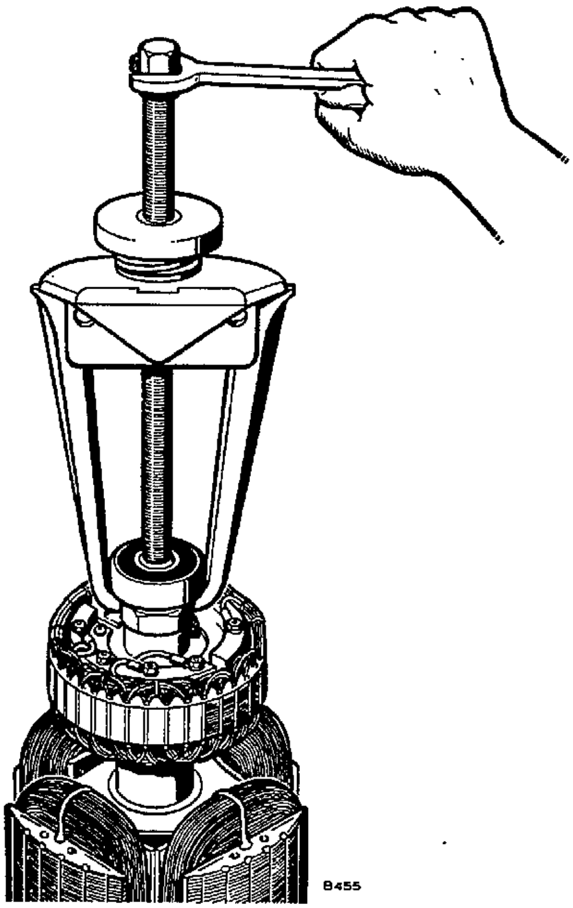


FIGURE 65. ROTOR BEARING REMOVAL

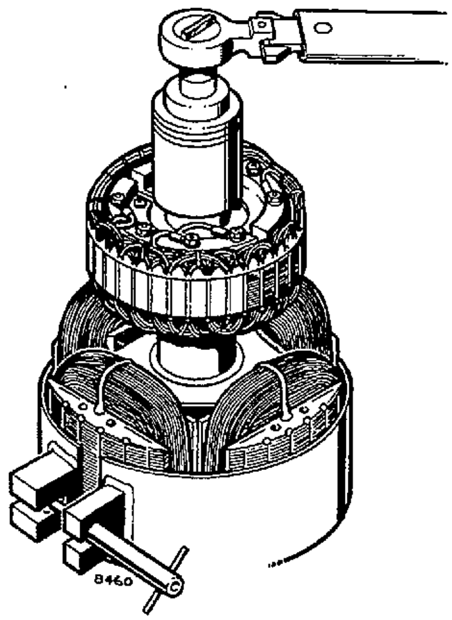


FIGURE 66. EXCITER ROTOR LOCKING NUT REMOVAL

14. If bearing, shaft, or oil seal replacement is required, hold gear case upright and tap drive pinion and shaft through gear case, Figure 67.
15. (Not Illustrated)—With vise grips, remove rotor through-stud from drive pinion shaft.
16. Remove snap ring from bearing on drive pinion shaft, Figure 68.
17. Press bearing from drive pinion shaft if bearing replacement is required.

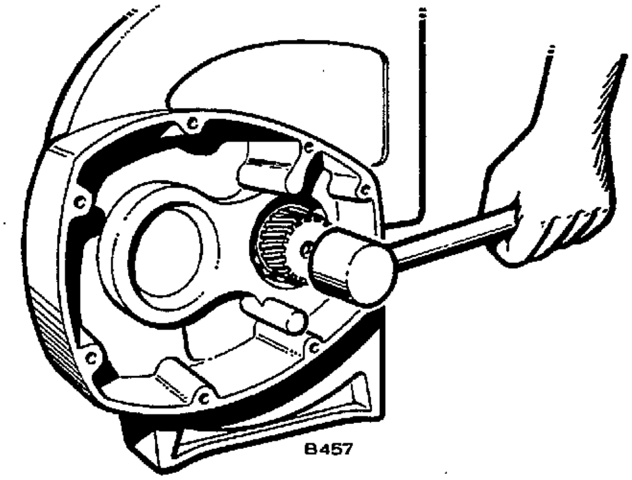


FIGURE 67. REMOVING DRIVE PINION SHAFT FROM GEAR CASE

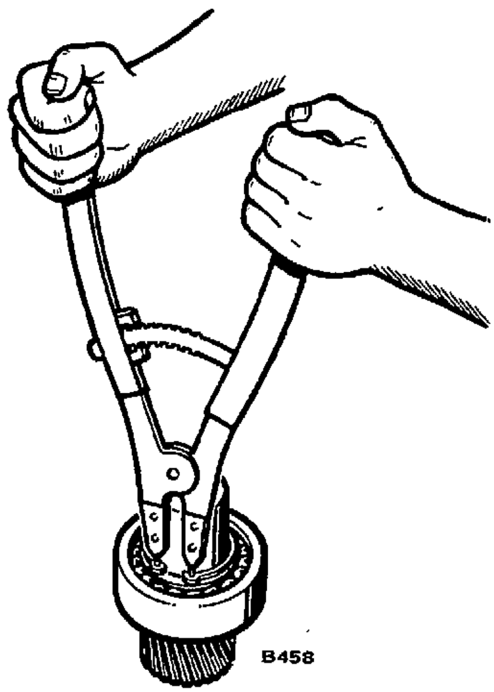


FIGURE 68. DRIVE PINION SHAFT BEARING SNAP RING REMOVAL

ALTERNATOR ASSEMBLY

Assemble alternator components in reverse order from disassembly using additional instructions that follow:

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

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

6. Install two stator through-studs in adapter for aligning stator assembly over rotor during assembly.
7. Install baffle ring.
8. Install remaining two stator through-studs in adapter.
9. Install stator and end bell. Torque nuts on through-studs to 19 to 21 ft-lbs (26 to 28 N•m).
10. Torque down rotor-through-stud nut to 55-60 ft. lb. (75-81 N•m).
11. Install mounting feet and control box.
12. Connect alternator output and control leads according to appropriate wiring diagram.
13. Replace end bell cover.
14. Replace control box cover.

CONTROL SYSTEMS

GENERAL

YD generator sets use several forms of control boxes and panels as shown in Figures 69 through 72. Instrumentation and control functions vary because of set design, different needs of each installation, and optional equipment ordered by the customer.

For description and troubleshooting information on the 30 kW SK engine DC controls, see Section 8A of Master Service Manual 900-0218.

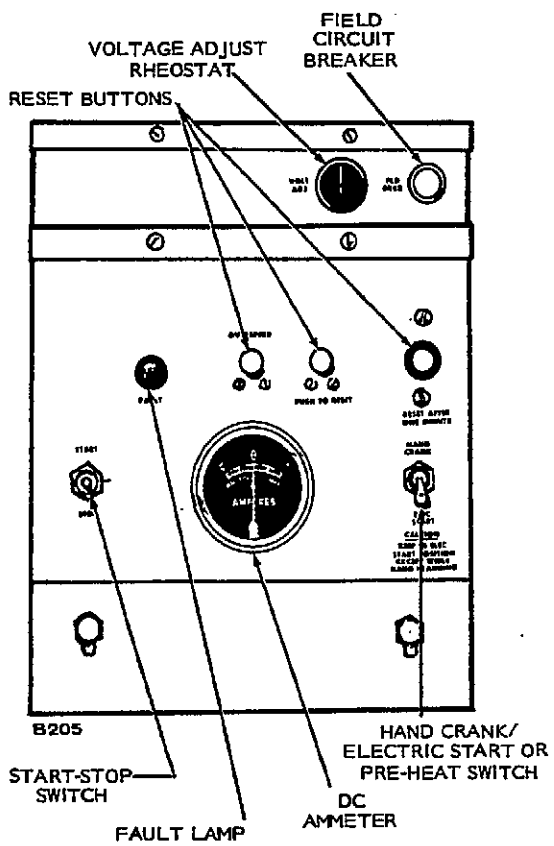


FIGURE 69. TYPICAL AIR-COOLED AND MARINE SET CONTROL PANEL

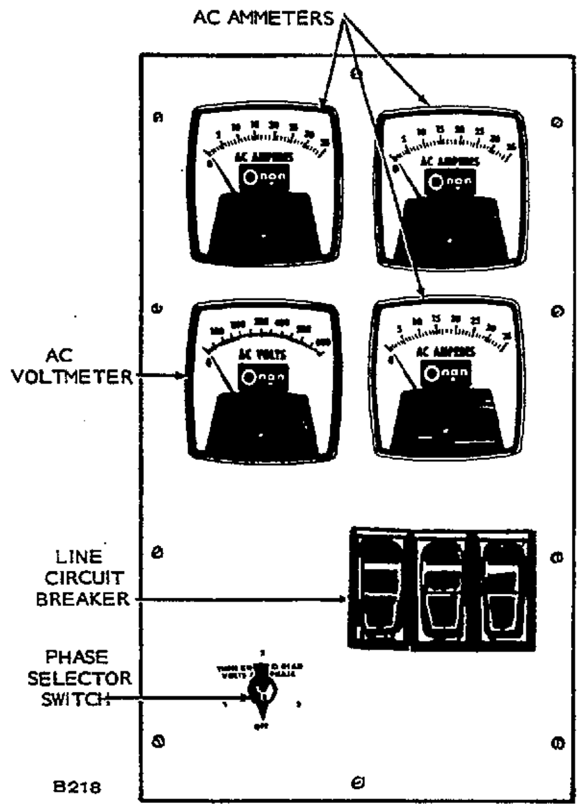


FIGURE 70. CONTROL PANEL AND OUTPUT BOX AIR-COOLED SET ONLY

CONTROL PANEL COMPONENTS

The following is a brief description of typical controls and instruments on the face of the panels; these may vary according to the customer purchase order.

Start-Stop Switch: Starts and stops the unit locally.

Battery Charge Rate DC Ammeter: Indicates the battery charging current.

Field Circuit Breaker: Provides generator exciter and regulator protection from overheating in the event of certain failure modes of the generator, exciter, and voltage regulator.

Pre-Heat Switch: Provides pre-heat control for manifold heater and glow plugs for cold diesel engine starting.

Oil Pressure Gauge: Indicates pressure of lubricating oil in engine (wired to a sensor unit located on the engine).

AC Voltmeter: Indicates AC generator output voltage.

Voltmeter Phase Selector Switch: Selects the phases of the generator output to be measured by the AC voltmeter.

Voltage Adjust Rheostat: Provides approximately plus or minus 5 percent adjustment of the rated output voltage.

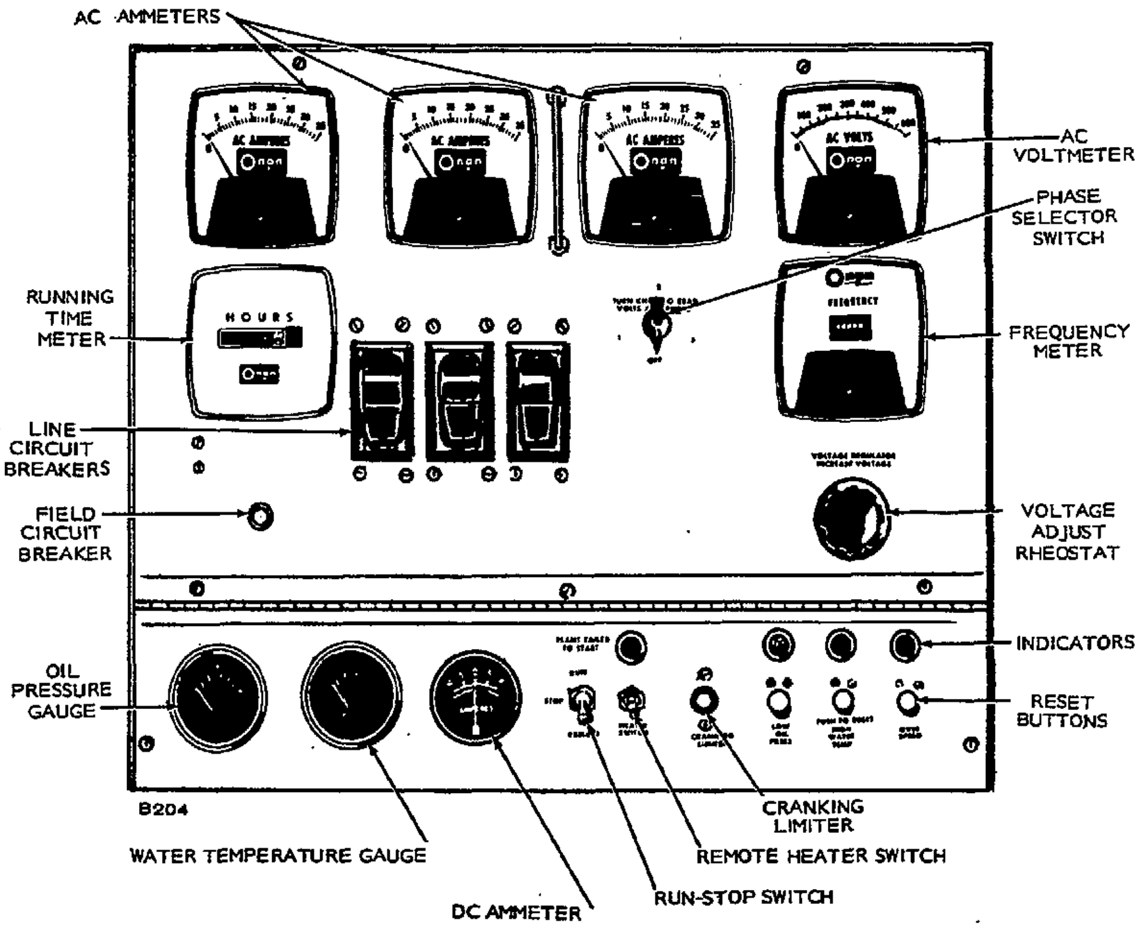


FIGURE 71. TYPICAL RADIATOR-COOLED SET CONTROL PANEL

Cranking Limiter: Some systems have a thermally activated device that limits cranking 45 to 90 seconds depending on ambient temperature. A red pushbutton pops out and cannot be reset until one minute has elapsed. Other solid state systems (DTA) limit cranking to 45-75 seconds before energizing a fault relay. The relay stops the cranking function and turns on a red Overcrank lamp.

Running Time Meter: Registers the total number of hours, to 1/10th that the unit has run. Use it to keep a record for periodic servicing. Time is accumulative; meter cannot be reset.

Frequency Meter: Indicates the frequency of the generator output in hertz. It can be used to check engine speed. (Each hertz equals 30 rpm.)

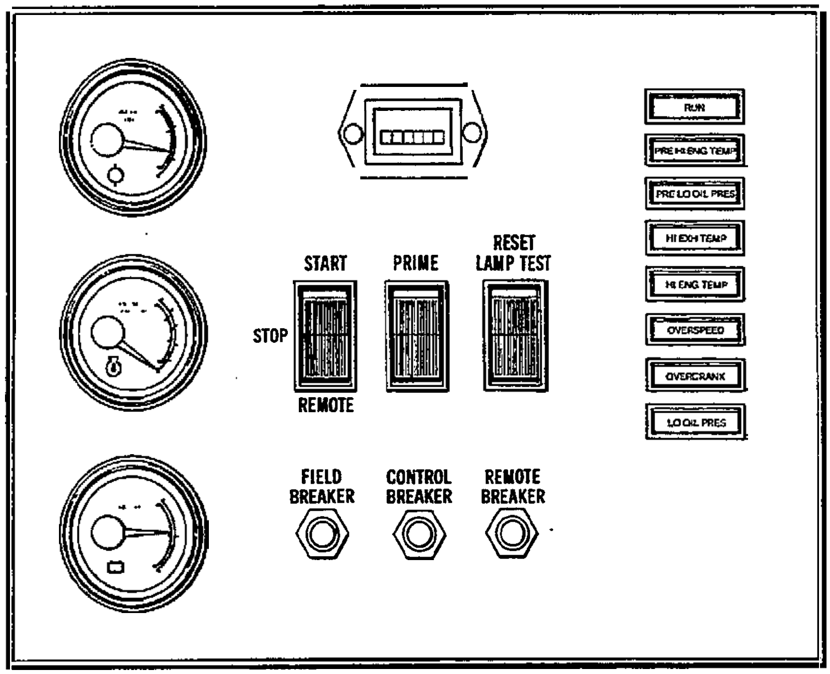
Warning Lights: Indicator lights are used on some controls to give warning of:

- Set failed to start
- Overspeed
- Low oil pressure
- Pre low oil pressure
- Low engine temperature
- High engine temperature
- Pre high engine temperature
- Overcrank
- Start switch in Off position

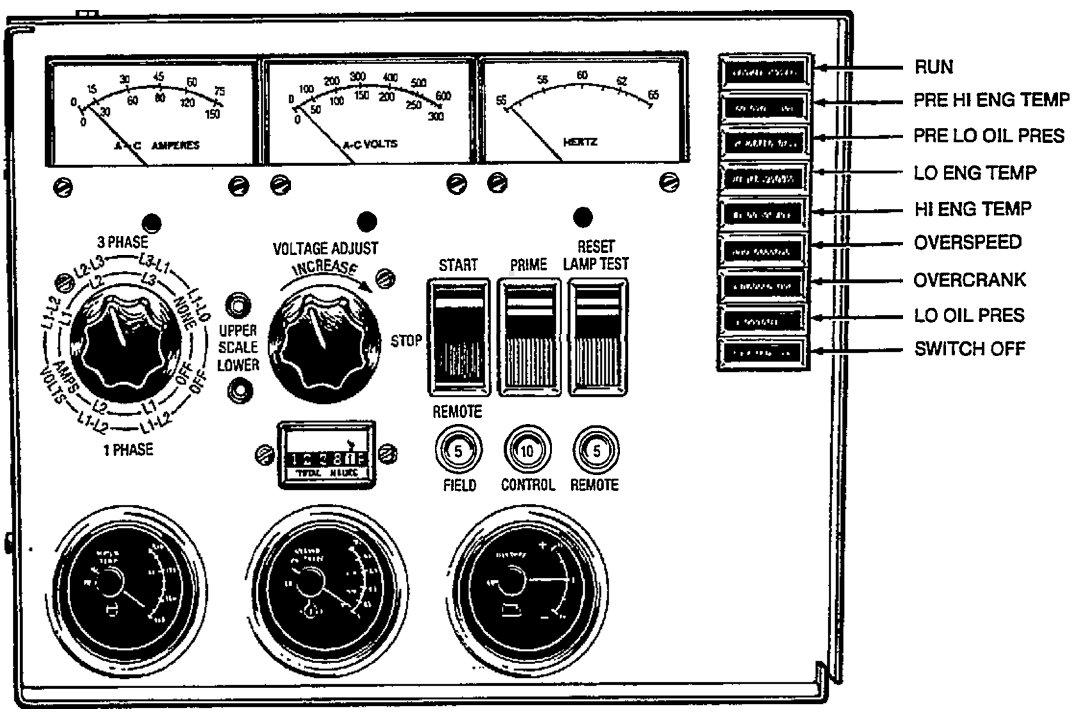
Reset pushbuttons or switches permit restarting after trouble is corrected.

Line Circuit Breaker: Protects generator from line overloads.

Water Temperature Gauge: Indicates temperature of circulating coolant in engine. (Wired to a sensor unit located on the engine.)



MDTA SERIES



DTA SERIES

FIGURE 72. TYPICAL CONTROL PANELS, DTA/MDTA

ENGINE CONTROL SYSTEM OPERATION

Dependable, trouble-free operation of the control system should be the major concern of any competent generator set service personnel. Service personnel must thoroughly understand how the controls operate, know how to check for troubles, and know how to make the proper adjustments, replacements, or repairs in a reasonable amount of time.

The circuitry, control components, and operating cycles for air-cooled and marine generator sets are similar, however the gasoline and diesel-powered sets are different enough to be described separately.

Prior to starting the generator set, check the fuel supply, engine oil level, and all battery connections for loose or broken wires. If an automatic demand control is in use, check for correct connections.

GASOLINE POWERED SETS

The DC start and run circuits are supplied by the 12-volt battery and charge winding of the generator. The control circuits are completed by returning to ground (negative post of battery).

Figure 73 shows a typical wiring diagram for gasoline powered sets described in the following Starting, Start-Disconnect and Stopping sequences. Relay contact references normally open (NO) and normally closed (NC) refer to position of contacts with the unit at rest (not energized).

Starting Sequence

The Start-Stop switch is pressed and held at Start position until the engine starts and runs.

CAUTION **Do not hold switch longer than 30 seconds during any attempt to start. Longer periods may harm the starter motor and discharge battery needlessly.**

1. The start circuit is completed by Start-Stop switch S11 at the Start position. This action energizes Start Relay K11 via NC contacts of the Start-Disconnect Ignition Relay K12.
2. Start Relay K11 has two sets of NO contacts performing the following functions when energized:
   a. One set connects battery B+ to: primer solenoid K3, thermal choke S3, and starter motor shift solenoid B1.
   b. The other set connects B+ to: the breaker point assembly S3 (via high temperature switch S2 and NC contacts of optional Emergency Relay *K14), thermal choke heater S3, and other fuel control components.

***If K14 should energize and stop the engine, a brief period is required for the relay's heater to cool before the relay contacts reset to the de-energized position for starting again.**

Start-Disconnect Sequence

When engine speed reaches 900 rpm, centrifugal switch S1 closes. This connects B+ to the Start-Disconnect Relay K12 via resistor R11. The NC contacts of K12 now opens the K11 start circuit. The NO contacts of K12 close to connect B+ (via K14 contacts) to the ignition circuit and fuel control components.

Stopping Sequence

Holding S11 in Stop position de-energizes K12 which opens B+ circuit to the ignition system and fuel control components.

DIESEL POWERED SETS

The DC start and run circuits are supplied by the 12-volt battery, and by the charge winding of the generator. The control circuits are completed by grounding to the negative pole of the battery.

CAUTION **Do not apply overvoltage to the starting circuit at any time. Overvoltage will destroy the glow plugs and air heater in two to three seconds. If it becomes necessary to use an additional source of power to start the unit—use a 12-volt battery connected in parallel with the starting batteries.**

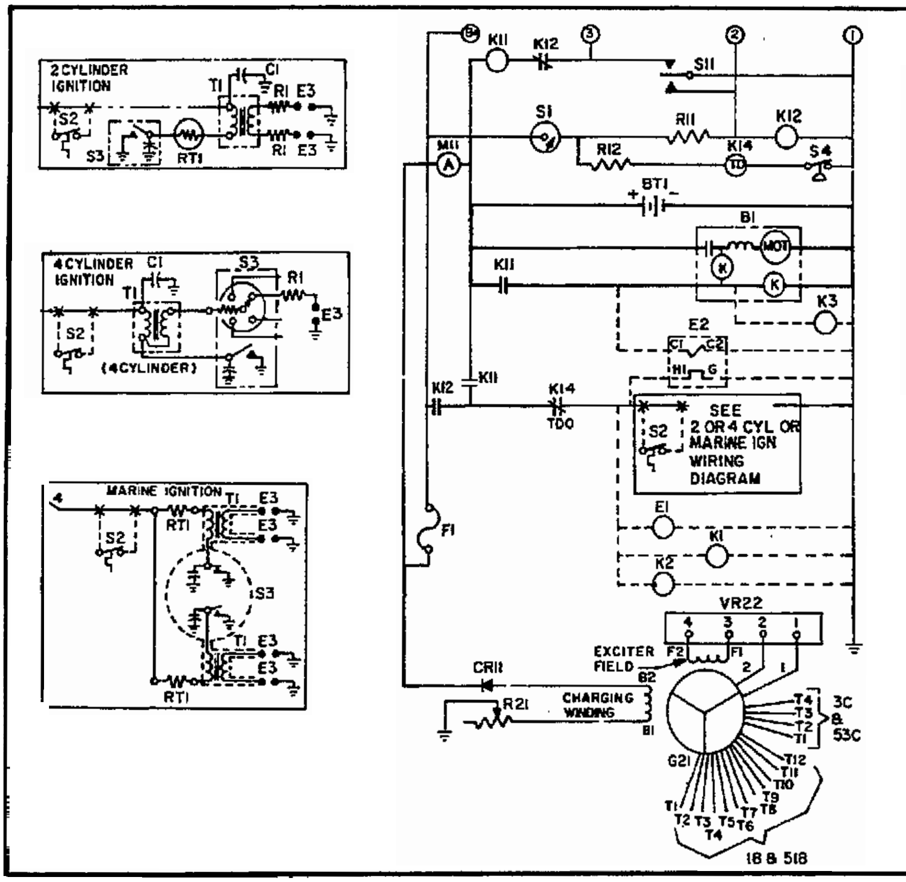
The following starting, start-disconnect and stopping sequences are referenced to the typical control schematic in Figure 74.

Test reference to relay contacts normally open (NO) and normally closed (NC) refer to position of contacts with the unit at rest (not energized).

Starting Sequence

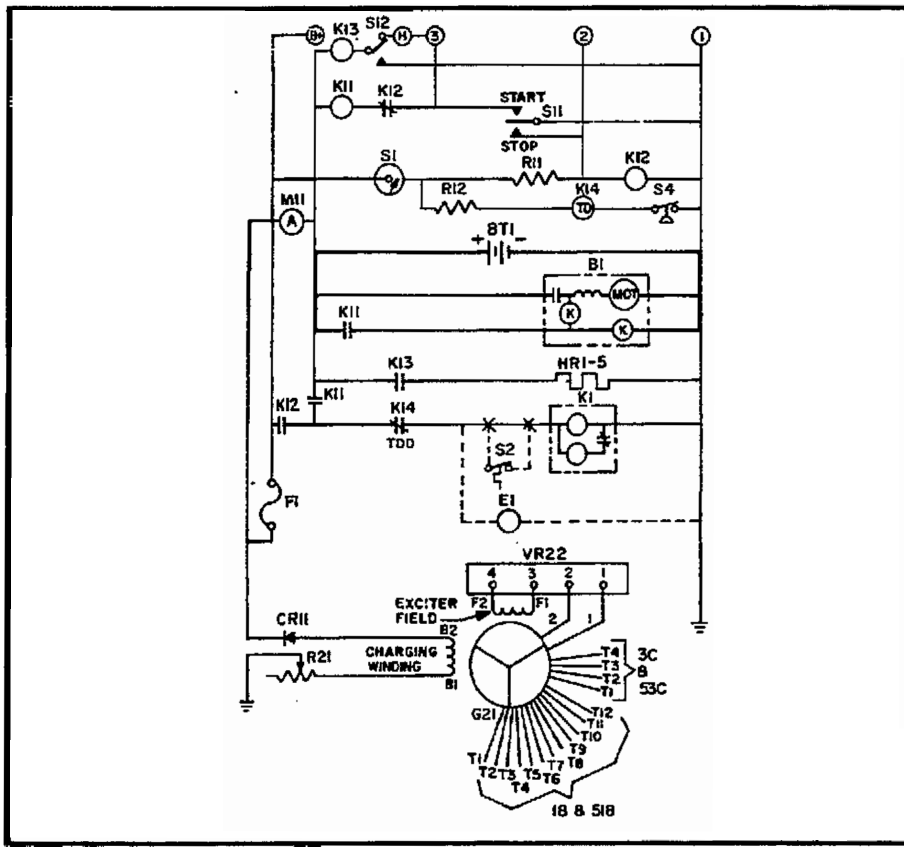
1. For cold engine starting, the Pre-Heat Switch S12 is held in the Heat position for 30 seconds if ambient temperature is above 55°F (43°C); 60 seconds if below 55°F. This action energizes the Manifold Heater Relay K13 which connects battery B+ to the manifold and glow plug heaters HR1-5.

   After proper pre-heat time, S12 is released and start circuit energized (Step 2).
2. The start circuit is completed by Start-Stop Switch S11 at the Start position. This action energizes Start Relay K11 via NC contacts of relay K12. Relay K13 is also energized by S11 at Start.



PARTS LIST (REF)	
REF DES	DESCRIPTION
B1	STARTER & SOLENOID-ENGINE
BT1	BATTERY 12V
* E1	FUEL PUMP
* E2	CHOKE & THERMO MAG
E3	SPARK PLUG (2 CYL)
E3	SPARK PLUG (4 CYL)
* K1	SOLENOID-FUEL
* K2	SOLENOID-DAY TANK FUEL
* K3	SOLENOID-PRIMER
R1	RESISTOR-SPARK PLUG (2CYL)
R1	RESISTOR-SPARK PLUG (4CYL)
RT1	RES-HYTEMCO 1.72 Ω, 25W (2CYL)
RT1	RES-HYTEMCO 1.72 Ω, 25W (MARINE)
S1	SWITCH-CENTRIFUGAL
* S2	SWITCH-HIGH TEMP
S3	BREAKER ASSY
S4	SWITCH-LOW OIL PRESS
T1	COIL-IGNITION
G21	GENERATOR
R21	RESISTOR ASSY
VR22	REGULATOR ASSY-VOLTAGE
	W/O V ADJ)-01,-02,-05,-06,-09,-10,-13,-14
VR23	REGULATOR ASSY-VOLTAGE
	W/V ADJ)-03,-04,-07,-08,-11,-12,-15,-16
CR11	RECTIFIER & LEAD ASSY
F1	FUSE-10 AMP
K11	RELAY-START SOLENOID
K12	RELAY & LEAD ASSY
K14	RELAY-EMERGENCY (LOP)
M11	AMMETER-CHARGE 5-0-5
R11,S11	SWITCH & RESISTOR ASSY
R12	RESISTOR & LEAD ASSEMBLY

FIGURE 73. TYPICAL GASOLINE ENGINE CONTROL SCHEMATIC



PARTS LIST (REF)	
REF. DES.	DESCRIPTION
B1	STARTER & SOLENOID
BT1	BATTERY 12V
* E1	FUEL PUMP
HR1	HEATER-MANIFOLD
HR2,3	HEATER-GLOW PLUG (2CYL)
HR2-5	HEATER-GLOW PLUG (4CYL)
K1	SOLENOID-FUEL
S1	SWITCH-CENTRIFUGAL
* S2	SWITCH-HIGH TEMP
S4	SWITCH-LOW OIL PRESS
G21	GENERATOR
R21	RESISTOR ASSY
VR22	REGULATOR ASSY-VOLTAGE
	(W/O V ADJ) -01,-02,-05,-06,-09,-10
VR23	REGULATOR ASSY-VOLTAGE
	(W/V ADJ) -03,-04,-07,-08,-11,-12
W9	WIRING HARNESS (F1-F2)
CR11	RECTIFIER
F1	FUSE - 10 AMP
K11	RELAY-START SOLENOID
K12	RELAY
K13	RELAY-MANIFOLD HEATER
K14	RELAY-EMERGENCY (LOP)
M11	AMMETER-CHARGE 5-0-5
R11,S11	SWITCH & RESISTOR ASSY
R12	RESISTOR
S12	SWITCH

* WHEN USED

FIGURE 74. TYPICAL DIESEL ENGINE CONTROL SCHEMATIC

CAUTION Limit cranking 15 to 20 seconds to conserve battery and prevent possible harm to the starter motor B1.

3. Start Relay K11 has two sets of NO contacts performing the following functions when energized:
   a. One set connects battery B+ to the starter motor shift solenoid B1.
   b. The other set connects B+ to the fuel solenoid K1 and optional fuel pump E1 via NC contacts of optional Emergency Relay *K14.

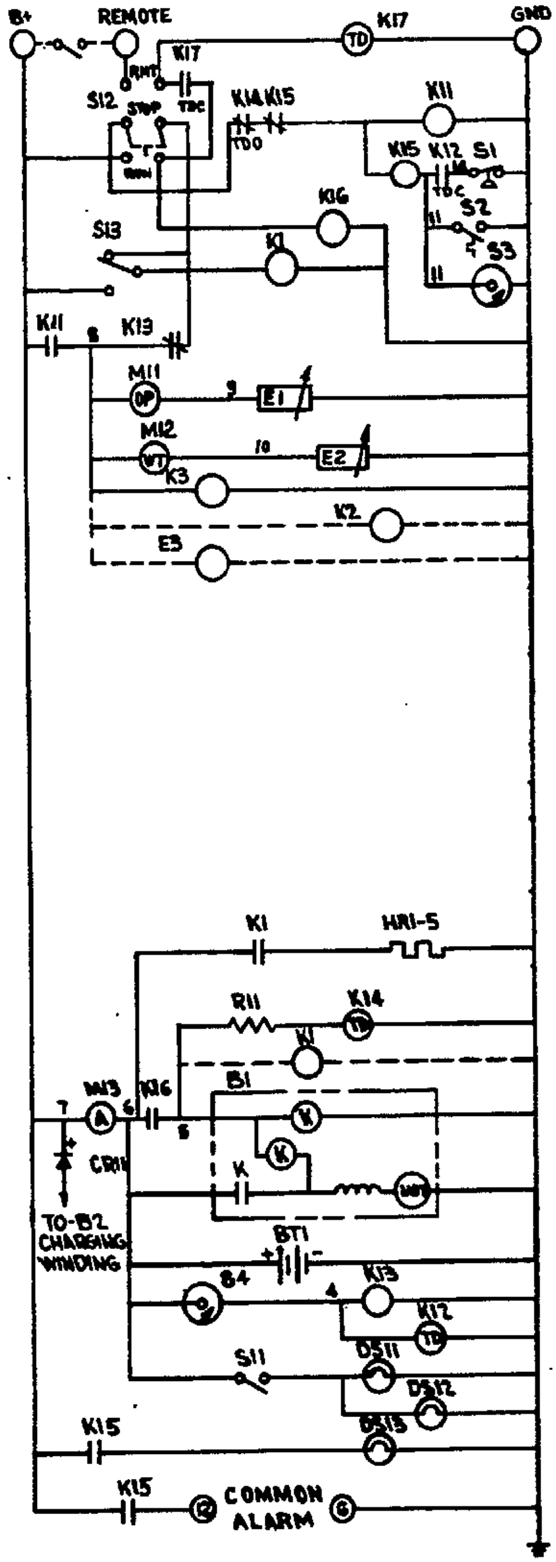
*If K14 should energize and stop the engine, a brief period is required for the relay's heater to cool before the relay contacts reset to the de-energized position for starting again.

Start-Disconnect Sequence

When engine speed reaches 900 rpm, centrifugal switch S1 closes. This connects B+ to the Start-Disconnect Relay K12 via resistor R11. The NC contacts of K12 open the cranking circuit. The NO contacts of K12 close to keep B+ (via K14 contacts) to the fuel solenoid K1 and the fuel pump E1.

Stopping Sequence

Holding S11 in Stop position de-energizes K12 which opens B+ circuit to the fuel solenoid and pump. The fuel solenoid shaft forces the injection pump control arm to the no-fuel position. The engine stops from lack of fuel.



NOTE:
UNLESS OTHERWISE NOTED, ALL COMPONENTS ARE SHOWN IN THE DE-ENERGIZED POSITION.

PARTS LIST (REF)

REF. DES.	DESCRIPTION
B1	STARTER AND SOLENOID - ENGINE
BT1	BATTERY - 12 VOLT
E1	SENDER - OIL PRESSURE
E2	SENDER - WATER TEMP
E3	FUEL PUMP
HR1	HEATER - MANIFOLD
HR2-5	HEATER - GLOW PLUG
K1	RELAY - HEATER
• K2	SOLENOID - WATER
• K3	SOLENOID - FUEL
S1	SWITCH - LOW OIL PRESS.
S2	SWITCH - HIGH WATER TEMP
• S3	SWITCH - OVERSPEED
S4	SWITCH - CENTRIFUGAL
CR11	RECTIFIER - CHARGE
DS11,12	LAMP - PANEL
DS13	LAMP - EMERGENCY
K11	RELAY - FUEL
K12	RELAY - OIL PRESS. TD 15 SEC
K13	RELAY - START DISCONNECT
K14	RELAY - CRANKING LIMITER
K15	RELAY - EMERGENCY SHUTDOWN
K16	RELAY - STARTER PILOT
K17	RELAY - TIME DELAY
M11	GAUGE - OIL PRESS.
M12	GAUGE - WATER TEMP
M13	AMMETER - CHARGE 5-0-5
R11	RESISTOR - 3-OHM, 10W
S11	SWITCH - PANEL LIGHT
S12	SWITCH - SELECTOR
S13	SWITCH - MANIFLOD HEATER
TB11	BLOCK - TERMINAL
TB12	BLOCK - TERMINAL

• WHEN USED

FIGURE 75. TYPICAL CONTROL SCHEMATIC, RADIATOR-COOLED J—SERIES DIESEL ENGINE

RADIATOR-COOLED DIESEL SETS

The control components on the water-cooled, diesel sets are similar to the air-cooled and marine sets, but the circuitry and operating cycles are different. The solid-state control used on the DTA/MDTA Series is described separately.

The DC start and run circuits are supplied by the 12-volt battery, and by the battery charging system.

CAUTION **Do not apply overvoltage to the starting circuit at any time. Overvoltage will destroy the glow plugs and air heater in two to three seconds. If it becomes necessary to use an additional source of power to start the unit—use a 12-volt battery connected in parallel with the starting batteries.**

Prior to starting, check the fuel supply, engine oil level, and all battery connections for loose or broken wires. If an automatic demand control is in use, check for correct connections and make sure the selector switch is in Remote position.

Figure 75 shows a typical schematic diagram for radiator cooled diesel sets described in the following Starting, Start-Disconnect and Stopping sequences.

Starting Sequence

The following sequence of electrical functions occur during the starting operation. Relay contact text references normally open (NO) and normally closed (NC) refer to position of contacts with the unit at rest (not energized).

With S12 in the Remote position, the operator can start the set from a remote location, or by an automatic demand control. In this position only is engine preheating controlled automatically by 20 second Time Delay Relay K17. Relay K17 is energized by B+ connected through the remote switch, and through S12 in the Remote position.

Manual starting at the set involves the following sequence of electrical and mechanical functions:

1. For cold engine starting, the Pre-Heat Switch S13 is held in the Heat position for 30 seconds if below 55°F (13°C); 60 seconds if below 55°F. This action energizes the Heater Relay K1 which connects B+ to the manifold and glow plug heaters HR1-5. After proper pre-heat time, S13 is released and the start circuit energized (Step 2).
2. The start circuit is completed when the selector switch is moved to the Run position. This action energizes Fuel Relay K11 via normally closed contacts K14 and K15 (Cranking Limiter and Emergency Shutdown Relays). When K11 contacts close, B+ energizes the following components.

   Oil pressure meter M11.

   Water temperature meter M12.

   Fuel solenoid K3.

   Optional water solenoid K2 and fuel pump E3.

   Heater Relay K1 via NC contacts of S13 and K13 (Start-Disconnect Relay).

   Starter Relay K16 via K13 and S12. (Relay K16 connects B+ to the B1 starter solenoid and Cranking Limiter Relay K14.)

Start-Disconnect Sequence

When engine reaches about 900 rpm, centrifugal switch S4 closes and energizes relays K12 and K13 (Oil Pressure and Start-Disconnect). The NC contacts of K13 opens the K16 Starter Relay circuit and starter solenoid B1.

Stopping Sequence

Positioning selector switch S12 to Stop position disconnects B+ voltage from the control circuits; thereby de-energizing all control components required to operate the engine in either Run or Remote condition.

Emergency Shutdown

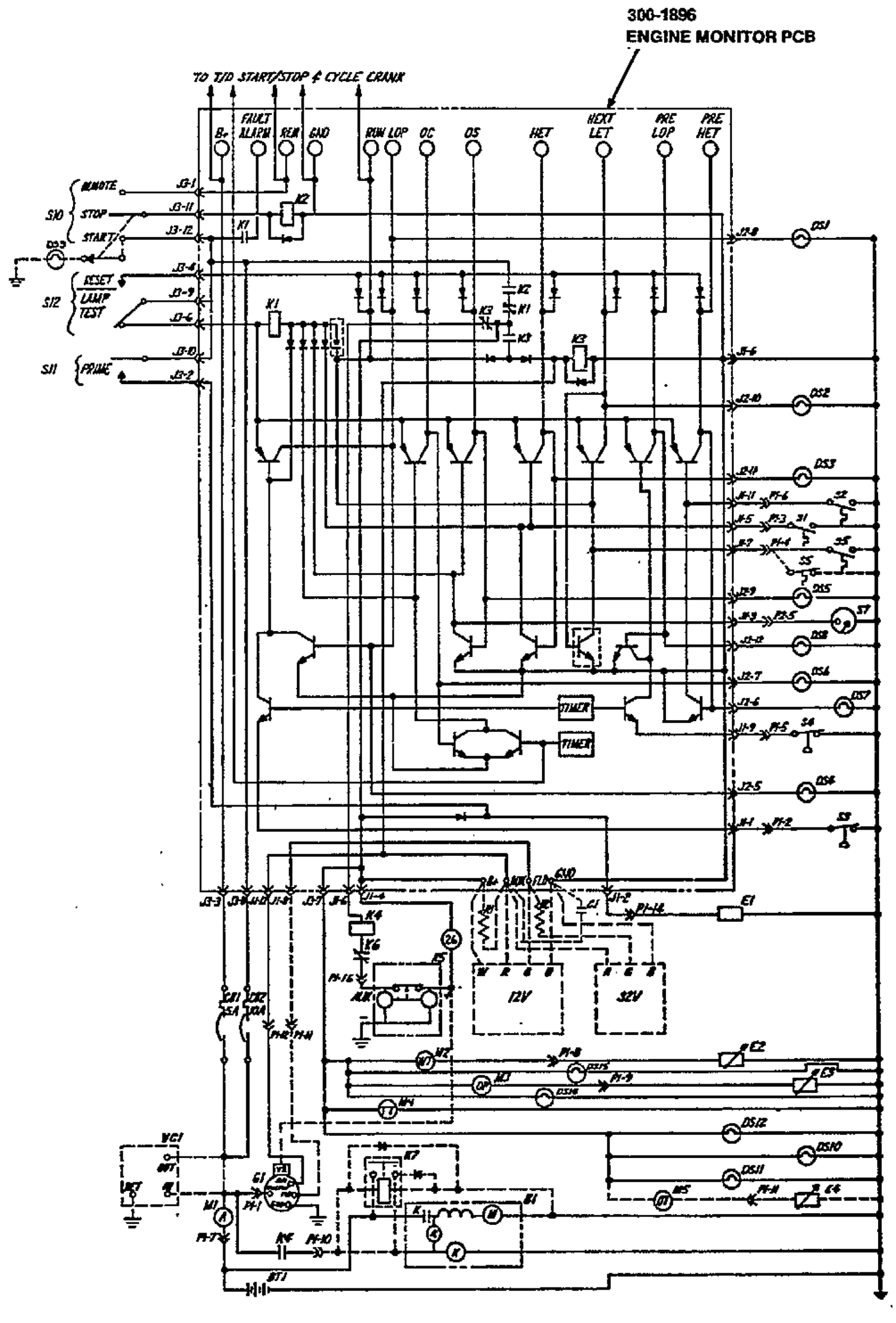
Emergency Shutdown Relay K15 is controlled by any one of three switches: S1 low oil pressure, S2 high water temperature, and S3 overspeed. Contacts of K15 control two circuits: one normally closed set of K15 contacts controls the fuel solenoid relay coil to shut off the fuel supply to the engine; the other normally open set closes to light the pilot light and set off the emergency alarm whenever the emergency shutdown relay energizes.

CONTROL OPERATION (DTA/MDTA SERIES)

Figures 76 and 77 show the PC board and DC control schematics for the solid state control. Relay contact text references normally open (NO) and normally closed (NC) refer to position of contacts with the unit at rest (not energized).

Starting Sequence

The start circuit is completed by switch S10 in the Start position. This action energizes On/Off Relay K2 which puts B+ at Stop Solenoid K5 and Fuel Pump E1 (via contacts K2, K1 and J1-4). As K5 energizes, its NC contacts open and allow the Starter Pilot Relay K4 to energize (via contacts K2, K1, K3, J1-6, K6, P1-16 and K5 auxiliary coil to ground). The K4 contacts connect B+ to the Starter Motor Solenoid K and cranking begins.



CONTROL PARTS LIST			
A11	1	ENGINE MONITOR	(-01)
	1	ENGINE MONITOR	(-02)
	1	ENGINE MONITOR	(-03,-04)
C1	1	CAPACITOR & LEAD	(-02)
CB1	1	CIRCUIT BREAKER (REMOTE, 5A)	
CB2	1	CIRCUIT BREAKER (CONTROL, 10A)	
CBL1	1	CABLE-3 CONDUCTOR (-02)	
DS1	1	LIGHT-IND (RUN)	
DS2	1	LIGHT-IND (NEXT) (-01,-02)	
DS3	1	LIGHT-IND (HET)	
DS2	1	LIGHT-IND (LET)	(-03,-04)
DS4	1	LIGHT-IND (LOP)	
DS5	1	LIGHT-IND (OS)	
DS6	1	LIGHT-IND (OC)	
DS7	1	LIGHT-IND (PRE HET)	
DS8	1	LIGHT-IND (PRE LOP)	
DS10-12	3	LAMP-PILOT	
F1	1	FUSE (5A)	(-02)
	1	HOLDER-FUSE	(-02)
K4	1	RELAY-STARTER PILOT	
K6	1	RELAY-STARTER PROT	(-02)
	1	SPRING-RELAY HOLDOWN	(-02)
	1	SOCKET-RELAY	(-02)
	2	SPACER-RELAY SOCKET	(-02)
M1	1	AMMETER-CHARGE	
M2	1	GAUGE-OIL PRESSURE	
M3	1	GAUGE-WATER TEMPERATURE	
M4	1	METER-RUNNING TIME	
M5	1	GAUGE-OIL TEMPERATURE (-04)	
R1	1	RESISTOR (300Ω)	(-02)
R2	1	RESISTOR (2.2Ω)	(-02)
S10	1	SWITCH (SPDT)	
S11	1	SWITCH (SPST)	
S12	1	SWITCH (SPDT)	
VR1	1	REGULATOR & LEAD-VOLTAGE	(-01)
	1	REGULATOR-VOLTAGE	(-02)
VC1	1	CONVERTER-VOLTAGE	(-02)
	1	BRACKET-POWER SUPPLY	(-02)
W1	1	LEAD (CB1-2, CB2-2)	(-02)
W2	1	LEAD (M1-1, F1-2)	(-02)
W3	1	LEAD (TB2-B+, R1-1)	(-02)
W4	1	LEAD (TB2-AUX, R1-2)	(-02)
W5	1	LEAD (TB2-FLD, R2-2)	(-02)
W6	1	LEAD (K6-A, TB5-10)	(-02)
W7	1	LEAD (K6-B, TB5-9)	(-02)
W8	1	LEAD (K6-1, P1-16)	(-02)
W9	1	LEAD (K6-7, K4-3)	(-02)
W10	1	LEAD (M5-2, P1-11)	(-04)
W11	1	LEAD (M2-1, M5-1)	(-04)
DS13	1	LAMP-PILOT	(-04)
	1	SOCKET-PILOT LAMP	(-04)
K7	1	SOLENOID & LEAD-STARTER	(-02)
DS9	1	LIGHT-INDICATING (SWITCH OFF)	

NOTE:

1. DASHED LINES ARE "WHEN USED"

MODEL	STD	WITH / OIL TEMP GAUGE
MDTA 12V	-01	
MDTA 32V	-02	
DTA 12V	-03	-04

FIGURE 76. DC CONTROL SCHEMATIC DTA/MDTA (OPTIONAL METERING)

Start-Disconnect Sequence

When cranking begins, the solid-state crank-limiter timer is activated. If engine does not start in 45-75 seconds, Fault Relay K1 energizes and cranking stops. Engine start is determined when voltage output at auxiliary terminal of the belt driven alternator energizes the Start-Disconnect Relay K3. Relay K3 stops the timer sequence and opens the cranking circuit.

Stopping Sequence

Placing switch S10 in Stop position de-energizes relay K2 which opens B+ circuit to the Stop Solenoid and Fuel Pump. The Stop Solenoid connecting rod moves the injection pump control to the no-fuel position. The engine stops from lack of fuel.

Emergency Shutdown

Fault Relay K1 can be energized by any of several sensors as follows: S3 low oil pressure switch, S5 high engine temperature switch, S7 overspeed switch, OC (overcrank) Limiter.

When K1 is energized, a NC set of contacts open B+ to the Stop Solenoid and Fuel Pump, and another set closes to connect B+ to an optional fault alarm. The engine sensor causing the fault triggers a transistor circuit that lights up the appropriate fault lamp on the control panel. The engine cannot be started until fault condition is corrected and the Reset Switch S12 pressed.

The Low Oil Pressure Delay circuit is not actuated until the Start-Disconnect Relay is energized. The circuit allows a delay of 7.5 to 12.5 seconds before LOP shutdown and pre-alarm are functional. Following this initial delay, both the LOP shutdown and pre-alarm functions are immediate.

REF. DES.	QTY.	DESCRIPTION OF MATERIAL
R36	1	RESISTOR (10 Ω, 1/2W, 5%)
Q6	1	TRANSISTOR - SIGNAL (MPS 6530)(-01,-02)
CR2	1	DIODE - 400V (4D4) (-01,-02)
	1	SILKSCREEN - PC BOARD (-03)
	1	SILKSCREEN - PC BOARD (-02)
	.10 oz	SOLDER-BAR
U1-2	2	IC-PROGRAMABLE TIMER
TB2	1	TERMINAL BLOCK-4 PLC (-01,-02)
TB1	1	TERMINAL BLOCK-12 PLC
R31	1	RESISTOR (22K, 1/2W, 5%)
R30,33	2	RESISTOR (100K, 1/2W, 5%)
R29,34	2	RESISTOR (47K, 1/2W, 5%)
R20-26	7	RESISTOR (180, 1/2W, 5%)
R7,9,11,13,15, 17,19	7	RESISTOR (680, 1/2W, 5%)
R35	1	RESISTOR (270 Ω, 2W, 5%)(-02)
R1-6,8,10,12,14 16,18,27,28,32	15	RESISTOR (10K, 1/2W, 5%)
Q11-17	7	TRANSISTOR-SIGNAL (MPS 6533)
Q4,5,7-10,18	7	TRANSISTOR-SIGNAL (MPS 6530)
Q1-3	3	TRANSISTOR (92PU45A)
K3	1	RELAY-MIN DPDT
K2	1	RELAY-SPST
K1	1	RELAY-TPDT
J1-3	3	PLUG-CONNECTOR
CR12	1	DIODE-400V (1R6054)
CR1,3-11,13-28,30	27	DIODE-400V (404)
CR29	1	DIODE - 400V (4D4)(-01,-03)
C12,9	2	CAPACITOR - TANT (47 MFD, 20V)
C11	1	CAPACITOR (.022 MFD, 400V)
C8,10	2	CAPACITOR (.15MFD, 100V)
C1-7	7	CAPACITOR-TANT (6.8MFD, 35V)

	DASH NO.	
VOLTAGE CONTROL	12V	32V
MDTA	-01	-02
DTA	-03	——

NOTE 1. USE CR29 FOR -01 & -03, USE R25 FOR -02.

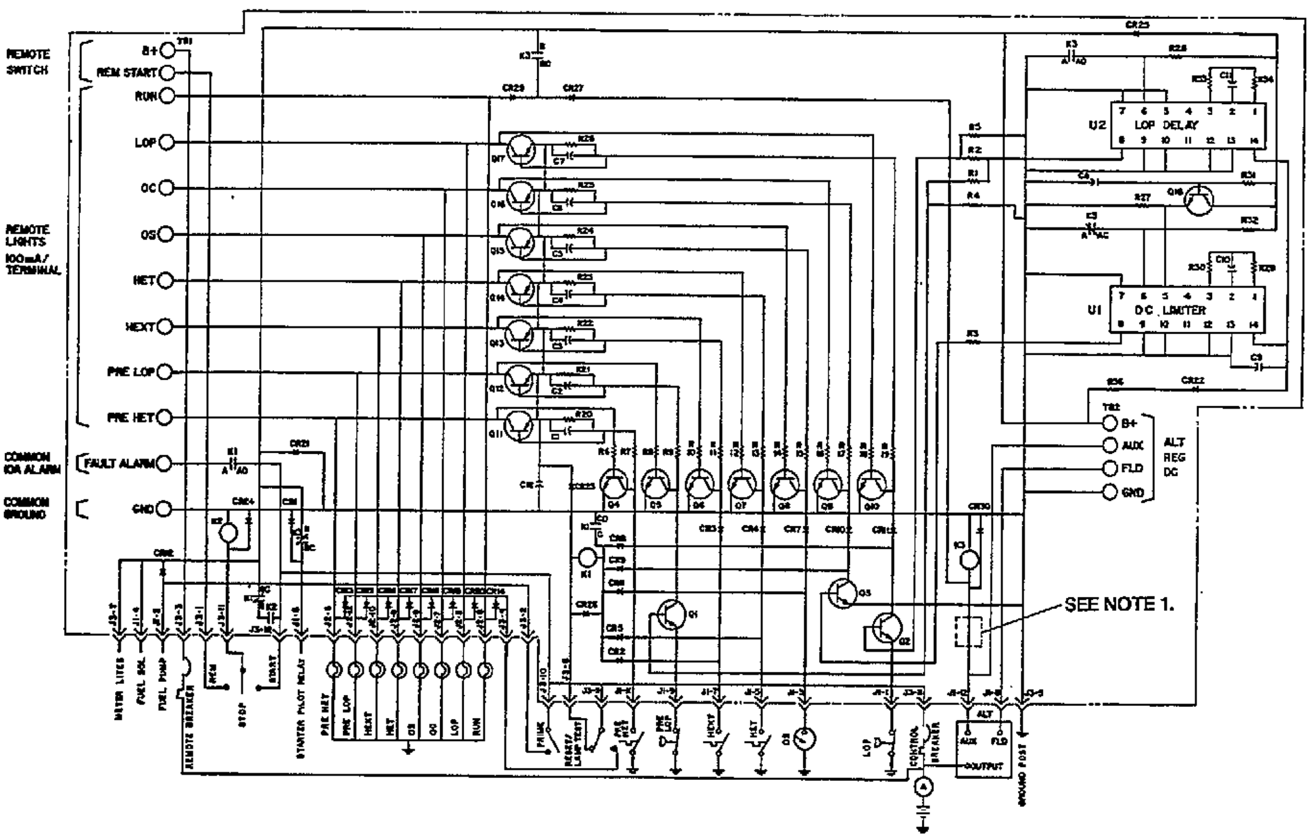


FIGURE 77. ENGINE MONITOR PCB SCHEMATIC 300-1896 (DTA/MDTA)

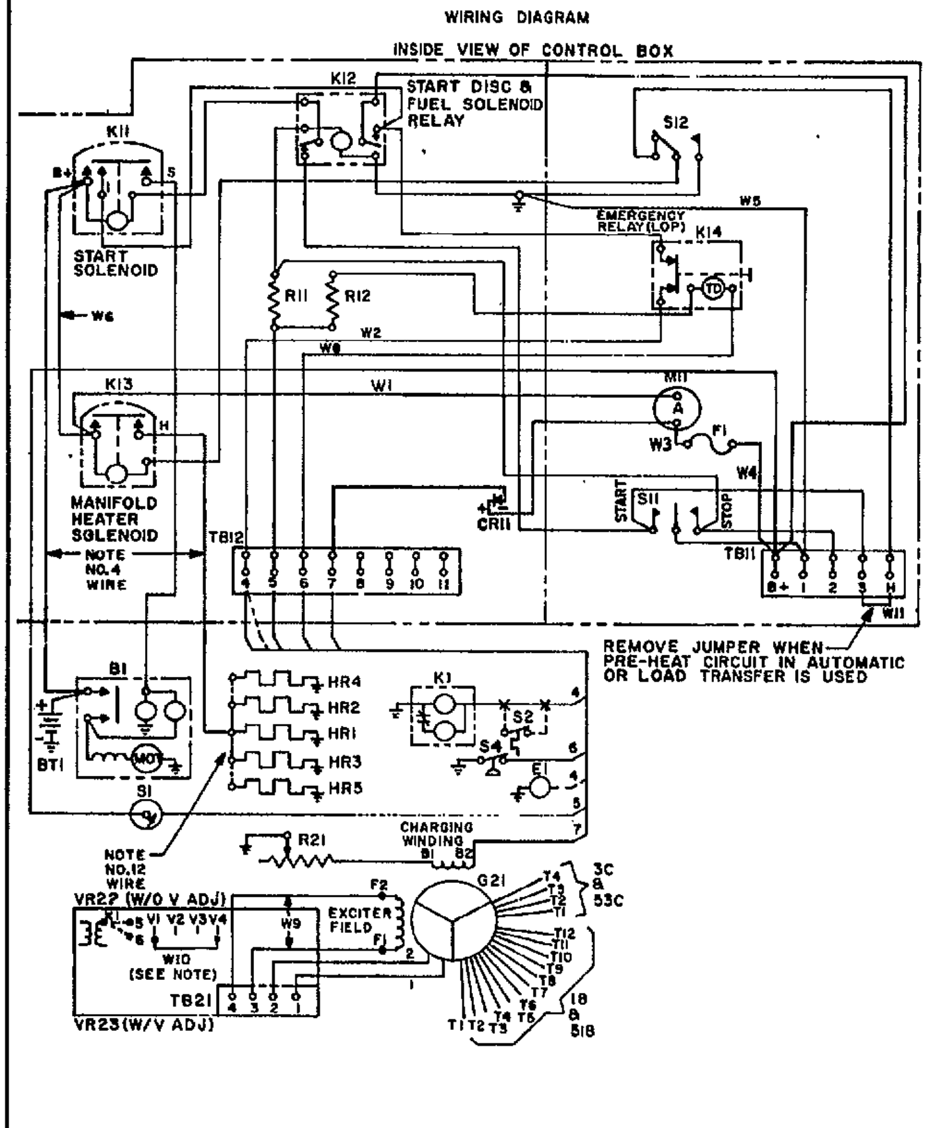


FIGURE 78. TYPICAL DIESEL ENGINE GENERATOR CONTROL WIRING DIAGRAM

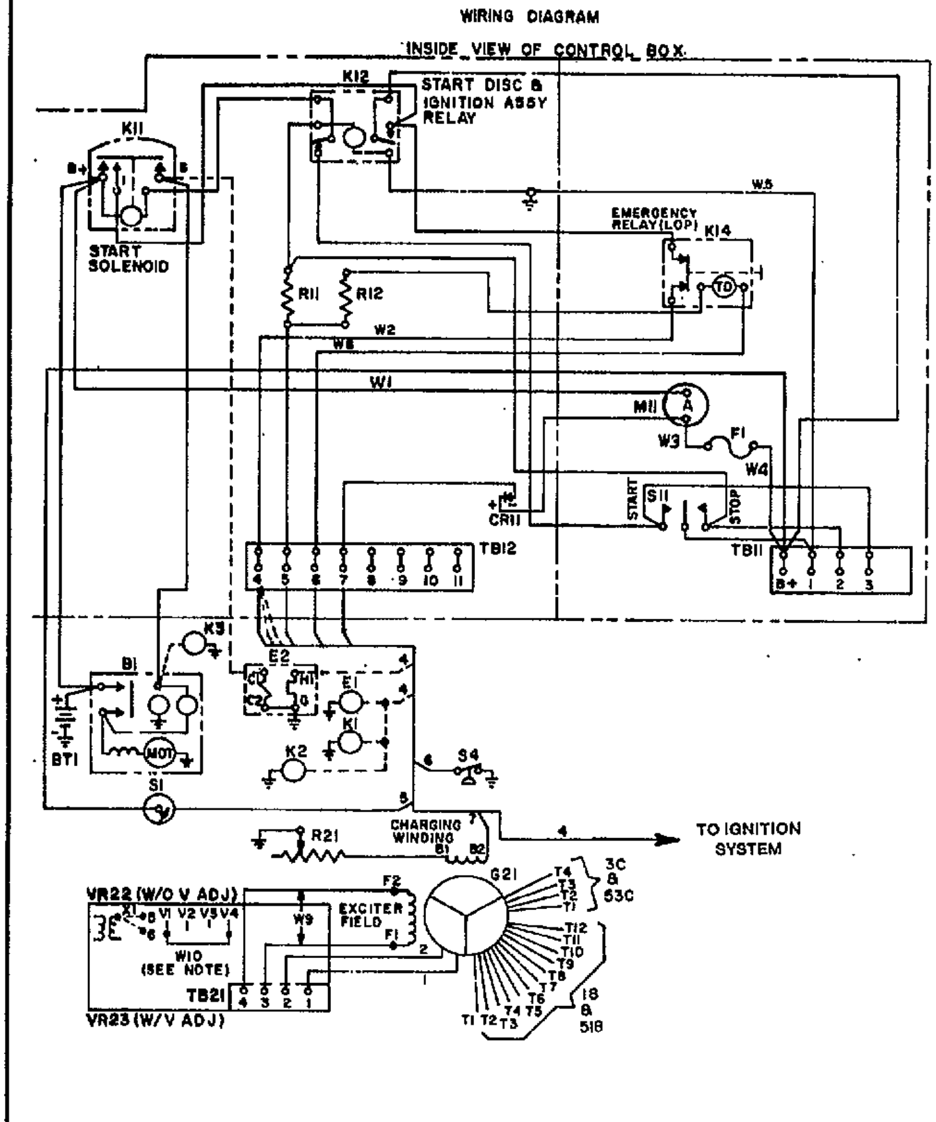


FIGURE 79. TYPICAL GASOLINE ENGINE GENERATOR CONTROL WIRING DIAGRAM

ENGINE CONTROL TROUBLESHOOTING

The data in this section is divided into three flow charts, and information on troubleshooting the DTA/MDTA solid-state control (page 69). The flow charts consist of:

A. Engine does not crank.

B. Engine cranks but does not start.

C. Engine starts but stops when start switch is released.

Before starting a troubleshooting procedure, make a few simple checks that may expose the problem and cut down on troubleshooting time.

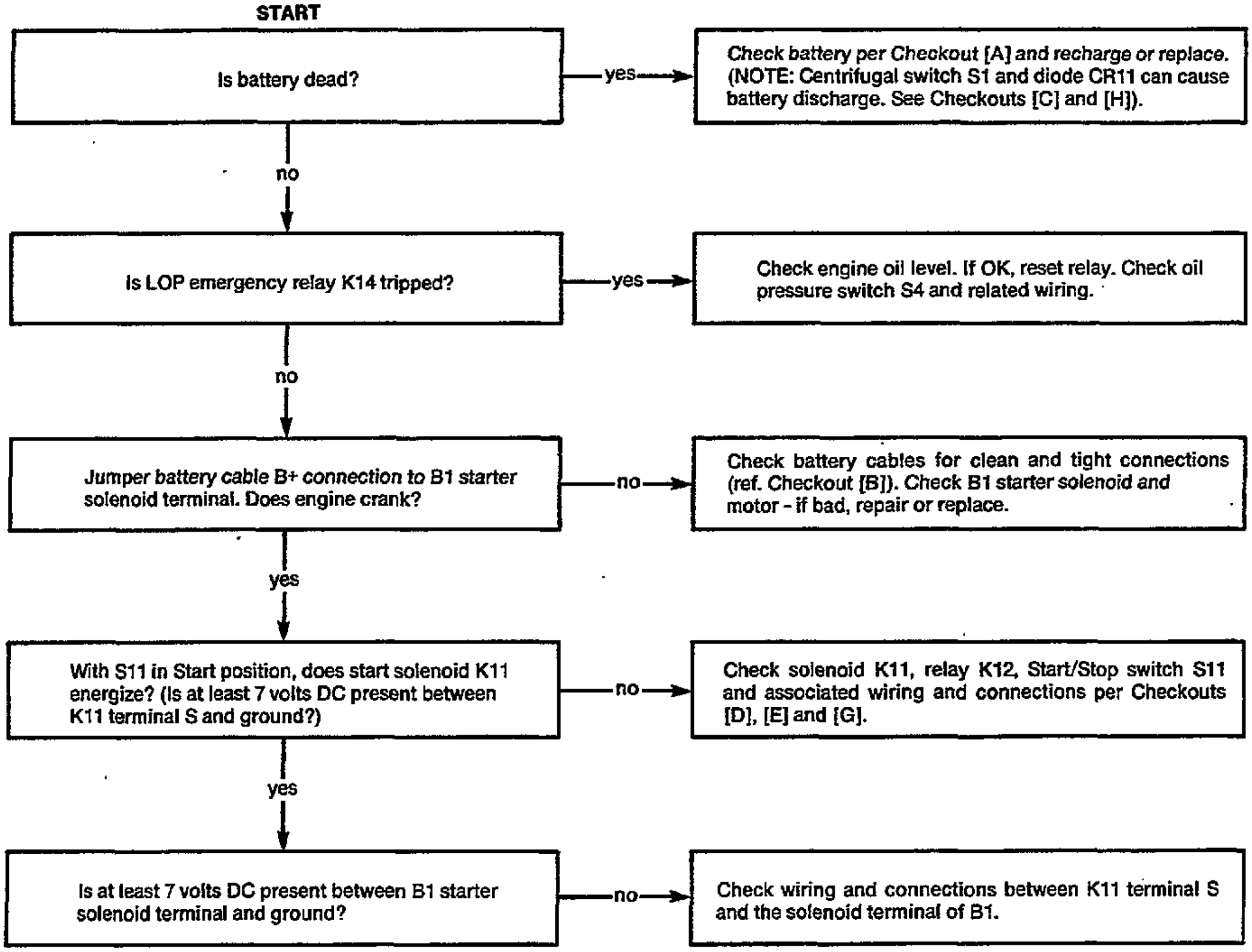
- Check all modifications, repairs, replacements performed since last satisfactory operation of set. A loose wire connection overlooked when installing a replacement part could cause problems. An incorrect connection, an opened switch or circuit breaker, or a loose plug-in are all potential problems that can be eliminated by a visual check.
- Unless absolutely sure that panel instruments are accurate, use portable test meters for troubleshooting.

To troubleshoot a problem, start at the upper-left corner of chart and answer all questions either YES or NO. Follow the chart until the problem is found, performing referenced Control Component Checkout procedures on page 70. Refer to typical wiring diagrams in Figures 78 and 79 for locating control component leads, terminals and other check points.

Check for correct voltage at terminal blocks as shown below. Measure voltage between terminal and ground, or as indicated.

TB11-B+	12 VDC
TB11-1	GROUND
TB11-2	12 VDC RUNNING
TB11-3	12 VDC STOPPED
TB11-H	12 VDC STOPPED
TB12-4	12 VDC RUNNING
TB12-5	12 VDC RUNNING
TB12-6	0-VDC STOPPED, 12 VDC RUNNING
TB12-7	19 to 21 VAC
TB21-1 to 2	120 to 139 VAC
K11-B+	12 VDC
K11-S	7 to 9 VDC ON CRANKING
K13-H	12 VDC ON PREHEAT

FLOW CHART A. ENGINE DOES NOT CRANK



FLOW CHART B. ENGINE CRANKS BUT DOES NOT START

DIESEL ENGINE

(Also see "Onan Diesel Starting Guide," page 71)

START

1. Does fuel transfer pump E1 and solenoid K1 operate when S11 is in Start position?
   - no → Check relays K11, K12 and K14 per Checkouts [D] and [E]. Check wiring. Replace transfer pump E1 if defective.
   - yes ↓
2. Is engine getting fuel? (Exhaust smoke should be blue-white, and fuel flow steady from fuel return line.)
   - no → Check fuel supply system: fuel tank, shutoff valves, fuel lines and connections, fuel filters and pumps.
   - yes ↓
3. Is preheat system operating properly?
   - no → Check heater solenoid K13 and switch S12 per Checkouts [D] and [G]. Check wiring and heater elements.
   - yes ↓
4. Incorrect fuel? (See Operator's Manual recommendations.)

GASOLINE ENGINE

START

1. Does fuel primer solenoid K3 energize when S11 is in Start position?
   - no → Check solenoid K3 and related wiring. Repair or replace as needed.
   - yes ↓
2. Is carburetor choke operation proper?
   - no → Check electric choke components and wiring (if used). Adjust per Operator's Manual instructions.
   - yes ↓
3. Is ample spark ignition voltage available at spark plugs?
   - no → Check ignition components: points, condenser, plugs, distributor, wiring, and HETCO. Battery voltage must appear at coil during cranking.
   - yes ↓
4. Is fuel pump OK? Does fuel pulsate from line removed at carburetor?

   WARNING Use extreme care for this test. Run fuel into a suitable container and make sure area is well ventilated to prevent an explosion or fire and resulting personal injury or death.

   - no → Check fuel supply system: fuel tank, shutoff valves, fuel lines and connections, fuel filters and pumps.

FLOW CHART C. ENGINE STARTS BUT STOPS WHEN START SWITCH IS RELEASED

START

1. Connect voltmeter from TB12-5 to ground. Is battery voltage indicated as engine rpm increases?
   - no → Check centrifugal switch S1 and related wiring. S1 should close at about 900 rpm and connect battery B+ to TB12-5.
   - yes ↓
2. Connect voltmeter to other side of resistor R11 (either at relay K12 or Stop terminal of S11). Is battery voltage read at rpm increase?
   - no → Check resistor R11 per Checkout [F]. If OK, check relay K12, switch S11 and related wiring for short to ground.
   - yes ↓
3. Jumper normally open contacts of relay K12. Does engine start and run?
   - no → Check wire between relay K12 and ammeter M11.
   - yes ↓
4. Replace relay K12.

TROUBLESHOOTING DTA/MDTA DC ENGINE CONTROL

Refer to Control Operation and the schematic in Figure 76 when troubleshooting this control. Repair information is not extensive since the solid-state printed circuit board lends itself more to replacement than repair. External components such as leads, switches, indicator lights, relays, gauge senders, circuit breakers, DC voltage regulator, etc., plug into the board.

If an external component is suspected of causing a problem, disconnect its associated jack (J1, J2 or J3) from the board (Figure 80) and check continuity of wiring and the component. Note some switches are NC and some NO with unit at rest. Individual components can be checked out simularily as referenced in "Control Component Checkout" on page 70.

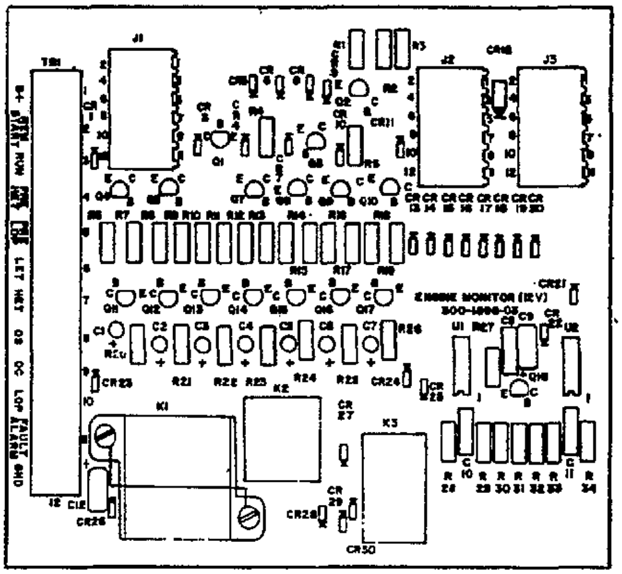


FIGURE 80. LOCATION OF JACKS AND RELAYS ON ENGINE MONITOR BOARD 300-1896

CONTROL COMPONENT CHECKOUT

The following component checkouts are referenced in the Control Troubleshooting flow charts, pages 67 to 69. They are an aid to isolating circuit problems caused by faulty engine control components.

[A]

BATTERY CHECKOUT

Check charge condition of the battery with a hydrometer. The electrolyte specific gravity should be about 1.260 for a fully charged battery at 80° F (27° C). If not, add approved water to keep electrolyte at proper level and recharge the battery. If battery will not recharge, replace it.

If the battery loses excess water, the generator charge rate may be set too high. Likewise, if battery state of charge is not maintained, the charge rate may be too low. Set charge rate per Adjustment Procedure **[C]** in the Generator Troubleshooting section (page 10).

[B]

BATTERY CABLE CHECKOUT

With the starter motor operating, check the voltage drops (1) from the battery negative post (not the cable clamp) to the cylinder block, (2) from the battery positive post to the battery terminal stud on the solenoid. Normally, each of these should be less than 0.3 volt. If extra long battery cables are used, slightly higher voltage drops may result. Thoroughly clean all connections in any part of the circuit showing excessive voltage drop.

[C]

RECTIFIER CHECKOUT

Disconnect one lead from, or remove, each rectifier for its individual test.

CAUTION **Note carefully the direction of mounting of any rectifier removed. It must be remounted in its original direction.**

1. Connect the ohmmeter across the rectifier contacts and observe the meter reading.
2. Reverse the connections and compare the new reading with the first reading.
3. If one reading is considerably higher than the other reading, the rectifier can be considered satisfactory. However, if both readings are low, or if both indicate an "open" circuit, replace the rectifier with a new identical part.

[D]

SOLENOID CHECKOUT

1. Apply 12 volts to battery terminal.
2. Jumper a ground wire to terminal marked "S." Solenoid should activate.
3. If contacts are good, 12 volts should be read between terminal S1 and ground. The voltage drop measured across contacts should never exceed 1 volt in circuit application.

[E]

RELAY CHECKOUT

1. Connect 12 volts across relay coil terminals. Relay should activate if coil is okay.
2. Connect a 12-volt source to one side of relay contacts.
3. Connect a voltmeter to other side of relay contact and 12-volt source. If 12 volts appears when relay is energized, contact is okay. The 12-volt reading appears in reverse order when checking normally closed (NC) contacts.

[F]

RESISTOR CHECKOUT

1. Remove battery B+ cable.
2. Disconnect one side of resistor and using an ohmmeter measure across resistor for an accurate reading.

[G]

SWITCH CHECKOUT

1. Remove battery B+ cable.
2. Place ohmmeter leads across switch.
3. Activate switch. If meter reads continuity, switch is good.

[H]

CENTRIFUGAL SWITCH CHECKOUT

The start-disconnect switch is located on the gear cover on the side of the engine above the oil filter. The switch opens when the engine stops and closes when the engine speed reaches about 900 rpm. Check the switch contacts for pitting. If necessary, loosen the stationary contact and adjust the point gap at 0.020 inch (0.51 mm). Replace burned or faulty points.

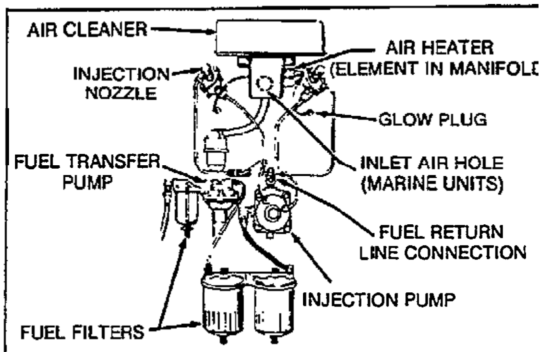
ONAN DIESEL STARTING GUIDE

IMPORTANT!

KEEP ENTIRE FUEL SYSTEM CLEAN AND FREE FROM WATER
- DIESEL INJECTION PUMPS WILL FAIL IF SYSTEM CLEANLINESS IS NEGLECTED

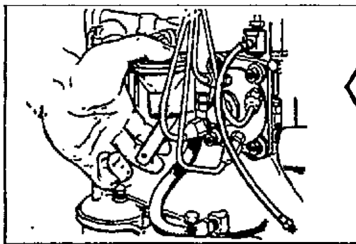
INJECTION PUMPS AND NOZZLES ARE NOT FIELD REPAIRABLE
- WHEN TROUBLESHOOTING, CHECK ALL OTHER COMPONENTS FIRST

WARNING DO NOT USE ETHER STARTING AIDS! ETHER IS EXTREMELY EXPLOSIVE AND MAY CAUSE SERIOUS PERSONAL INJURY. ENGINE DAMAGE IS ALSO LIKELY.



BEFORE STARTING:

CHECK FUEL SUPPLY. BE SURE SHUTOFF VALVES ARE OPEN.



PRIME FUEL SYSTEM IF: FUEL FILTERS WERE DRAINED OR CHANGED, SYSTEM WAS JUST INSTALLED, FUEL TANK RAN DRY.

TO PRIME PUMP. MOVE PRIMING LEVER UP AND DOWN UNTIL FUEL FLOWS STEADILY FROM RETURN LINE (DISCONNECTED).

PREHEAT

PREHEAT COLD ENGINE: PUSH PREHEAT SWITCH AND HOLD —
- 30 SECONDS IF ABOVE 55°F (13°C);
- 60 SECONDS IF BELOW 55°F (13°C).

TO START:

PREHEAT — RELEASE PREHEAT

START / STOP — ENGAGE START SWITCH

LIMIT CRANKING TO 15 TO 20 SECONDS TO CONSERVE BATTERY. ALLOW 1 MINUTE BEFORE RE-CRANKING.

IF ENGINE DOES NOT START:

IF ENGINE FIRED, REPEAT ABOVE PROCEDURES, INCLUDING PREHEAT. IF IT STILL DOES NOT START, PROCEED AS FOLLOWS:

TEMPERATURES BELOW 32°F (0°C): USE NUMBER 1 DIESEL FUEL. USE CORRECT VISCOSITY OIL. KEEP BATTERIES FULLY CHARGED. DO NOT USE ETHER STARTING AID.

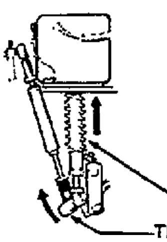
OBSERVE ENGINE EXHAUST "SIGNALS":

BLUE-WHITE EXHAUST SMOKE: ENGINE IS GETTING FUEL

CHECK PREHEAT SYSTEM:
1. OBSERVE AIR HEATER THRU AIR INLET HOLE OR BY REMOVING AIR CLEANER.
2. ENGAGE PREHEAT.
3. IF HEATER ELEMENT DOES NOT GLOW RED WITHIN 30 SECONDS, CHECK AIR HEATER AND GLOW PLUG WIRING:
   - CONNECTIONS TIGHT?
   - FREE FROM CORROSION?

LITTLE OR NO EXHAUST SMOKE: ENGINE IS NOT GETTING FUEL. PRIME FUEL SYSTEM AS SHOWN ABOVE: OBSERVE FUEL FLOW FROM RETURN LINE

FUEL FLOWS STEADILY



CHECK FUEL SOLENOID:
SOLENOID ROD SHOULD PULL IN AND THROTTLE ARM FOLLOW (AS SHOWN) WHEN START SWITCH IS TURNED ON. IF NOT, CHECK FOR
- BINDING LINKAGE
- LOOSE OR BROKEN WIRES

LITTLE OR NO FUEL FLOW

CHECK FUEL SUPPLY SYSTEM:
- FUEL TANK EMPTY?
- SHUTOFF VALVES CLOSED?
- FUEL LINES KINKED?
- LOOSE CONNECTIONS?
- CLOGGED FUEL FILTERS?

IF ENGINE IS STILL NOT GETTING FUEL, CHECK TRANSFER PUMP:
1. CRANK ENGINE AND OBSERVE FUEL FLOW FROM RETURN LINE.
2. IF FUEL DOES NOT SPURT OUT. PUMP MAY BE DEFECTIVE.

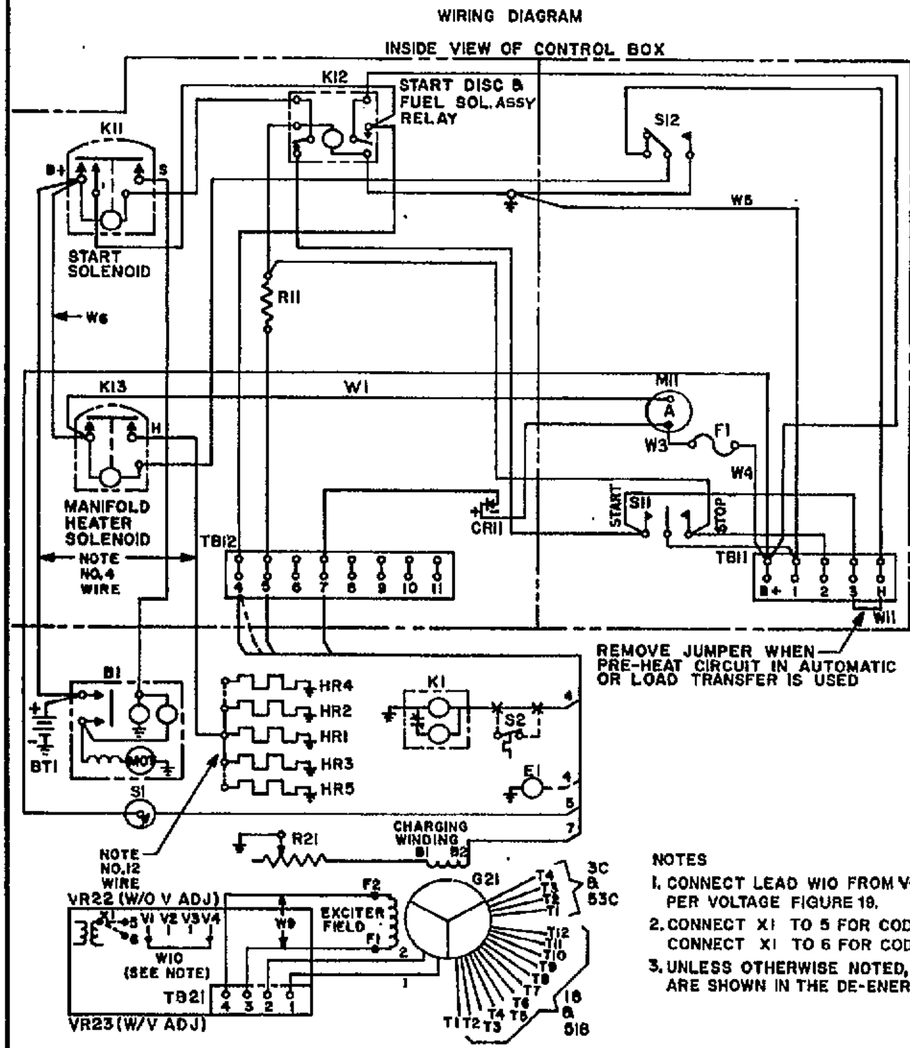
2-79 900-0217

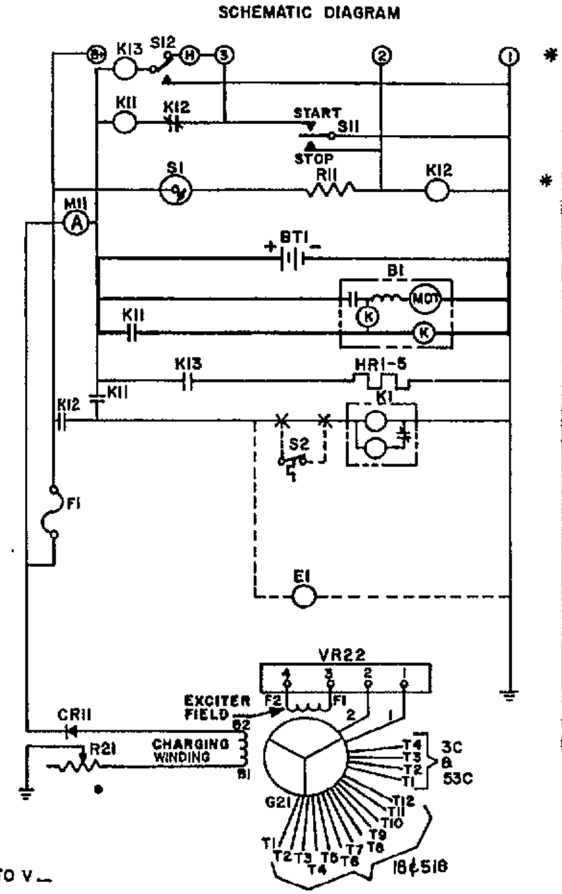
IF ENGINE STILL DOES NOT START, CONTACT AUTHORIZED ONAN SERVICE REPRESENTATIVE

WIRING DIAGRAMS

The wiring and schematic diagrams in this section represent typical air-cooled, marine, and radiator cooled engine driven YD generator sets. Wiring diagrams for special order generator sets are shipped with the units and should be referred to whenever possible.

NOTE: Special order generator sets with optional specification codes such as, 4R-,4XR-, and 5DR - 60 Hertz; 5R and 55R - 50 Hertz; and many others are basic 18R - 60 Hertz or 518R - 50 Hertz and 3C - 60 Hertz or 53C - 50 Hertz generators. Optional meter equipment and voltage output capabilities change the specification codes of these units and each wiring arrangement is slightly different.





PARTS LIST (REF)

REF. DES.	DESCRIPTION
B1	STARTER & SOLENOID
BT1	BATTERY 12V
E1	FUEL PUMP
HR1	HEATER-MANIFOLD
HR2,3	HEATER-GLOW PLUG (2 CYL)
HR2-5	HEATER-GLOW PLUG (4 CYL)
K1	SOLENOID-FUEL
S1	SWITCH-CENTRIFUGAL
S2	SWITCH-HIGH TEMP
G21	GENERATOR
R21	RESISTOR ASSY
VR22	REGULATOR ASSY-VOLTAGE (W/O V ADJ) -01,-02,-05,-06
VR23	REGULATOR ASSY-VOLTAGE (W/V ADJ) -03,-04,07,08
W9	WIRING HARNESS (F1-F2)
CR11	RECTIFIER & LEAD ASSY
F1	FUSE - 10 AMP
K11	RELAY-START SOLENOID
K12	RELAY-START DISC & FUEL SOL.ASSY
K13	RELAY-MANIFOLD HEATER
M11	AMMETER-CHARGE 5-0-5
R11,S11	SWITCH & RESISTOR ASSY
S12	SWITCH & LEAD ASSY
TB11	TERMINAL BLOCK
TB12	TERMINAL BLOCK
W1	LEAD ASSY
W3	LEAD ASSY
W4	LEAD ASSY
W5	LEAD ASSY
W6	JUMPER
W11	JUMPER

* WHEN USED

NOTES

1. CONNECT LEAD W10 FROM V4 TO V__ PER VOLTAGE FIGURE 19.
2. CONNECT X1 TO 5 FOR CODE 53C & 518(50HZ)
   CONNECT X1 TO 6 FOR CODE 3C & 18(60HZ)
3. UNLESS OTHERWISE NOTED, ALL COMPONENTS ARE SHOWN IN THE DE-ENERGIZED POSITION.

AIR-COOLED

DJB AND DJC MODELS

DIESEL

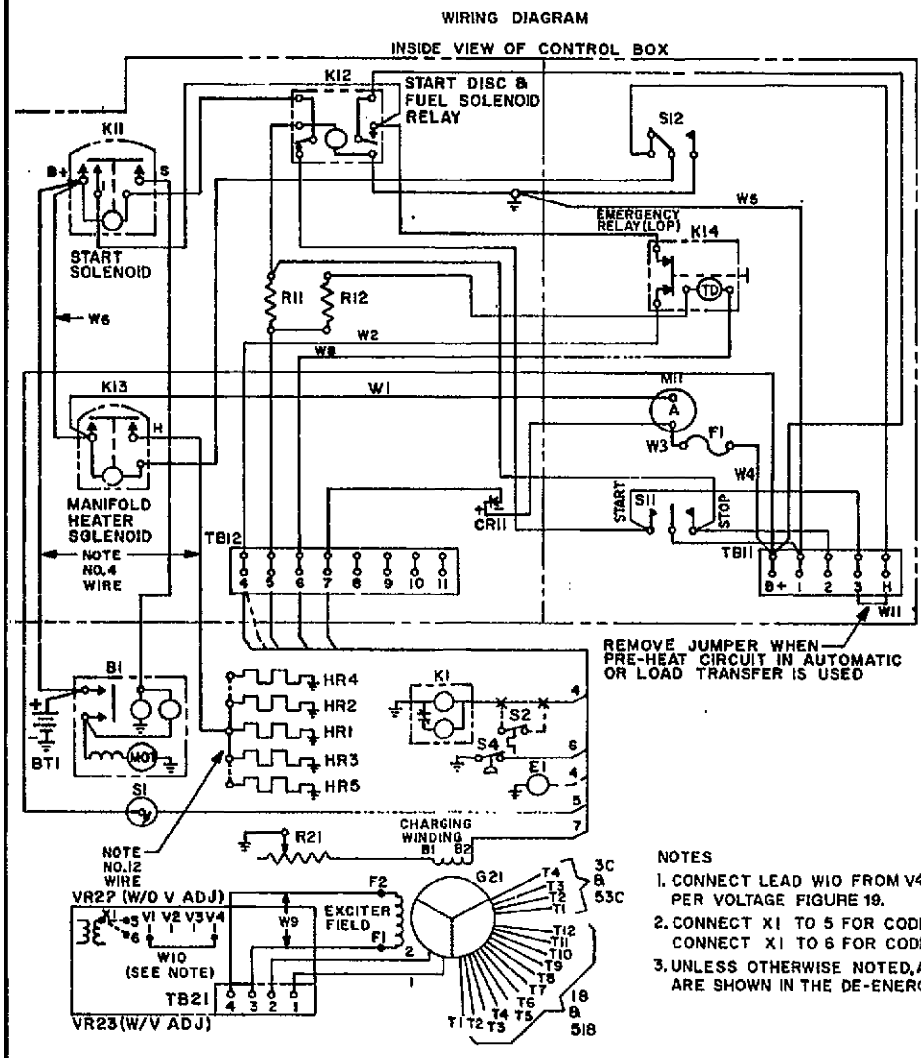
MODEL NO.
4.5 & 9.0KW-53CR/1AA
4.5 & 9.0KW-518R/1AA
6.0 & 12.0KW-3CR/1AA
6.0 & 12.0KW-18R/1AA
1&3PH, 50 & 60HZ

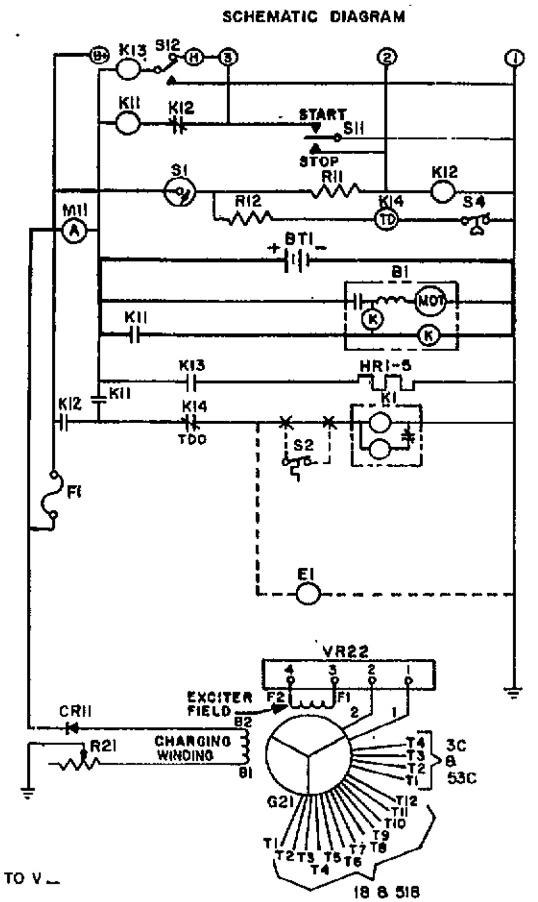
Onan DIVISION OF STUDEBAKER CORPORATION Minneapolis, Minnesota

DATE 6-5-73 DR. CIP CHK. GSK

NAME CONTROL-GEN SET (WIRING DIAGRAM)

DWG NO 612-4791 DWG SIZE C





PARTS REFERENCE

REF. DES.	DESCRIPTION
B1	STARTER & SOLENOID
BT1	BATTERY 12V
* E1	FUEL PUMP
HR1	HEATER-MANIFOLD
HR2,3	HEATER-GLOW PLUG (2 CYL)
HR2-5	HEATER-GLOW PLUG (4 CYL)
K1	SOLENOID-FUEL
S1	SWITCH-CENTRIFUGAL
* S2	SWITCH-HIGH TEMP
S4	SWITCH-LOW OIL PRESS
G21	GENERATOR
R21	RESISTOR ASSY
VR22	REGULATOR ASSY-VOLTAGE (W/O V ADJ) -01,-02,-05,-06,-09,-10
VR23	REGULATOR ASSY-VOLTAGE (W/V ADJ) -03,-04,-07,-08,-11,-12
W9	WIRING HARNESS (F1-F2)
CR11	RECTIFIER
F1	FUSE - 10 AMP
K11	RELAY-START SOLENOID
K12	RELAY
K13	RELAY-MANIFOLD HEATER
K14	RELAY-EMERGENCY (LOP)
M11	AMMETER-CHARGE 5-0-5
R11,S11	SWITCH & RESISTOR ASSY
R12	RESISTOR
S12	SWITCH
TB11	TERMINAL BLOCK
TB12	TERMINAL BLOCK
W1	LEAD ASSY
W2	LEAD ASSY
W3	LEAD ASSY
W4	LEAD ASSY
W5	LEAD ASSY
W6	JUMPER
W8	LEAD ASSY
W11	JUMPER

NOTES

1. CONNECT LEAD W10 FROM V4 TO V_ PER VOLTAGE FIGURE 19.
2. CONNECT X1 TO 5 FOR CODE 53C & 518(50HZ)
   CONNECT X1 TO 6 FOR CODE 3C & 18(60HZ)
3. UNLESS OTHERWISE NOTED, ALL COMPONENTS ARE SHOWN IN THE DE-ENERGIZED POSITION.

* WHEN USED

MODEL NO. (DIESEL)
4.5 & 9.0KW-53CR/96AA
4.5 & 9.0KW-518R/96AA
6.0 & 12.0KW-3CR/96AA
6.0 & 12.0KW-18R/96AA
6.0,10.0 & 12.0KW-53CR/IAA
6.0,10.0 & 12.0KW-518R/IAA
7.5,12.0 & 15.0KW-3CR/IAA
7.5,12.0 & 15.0KW-18R/IAA
1 & 3 PH.50 & 60HZ

MARINE

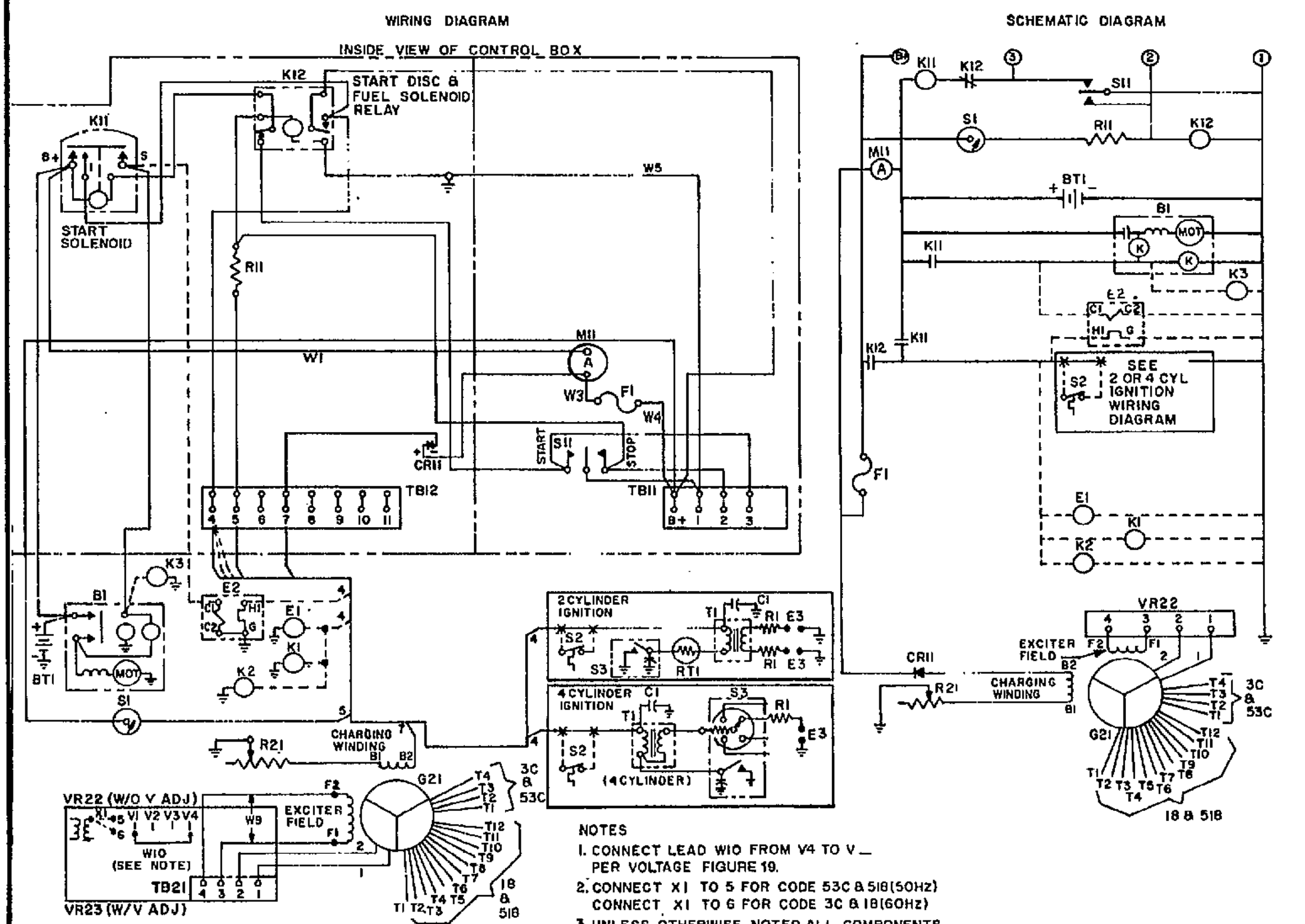
Onan DIVISION OF STUDEBAKER CORPORATION, Minneapolis, Minnesota
12-20-77 KJR

CONTROL-GEN SET (WIRING DIAGRAM)

612-4792

DWG SIZE

DJB, DJC, DJE, MDJC, MDJE, AND MDJF MODELS WITH LOW OIL PRESSURE SWITCH



NOTES

1. CONNECT LEAD W10 FROM V4 TO V__ PER VOLTAGE FIGURE 19.
2. CONNECT X1 TO 5 FOR CODE 53C & 518 (50Hz)
   CONNECT X1 TO 6 FOR CODE 3C & 18 (60Hz)
3. UNLESS OTHERWISE NOTED, ALL COMPONENTS ARE SHOWN IN THE DE-ENERGIZED POSITION.

PARTS LIST (REF)

REF DES	DESCRIPTION
B1	STARTER & SOLENOID-ENGINE
BT1	BATTERY 12V
* E1	FUEL PUMP
* E2	CHOKE & THERMO MAG
E3	SPARK PLUG (2 CYL)
E3	SPARK PLUG (4 CYL)
* K1	SOLENOID-FUEL
* K2	SOLENOID-DAY TANK FUEL
* K3	SOLENOID-PRIMER
R1	RESISTOR-SPARK PLUG (2CYL)
R1	RESISTOR-SPARK PLUG (4CYL)
RT1	RES-HYTEMCO 1.72 Ω, 25W (2CYL)
S1	SWITCH-CENTRIFUGAL
* S2	SWITCH-HIGH TEMP
S3	BREAKER ASSY
T1	COIL-IGNITION
G21	GENERATOR
R21	RESISTOR ASSY
VR22	REGULATOR ASSY-VOLTAGE W/O V ADJ-01,-02,-05,-06,-09,-10
VR23	REGULATOR ASSY-VOLTAGE W/V ADJ -03,-04,-07,-08,-11,-12
W9	WIRING HARNESS (F1-F2)
CR11	RECTIFIER & LEAD ASSY
F1	FUSE-10AMP
K11	RELAY-START SOLENOID
K12	RELAY & LEAD ASSY
M11	AMMETER-CHARGE 5-0-5
R11, S11	SWITCH & RESISTOR ASSY
TB11	TERMINAL BLOCK
TB12	TERMINAL BLOCK
W1	LEAD ASSY
W3	LEAD ASSY
W4	LEAD ASSY
W5	LEAD ASSY

* WHEN USED

GASOLINE

MODEL NO.
6.0-12.5KW-53CR/1AA
6.0-12.5KW-518R/1AA
7.5-15.0KW-3CR/1AA
7.5-15.0KW-18R/1AA

1&3PH, 50 & 60HZ

Onan

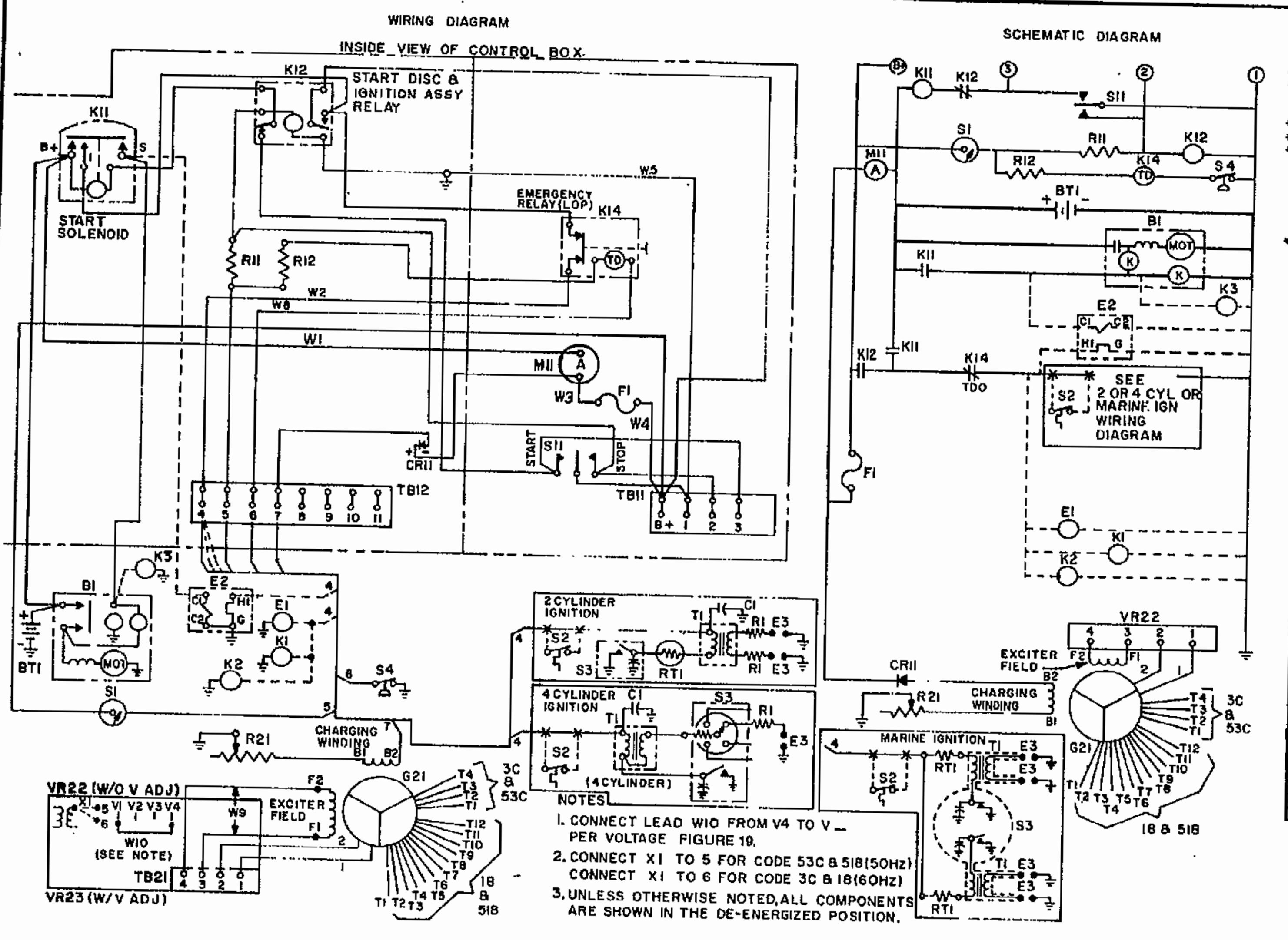
6-8-73 | CIP

CONTROL-GEN SET (WIRING DIAGRAM)

612-4793

DWG SIZE C

AIR COOLED
JB AND JC MODELS



NOTES

1. CONNECT LEAD W10 FROM V4 TO V__ PER VOLTAGE FIGURE 19.
2. CONNECT X1 TO 5 FOR CODE 53C & 518 (50Hz)
   CONNECT X1 TO 6 FOR CODE 3C & 18 (60Hz)
3. UNLESS OTHERWISE NOTED, ALL COMPONENTS ARE SHOWN IN THE DE-ENERGIZED POSITION.

PARTS LIST (REF)

REF DES	DESCRIPTION
B1	STARTER & SOLENOID-ENGINE
BT1	BATTERY 12V
E1	FUEL PUMP
E2	CHOKE & THERMO MAG
E3	SPARK PLUG (2 CYL)
E3	SPARK PLUG (4 CYL)
K1	SOLENOID-FUEL
K2	SOLENOID-DAY TANK FUEL
K3	SOLENOID-PRIMER
R1	RESISTOR-SPARK PLUG (2CYL)
R1	RESISTOR-SPARK PLUG (4CYL)
RT1	RES-HYTEMCO 1.72 Ω, .25W (2CYL)
RT1	RES-HYTEMCO 1.72 Ω, .25W (MARINE)
S1	SWITCH-CENTRIFUGAL
S2	SWITCH-HIGH TEMP
S3	BREAKER ASSY
S4	SWITCH-LOW OIL PRESS
T1	COIL-IGNITION
G21	GENERATOR
R21	RESISTOR ASSY
VR22	REGULATOR ASSY-VOLTAGE W/O V ADJ)-01,-02,-05,-06,-09,-10,-13,-14
VR23	REGULATOR ASSY-VOLTAGE W/V ADJ)-03,-04,-07,-08,-11,-12,-15,-16
W9	WIRING HARNESS (F1-F2)
CR11	RECTIFIER & LEAD ASSY
F1	FUSE-10 AMP
K11	RELAY-START SOLENOID
K12	RELAY/LEAD ASSY
K14	RELAY-EMERGENCY (LOP)
M11	AMMETER-CHARGE 5-0-5
R11, S11	SWITCH & RESISTOR ASSY
R12	RESISTOR & LEAD ASSEMBLY
TB11	TERMINAL BLOCK
TB12	TERMINAL BLOCK
W1	LEAD ASSY
W2	LEAD ASSY
W3	LEAD ASSY
W4	LEAD ASSY
W5	LEAD ASSY
W8	LEAD ASSY

* WHEN USED

GASOLINE

MODEL NO.
6.0-12.5KW-53CR/96AA
6.0-12.5KW-518R/96AA
7.5-15.0KW-3CR/96AA
7.5-15.0KW-18R/96AA
MARINE 10.0-15.0KW-3CR/1AA
10.0-15.0KW-18R/1AA

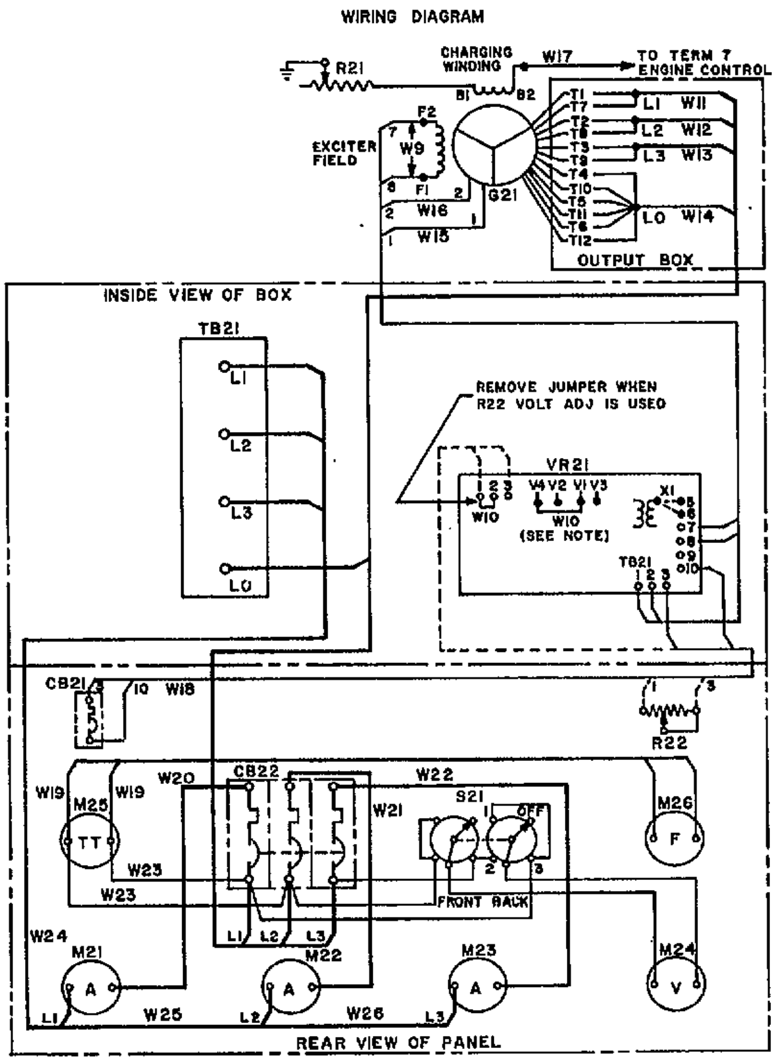
183PH, 50 & 60HZ

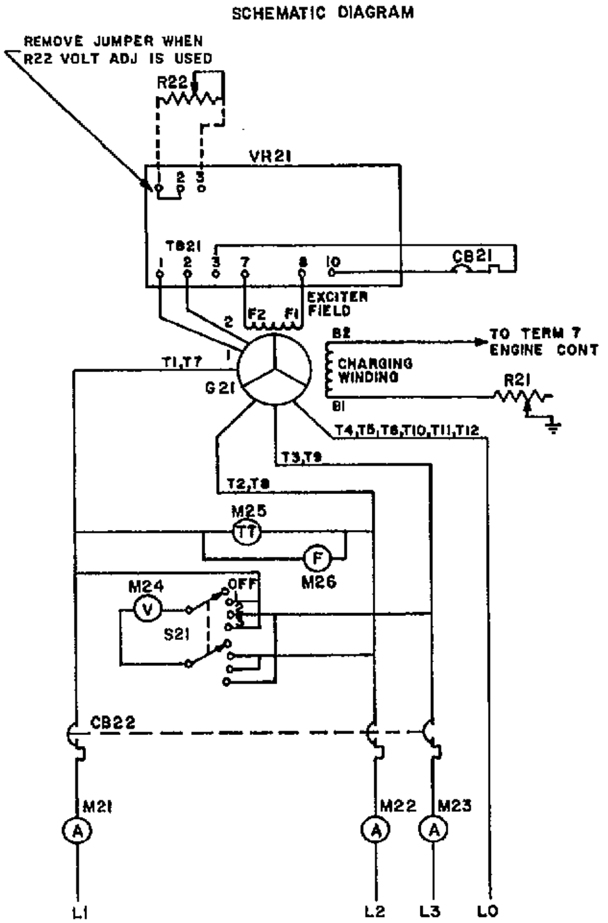
Onan — 1-10-78 — KJR — CIP

CONTROL-GEN SET (WIRING DIAGRAM)

612-4794 — DWG SIZE C

JB, JC, AND MJC MODELS WITH LOW OIL PRESSURE SWITCH

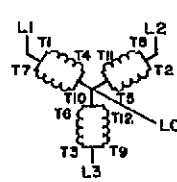




PARTS LIST

REF. DES.	DESCRIPTION
CB21	CIRCUIT BREAKER
CB22	CIRCUIT BREAKER 45A (12.5KW)
	CIRCUIT BREAKER 50A (14.5KW)
	CIRCUIT BREAKER 55A (15.0KW)
	CIRCUIT BREAKER 65A (17.5KW)
G21	GENERATOR
M21-23	AMMETER-AC 0-50A (12.5KW)
	AMMETER-AC 0-80A (14.5-17.5KW)
M24	VOLTMETER-AC 0-300V
M25	METER-RUNNING TIME 50Hz
	METER-RUNNING TIME 60Hz
M26	METER-FREQUENCY 50Hz
	METER-FREQUENCY 60Hz
R21	RESISTOR ASSY
R22	RHEOSTAT ASSY -11 THRU -20
S21	SWITCH & LEADS (VM SEL)
TB22	TERMINAL BLOCK
VR21	REGULATOR ASSY-VOLTAGE
W9	WIRING HARNESS (F1-F2)
W11	LEAD ASSY (L1)
W12	LEAD ASSY (L2)
W13	LEAD ASSY (L3)
W14	LEAD ASSY (LO)
	SLEEVING
W15	LEAD ASSY (1) (HSD ONLY)
W16	LEAD ASSY (2) (HSD ONLY)
W17	LEAD ASSY (B2) (HSD ONLY)
W18	WIRING HARNESS
W19 THRU W26	LEAD ASSY

KW & Hz	UNHSD W/O V ADJ	HSD W/O V ADJ	UNHSD W/ V ADJ	HSD W/ V ADJ
12.5 60Hz	-01	-06	-11	-16
15.0 60Hz	-02	-07	-12	-17
17.5 60Hz	-03	-08	-13	-18
12.5 50Hz	-04	-09	-14	-19
14.5 50Hz	-05	-10	-15	-20



CODE 18 60Hz
120/208V V4-V1

CODE 518 50Hz
120/208V V4-V3

NOTES
1. CONNECT LEAD W10 FROM V4 TO V_ PER VOLTAGE CHART FIGURE 19.
2. CONNECT X1 TO 5 FOR CODE 518(50Hz)
CONNECT X1 TO 6 FOR CODE 18(60Hz)
3. UNLESS OTHERWISE NOTED, ALL COMPONENTS ARE SHOWN IN THE DE-ENERGIZED POSITION.

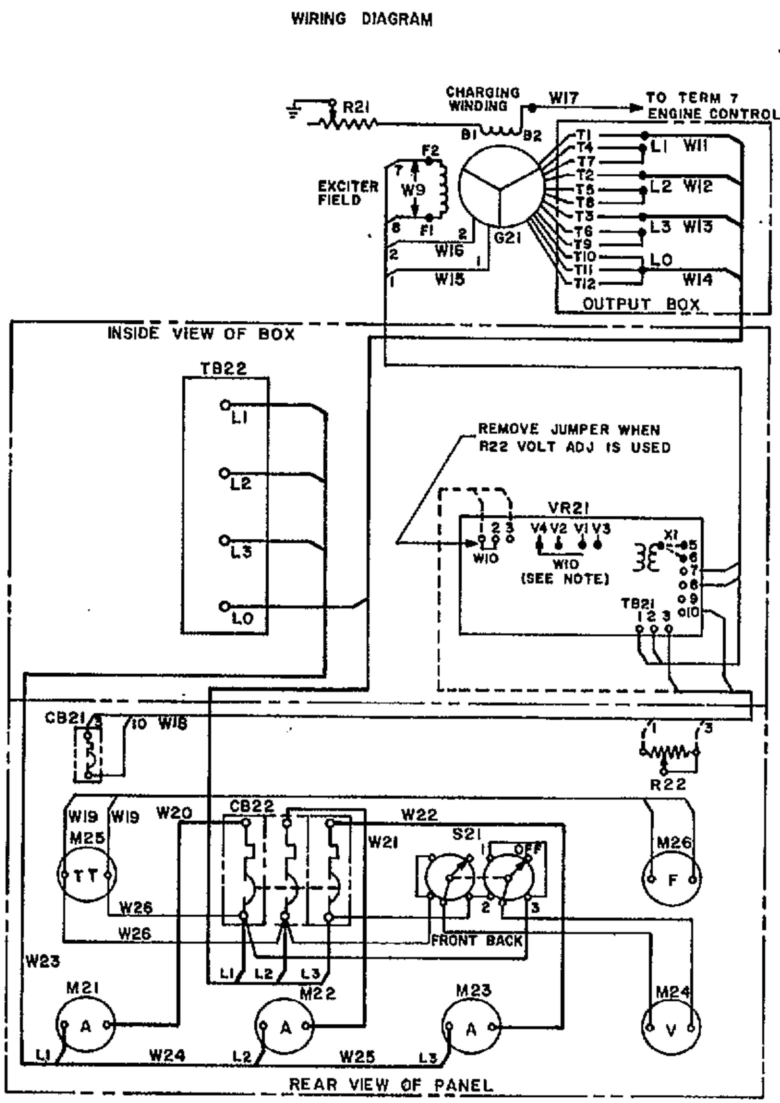
RJC
RDJF

RJC, AND RDJF MODELS

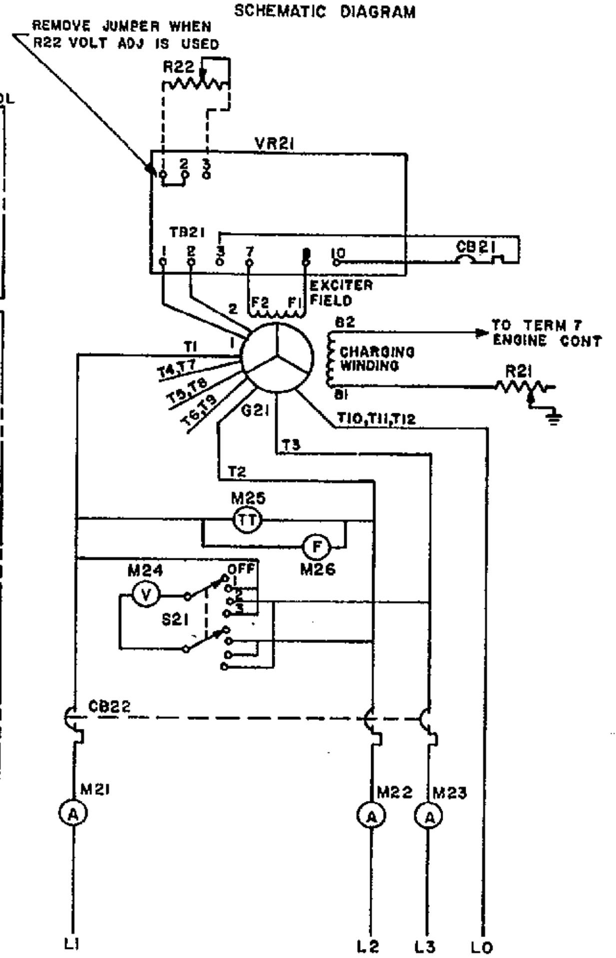
MODEL NO	12.5-14.5KW-54R/14AA 12.5-17.5KW-4R/14AA
	120/208V, 3PH, 4W, 50-60Hz
Onan	DIVISION OF STUDEBAKER CORPORATION
DATE	8-1-73 C.I.P.
NAME	CONTROL-GEN SET AC (WIRING DIAGRAM)
DWG NO	612-4816
DWG SIZE	C

Power Generation

WIRING DIAGRAM

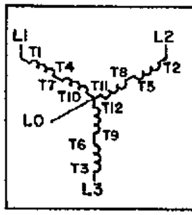


SCHEMATIC DIAGRAM



PARTS LIST	
REF. DES.	DESCRIPTION
CB21	CIRCUIT BREAKER
CB22	CIRCUIT BREAKER
G21	GENERATOR
M21-23	AMMETER-AC 0-30A (12.5-15.0KW)
	AMMETER-AC 0-35A (17.5KW)
M24	VOLTMETER-AC 0-600V
M25	METER-RUNNING TIME 50Hz
	METER-RUNNING TIME 60Hz
M26	METER-FREQUENCY 50Hz
	METER-FREQUENCY 60Hz
R21	RESISTOR ASSY
R22	RHEOSTAT ASSY -07 THRU -12
S21	SWITCH & LEADS (VM SEL)
TB22	TERMINAL BLOCK
VR21	REGULATOR ASSY-VOLTAGE
W11	LEAD ASSY (L1)
W12	LEAD ASSY (L2)
W13	LEAD ASSY (L3)
W14	LEAD ASSY (LO)
W15	LEAD ASSY (1) (HSD ONLY)
W16	LEAD ASSY (2) (HSD ONLY)
W17	LEAD ASSY (B2) (HSD ONLY)
W18	WIRING HARNESS
W19 THRU W26	LEAD ASSY

KW & Hz	UNHSD W/O V ADJ	HSD W/O V ADJ	UNHSD W/ V ADJ	HSD W/ V ADJ
12.5 60Hz	-01	-04	-07	-10
15.0 60Hz	-02	-05	-08	-11
17.5 60Hz	-03	-06	-09	-12



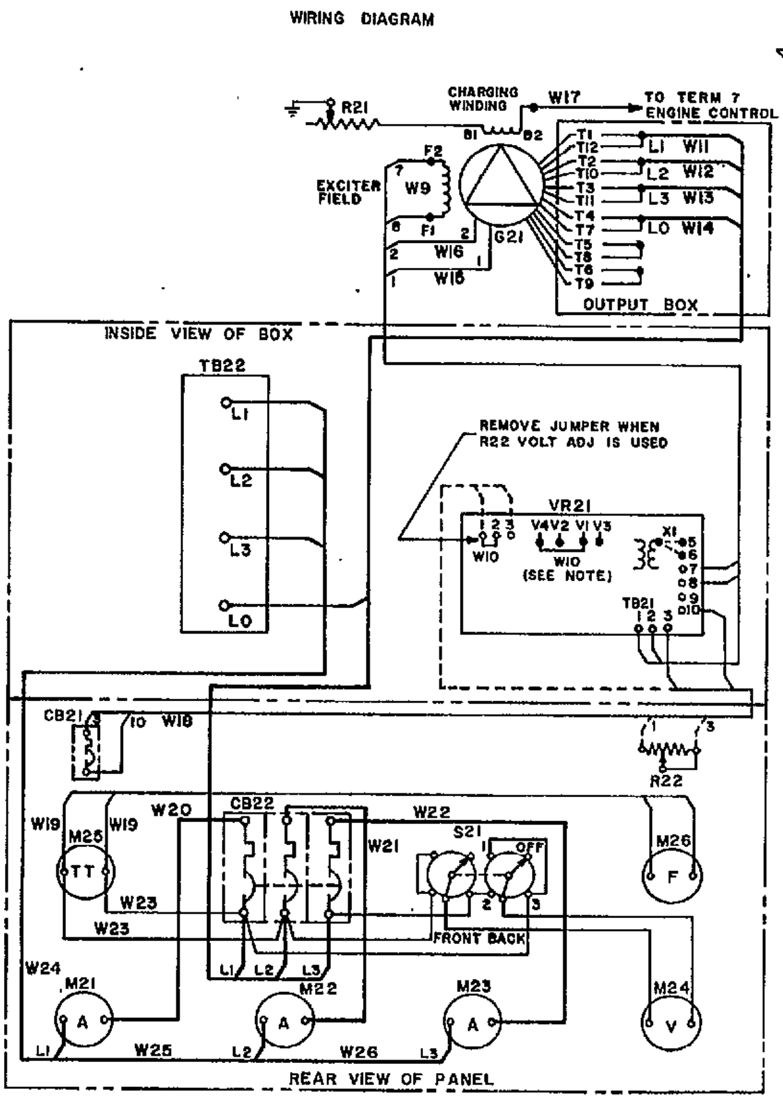
CODE 18 60Hz
277/480V V4-V4

NOTES
1. REMOVE LEAD W10 FROM V4 TO V... REFER TO FIGURE 19.
2. CONNECT X1 TO 6 FOR CODE 18 (60Hz)
3. UNLESS OTHERWISE NOTED, ALL COMPONENTS ARE SHOWN IN THE DE-ENERGIZED POSITION

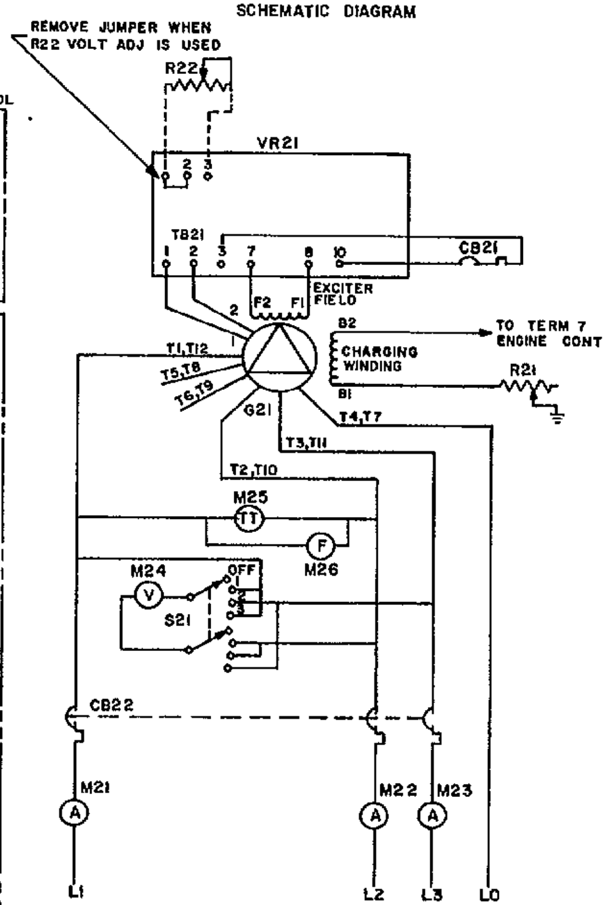
JC. RJC AND RDJF MODELS

PROD REL [signature] 8-21-73	Onan DIVISION OF STUDEBAKER CORPORATION
PROD REL [signature] 12-3-73	DATE 8-2-73 DR C.I.P. ENGR [signature] 9-?-73
12.5-17.5 KW-4XR/14AA	NAME CONTROL-GEN SET AC (WIRING DIAGRAM)
277/480V, 3PH, 4W, 60Hz	DWG NO 612-4817 DWG SIZE C

WIRING DIAGRAM

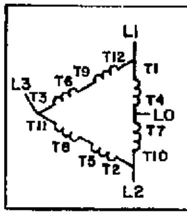


SCHEMATIC DIAGRAM



REF. DES.	PARTS LIST DESCRIPTION
CB21	CIRCUIT BREAKER
	SILKSCREEN-FIELD BRKR
CB22	CIRCUIT BREAKER 40A (12.5KW)
	CIRCUIT BREAKER 45A (14.5KW)
	CIRCUIT BREAKER 50A (15.0KW)
	CIRCUIT BREAKER 55A (17.5KW)
	TIE BAR
G21	GENERATOR
M21-23	AMMETER-AC 0-50A (12.5-15.0KW)
	AMMETER-AC 0-80A (17.5KW)
M24	VOLTMETER-AC 0-300V
M25	METER-RUNNING TIME 50Hz
	METER-RUNNING TIME 60Hz
M26	METER-FREQUENCY 50Hz
	METER-FREQUENCY 60Hz
R21	RESISTOR ASSY
R22	RHEOSTAT ASSY-11 THRU -20
S21	SWITCH-LEADS (VR SEL)
TB22	TERMINAL BLOCK
VR21	REGULATOR-ASSY VOLTAGE
W9	WIRING HARNESS (F1-F2)
W11	LEAD ASSY (L1)
W12	LEAD ASSY (L2)
W13	LEAD ASSY (L3)
W14	LEAD ASSY (LO)
W15	LEAD ASSY (1) (HSD ONLY)
W16	LEAD ASSY (2) (HSD ONLY)
W17	LEAD ASSY (B2) (HSD ONLY)
W18	WIRING HARNESS
W19 THRU W26	LEAD ASSY

KW & Hz	UNHSD W/O V ADJ	HSD W/O V ADJ	UNHSD W/ V ADJ	HSD W/ V ADJ
12.5 60Hz	-01	-06	-11	-16
15.0 60Hz	-02	-07	-12	-17
17.5 60Hz	-03	-08	-13	-18
12.5 50Hz	-04	-09	-14	-19
14.5 50Hz	-05	-10	-15	-20



CODE 18 60Hz
120/240V V4-V1

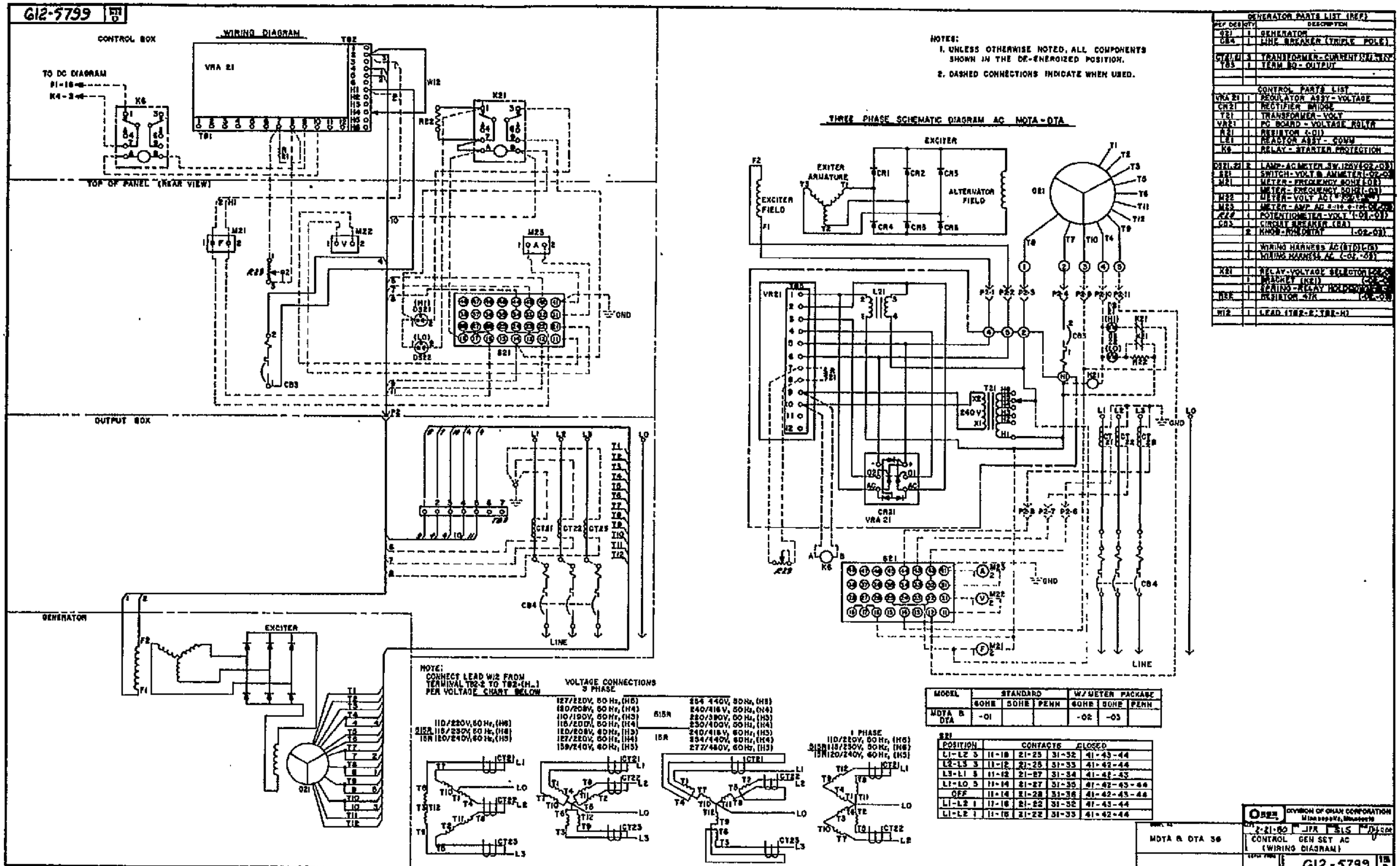
CODE 518 50Hz
120/240V V4-V3

NOTES

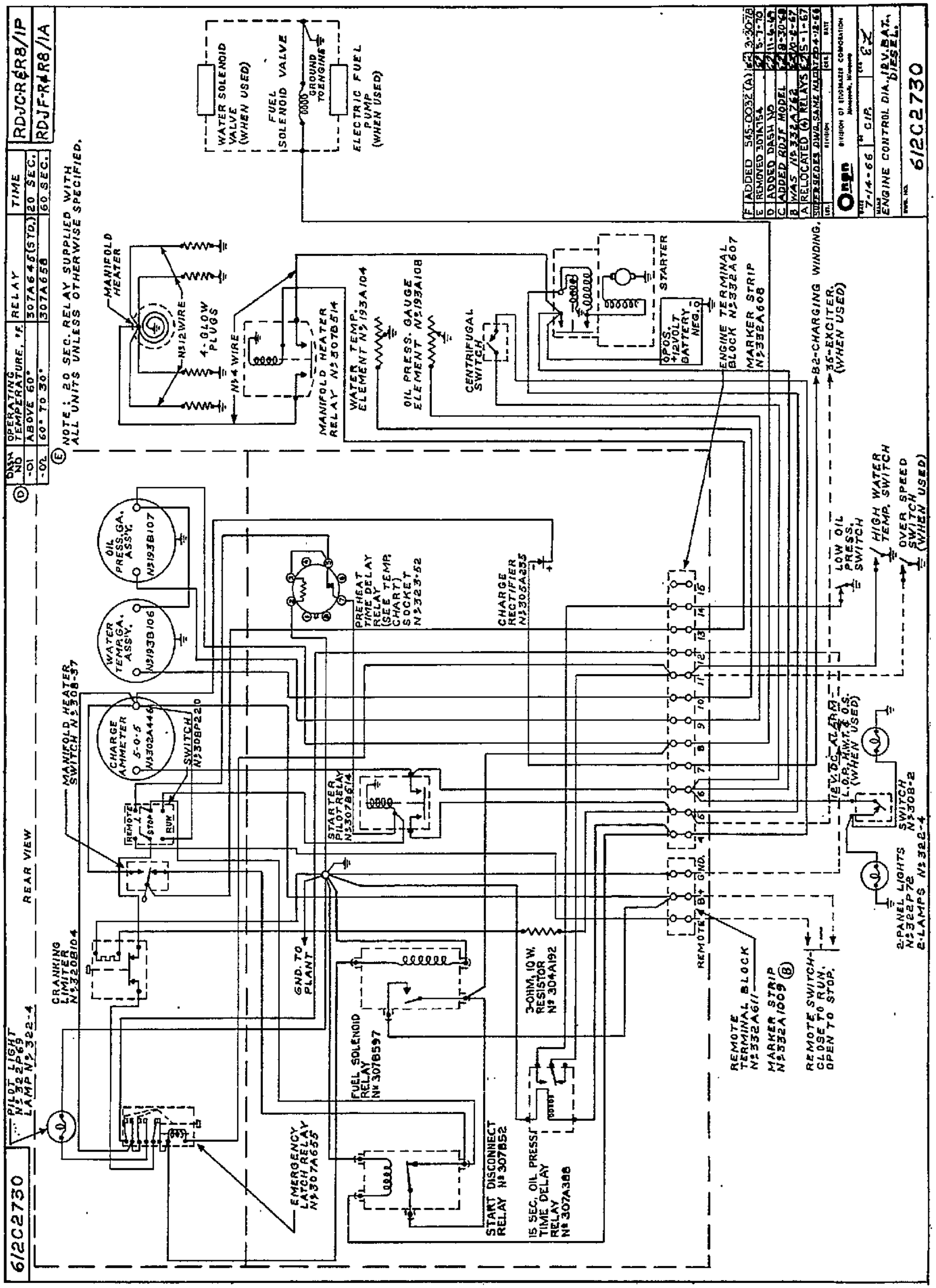
1. CONNECT LEAD W10 FROM V4 TO V_ PER VOLTAGE CHART REFER TO FIGURE 19.
2. CONNECT X1 TO 5 FOR CODE 518 (50Hz)
   CONNECT X1 TO 6 FOR CODE 18 (60Hz)
3. UNLESS OTHERWISE NOTED, ALL COMPONENTS ARE SHOWN IN THE DE-ENERGIZED POSITION.

JC, RJC, AND RDJF MODELS

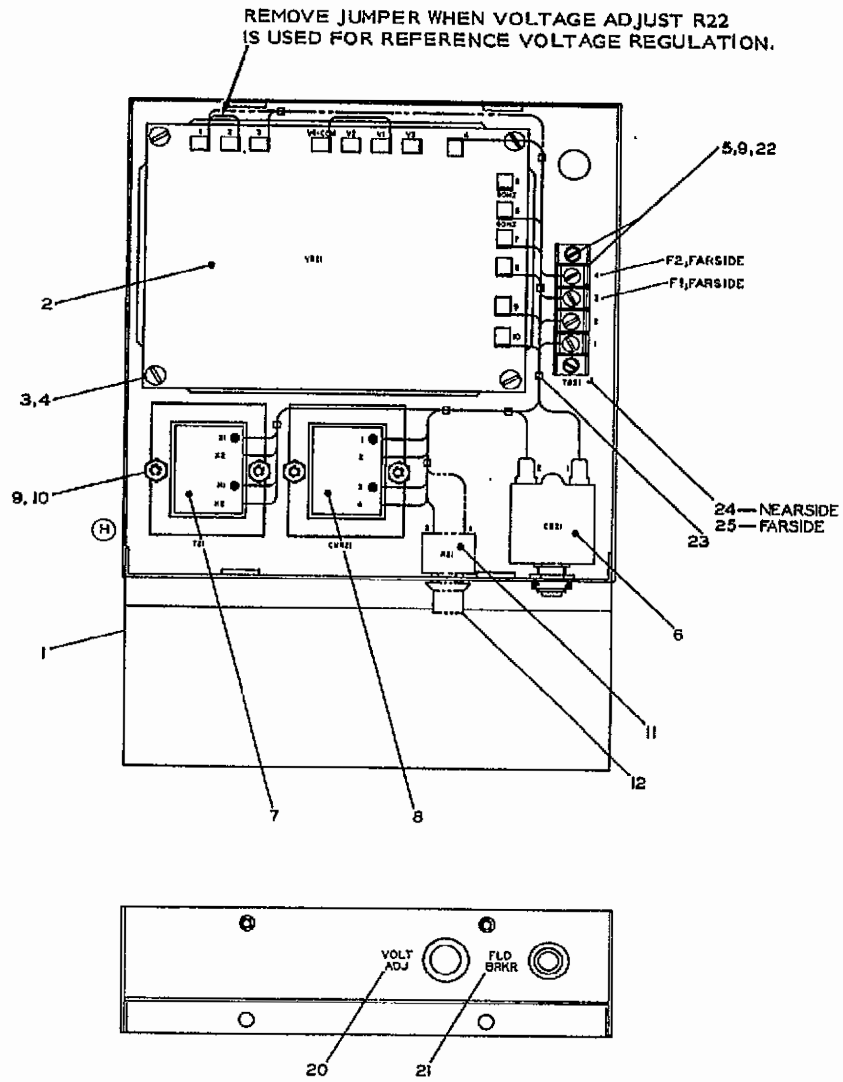
MODEL NO. 12.5-14.5 KW-55DR/14AA 12.5-17.5 KW-5DR/14AA	Onan DIVISION OF STUDEBAKER CORPORATION
120/240V, 3PH, 4W Δ, 50-60 Hz	DATE 8-2-73 C.I.P.
	NAME CONTROL-GEN SET AC (WIRING DIAGRAM)
	DWG NO. 612-4818 DWG SIZE C



RADIATOR-COOLED MDTA/DTA SETS



RADIATOR-COOLED J-SERIES SETS



WIRING TABULATION		
FROM STATION NO.	TO STATION NO.	LEAD FIND NO.
T21-X1	VR21-0	———
T21-X2	VR21-4	———
T21-H1	TB21-1	———
T21-H2	TB21-2	———
CMR21-1	CB21-2	———
CMR21-2	TB21-1	———
CMR21-3	TB21-2	———
CMR21-4	VR21-8	———
CB21-1	VR21-10	17
TB21-3	VR21-6	18
TB21-4	VR21-7	18
VR21-V4 COM	VR21-V1	19
VR21-1	VR21-2	19
R21-2	VR21-1	———
R21-1	VR21-3	———

ITEM	DESCRIPTION OR MATERIAL
25	SILKSCREEN-TB21 (FARSIDE)
24	SILKSCREEN-TB21 (NEARSIDE)
23	TIE-CABLE (SELF LOCKING)
22	SCREW-RHM (6-32×1/2 LG)
21	SILKSCREEN-FLD BRKR
20	SILKSCREEN-VOLT ADJ
19	LEAD ASSY
18	LEAD ASSY
17	LEAD ASSY
16	NUT-HMS (4-40)
15	WASHER-ET LK (#4)
14	SCREW-RHM (4-40 x 1 4 LG)
13	PLUG-DOT BUTTON
12	KNOB-RHEOSTAT
11	RHEOSTAT ASSY
10	SCREW-RHM (6-32 x 1-1/4" LG)
9	NUT-HEX & ET (6-32)
8	REACT-COMM
7	TRANSFORMER-VOLT RC.
6	CIRCUIT BREAKER
5	TERMINAL STRIP
4	WASHER-ET LK #8
3	SCREW-RH THD CTG (8-32 x 1 2)
2	REGULATOR BOARD ASSY
1	PANEL-VOLT RGLTR MTG

Onan DIVISION OF ONAN CORPORATION Minneapolis, Minnesota

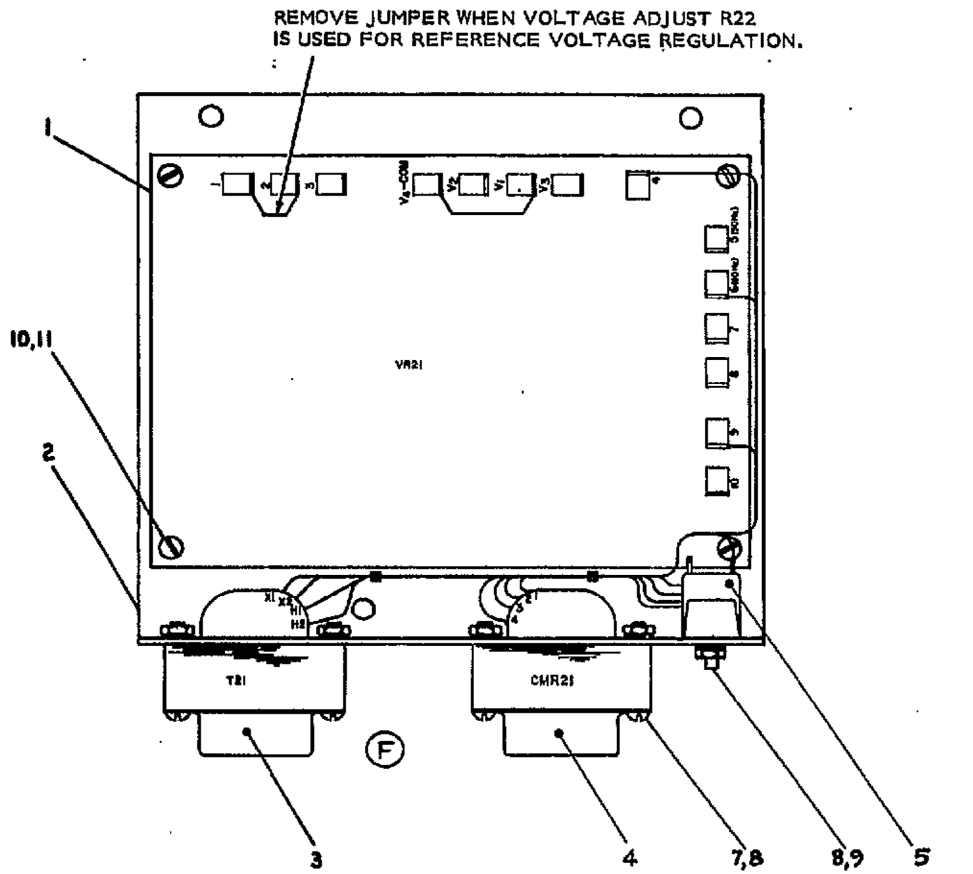
3-31-75 YD

REGULATOR ASSY-VOLTAGE

305-0552
305-0553

D

AIR-COOLED AND MARINE SETS



WIRING TABULATION		
FROM STATION NO.	TO STATION NO.	LEAD FIND NO.
T21 X1	VR21-6	——
T21-X2	VR21-4	——
T21-H1	TB21-1	——
T21-H2	TB21-2	——
CMR21-1	TB21-3	——
CMR21-2	TB21-1	——
CMR21-3	TB21-2	——
CMR21-4	VR21-9	——
VR21-1	VR21-2	13
VR21-V4 COM	VR21-V1	13

ITEM	
13	LEAD ASSY
12	TIE-CABLE (SELF LOCKING)
11	WASHER-ET LK (#6)
10	SCREW-RHM (6-32 x 3/8" LG)
9	SCREW-RHM (8-32 x 1 2" LG)
8	NUT-HEX W ET (8-32)
7	SCREW-RHM (6-32 x 1-1/4" LG)
6	
5	TERMINAL STRIP
4	REACT-COMM
3	TRANSFORMER-VOLTAGE REF
2	PANEL-VOLT RGLTR MTG
1	REGULATOR BOARD ASSY

RADIATOR COOLED SETS

Onan

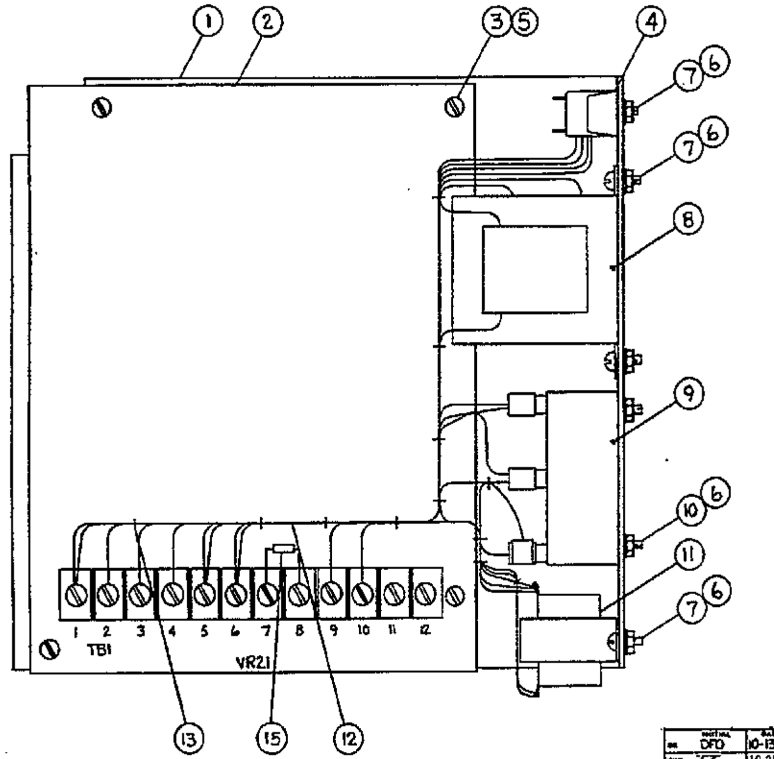
REGULATOR ASSY-VOLTAGE

6-19-79 1/1

YD

305-0534

RADIATOR COOLED SETS



TRANSFORMER CONNECTION (T11)

A. X_1 TO VR1-9

B. X_2 TO VR1-10

C. H_1 TO TB2-3

D. H_5 TO TB2-1

REF DES	ITEM	QTY.	DESCRIPTION OR MATERIAL
	15	1	RESISTOR ASSY
	14		
	13	10	TIE - CABLE
	12	1	HARNESS - WIRING
L11	11	1	REACTOR ASSY - COMM
	10	2	SCREW - RHM (1¼ x 6-32)
CR11	9	1	BRIDGE - SCR
T11	8	1	TRANSFORMER - VOLT
	7	6	SCREW - RHM (3/8 x 6-32)
	6	8	NUT - H W/ET (6-32)
	5	4	WASHER-ET LK (#6)
TB2	4	1	TERMINAL BLOCK
	3	4	SCREW - RHM (1/4 x 6-32)
	2	1	BOARD ASSY - PC
	1	1	PANEL - VOLT RGLTR MTG

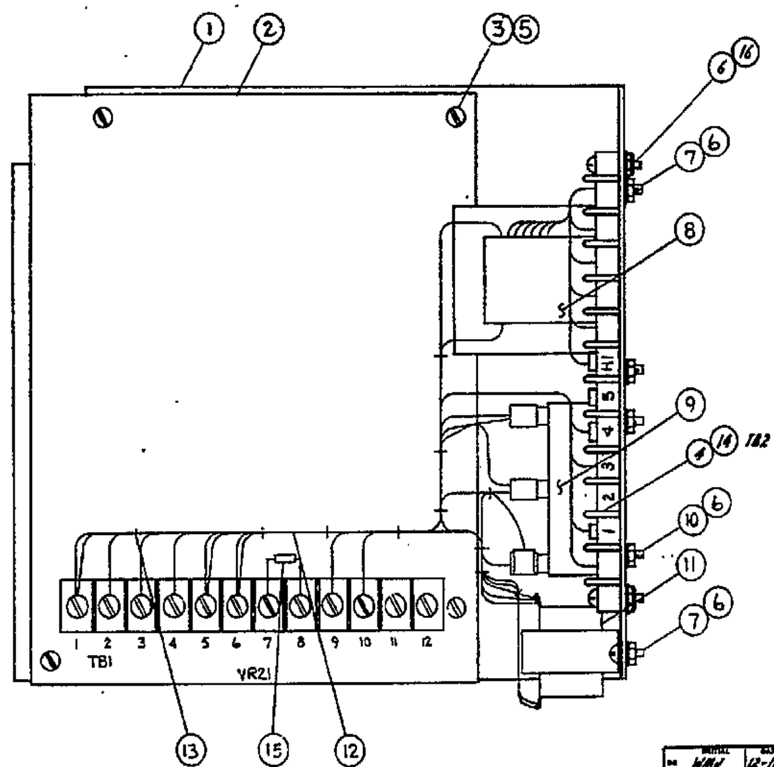
DFO 10-13-77
10-21-77

Onan — A DIVISION OF ONAN CORPORATION, Minneapolis, Minnesota

REGULATOR ASSY - VOLTAGE

30.0YD | 305-0579 | C

RADIATOR COOLED AND PTO MODELS



TRANSFORMER CONNECTION (T11)

A X_1 TO VR1-9

B. X_2 TO VR1-10

C. H_1 TO TB2-3

D. H_5 TO TB2-1

REF DES	ITEM	QTY.	DESCRIPTION OR MATERIAL
	17	4	TERMINAL-TAB
	16	2	SCREW - RHM (6-32 X 5/8)
	15	1	RESISTOR ASSY
	14	1	MARKER STRIP
	13	10	TIE - CABLE
	12	1	HARNESS - WIRING
L11	11	1	REACTOR ASSY - COMM
	10	2	SCREW - RHM (1¼ x 6-32)
CR11	9	1	BRIDGE - SCR
T11	8	1	TRANSFORMER - VOLT
	7	4	SCREW - RHM (3/8 x 6-32)
	6	8	NUT - H W/ET (6-32)
	5	4	WASHER-ET LK (#6)
TB2	4	1	TERMINAL BLOCK
	3	4	SCREW - RHM (1/4 x 6-32)
	2	1	BOARD ASSY - PC
	1	1	PANEL - VOLT RGLTR MTG

12-11-79
2-4-80
1-31-80
1-31-80

Onan — A DIVISION OF ONAN CORPORATION, Minneapolis, Minnesota

REGULATOR ASSY - VOLTAGE

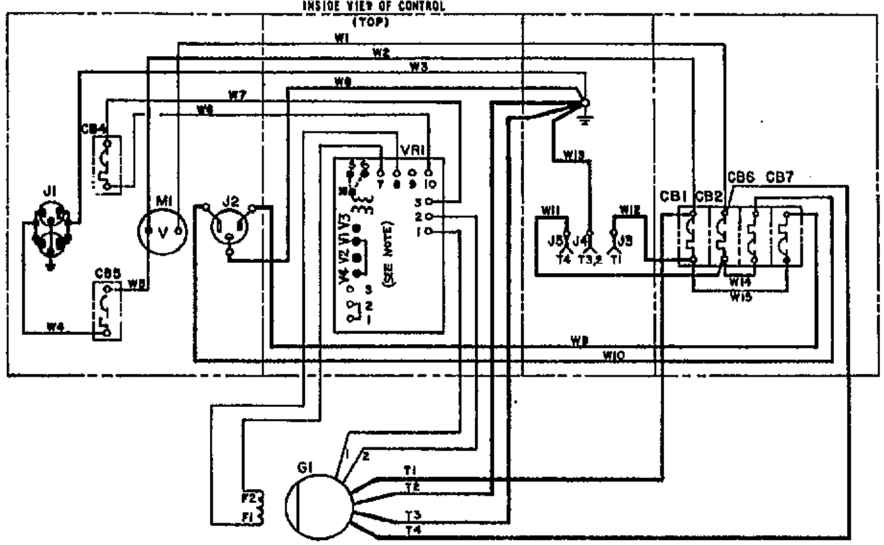
I-YD PTO | 305-0618 | C

PARTS LIST

REF. DES.	DESCRIPTION
CB1,2	CIRCUIT BREAKER, 85 AMP -03
CB1,2	CIRCUIT BREAKER, 85 AMP -01
CB1,2	CIRCUIT BREAKER, 100 AMP -02
CB4	CIRCUIT BREAKER, 3 AMP
CB5	CIRCUIT BREAKER, 15 AMP
CB6,7	CIRCUIT BREAKER, 50 AMP
G1	ALTERNATOR
J1	RECEPTACLE-DUPLEX
J2	RECEPTACLE, 50 AMP
J3,5	HOUSING - CONNECTOR (BLACK)
J4	HOUSING - CONNECTOR (WHITE)
M1	VOLTMETER - AC
VR1	REGULATOR ASSY-VOLTAGE
W1	LEAD ASSY
W2	LEAD ASSY
W3	LEAD ASSY
W4	LEAD ASSY
W5	LEAD ASSY
W6	LEAD ASSY
W7	LEAD ASSY
W8	LEAD ASSY
W9,10	LEAD ASSY
W11,12	LEAD ASSY -01
W13	LEAD ASSY -01
W11,12	LEAD ASSY -02 & -03
W13	LEAD ASSY -02 & -03
W14,15	LEAD ASSY

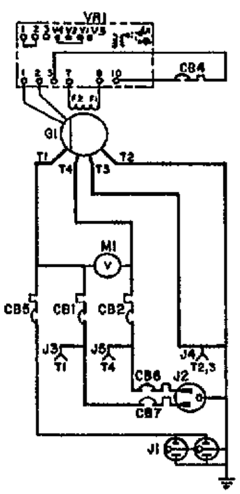
WIRING DIAGRAM

INSIDE VIEW OF CONTROL (TOP)



CODE 3C, 60HZ
120/240V V4-V1
1PH
3W
CODE 53G, 50HZ
110/220V V4-V1
115/230V V4-V2
120/240V V4-V3
1 PH, 3W

SCHEMATIC



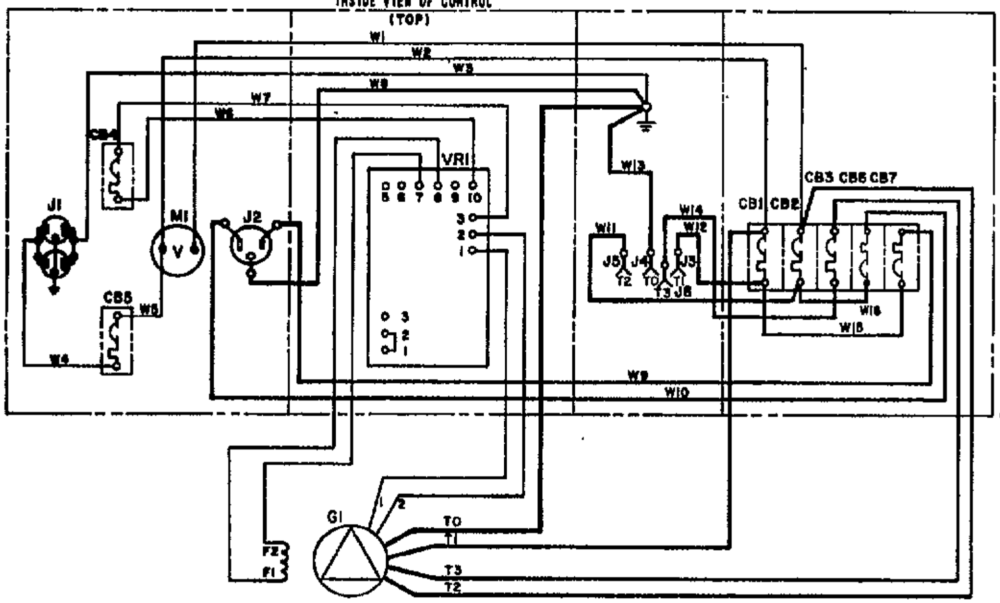
NOTES
1. CONNECT LEAD FROM V4 TO V__ PER VOLTAGE CHART
2. CONNECT X1 TO 5 FOR CODE 53G (50HZ)
CONNECT X1 TO 6 FOR CODE 3C (60HZ)

TYPICAL SINGLE-PHASE PTO ALTERNATOR

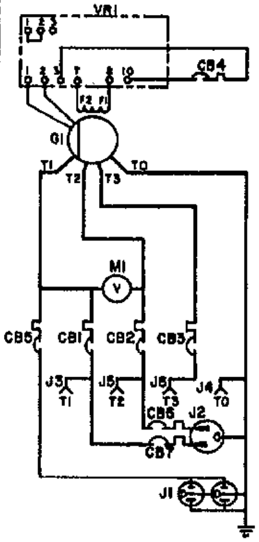
-03	20.0YD-3G & 53G/1AA
	ONAN
-01	15.0YD-3G & 53G/1AA
-02	25.0YD-3G/1AA
	120/240V, 1PH, 3W, 50 & 60Hz

Onan — 10-10-74 — GJC — CONTROL-GEN (WIRING DIAGRAM) — 620-0155 C

WIRING DIAGRAM
INSIDE VIEW OF CONTROL
(TOP)



SCHEMATIC

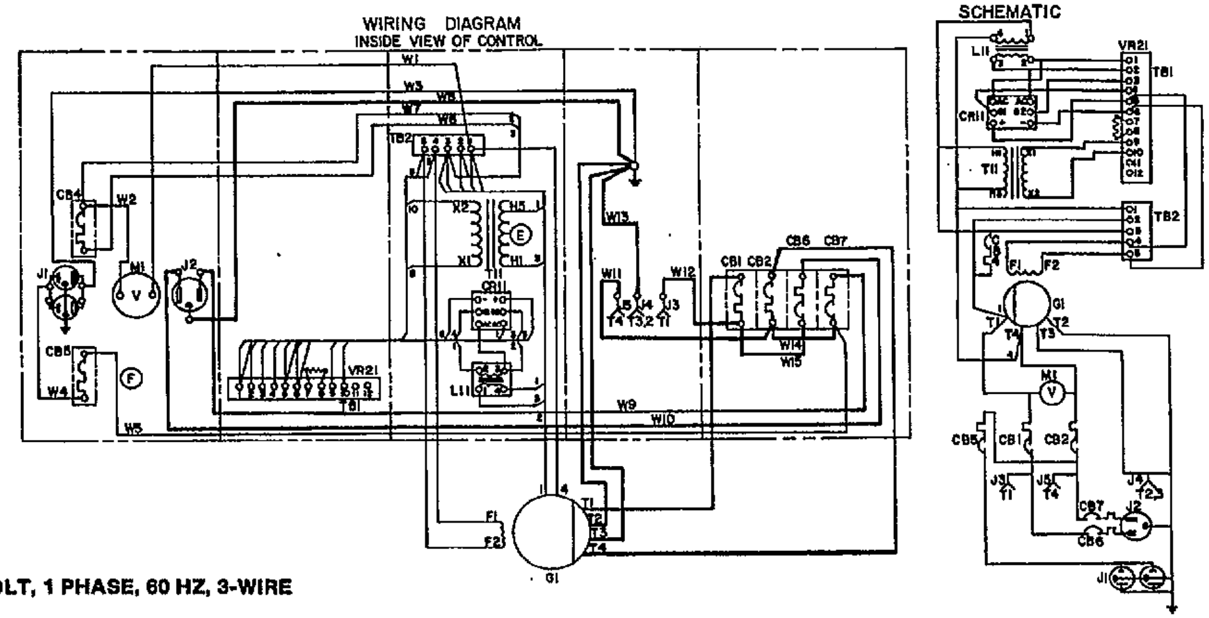


PARTS LIST	
REF. DES.	DESCRIPTION
CB1,2,3	CIRCUIT BREAKER
CB4	CIRCUIT BREAKER, 3 AMP
CB5	CIRCUIT BREAKER, 15 AMP
CB6,7	CIRCUIT BREAKER, 80AMP
G1	ALTERNATOR
J1	RECEPTACLE-DUPLEX
J2	RECEPTACLE, 50 AMP
J3,5,6	HOUSING-CONNECTOR (BLACK)
J4	HOUSING-CONNECTOR (WHITE)
M1	VOLTMETER-AC
VR1	REGULATOR ASSY-VOLTAGE
W1	LEAD ASSY
W2	LEAD ASSY
W3	LEAD ASSY
W4	LEAD ASSY
W5	LEAD ASSY
W6	LEAD ASSY
W7	LEAD ASSY
W8	LEAD ASSY
W9,10	LEAD ASSY
W11,12,14	LEAD ASSY
W13	LEAD ASSY
W15,16	LEAD ASSY

TYPICAL THREE-PHASE PTO ALTERNATOR

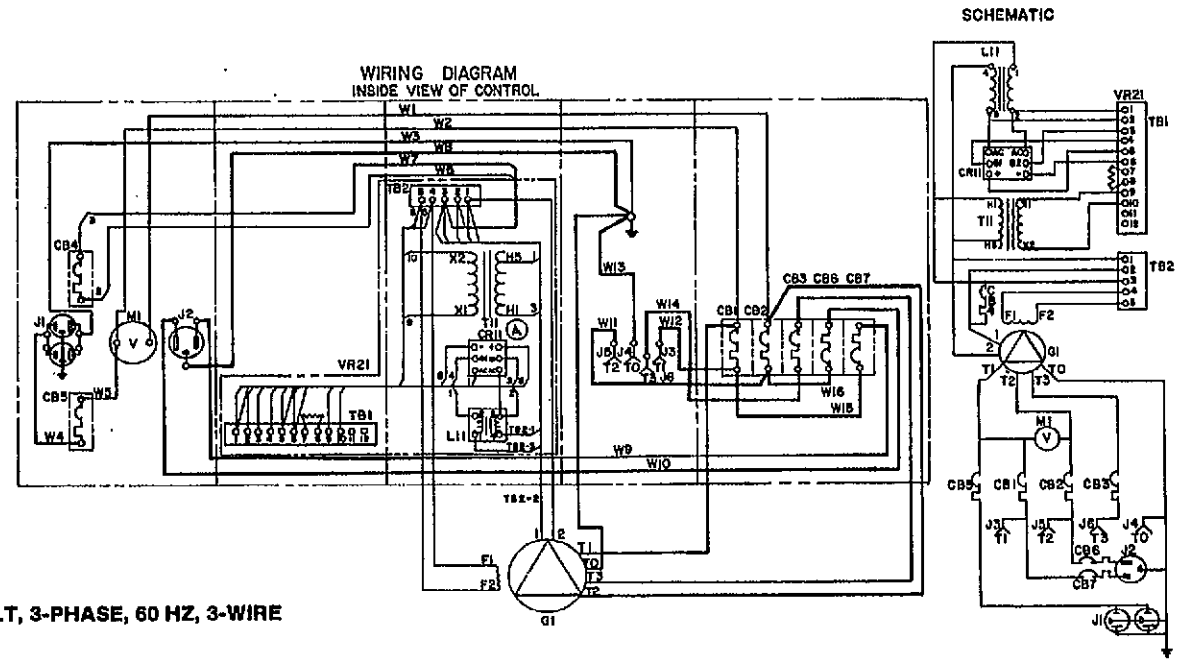
	MODEL NO.
-01	25.0YD-5DG/1AA
-02	20.0YD-5DG/1AA
	120/240V., 3PH∆., 3W., 60Hz.

Onan — DATE B-6-75 — DR CDR — CHK WAH — CONTROL-GEN (WIRING DIAGRAM) — 620-0156 C



620-0193

120/240 VOLT, 1 PHASE, 60 HZ, 3-WIRE

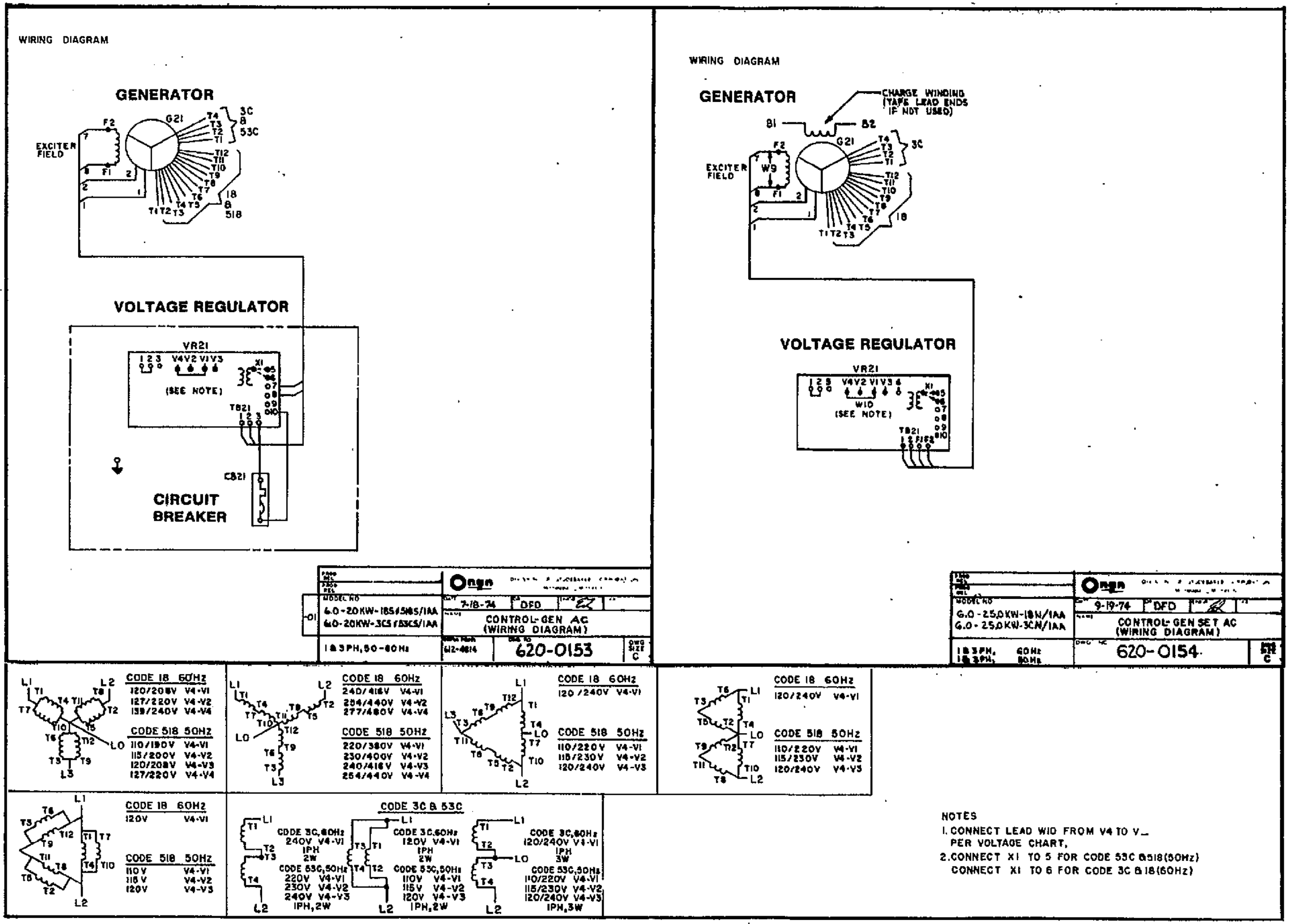


620-0205

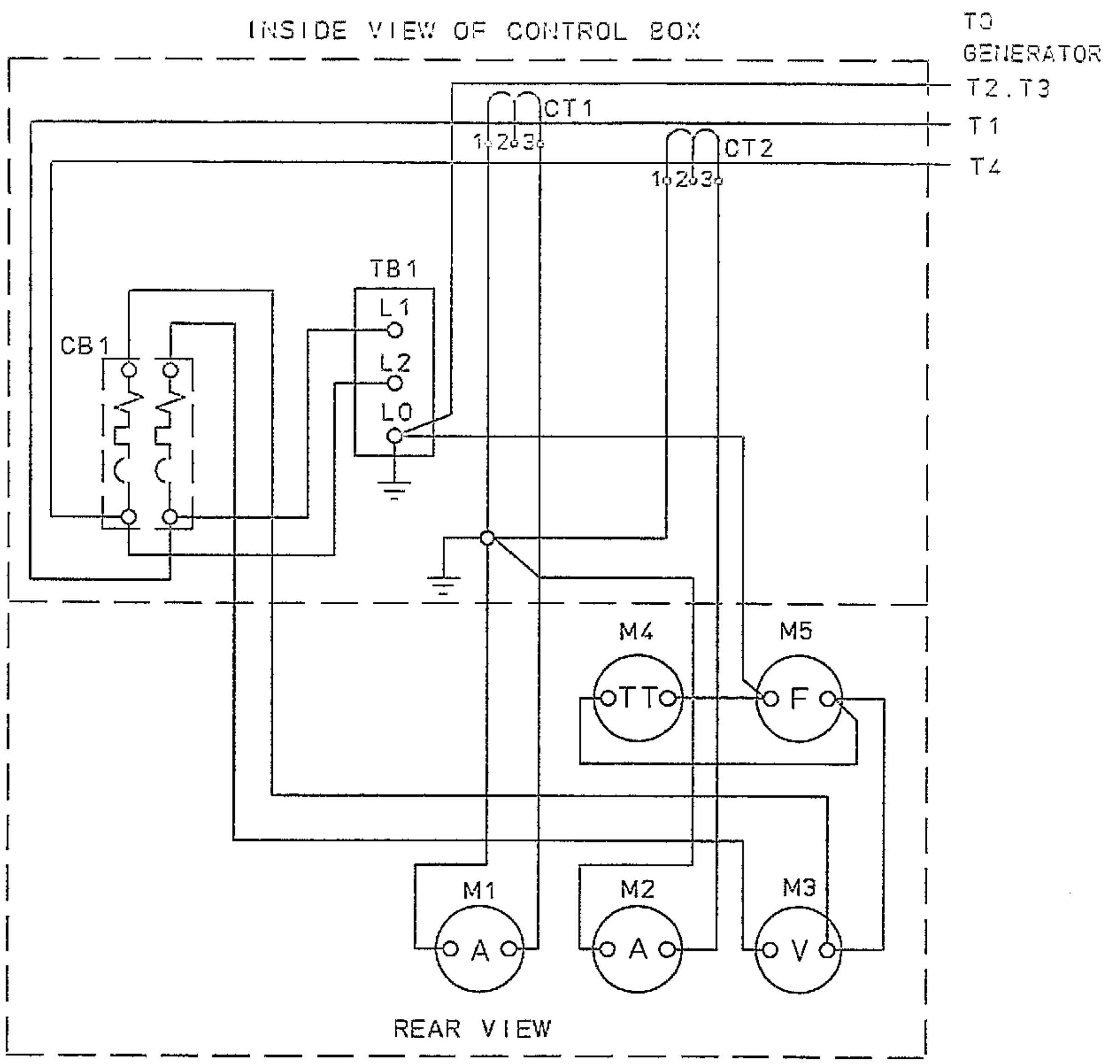
120/240 VOLT, 3-PHASE, 60 HZ, 3-WIRE

PARTS LIST	
REF DES	DESCRIPTION
CB1,2	CIRCUIT BREAKER, 125 AMP (3G)
CB1,2,3	CIRCUIT BREAKER, 90 AMP (5DG)
CB4	CIRCUIT BREAKER, 3 AMP
CB5	CIRCUIT BREAKER, 15 AMP
CB6,7	CIRCUIT BREAKER, 50 AMP
G1	ALTERNATOR
J1	RECEPTACLE - DUPLEX
J2	RECEPTACLE, 50 AMP
J3,5	HOUSING - CONNECTOR (BLACK)
J4	HOUSING - CONNECTOR (WHITE)
M1	VOLTMETER - AC
VR11	REGULATOR ASSY - VOLTAGE
W1	LEAD ASSY
W2	LEAD ASSY
W3	LEAD ASSY
W4	LEAD ASSY
W5	LEAD ASSY
W6	LEAD ASSY
W7	LEAD ASSY
W8	LEAD ASSY
W9,10	LEAD ASSY
W11,12	LEAD ASSY
W13	LEAD ASSY
W14,15	LEAD ASSY
(REF	SILKSCREEN - W.D.
CR11	RECTIFIER BRIDGE (REF)
L11	REACTOR ASSY - COM (REF)
T11	TRANSFORMER - VOLT (REF)
VR11	BOARD ASSY - PC VOLT REG (REF)

30.0 kW YD PTO ALTERNATOR CONTROL



TYPICAL TWO BEARING ALTERNATORS (SINGLE AND THREE PHASE)

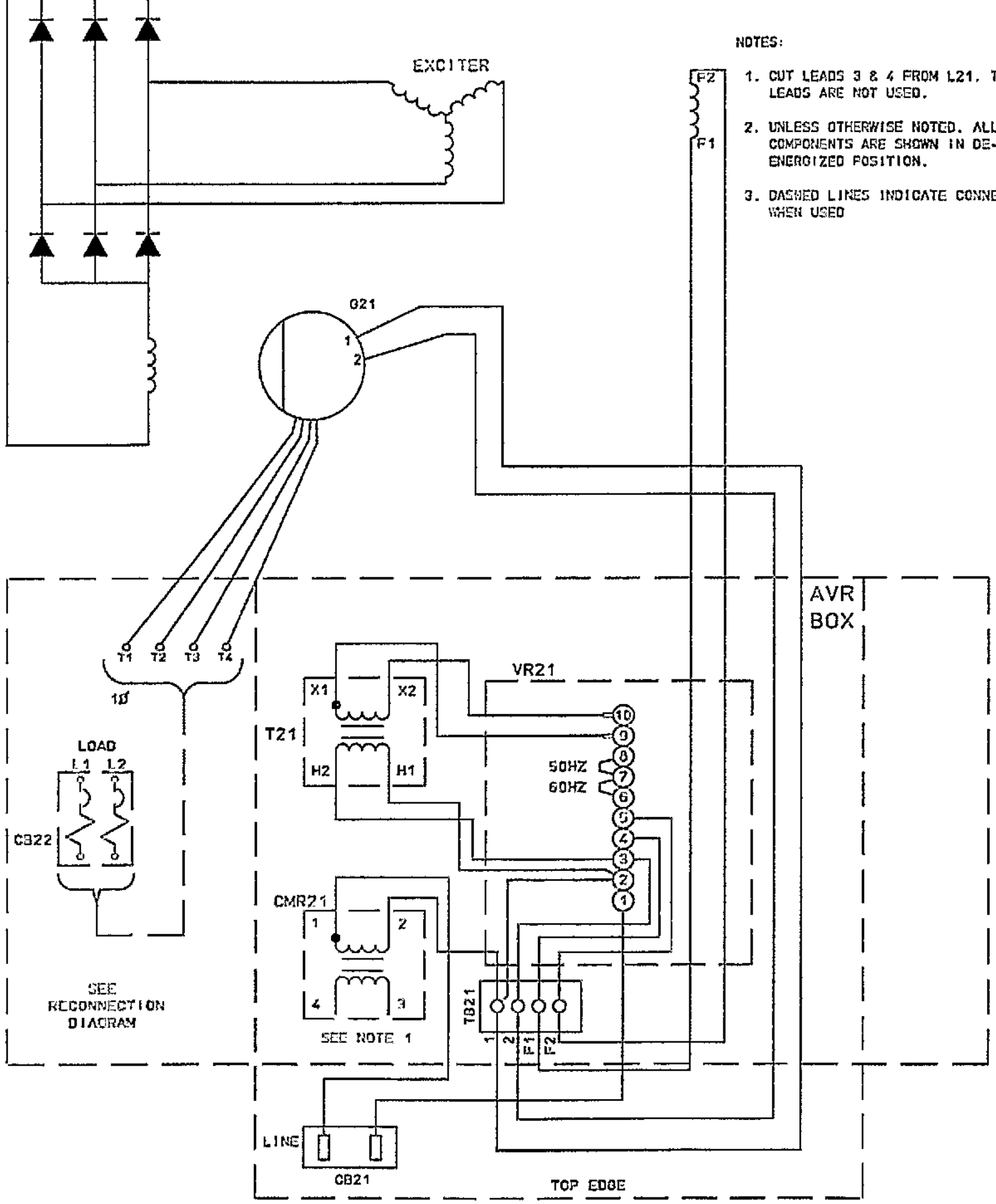


7	TERMINAL BLOCK	TB1
6	CIRCUIT BREAKER	CB1
5	TRANSFORMER-CURRENT	CT1,CT2
4	METER-FREQUENCY	M5
3	METER-TIME TOTALIZING	M4
2	METER-AC VOLTAGE	M3
1	METER-AC AMMETER	M1,2
ITEM	DESCRIPTION OR MATERIAL	REF DES

24/30, 30/35 KW GENERATOR METER/BREAKER PANEL SCHEMATIC DIAGRAM

NO. 615-0428
REV. A
MODIFIED

AC WIRING DIAGRAM - ELECTRONIC REGULATION 50/60HZ

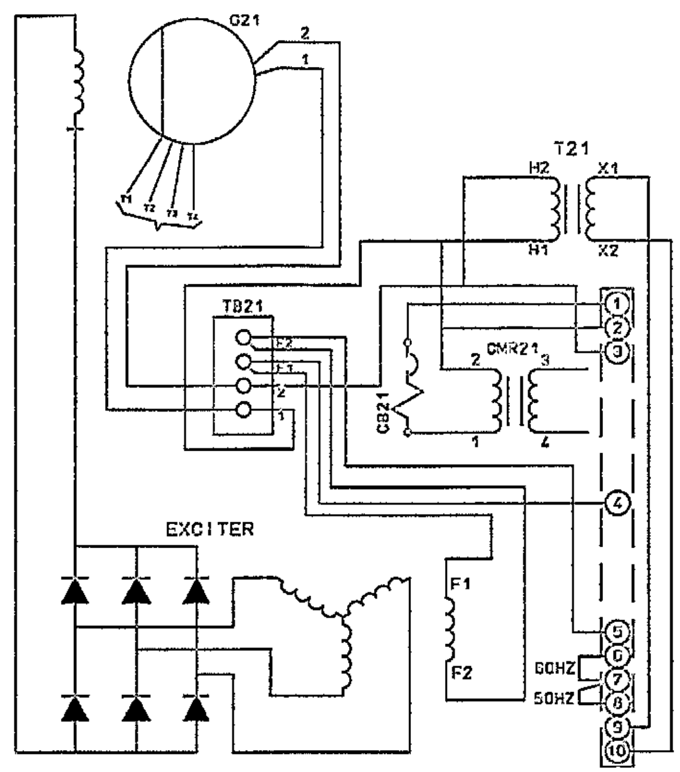


FRONT PANEL (REAR VIEW)

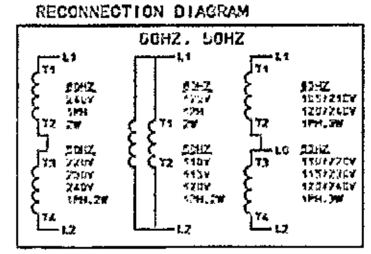
NOTES:

1. CUT LEADS 3 & 4 FROM L21. THESE LEADS ARE NOT USED.
2. UNLESS OTHERWISE NOTED, ALL COMPONENTS ARE SHOWN IN DE-ENERGIZED POSITION.
3. DASHED LINES INDICATE CONNECTIONS WHEN USED

AC SCHEMATIC - ELECTRONIC REG 50/60HZ



RECONNECTION DIAGRAM



QTY	ITEM	DESCRIPTION OR MATERIAL	[illegible]
	10		
	9		
	8		
	7		
	6	TRANSFORMER-VOLT REF	T21
	5	REACTOR ASSY-COM	CMR21
	4	GENERATOR (AC)	G21
	3	CIRCUIT BREAKER-LOAD	CB22
	2	CIRCUIT BREAKER-MAG 3A	CB21
-	1	REGULATOR-ASSY VOLT	VR21

SECTION 4.
REVOLVING FIELD GENERATORS

INDEX

REVOLVING FIELD GENERATORS

GENERAL

Keeping in mind the material on revolving armature power generation in the preceding section we can now discuss revolving field generators.

Suppose instead of turning a coil of wire in the magnetic field rotated inside the coil. The result is a revolving field generator (Figure 4-1). The revolving field is the rotor and permanently fixed winding is the stator. With this type of generator there is no need for slip rings to transfer power from the stationary armature coils.

Slip rings are used to supply direct current to the electromagnetic field of the alternator. Onan generators use a static exciter, a non rotating device that converts AC output to DC and regulates current to the field. This static exciter is called a Magneciter (Figure 4-2).

The output frequency of the revolving field generator depends directly on its rotating speed. The voltage output of this generator is determined by rotating speed, number of turns in the stator, and the field strength by controlling the field current. The magneciter allows the adjusting of output voltage over a limited range – 3% at a steady speed – and has rapid recovery capabilities from a sudden load application or removal.

MAGNECITER DESCRIPTION, TROUBLESHOOTING, AND REPAIR.

The static exciter (Magneciter) supplies direct current to the alternator field coils and regulates the voltage produced by the alternator. Voltage stabilization occurs within two seconds after a change in load. Voltage regulation should be within ±3 percent.

The Onan static exciter has no moving parts and consequently demands minimum maintenance. By periodically performing preventive maintenance (blowing dust from the unit using filtered, low pressure air), corrective maintenance will be virtually eliminated.

Corrective maintenance can be handled by anyone with a knowledge of basic electricity and with the proper equipment for applying that knowledge. Most troubleshooting can be accomplished with a multimeter or a battery operated volt-ohmmeter, and a 120-volt, 25-watt AC test lamp.

Troubleshooting

Troubles are listed in advancing order, from no output voltage to a rated but fluctuating output voltage. The relationship between trouble and cause is not always consistent from model to model, so the following information must be used as a guide, *not an absolute rule!* The column entitled "Method" indicates the method for testing a standard component. When the word "None" appears in that column, all the information needed to complete the check is given in the column headed "Corrective Action". When more than one letter appears in that column for a single action,

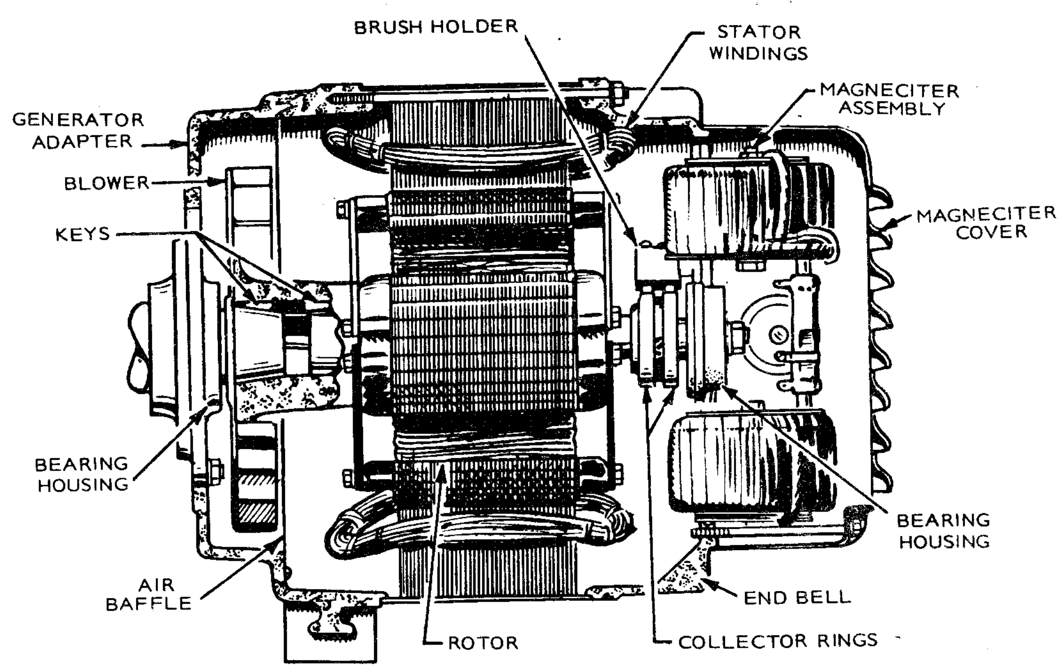


FIGURE 4-1. REVOLVING FIELD GENERATOR

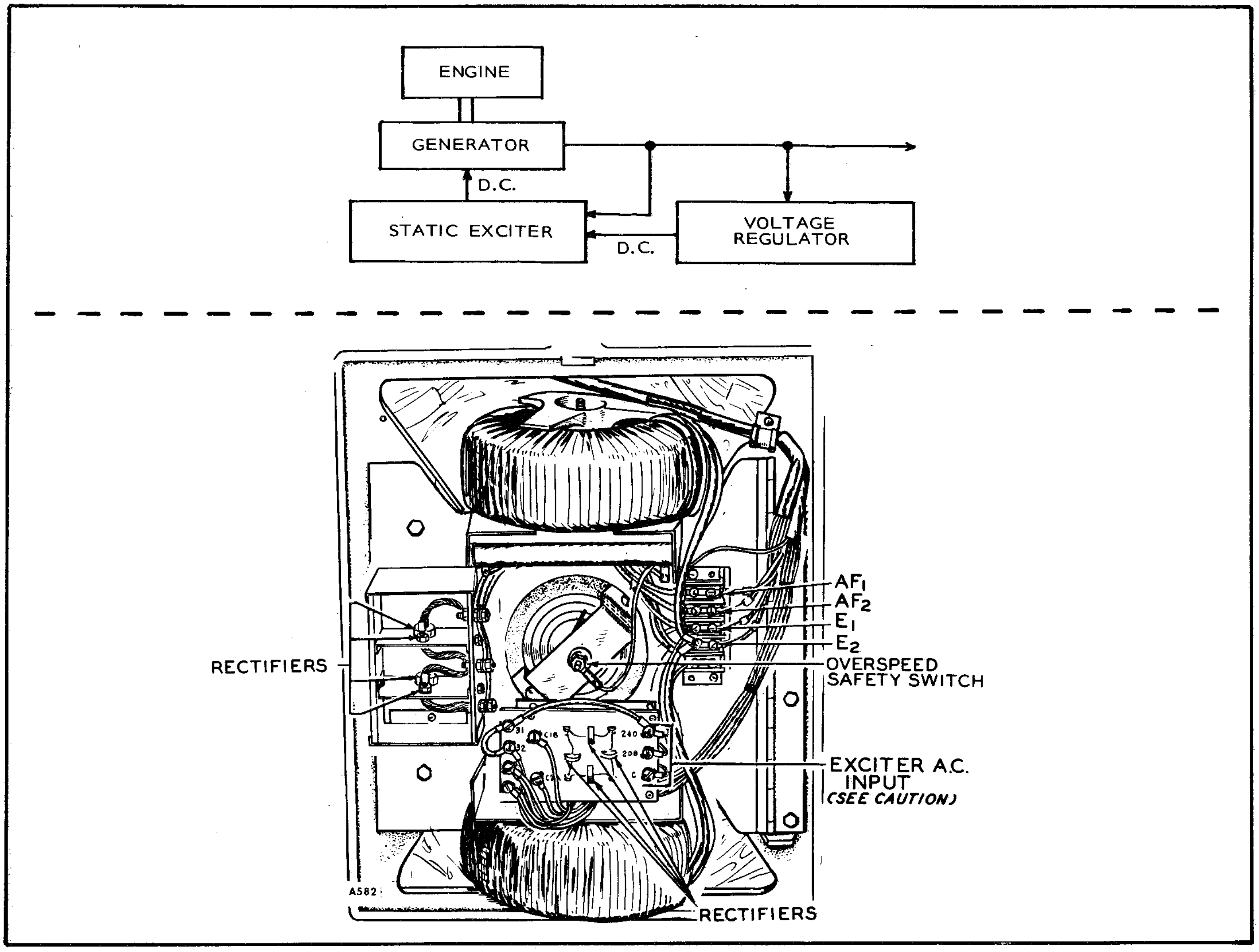


FIGURE 4-2. ONAN MAGNECITER

more than one method of checking a component or situation is given in the section on testing.

NOTE: *It is imperative that the testing procedures are completely understood by the service technician before attempting to perform corrective procedures.*

TESTING

CAUTION *Avoid grounding the hot lead of a tester (Figure 4-3) when checking a Magneciter component installed on a generator. A tester with an isolation transformer circuit (Figure 4-4) is not subject to such a problem. This is the preferred type to use with a Magneciter.*

Because more than one method of testing Magneciter components can be used, test procedures for both multimeters and continuity testers are outlined here.

METHOD A

Rectifier: Using an ohmmeter (multimeter)

1. Select the middle resistance range (RX10 or RX100) for measurements.
2. Isolate the rectifier by disconnecting one end from its point of connection.
3. Connect the test leads to the rectifier ends and observe the meter reading.
4. Reverse the leads and again observe the meter reading.

Results:

a. RECTIFIER IS GOOD if one reading is much higher than the other.
b. RECTIFIER IS DEFECTIVE if both readings are low, indicating the presence of a short, or if both readings are high, indicating the presence of an open circuit. In either case, the rectifier should be replaced.

Rectifier: Using 6-volt buzzer tester

1. Connect tester leads to rectifier ends.
2. Reverse the leads and connect again.

Results:

a. RECTIFIER IS GOOD if there is a buzz for one connection and *no* buzz for the other.

TABLE 1. MAGNECITER TROUBLESHOOTING

NATURE OF TROUBLE	PROBABLE CAUSE	CORRECTIVE ACTION	METHOD
Generator will not build up voltage	Circuit breaker in "off" or "tripped" position	Reset and close breaker	None
	Open in circuit breaker	Stop plant and check breaker continuity	None
	No AC power to Magneciter	Check AC voltage at E1-E2 with the plant operating*. Voltage should be 5 percent of the rated voltage. If not, check continuity from E1-E2 back to the generator	None
	Shorted or Grounded Rotor	Replace Rotor	Ohmmeter or Series Test Light
	Contacts dirty in Build-up Relay of 02SX1N1A	Stop plant. Clean by drawing hard surfaced paper between contacts	None
	Partial loss of residual in Rotor	With plant operating*, short out reactor(s)	J or K
	Field Rectifiers W & Z or X & Y open	Test rectifiers and replace if defective	A or B
	Field Rectifiers X & Y shorted	Test rectifiers and replace if defective	A or B
Output voltage slow to build up. Circuit breaker opens in about five seconds	Either Field Rectifier X or Y shorted	Test rectifiers and replace if defective	A or B
Output voltage slow to build up. 5 percent below rated voltage. Poor voltage regulation	Either Field Rectifier W or Z shorted	Test rectifier and replace if defective	A or B
Output voltage slow to build up and higher than rated voltage after build up	Open circuit in one or more Control Rectifier	Test rectifier and replace if defective. Check soldered connections to rectifiers	A or B
Output voltage slow to build up and 10 to 20 percent above rated voltage after build up	Open in one Field Rectifier	Test rectifiers and replace if defective	D or E
	Open circuit in Gate winding G1-G2 of Reactor A or B	If Field Rectifiers Y and Z check okay, check continuities of Gate windings G1-G2	D or E

* **WARNING** *USE CAUTION WHEN TROUBLESHOOTING A UNIT IN OPERATION! ELECTRICAL SHOCK HAZARD IS PRESENT.*

TABLE 1. MAGNECITER TROUBLESHOOTING
(Continued)

NATURE OF TROUBLE	PROBABLE CAUSE	CORRECTIVE ACTION	METHOD
Output voltage builds up normally but less than rated voltage after build up	Shorted winding in Control Reactor	Test Control Reactor and replace if defective	F
Output voltage builds up normally with slightly less than rated voltage at no load and low voltage at full load	Compound winding S1-S2 installed backward or has open circuit	Check wiring diagram for polarity of Compound windings thru Reactors A and B and test for continuity	None
Output voltage builds up normally but 20 percent above rated voltage after build up. Voltage regulation poor.	Compound winding S1-S2 installed backward thru one Reactor (A or B)	Check wiring diagram for polarity of Compound winding thru Reactor A or B	None
Output voltage builds up normally but is 25 percent above rated voltage after build up	Open circuit in Control Rectifier bridge	Check continuity from the junction of Control Rectifiers Y and Z to the junction of Control Rectifiers W and X	C
Output voltage builds up normally but 125 to 150 percent above rated voltage after build up	Shorted turn in gate winding G1-G2 of Reactor A or B	Test Reactors A and B for shorted turns and replace if defective	D or E
Output voltage builds up normally but 150 to 200 percent above rated voltage after build up. No regulation possible	Control winding C1-C2 of Reactor A or B polarized incorrectly	Check circuit connections of both Reactors A and B	None
	Shorted turn in Control winding C1-C2 of Reactor A or B	Test Reactors A and B for shorted turn and replace if defective	D or E
	Relay inoperative	Check coil continuity; replace if defective	H
	Open in Control Circuit	Check continuity from E1 to E2 thru Control Circuit	None
Generator voltage fluctuating while engine running at constant speed	Incorrect setting on the Stabilizing Resistor	Check resistance and compare with resistance value in Table	G
Output Voltage High	Shorted Control Diode	Replace Diode	C

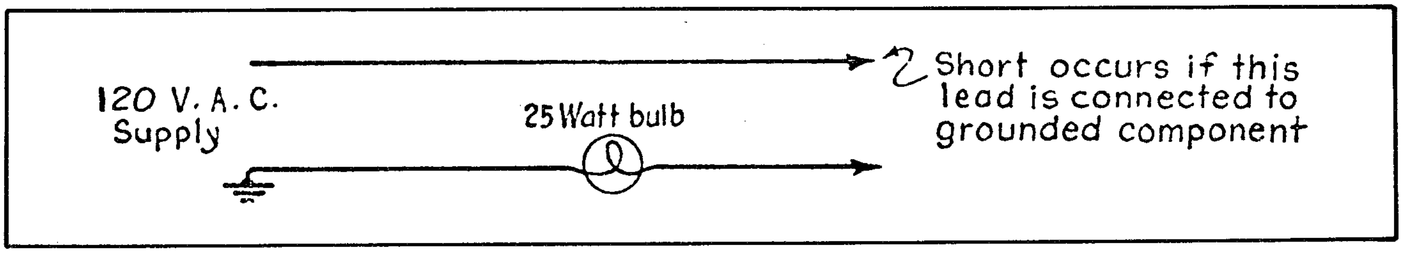


FIGURE 4-3. TEST LAMP SET

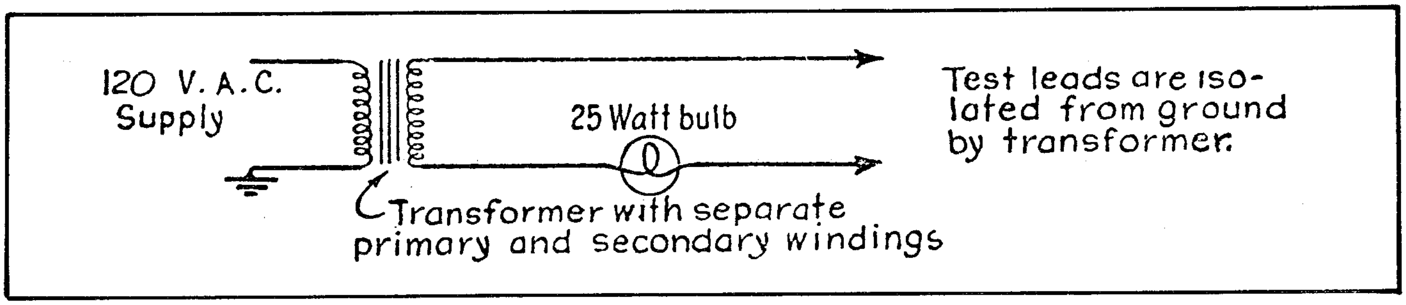


FIGURE 4-4. RECOMMENDED TEST LAMP SET

b. RECTIFIER IS DEFECTIVE if (1) there is no buzz for either connection or (2) a buzz in both connections. In either case, replace the rectifier.

METHOD B

Rectifier: Using 120-volt AC tester

1. Make certain that no component part of the Magneciter is electrically grounded.
2. Isolate the rectifier by disconnecting one end from its point of connection.
3. Connect the two test leads together and observe the brilliance of the bulb. (Only the lead resistance is present in the test circuit.)
4. Connect the test leads to the rectifier and observe the brilliance of the bulb.

Results:

a. RECTIFIER IS GOOD if the bulb lights with a low intensity.
b. RECTIFIER IS DEFECTIVE if the bulb lights with high intensity, indicating the presence of a short, or if the bulb fails to light at all, indicating the presence of an open circuit. In either case, the rectifier should be replaced. *BE SURE TO INSTALL THE RECTIFIER IN THE PROPER DIRECTION. (SEE WIRING DIAGRAM FOR CORRECT POLARITY.)*

NOTE: *Results which are questionable can be affirmed by testing a good rectifier.*

METHOD C

Control Rectifier Bridge Circuit

1. Follow the above procedures for troubleshooting rectifiers. The multimeter will indicate no continuity in one direction or the other if an open circuit exists in the bridge circuit.

METHOD D

Reactors: Using an ohmmeter (multimeter)

These reactors are basically transformers having isolated primary and secondary windings. The reactors can be tested as transformers.

1. Select the resistance range on the meter to the resistance specified in Table 3 for a given rectifier model.
2. Isolate one gate winding by disconnecting either end of gate winding G1-G2 from its point of connection; for example, disconnect G1 at E2.
3. Measure the resistance in the gate winding across G1-G2.
4. Isolate the control winding by disconnecting either lead C1 or C2 from the terminal strip. Measure the resistance in the control winding across C1-C2.
5. Connect one meter lead to the disconnected gate winding lead and the other meter lead to the disconnected control winding lead and check for continuity.

Results:

a. REACTOR IS GOOD if resistance is within ± 20 percent of the value listed in Table 3 and if there is also no continuity between the control and gate windings.
b. REACTOR IS DEFECTIVE if there is an open circuit in either the gate or the control windings. Continuity between the gate and the control windings is also an indication of a defective reactor. In either case, the reactor should be replaced.

METHOD E

Reactors A and B: Using 120-volt AC tester

1. Remove exciter from generator.
2. Make certain that no part of the Magneciter is

grounded.
3. Isolate the gate winding by disconnecting one lead from its point of connection.
4. Isolate the control winding by disconnecting both leads C1 and C2 from their points of connection.
5. Connect one test lead to G1 and the other test lead to G2 and observe the light bulb.
6. With the test leads still connected to the gate winding leads, short across leads C1 and C2 and again observe the bulb.
7. Connect one test lead to the control winding lead and the other test lead to one of the gate winding leads and observe the bulb.

Results:

a. REACTOR IS GOOD if bulb is dark for steps 5 and 7 but bright for step 6.
b. REACTOR IS DEFECTIVE if bulb lights with low intensity for step 5, indicating the presence of a short in either the gate winding or the control winding. If the bulb lights for step 7, the gate winding and the control are shorted together. If the bulb fails to light in step 6, there is very likely an open circuit in either the gate winding or the control winding. Replacement is required.

METHOD F

Control Reactor: Using an ohmmeter only

This method of testing the control reactor is not always positive, but the meter reading will indicate a trouble if one exists.

1. Isolate the control reactor by disconnecting common lead "C" from its point of connection and carefully measure the resistance from this lead to the numbered lead on the control reactor.

Results:

a. CONTROL REACTOR IS GOOD if resistance is within 10 percent of the value specified in Table 1.
b. CONTROL REACTOR IS DEFECTIVE if no resistance is indicated between the common lead "C" and the numbered lead. (Open circuit is indicated.)

METHOD G

Resistor: Using an ohmmeter only

1. The resistance should be measured with an ohmmeter. See Table 3 for selecting the resistance range (RX10, RX100, etc.) so readings are near center of meter scale.
2. Isolate the resistor by disconnecting one end from its point of connection before measuring the resistance.

Results:

a. RESISTOR IS GOOD if the measured resistance falls within ± 20 percent either way of the value given in Table 3.
b. RESISTOR IS DEFECTIVE if there is no indication of continuity through the resistor or if the measured resistance exceeds the allowable tolerance.

NOTE: *The stabilizing resistor can be adjusted to bring the specified resistance within the required limits.*

METHOD H

Build-up Relay Coil: Using an ohmmeter

This test will determine whether the resistance through the coil winding is within tolerance.

1. Isolate the coil by disconnecting one of its leads. With the meter adjusted to indicate center scale resistance reading, connect the meter leads to the coil.

Results:

a. COIL IS GOOD if 525 ohms ± 10 percent resistance is measured.
b. COIL IS DEFECTIVE if no resistance or low resistance is indicated; replace the relay.

METHOD J

Producing Voltage Build-up:

The first method used is shorting out the gate reactor(s) (temporarily removing their resistance) and thus applying full residual voltage to alternator field. Refer to diagrams to locate *terminal points* for the jumper connections. *Have set running but be cautious!*

1. For 04SX and 06SX press residual reset switch in Magneciter.

   EXCEPTION: For Spec A, which has no switch, place a jumper joining G1 - G2 - E2. Remove jumper wires when AC voltage starts to build up.
2. For 07SX, 102SX, and 2SX, jumper E2 to heat sink of rectifier No. 1. Remove jumper wires when AC voltage starts to build up.

METHOD K

Restoring Residual Magnetism: Flashing the field (Figure 4-5)

If output voltage won't build up after trying Method J, then it may be necessary to restore residual magnetism by flashing the field with a *separate* battery. Connect a voltmeter across terminals E1 and E2. After starting the set touch the positive leads of a 6-volt dry cell lantern battery to F1 positive (+) and the negative (–) lead to F2. When voltage starts to build-up, remove the battery leads. If voltage does not build up to normal and then drops to zero when you remove the battery leads, the trouble is a faulty component(s) in the exciter.

NOTE: *You may substitute a 12-volt automotive battery for the 6-volt lantern battery if a 10-ohm resistance is connected in series with the battery to limit current to the exciter circuit.*

AUTOMATIC FIELD FLASHING (Figure 4-5)

Some new units have an automatic field flashing circuit which uses the set battery to "flash the field" when the engine cranks. This helps insure voltage buildup. All generators use this circuit except the 5DR and 4XR models. The circuit is identified by the additional field rectifier ("V") shown on the set exciter wiring diagram.

Two things are necessary for this circuit to work properly:

1. The plant battery must be negative ground.
2. Alternator lead T2 must be grounded (T2 must be grounded on a 3-phase, 4 wire.)

CAUTION *If these conditions are not followed, the field flashing circuit will be ineffective or it may damage the exciter.*

INSTALLING NEW RECTIFIERS (Figure 4-6).

Observe caution when installing a new field rectifier. Applying too much torque on the holding nut will strain the internal connection and cause premature failure. Small rectifiers used on the J series should not be torqued over 20-inch lbs. If no torque wrench is available this is finger-tight plus one-quarter turn.

Larger rectifiers require 35 to 40-inch lbs. of torque.

EXCITER VOLTAGE TEST (Figure 4-7).

A. *Bench Test (Auxiliary Power)*

1. Connect Variac to exciter terminals E1 and E2 as shown in Figure 5.
2. Connect an AC voltmeter to these same terminals E1 and E2.
3. Connect DC voltmeter to field leads F1 and F2.
4. Connect a 100 watt light bulb across these same terminals F1 and F2.
5. Adjust Variac until voltage reaches value shown in column 2 (according to exciter model shown on Onan nameplate). DC voltage should now be within limits shown in column 3. (TABLE 4-2).

B. *Generator Running at No Load*

1. Connect an AC voltmeter to exciter terminals E1 and E2 as shown in Figure 4-8.
2. Connect DC voltmeter to exciter terminals F1 and F2.
3. With generator running at recommended rpm and no load connected, AC voltage values should be the same as those given in column 1; DC voltage values should be the same as those shown in column 2 (according to exciter model). SEE TABLE 4-3.

MAINTENANCE AND ADJUSTMENTS

J-Series

Revolving field generators normally need little care other than periodic inspection of the exciter, ball-bearing, collector rings, and brushes. These items must be inspected at least every 1000 hours.

NOTE: *J-series generator sets using 02SX exciters require voltage build-up relay cleaning every 500 hours.*

Brushes (J-Series)

To examine the brushes, brush springs, and slip rings the exciter cover at the rear of the generator must be removed. The exciter mounts on a hinged plate. Remove the screw from the right side of the plate and swing the assembly outward. To remove the brush holders unscrew the four machine screws on the end-bell near the ballbearing (Figure 4-9).

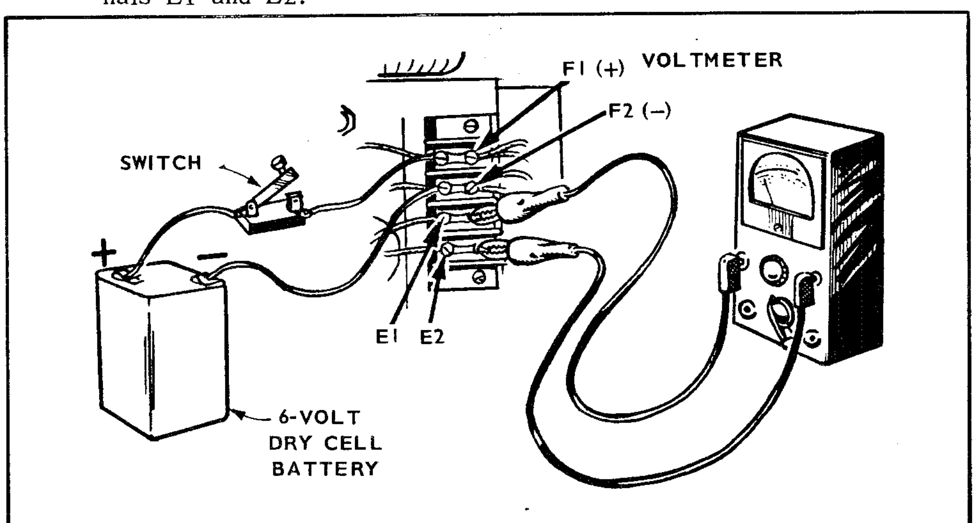


FIGURE 4-5. FLASHING THE FIELD

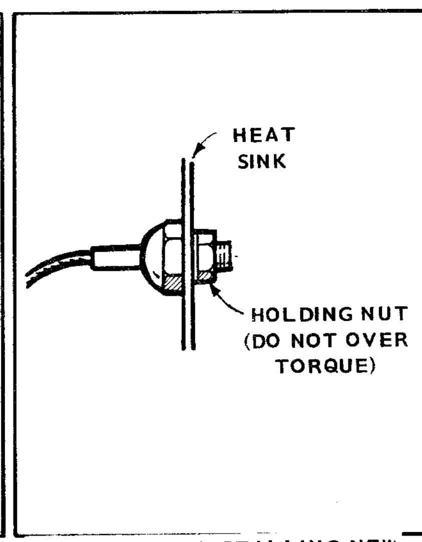


FIGURE 4-6. INSTALLING NEW RECTIFIERS

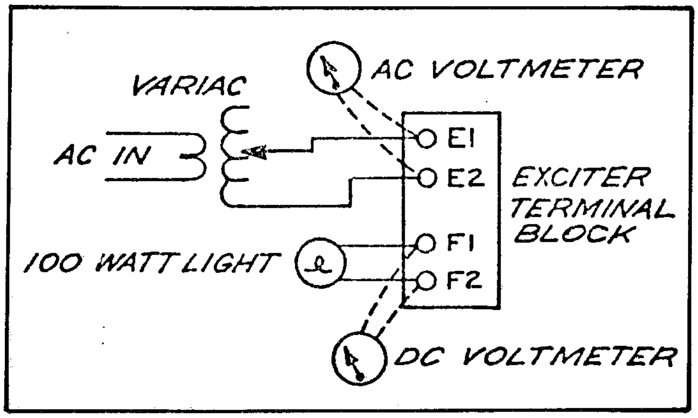


FIGURE 4-7. BENCH TEST SCHEMATIC

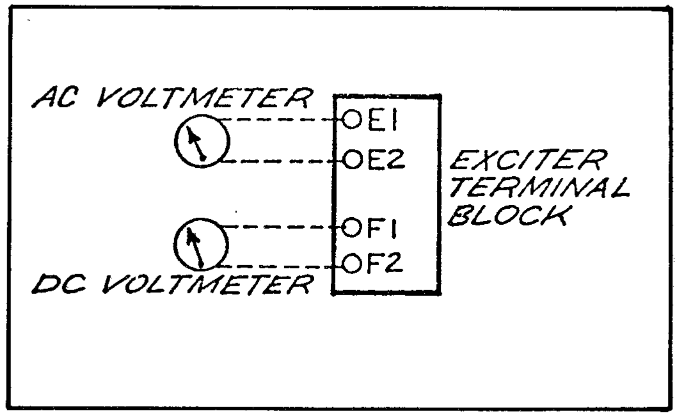


FIGURE 4-8. TEST SCHEMATIC (GENERATOR RUNNING AT NO LOAD)

TABLE 4-2. VOLTAGE VALUES FOR BENCH TEST

EXCITER MODEL	1 NOMINAL EXCITER VOLTAGE	2 AC VOLTS AT FIRE DOWN *	3 DC VOLTS AT FIRE DOWN *
04SXIN	120	138-140	60-80
06SXIN			
06SXIN	120	122-129	60-80
06SX5IN	120	146-150	70-90
07SXIN	120	116-119	60-80
07SX5IN	120	136-140	70-90
102SXIN	120	118-119	70-90
102SX5IN	120	133-140	80-100
2SXIN	240	236-240	150-170
	208	208-210	130-150
2SX5IN	240	258-262	150-170
	208	222-228	130-150

NOTE: All bench test values are the same for 50 cycle and 60 cycle models.
* - Value will vary with rheostat setting.

TABLE 4-3. VOLTAGE VALUES FOR EXCITER (GENERATOR RUNNING AT NO LOAD)

EXCITER MODEL	NOMINAL EXCITER VOLTAGE	1 AC VOLTAGE AT E1, E2	2 DC VOLTAGE AT F1, F2	3 ENGINE SPEED
04SXIN	120	124	21	1860
06SXIN	120	126	22	1860
07SXIN	120	123	21	1860
102SXIN	120	122	19	1860
2SXIN	240	253	39	1875
	208	215	36	1860

NOTE: Values will vary with engine speed and rheostat setting. All values at no load.

TABLE 4-4. RESISTANCE VALUES

CAUTION *Always use an accurate ohmmeter for checking resistance values. Resistance readings in the range of values found between G1 and G2 cannot be read with accuracy on the multimeter.*

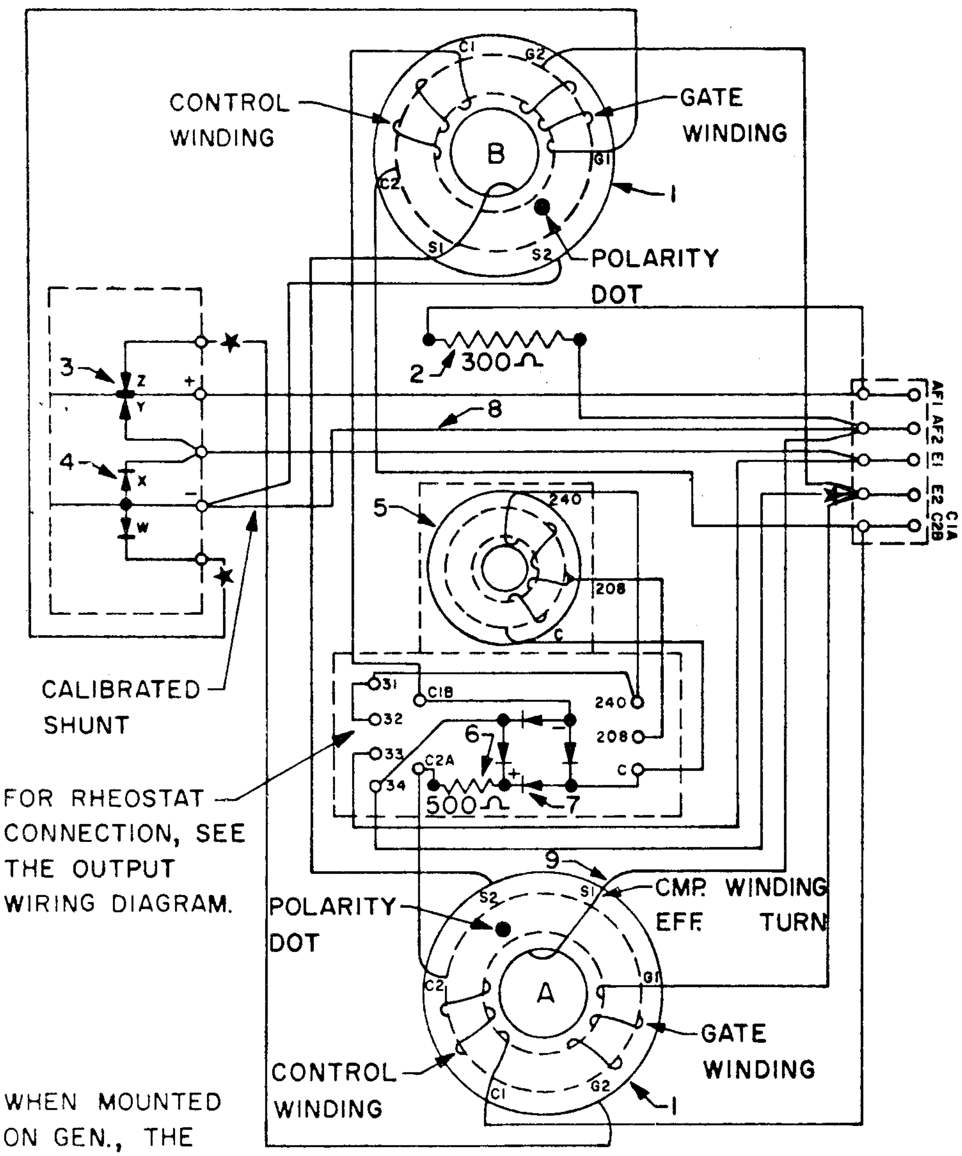
MODEL OF MAGNECITER	CONTROL REACTOR				LARGE REACTOR		STABILIZING RESISTOR SETTINGS
	from C to 25	from C to 31	from C to 4	from C to 1	from C1 to C2	from G1 to G2	
02SX1N1A				14.0	5.0	1.0	Fixed
07SX1N1A	23.0				9.0	.75	113.0
07SX1N1B	23.0				9.0	.75	113.0
07SX1N1C		18.0			9.0	.75	150.0
102SX1N1A	23.0				8.5	.30	80.0
102SX1N1B		18.0			8.5	.30	80.0
2SX2N1A			155.0		17.5	.37	Fixed
2SX2N1B				150.0	17.5	.37	Fixed
07SX51N1A	28.0				9.0	.90	113.0
07SX51N1B	28.0				9.0	.90	113.0
07SX51N1C		22.0			9.0	.90	150.0
102SX51N1A	28.0				8.5	.35	80.0
102SX51N1B		22.0			8.5	.35	80.0
2SX52N1A			192.0		17.5	.45	Fixed
2SX52N1B			180.0		17.5	.45	Fixed
04SX1N1A		12.5			11.0	1.77	Fixed
04SX1N1B, 2B, 3B, 4B		12.5			11.0	1.77	Fixed
06SX1N1A		12.5			5.5	.66	Fixed
06SX1N1B, 2B, 3B, 4B		12.5			5.5	.66	Fixed
06SX51N1A		15.0			6.6	.79	Fixed
06SX51N1B, 2B, 3B, 4B		15.0			6.6	.79	Fixed

TABLE 4–5. MAGNECITER DIAGRAMS

2SX MAGNECITER
07SX AND 102SX MAGNECITER
04SX AND 06SX MAGNECITER
WITH AND WITHOUT AUTOMATIC FIELD FLASHING
02SX1N1A MAGNECITER

TYPICAL DIAGRAM OF 2SX MAGNECITERS

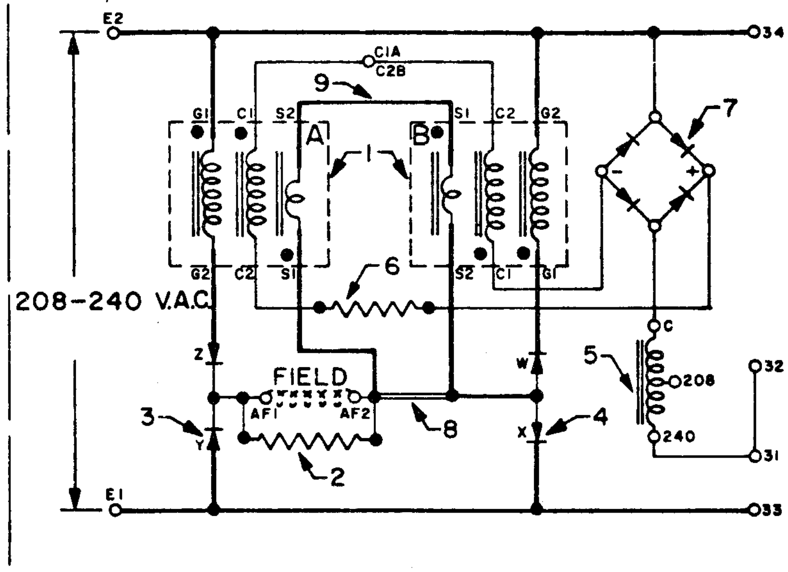
PICTORIAL



FOR RHEOSTAT CONNECTION, SEE THE OUTPUT WIRING DIAGRAM.

WHEN MOUNTED ON GEN., THE POLARITY DOTS WILL BE ON TOP OF EACH REACTOR.

SCHEMATIC

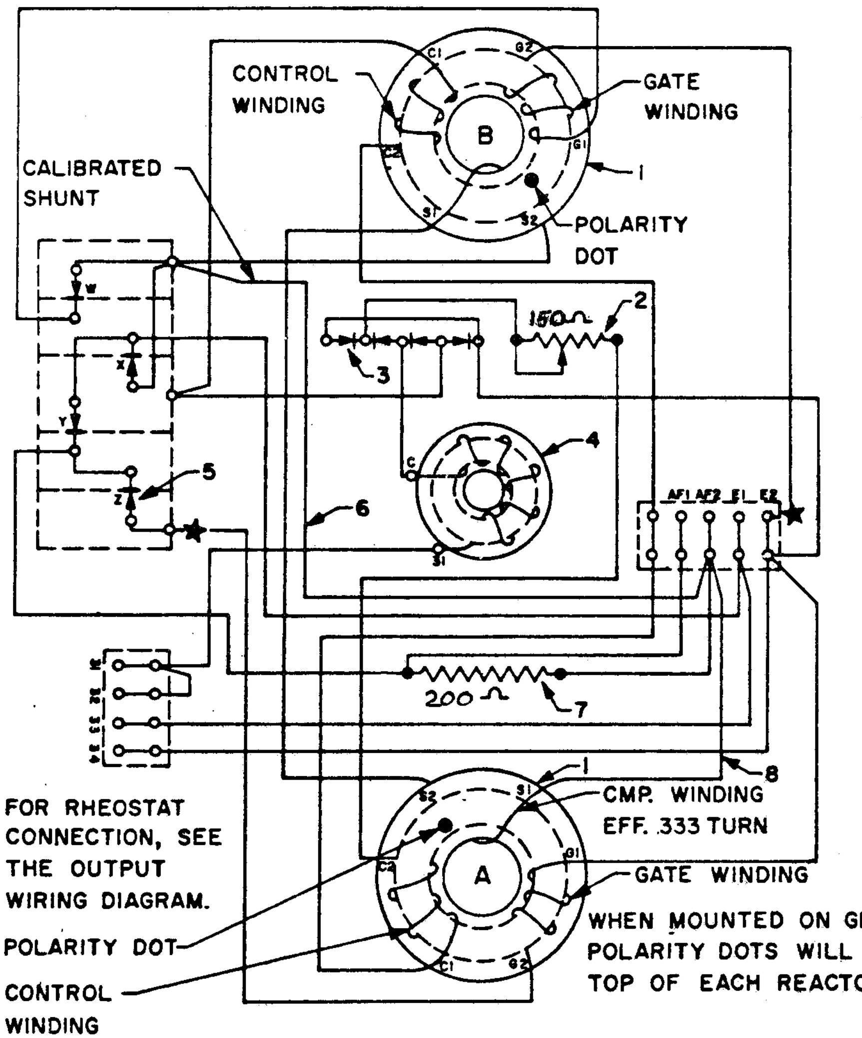


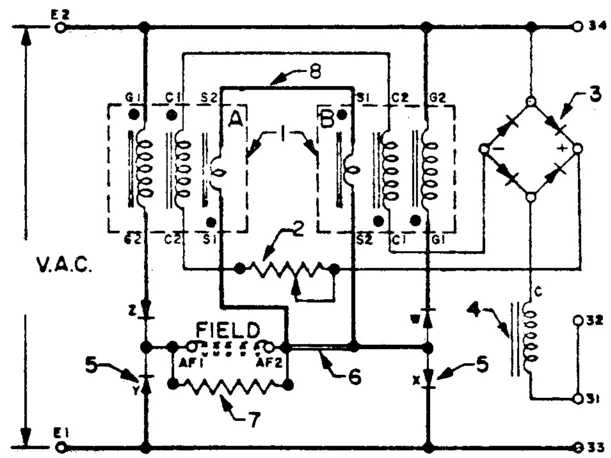
ITEM	QTY	DESCRIPTION
9	1	NO. 12 WIRE, 40" LG.
8	1	NO. 12 WIRE, 20" LG.
7	4	RECTIFIER-CONTROL
6	1	RESISTOR-STABILIZING
5	1	REACTOR-CONTROL
4	2	RECTIFIER-FIELD, NEG.
3	2	RECTIFIER-FIELD, POS.
2	1	RESISTOR-DAMPING
1	2	REACTOR-GATE

PARTS LIST

★ JUMPER CONNECTION POINTS FOR METHOD J. TESTING

TYPICAL DIAGRAM OF 07SX AND 102SX MAGNECITERS





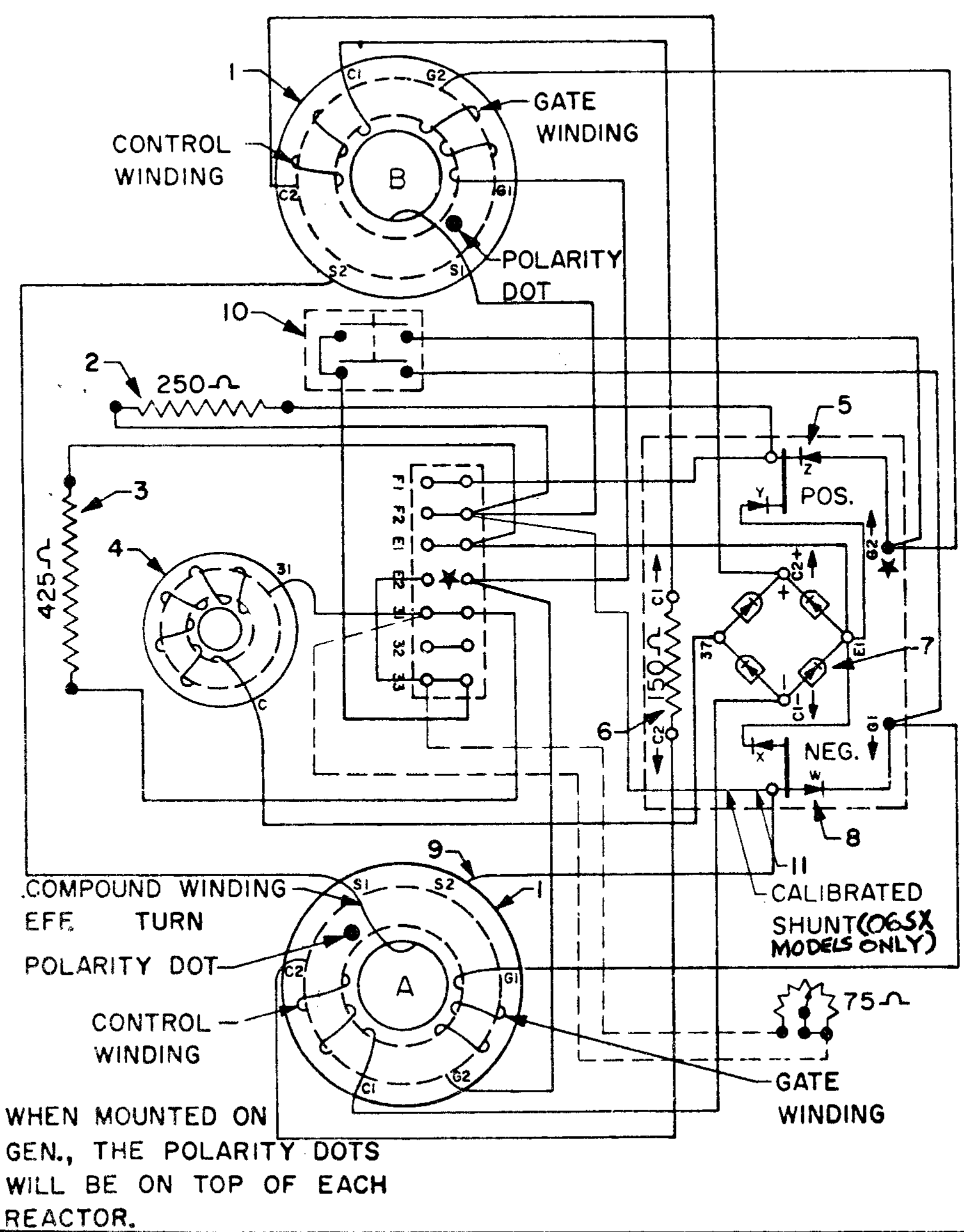
ITEM	QTY	DESCRIPTION
8	1	NO. 14 WIRE, 27" LG.
7	1	RESISTOR-DAMPING
6	1	NO. 14 WIRE, 13½" LG.
5	4	RECTIFIER-FIELD
4	1	REACTOR-CONTROL
3	4	RECTIFIER-CONTROL
2	1	RESISTOR-STABILIZING
1	2	REACTOR-GATE

PARTS LIST

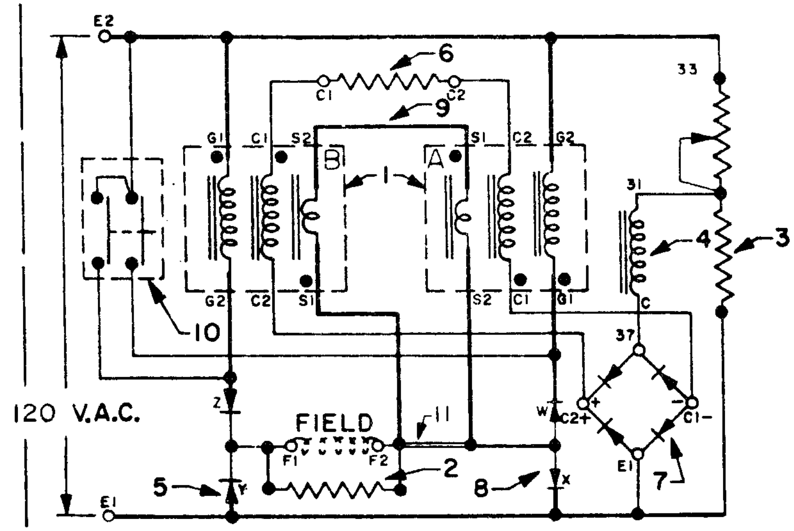
★JUMPER CONNECTION POINTS FOR METHOD J. TESTING

TYPICAL DIAGRAM OF 04SX AND 06SX MAGNECITERS

PICTORIAL



SCHEMATIC



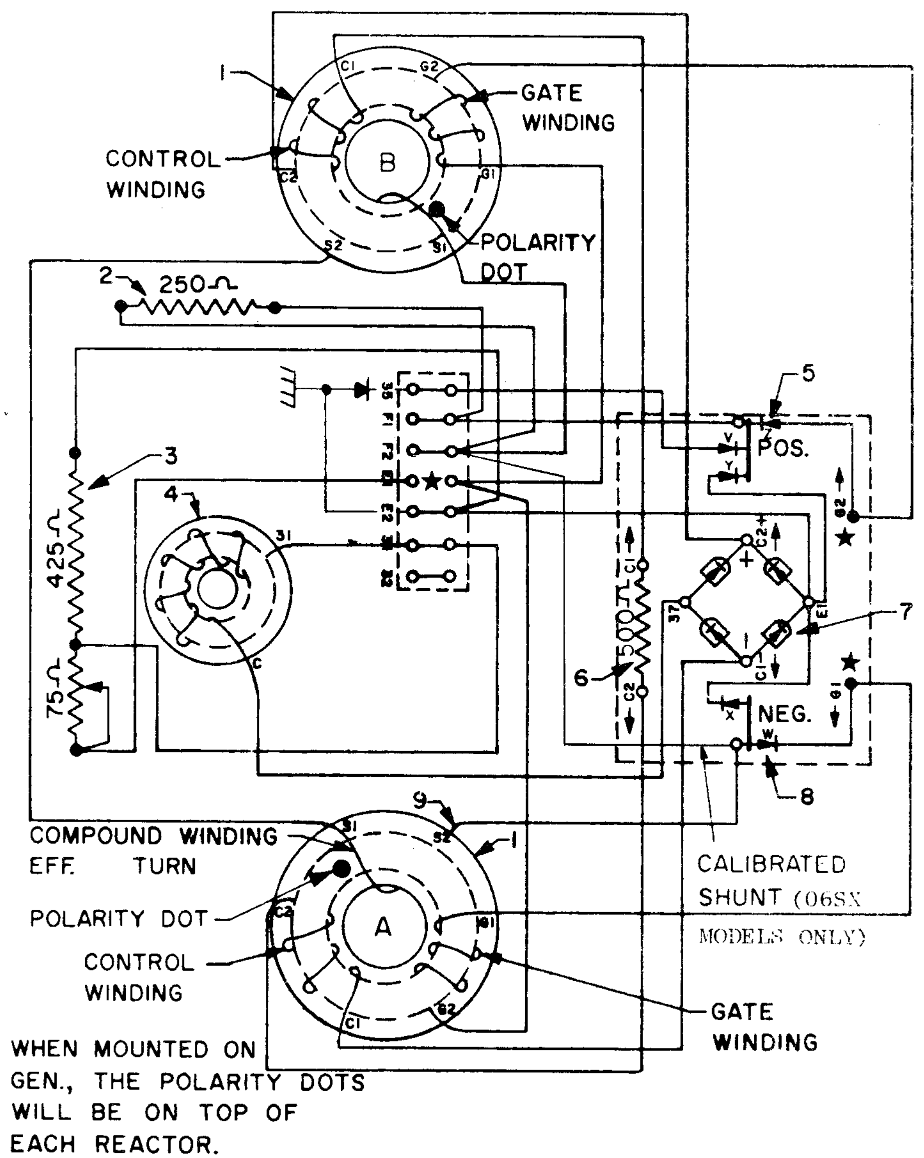
ITEM	QTY	DESCRIPTION
11	1	NO. 16 WIRE, 27½" LG.
10	1	SWITCH-RESIDUAL RESET
9	1	NO. 14 WIRE, 27½" LG.
8	2	RECTIFIER-FIELD NEG.
7	4	RECTIFIER-CONTROL
6	1	RESISTOR-STABILIZING
5	2	RECTIFIER-FIELD POS.
4	1	REACTOR-CONTROL
3	1	RESISTOR-VOLT. CONTROL
2	1	RESISTOR-DAMPING
1	2	REACTOR-GATE

PARTS LIST

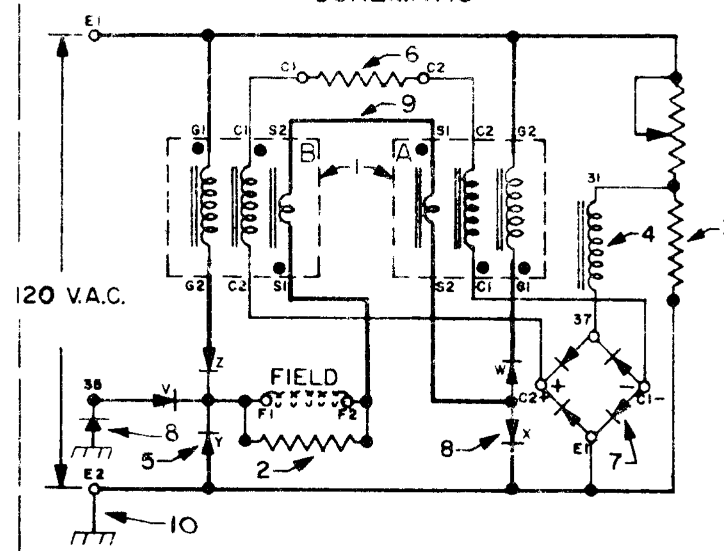
★JUMPER CONNECTION POINTS FOR METHOD J. TESTING

TYPICAL DIAGRAM OF 04SX AND 06SX MAGNECITERS WITH AUTOMATIC FIELD FLASHING

PICTORIAL



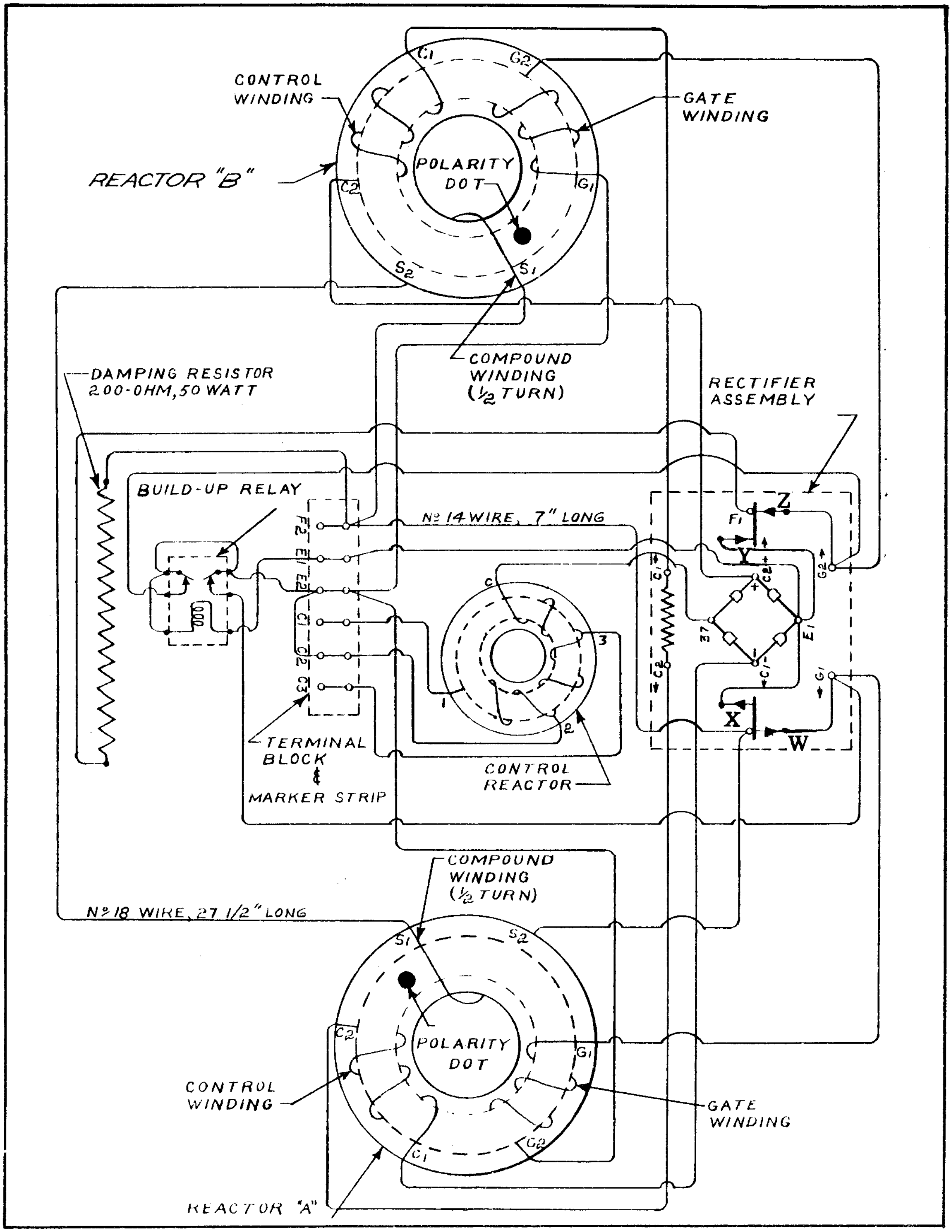
SCHEMATIC



10	1	LEAD ASSY
9	1	NO. 14 WIRE, 27 1/2" LG.
8	3	RECTIFIER-FIELD NEG.
7	4	RECTIFIER-CONTROL
6	1	RESISTOR-STABILIZING
5	3	RECTIFIER-FIELD POS.
4	1	REACTOR-CONTROL
3	1	RESISTOR-VOLT. CONTROL
2	1	RESISTOR-DAMPING
1	2	REACTOR-GATE
ITEM	QTY	DESCRIPTION

PARTS LIST

★ JUMPER CONNECTION POINTS FOR METHOD J. TESTING



02SX1N1A MAGNECITER

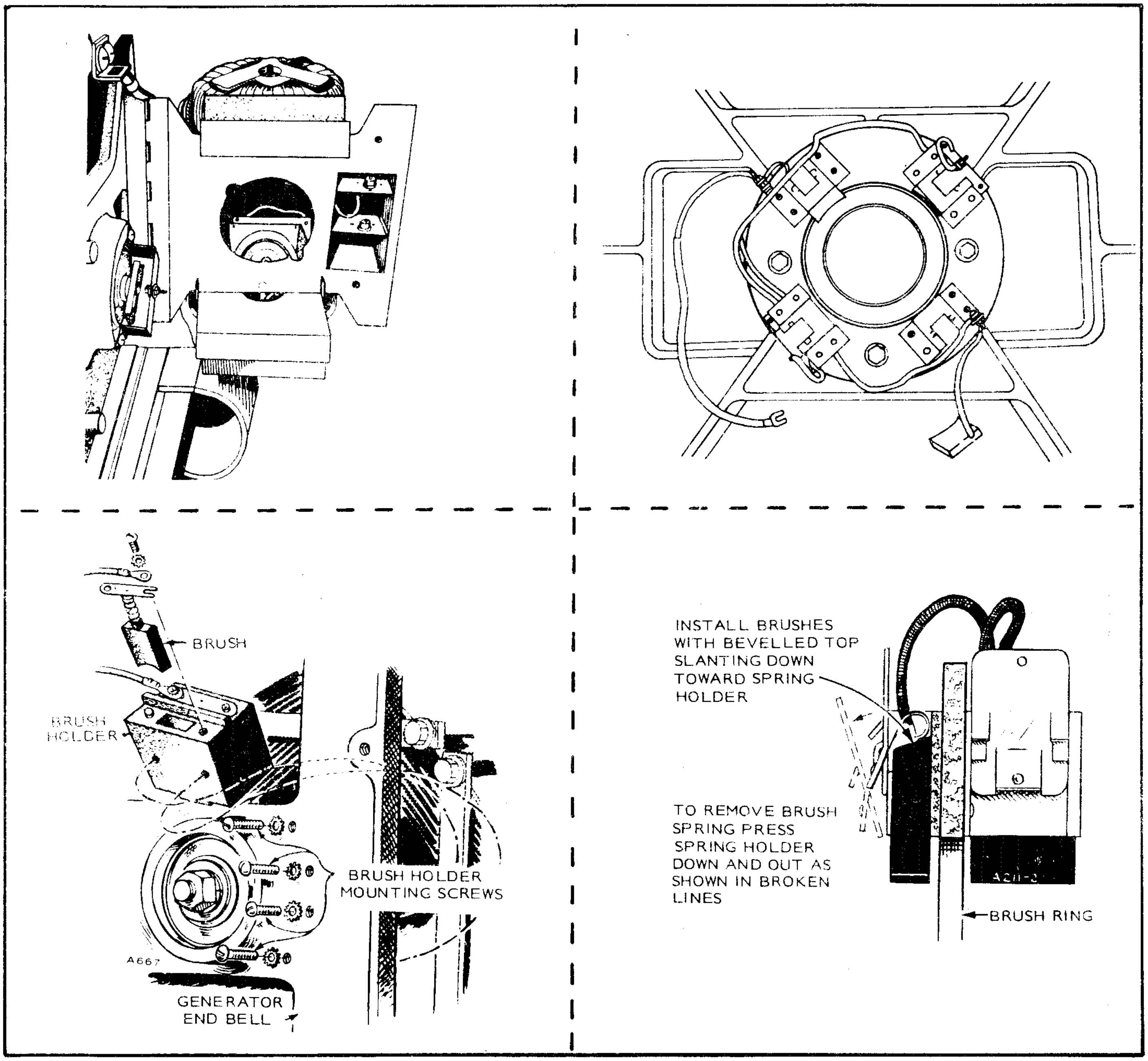


FIGURE 4-9. BRUSH LOCATION AND REPLACEMENT

Brushes should be replaced when they wear to about 5/16 inch.

CAUTION *Use only Onan parts when replacing brushes. Other replacement brushes may look identical but they may have entirely different electrical characteristics.*

TESTING AND REPAIR

If repair work is necessary on the generator, it should be performed by a competent electrician who is familiar with operation of electric generating equipment.

TROUBLESHOOTING

In the event of abnormal generator output voltage, observe the following procedures.

No Voltage Buildup: Remove the exciter cover and with the set running, operate the residual reset button on the Magneciter.

NOTE: *Early 04SX and 06SX models had no reset button. On these models place jumpers momentarily from G1 to G2 of each reactor simultaneously with the unit running. On the 02SX exciter, the buildup relay automatically performs this function. Units beginning Spec P have a voltage tap at terminal 35 which allows automatic field flashing during unit cranking to assure voltage buildup.*

If output voltage won't buildup after pushing the reset button, flash the field (Figure 4-11). Connect a voltmeter across the AC output. Then run the unit and momentarily touch the leads of a 6-volt lantern battery to the exciter to brush leads . . . positive (+) to F1 and negative (–) to F2.

While viewing the voltmeter:

1. If voltage builds up to normal, trouble was due to lost residual in the field.
2. If voltage is low, the Magneciter is probably defective. (See *Magneciter Troubleshooting Chart.)*
3. If there is no voltage output with battery connected to F1 and F2, trouble is in alternator.

Over-Voltage or Fluctuating Voltage: If the engine is operating at the correct speed, see *Magneciter Troubleshooting Chart.*

GENERATOR BEARING

The generator ballbearing is prelubricated and double-sealed. Inspect every 1000 hours with the unit running.

If the set is used for "standby power", replace bearing every five years. If used as "prime power", replace bearing every 10,000 hours or two years. Deterioration of the bearing grease due to oxidation makes this replacement necessary.

If the bearing becomes noisy, worn or otherwise defective, replace it. Remove the old ballbearing with a gear puller and press a new one into place (Figure 4-10).

COLLECTOR RINGS

The collector rings must be clean and free of burrs, scratches and marks. If necessary, use No. 00 sandpaper to clean the surface. Never use emery cloth or other conducting abrasives.

Collector rings may have a dark brown or black appearance. This is a thin lubricating film and aids the life of the brushes and slip rings. (Do not remove film.)

If the collector rings are grooved, out-of-round, pitted or rough so that good brush seating can't be maintained, remove the rotor and refinish the rings in a lathe. Remove or shield the ballbearing during refinishing. The collector rings should have a Total Indicated Reading (T.I.R.) of .002″.

MAGNECITER

The magneciter contains no moving parts except for the 02SX. Periodically blow out any dust and make certain that all components and connections are secure.

For detailed magneciter description see the *Magneciter Description, Troubleshooting,* and *Repair* portion of this section.

ALTERNATOR TESTING

Most alternator testing can be performed without disassembling the generator.

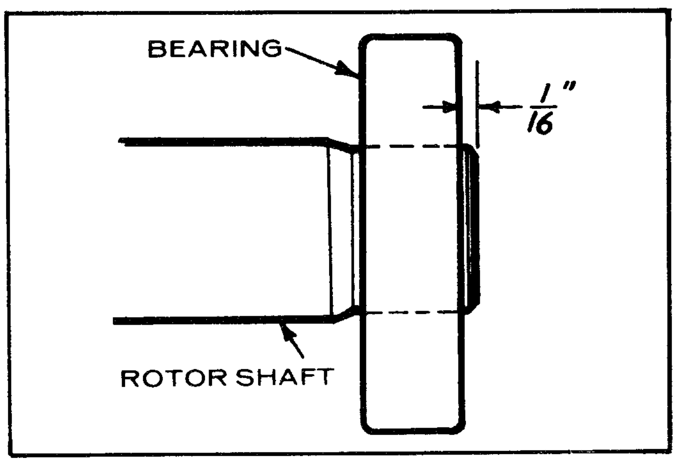


FIGURE 4-10. BEARING INSTALLATION.

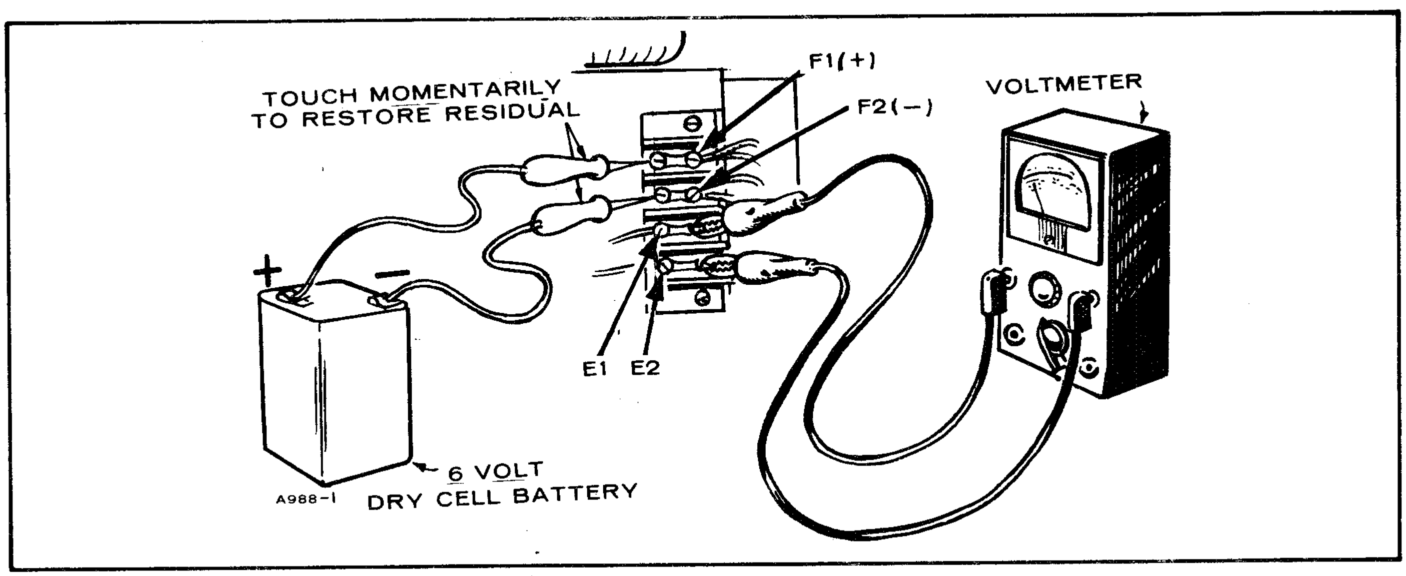


FIGURE 4-11. FLASHING THE FIELD.

Test Rotor Continuity As Follows:

Remove the brushes so none touch the collector rings.

1. Using an ohmmeter, test for grounding between each slip ring and the rotor shaft.
2. Test for a short or open circuit in rotor winding by measuring resistance of winding. It should measure between 3.5 and 4.8 ohms for the JB and between 2 and 3 ohms for the JC (at 70°F). If an accurate ohmmeter isn't available, check the rotor for open circuit or grounding with an AC test lamp (Figure 4-12). Replace the rotor if it is grounded, or has an open circuit or short.

Test Stator Continuity As Follows:

1. Disconnect the generator output leads in the control box. Use the wiring diagrams to determine the output leads in the control box. Use the wiring diagrams to determine the output lead coding. Using either the test lamp or an ohmmeter, check each winding of the stator for grounding to the laminations or frame.

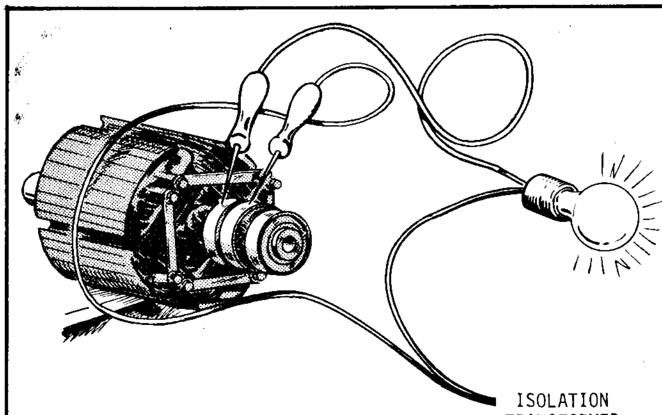
   NOTE: *Some generators have ground connections to the frame. Check the wiring diagrams.*

2. Using an accurate ohmmeter, test the resistance of each stator winding. Compare the resistances obtained. All windings of equal output voltage should indicate about the same resistance. An unusually low reading indicates a short; a high reading an open circuit. If the ohmmeter required for this test isn't available, check for open circuits with the test lamp.
3. If any windings are shorted, open-circuited or grounded, replace the stator assembly. Before replacing the assembly, check the leads for broken wires or insulation and replace any defective lead. If this does not correct the fault, replace the assembly.

Battery Charging Winding Tests: Remove the lead from from the battery polarity reconnection block to ammeter at the ammeter. Install a DC voltmeter between the lead and ground. At governed engine speed, the average DC output should be 19 to 21 volts. If the output is defective, test for open circuit or grounding in the leads and windings. If leads are defective, replace them. If the winding is defective, replace the stator.

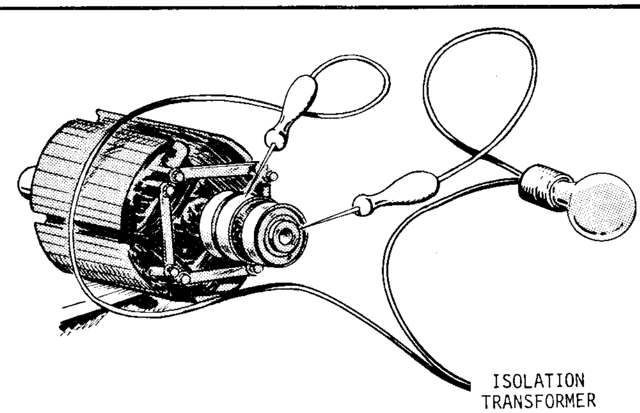
GENERATOR DISASSEMBLY (Figure 4-14)

1. Disconnect the battery to prevent accidental starting of the set.
2. Remove the exciter cover and open the exciter. This will reveal the rotor-thru-stud nut.
3. Remove the four machine screws on the end bell near the bearing and lift out the brush holders.
4. Remove the lead from the tapped adjustable resistor in the generator air outlet opening.
5. Remove the leads from the control box to the ignition system choke, start disconnect switch, etc. on the engine.
6. Remove generator-through-stud nuts, remove the end bell and stator assembly. Screwdriver slots in the adapter provide a means for prying the stator loose. Be careful not to let the stator touch or drag on the rotor.
7. Remove baffle ring from adapter. Turn rotor-through-stud nut to the end of the through stud. While pulling the rotor outward with one hand, strike a sharp blow to the nut (in the direction of the through stud, *not vertically*) with a heavy, soft faced hammer to loosen the rotor from its tapered shaft fit. If the rotor does not come loose, strike it with a sharp downward blow in the center of the lamination stack with a lead or plastic hammer. Rotate the rotor and repeat until it comes loose. Be careful not to hit the collector rings, bearings or windings.
8. After disassembly, all parts should be wiped clean and visually inspected.



TESTING FOR OPEN CIRCUIT

CONTACT ONE TEST PROD TO ONE SLIP RING AND THE OTHER PROD TO THE SECOND SLIP RING.
IF GOOD BULB SHOULD LIGHT.



TESTING FOR GROUNDS

CONTACT ONE PROD TO EACH OF THE SLIP RINGS AND THE OTHER PROD TO THE ROTOR SHAFT.
IF GOOD BULB SHOULD NOT LIGHT.

FIGURE 4-12. TESTING FOR OPEN CIRCUIT AND GROUNDS.

GENERATOR ASSEMBLY

1. Clean and inspect all mating surfaces.
2. Coat the mating area between the generator shaft and the engine crankshaft with a thin film of lubricating oil, "Molykote" or equal.
3. Install the rotor-through-stud in the engine crankshaft.
4. Install the key in the crankshaft.
5. Slide the rotor over the through-stud and onto the crankshaft. Be careful not to let the weight of the rotor rest on the through-stud.
6. Install the baffle ring.
7. Install generator through studs in the adapter.
8. Install the stator and bearing support (end bell). Tighten the nuts on through-studs.

   NOTE: *Make certain the B1 lead is placed through the grommet in the baffle ring and out the air discharge opening in the adapter.*

9. Now torque down the rotor-through-stud nut (55-60 ft. lb.). Because the stator and bearing support were tightened before tightening the rotor, the rotor and stator are automatically aligned.
10. Tap the bearing support to the horizontal and vertical plane with a lead hammer to relieve stresses on the components (recheck torque).
11. Reconnect the leads to the preheater, centrifugal switch and governor solenoid.
12. Install lead B1 on the adjustable resistor.

    CAUTION *Check this lead to see that it is short and is kept away from the blower. If necessary when installing a new stator or leads, cut it shorter and reinstall the connector.*

13. Install the brushes and brush holders.
14. Close the Magneciter, secure with four capscrews and install the end cover.

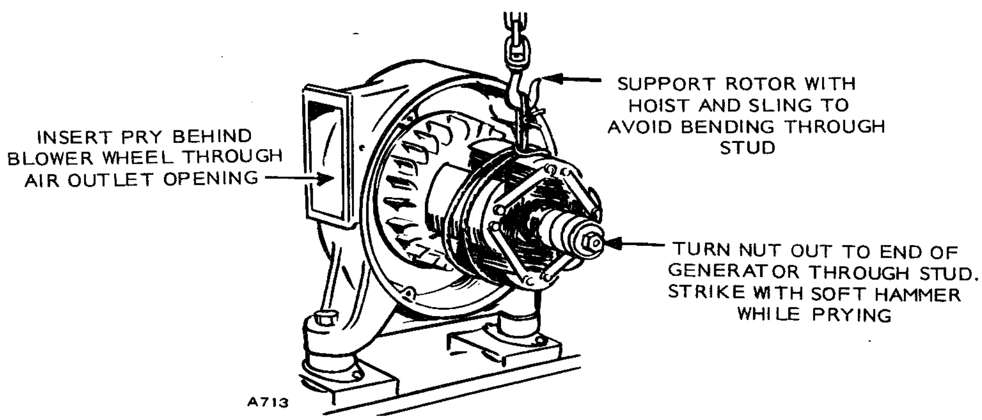


FIGURE 4-13. SUPPORTING THE ROTOR

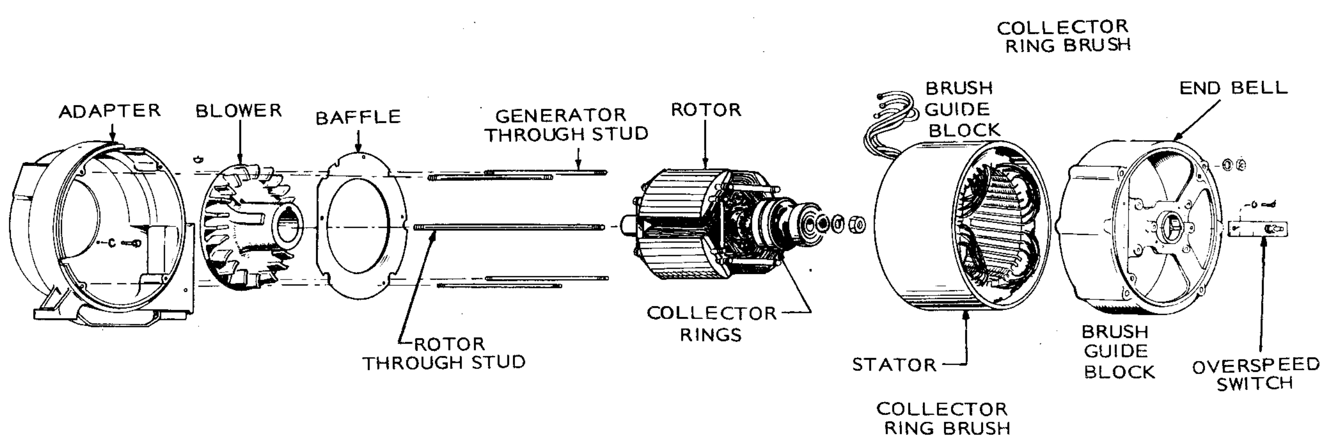


FIGURE 4-14. REVOLVING FIELD GENERATOR ASSEMBLY.

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