Onan

Service Manual

UR Generator

UR Generator with Torque Match-2™ Regulator

982-0002
3-87
Printed in U.S.A.

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.

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

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

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

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.

Table of Contents

Section 1. Introduction

ABOUT THIS MANUAL

This manual provides troubleshooting and repair information for the Onan series UR generator with a Torque Match-2 (VRAS-2) voltage regulator. For further operation, service, and troubleshooting information regarding engine or controller components, refer to support manuals specific to your generator set.

Study all manuals carefully and observe all warnings and cautions found on page ii and throughout this manual. Knowing your generator set, using it properly, and following a regular maintenance schedule will help you obtain longer unit life, better performance, and safer operation.

Repair information in this manual for printed circuit board components other than fuses is not extensive as solid state printed circuit boards lend themselves more to replacement than repair. Application of meters or hot soldering irons to printed circuit boards by other than qualified personnel can cause unnecessary and expensive damage. Repair of the printed circuit boards is not recommended except by the factory.

⚠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 or a digital VOM. Some other instruments to have available are:

- Onan Multitester
- Jumper Leads
- AC Voltmeter
- DC Voltmeter
- Frequency Meter
- Wheatstone or Kelvin Bridge

See Onan Tool Catalog 900-0019.

HOW TO OBTAIN SERVICE

In the event the generator requires servicing beyond the scope of information contained in this manual, contact an Onan Distributor for assistance. Onan factory trained Parts and Service representatives are ready to handle all your service needs.

When contacting an Onan Distributor, always supply the complete Model number and Serial number as shown on the Onan nameplate. The Onan nameplate is located on the side of the generator control box.

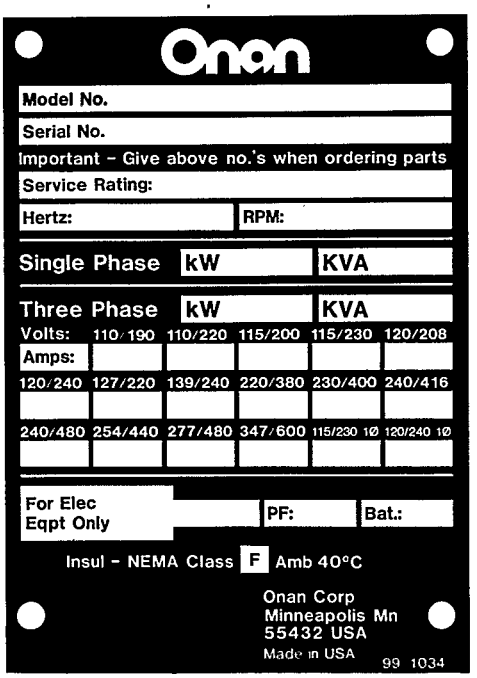

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FIGURE 1-1. ONAN NAMEPLATE

⚠WARNING

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

Section 2. Generator and Voltage Regulator

GENERATOR DESCRIPTION

The UR generator is a four pole, revolving field generator designed for 1500 (50 Hz) or 1800 (60 Hz) r/min operation. Excitation is provided with a brushless exciter mounted inboard of the generator endbell. The generator rotor is directly coupled to the engine flywheel with a flexible drive disc. Engine speed determines generator frequency. A centrifugal blower (on the drive disc) circulates discharged air through an outlet in the blower end. See Figure 2-1.

As specified in Voltage/Current Options, Table 2-1, generators are reconnectible to provide the listed voltage options. Output rating is 0.8 PF. See Figure 2-2 and Table 2-1.

AC output leads extending from the stator housing are tapped with control wires (leads: 4,7,8,9 and 10). These control wires are routed into the control box and used for control input and metering, Figure 2-3.

The brushless exciter stator mounts in the end bell while the exciter rotor and its rotating rectifier assemblies mount on the generator rotor shaft. Within the endbell, leads F1+ and F2- from the exciter stator winding are connected to the output terminals of the voltage regulator, Figure 2-3.

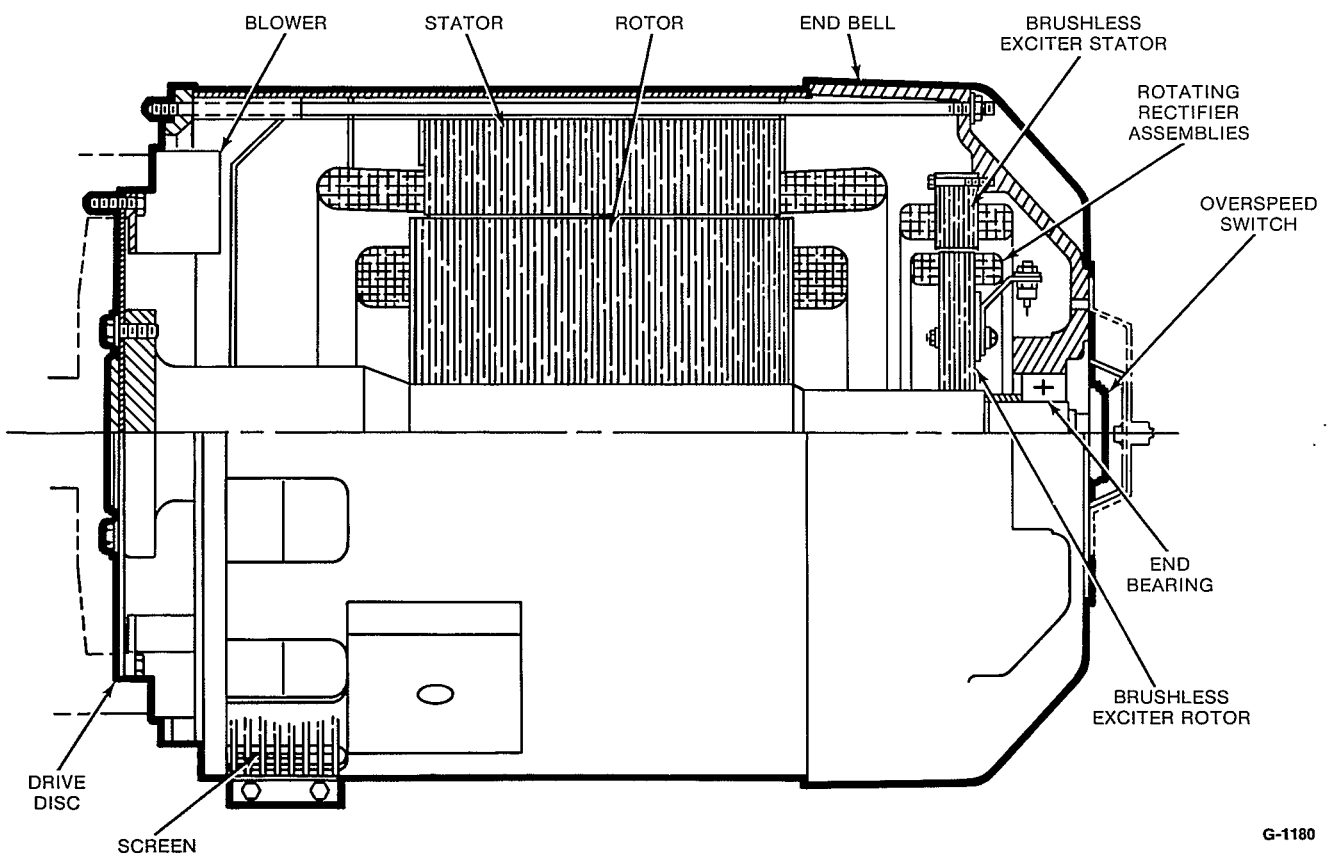
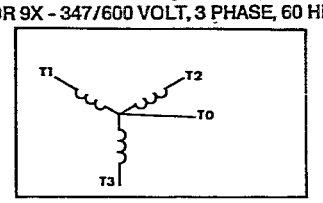
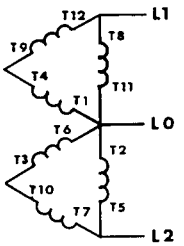
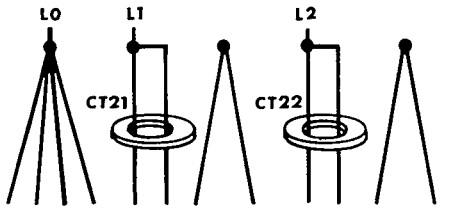
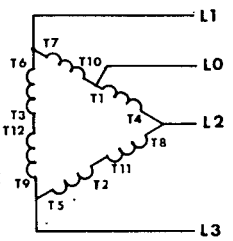
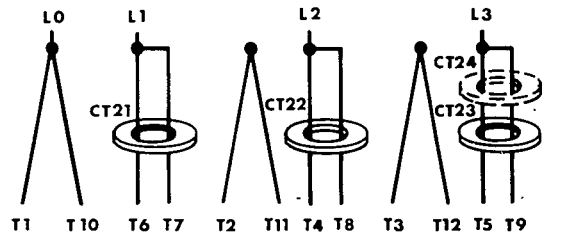
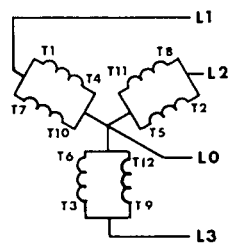
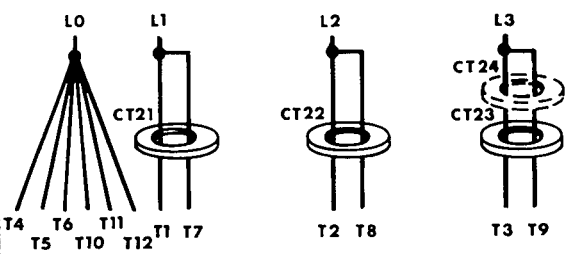
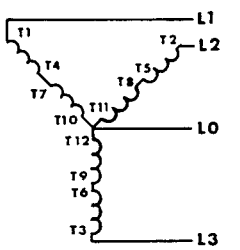
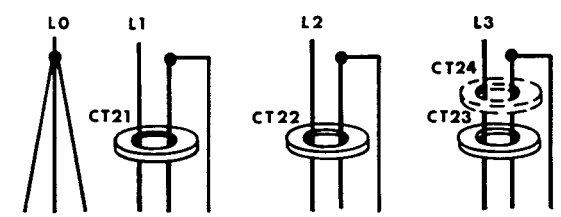


FIGURE 2-1. UR GENERATOR

VOLTAGE CODE:
"F" OR 7 - 220/380 VOLT, 3 PHASE, 60 HERTZ
"H" OR 9X - 347/600 VOLT, 3 PHASE, 60 HERTZ



NAMEPLATE VOLTAGE CODE		VOLTAGE	PHASES	HERTZ	GENERATOR CONNECTION	GENERATOR CONNECTION SCHEMATIC DIAGRAM	GENERATOR CONNECTION WIRING DIAGRAM (WITH CURRENT TRANSFORMERS WHEN USED)
L	15	120/240	1	60	DOUBLE DELTA		
Z	515	115/230	1	50			
		110/220	1	50			
R	32	110/220	1	60			
		115/230	1	60			
L	15	120/240	3	60	SERIES DELTA		
Z	515	115/230	3	50			
		110/220	3	50			
R	32	110/220	3	60			
		115/230	3	60			
L	15	120/208	3	60	PARALLEL WYE		
		127/220	3	60			
		139/240	3	60			
Z	515	110/190	3	50			
		115/200	3	50			
		120/208	3	50			
		127/220	3	50			
R	32	110/190	3	60			
		115/200	3	60			
L	15	240/416	3	60	SERIES WYE		
		254/440	3	60			
		277/480	3	60			
Z	515	220/380	3	50			
		230/400	3	50			
		240/416	3	50			
		254/440	3	50			
R	32	220/380	3	60			
		230/400	3	60			
R	523	200/346	3	50			

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NOTE: This figure is for reference only. Refer to electrical schematic specific to your generator for further connection information.

FIGURE 2-2. VOLTAGE CONNECTIONS

TABLE 2-1. UR GENERATOR VOLTAGE/CURRENT OPTIONS

RATING		HERTZ		1-PHASE STANDARD	1-PHASE SPECIAL (B125)			3-PHASE													
				(2) (4)	(1)	(1)	(2)	(1)	(1)	(3)	(1)	(3)	(1)	(2)	(2)	(1)	(1)	(3)	(3)	(2)	(2) (4)
				120/240	110/220	115/230	120/240	110/190	115/200	120/208	110/220	127/220	115/230	120/240	139/240	220/380	230/400	240/416	254/440	277/480	347/600
kW	kVA	50	60																		
25.0	31.25	x			142	136		95	90	87	82	82	78			47	45	43	41		
30.0	37.50		x	156			156			104		98		90	90			52	49	45	36
37.5	46.88	x			213	204		142	135	130	123	123	118			71	68	65	62		
40.0	50.0	x			227	217		152	144	139	131	131	126			76	72	69	66		
45.0	56.25	x	x	234	256	245	234	171	162	156	148	148	141	135	135	85	81	78	74	68	54
50.0	62.5	x	x		284	272	260	190	180	173	164	164	157	150	150	95	90	87	82	75	60
55.0	68.75	x	x		313	299	286	209	198	191	180	180	173	165	165	104	99	95	90	83	66
60.0	75.0		x				313			208		197		180	180			104	98	90	72
62.5	*78.13*	x			355	340		237	226	217	205	205	196			119	113	108	103		
65.0	81.25		x				339			226		213		195	195			113	107	98	78
70.0	87.5	x	x		398	380	365	266	253	243	230	230	220	210	210	133	126	121	115	105	84
75.0	93.75	x	x		426	408	391	285	271	260	246	246	235	226	226	142	135	130	123	113	90
80.0	100.0	x			455	435		304	289	278	262	262	251			152	144	139	131		
85.0	106.25		x				443			295		279		256	256			147	139	128	102
90.0	112.5		x				469			312		295		271	271			156	148	135	108
95.0	118.75	x			540	516		361	343	330	312	312	298			180	171	165	156		
100.0	125.0	x	x		568	543	521	380	361	347	328	328	314	301	301	190	180	173	164	150	120
115.0	143.75	x	x				599	437	415	399	377	377	361	346	346	218	207	200	189	173	138
120.0	150.0						625														
125.0	156.25	x	x					475	451	434	410	410	392	376	376	237	226	217	205	188	150
130.0	162.50	x						494	469	451	426	426	408			247	235	226	213		
140.0	175.0	x	x					532	505	486	459	459	439	421	421	266	253	243	230	210	168
145.0	181.25	x						551	523	503	476	476	455			275	262	252	238		
150.0	187.5	x	x					570	541	520	492	492	471	451	451	285	271	260	246	226	180
155.0	193.75		x							538		508		466	466			269	254	233	186
170.0	212.5		x							590		558		511	511			295	279	256	204
175.0	218.75		x							607		574		526	526			304	287	263	210
180.0	225.25		x							625		591		542	542			313	296	271	217

(1) - 50 Hz only.
(2) - 60 Hz only.
(3) - 50- and 60 Hz
(4) - Not Reconnectible.

FIGURE 2-3 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 7, F, 9X and H 3-phase generators.

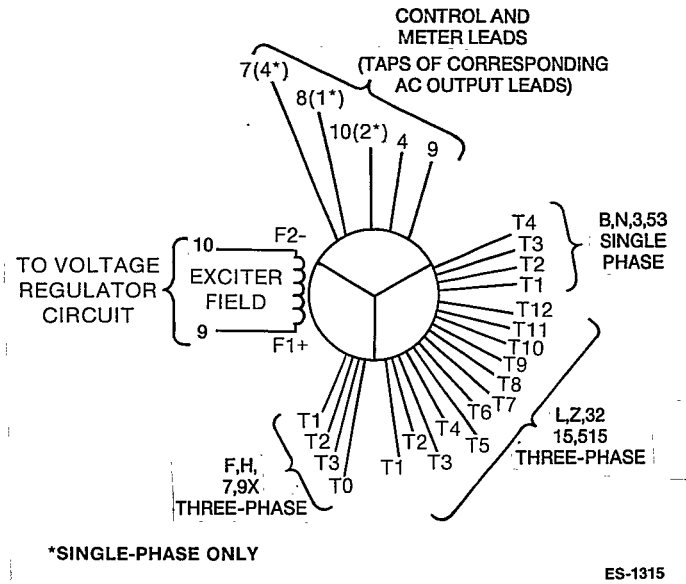


FIGURE 2-3. SINGLE AND THREE PHASE GENERATOR SCHEMATIC (COMPOSITE)

Optional Circuit Breaker

Depending on site specifications and any applicable code requirements, an optional circuit breaker may be mounted on the generator housing. The location of the circuit breaker varies by generator set application, either side or top mount.

All Onan supplied circuit breakers are thermal and magnetic trip type. Depending on customer requirements, the circuit breaker may also include shunt trip and remote alarm connections. Review the following and refer to Figure 2-4.

- Generator set output is connected to the load through the circuit breaker.
- When an overload or short circuit occurs on any one conductor, a common trip bar will disconnect all three conductors.
- The thermal trip action of the circuit breaker is accomplished by bimetal strips (inside breaker). A sustained overcurrent condition will cause a thermal reaction of the bimetal, and thereby trip the breaker. Response of the bimetal is proportional to current; high current - fast response, low current - slow response. This action provides a time delay for normal inrush current and temporary overload conditions (i.e., motor starting).
- The magnetic trip action of the circuit breaker is caused by an electromagnet which partially surrounds the internal bimetal strips. In the event of a short circuit, the high current through the electromagnet will attract the bimetal armature and trip the breaker. Some circuit breaker models provide front-adjustability of the magnetic trip action. These adjustors are normally set at the factory at the high position, but provide for individual conductor settings to suit customer requirements.
- The shunt trip mechanism (if equipped) consists of a solenoid tripping device mounted in the circuit breaker and external lead connections for remote signaling. A momentary signal to the solenoid coil will cause the breaker to trip.

  This feature is available in AC and DC voltages, and is normally installed at the factory to meet customer requirements. For paralleled generator set installations, the shunt trip mechanism is most often connected to a common fault shutdown circuit of the generator set; in order to quickly disconnect the set from the load during a fault shutdown and thereby avoid a reverse power condition. Refer to site requirements for further information regarding the intended use of this feature.
- Auxiliary contacts (if equipped) consist of a set of contacts (one normally-open, and one normally-closed) intended for local or remote annunciation of breaker status. Refer to site requirements and proper wiring diagram for further information.
- The trip actuator is for periodic exercise of the breaker to clean and maintain its proper operation. Rotating this actuator mechanically simulates overcurrent tripping through actuation of linkages not operated by the On/Off handle. Refer to Section 4 - Tests/Adjustments for further information.
- Operation of the circuit breaker is determined by site-established procedures. In emergency standby installations, the circuit breaker is most often placed to the On position, and is intended for safety trip actuation in the event of a fault condition. When the breaker is caused to trip open, operator action is required; firstly, to investigate the cause of the trip and perform remedial steps required (see Troubleshooting), and secondly, the circuit breaker handle must be placed to the Reset position and then to On to reclose the breaker. Refer to Troubleshooting, and Tests/Adjustments sections for further information.

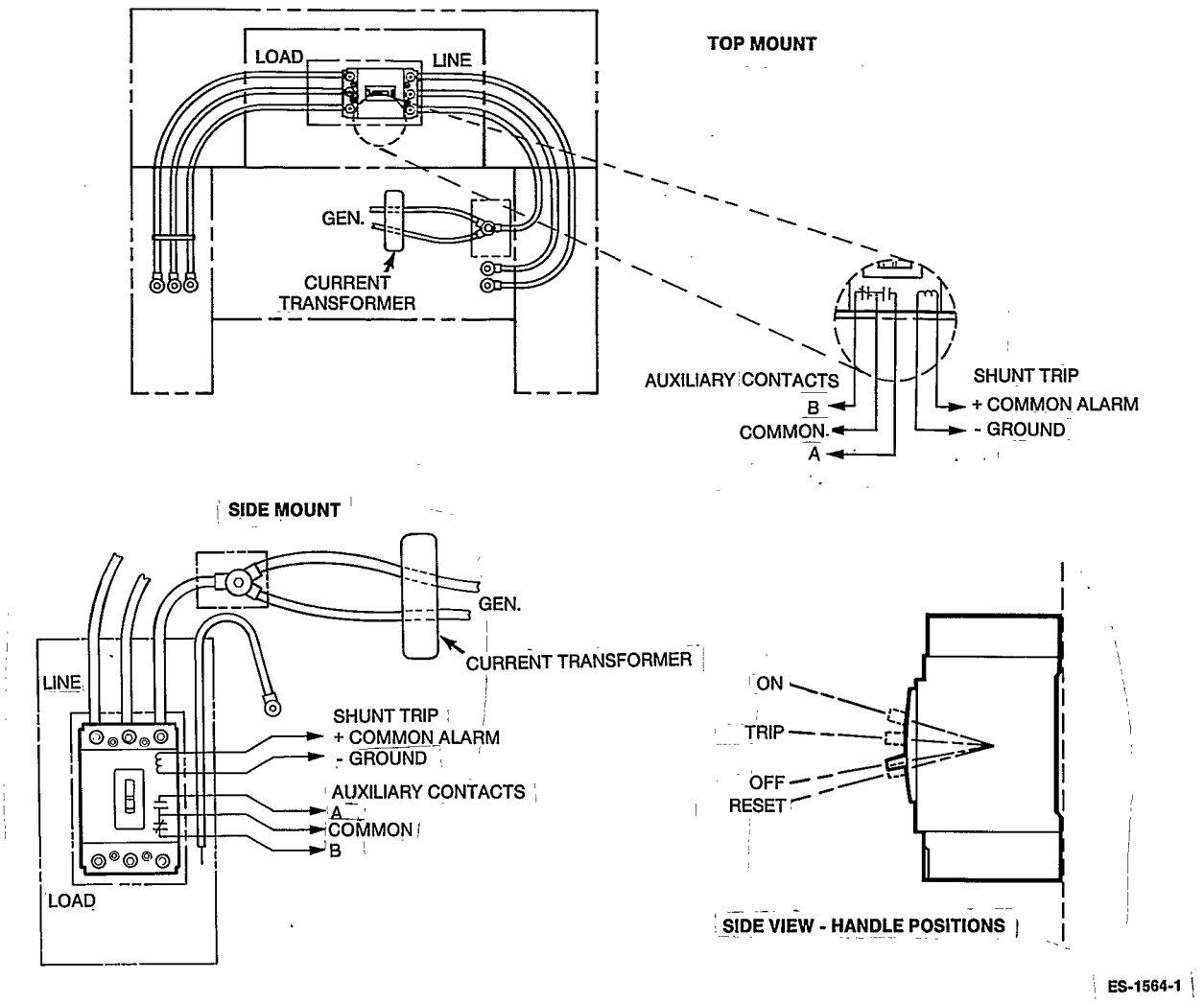


FIGURE 2-4. GENERATOR-MOUNTED CIRCUIT BREAKER

GENERATOR OPERATION

With the generator directly coupled to the engine flywheel, full rated output voltage is accomplished in a matter of seconds. The following briefly describes generator operation and voltage regulator interaction, in reference to Figure 2-5.

Refer to Voltage Regulator Description for further specifics regarding regulator operating modes.

1. Demand for power starts the engine, thereby turning the generator rotor.
2. Residual magnetism in the rotor's main field, induces voltage in the main stator.
3. Single-phase AC voltage is taken from the main stator winding and fed to the Torque Match-2 Voltage Regulator (VRAS-2) as a reference voltage.
4. The voltage regulator compares the input with the preset requirements, rectifies AC to DC, and sends a DC voltage to the exciter field.
5. The exciter stator field induces voltage in the exciter rotor.
6. Three-phase AC voltage is tapped from the exciter and fed to the rotating full-wave bridge rectifiers.
7. DC voltage from the rotating rectifiers is fed to the main field of the generator rotor.
8. The main field continues to build until rated (or preset) voltage is reached.

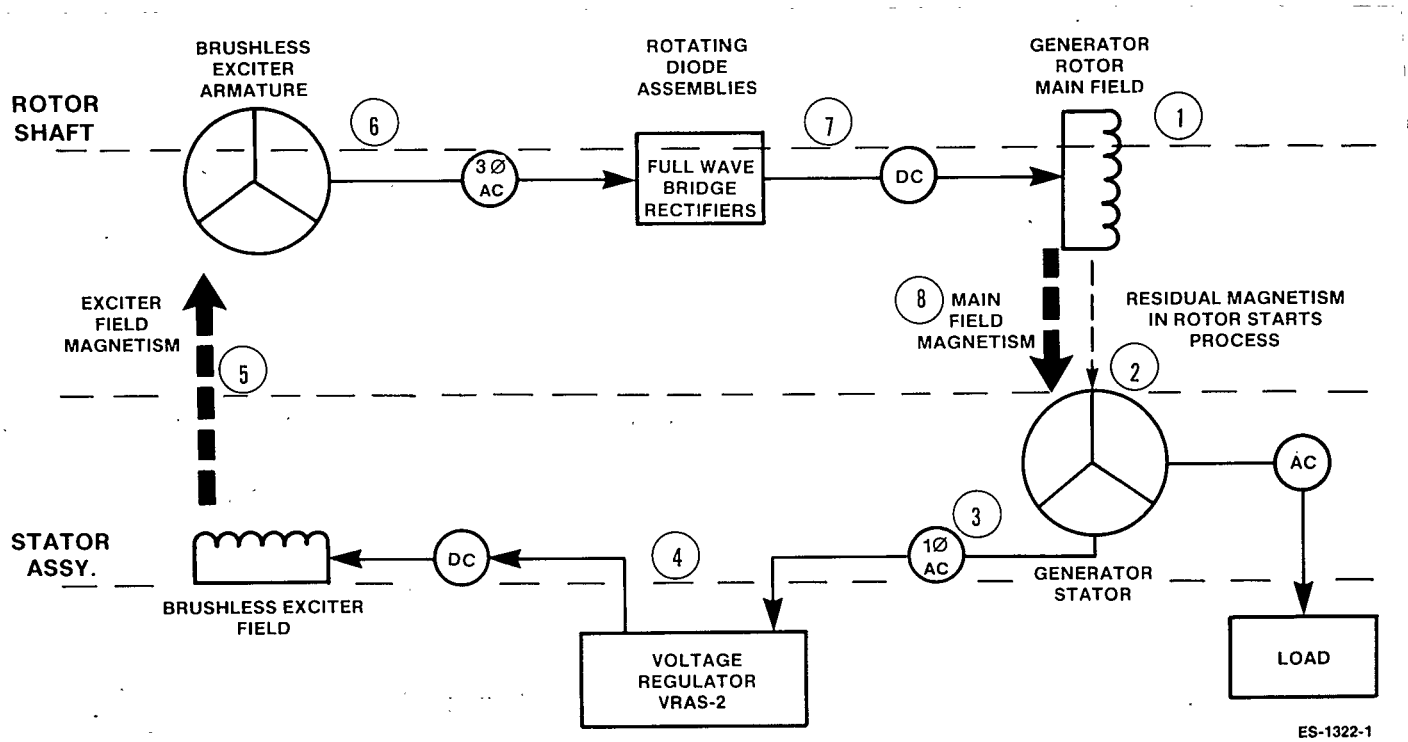


FIGURE 2.5 EXCITATION BLOCK DIAGRAM

VOLTAGE REGULATOR DESCRIPTION

The design of the Torque Match-2 Voltage Regulator (VRAS-2) provides switch selections that alter its sensing and command signals in order to achieve maximum operating performance in a variety of generator sizes and applications. Review the following, then refer to Voltage Regulator Adjustments for switch locations and settings specific to your generator set model.

Operating Modes

Torque-Matching: In most applications, in order for the generator set to accept the application of a large momentary overload, such as motor starting, matching the torque characteristics of the engine and generator is required.

Because of the differences in engine characteristics, different torque matching may be used for various engine/generator combinations. The switch-selectable design of the VRAS-2 provides Onan the flexibility to test and set the torque-matching function to best suit each engine/generator configuration.

When set to the proper torque-matching switch settings, the VRAS-2 voltage regulator is able to maintain output voltage, within reasonable limits, by reducing the voltage just enough to take full advantage of the engine's full available power under transient conditions and prevent an unstable response.

Non-Torque-Matching: Even though the voltage regulator can also be switch-selected to a non-torque-matching constant voltage mode, independent of engine speed, this mode will not prevent the generator set from stalling during momentary overload conditions, and is not recommended for use. Consult an Onan service representative before selecting this voltage regulation mode to ensure that load demands specific to your installation would not cause an unstable operation of the generator set.

Operating Stability

Because of the differences in exciter and main field time constants, different gain compensation is required for the various generator sizes and applications. The VRAS-2 voltage regulator is switch-selectable to a kW range of operation that best suits the generator set application.

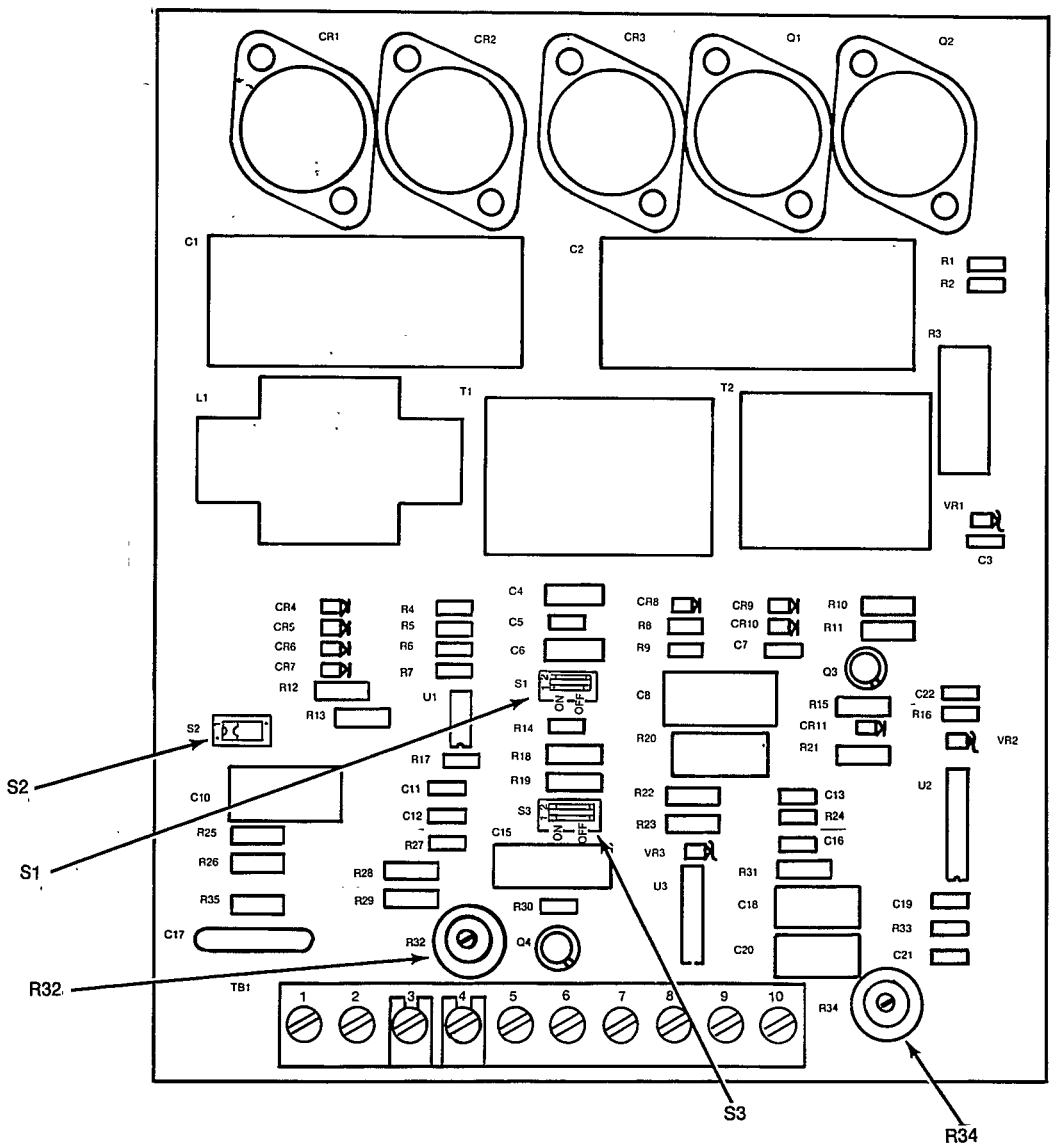
VOLTAGE REGULATOR ADJUSTMENTS

The VRAS-2 Voltage Regulator is shown in Figure 2-6. There are three switches that require actuation and two potentiometers on the voltage regulator as follows:

- Switch S1 - Selects the overall range of operation for the regulator. Refer to Table 2-2.
- Switches S2 and S3 - Determine the mode of regulation (Torque-Matched, or Non-Torque-Matched). Refer to Table 2-2.
- Potentiometer R32 - Provides adjustability to increase or decrease generator voltage to achieve proper setting.
- Potentiometer R34 - Is adjusted at the factory to set the frequency breakpoint, and does not require further adjustment.

TABLE 2-2. VRAS-2 SWITCH SETTINGS

GENSET kW RATING	STABILITY RANGE		REGULATION MODE								
			60 HZ TORQUE-MATCHING			50 Hz TORQUE-MATCHING			NON-TORQUE-MATCHING		
	S1-1	S1-2	S2	S3-1	S3-2	S2	S3-1	S3-2	S2	S3-1	S3-2
20-35	OFF	OFF	POS 2	OFF	ON	POS 2	ON	ON	POS 2	OFF	OFF
40-50	OFF	ON	POS 2	OFF	ON	POS 2	ON	ON	POS 2	OFF	OFF
60-100	ON	OFF	POS 2	OFF	ON	POS 2	ON	ON	POS 2	OFF	OFF
150-180	ON	ON	POS 2	OFF	ON	POS 2	ON	ON	POS 2	OFF	OFF



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TB1-2, -3 AC INPUT VOLTS
TB1-3, -4 CROSS-CURRENT COMPENSATION
TB1-7, -8 VOLTAGE ADJUSTING RHEOSTAT
TB1-9, -10 EXCITER FIELD
F1 — TB1-9
F2 — TB1-10

FIGURE 2-6. VOLTAGE REGULATOR

Section 3. Generator/Regulator Troubleshooting

CONTROL LOCATIONS

Review the following listing of component parts involved in generator troubleshooting. The following Troubleshooting Flow Charts will only be calling them by name and not location.

Generator Set Output Circuit Breaker: Mounted on outside of generator control output box housing.
Voltage Regulator - VRAS-2: Inside control box.
Terminal Board TB21: Inside control box.
Field Breaker CB21: On AC control box door.
Current Transformer CT21, 22, and 23: Inside housing, behind control box.
Rotating Rectifiers: Inside generator end bell, beneath control box.

⚠WARNING ***Accidental generator set starting can result in severe personal injury or death during service procedures. Disconnect battery cable before performing any checks on generator.***

PREPARATION

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

1. Check all modifications, repairs, and replacements performed since the last satisfactory operation of the set to ensure that all generator leads are correctly connected. A loose wire connection overlooked when installing a replacement part could cause problems, as could an incorrect connection, an opened circuit breaker, or a loose connection on a printed circuit board. A thorough visual check can quickly eliminate these potential problems.
2. Visually inspect the components of Voltage Regulator VRAS-2. Look for dust, dirt, or moisture and cracks in the printed solder conductors. Burned resistors and arcing tracks are readily identifiable. Do not mark on PC boards with a pencil; graphite lines conduct and can cause leakage or short circuits between components.
3. Visually inspect the exciter rotor assembly for burned components, broken wires, loose connections, and carbon tracks caused by arcing between parts or between parts and ground. Also check for shorted paths between terminals caused by dust, dirt, and moisture.

Unless absolutely sure that panel instruments are accurate, use portable test meters for troubleshooting.

⚠CAUTION ***To prevent meter damage, ohmmeter checks must be made with the unit stopped.***

TROUBLESHOOTING PROCEDURES

The information in this section is divided into Troubleshooting Flow Charts as follows:

A. No AC Output Voltage at Rated Engine Speed.
B. Unstable Output Voltage, Engine Speed Stable at Rated Speed.
C. Output Voltage Too High or Low.
D. Exciter Field Breaker Trips.
E. Unbalanced Generator Output Voltage.
F. No AC Output Through Set Mounted Circuit Breaker.

To troubleshoot a problem, determine the problem and then refer to the appropriate troubleshooting flow chart. Start at the upper left-hand corner of chart, and answer all the questions with either a YES or NO. Follow the chart until the problem is found, performing the referenced Adjustment and Test Procedures following the flow charts.

The referenced components in the flow charts and in the Adjustment and Test Procedures can be found on the electrical schematic in Figure 3-1, and on assembly and wiring diagrams.

This figure is for reference only. Use electrical schematic specific to your application when troubleshooting.

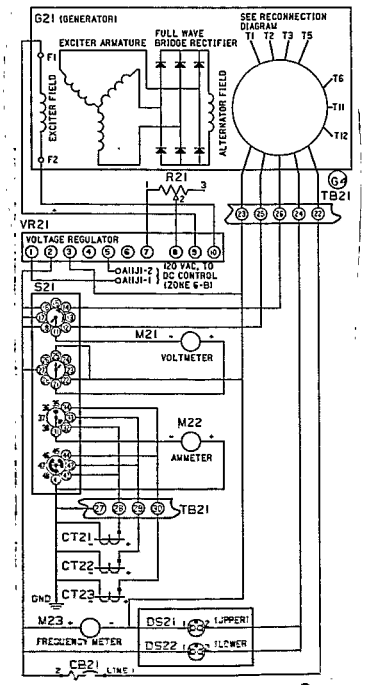
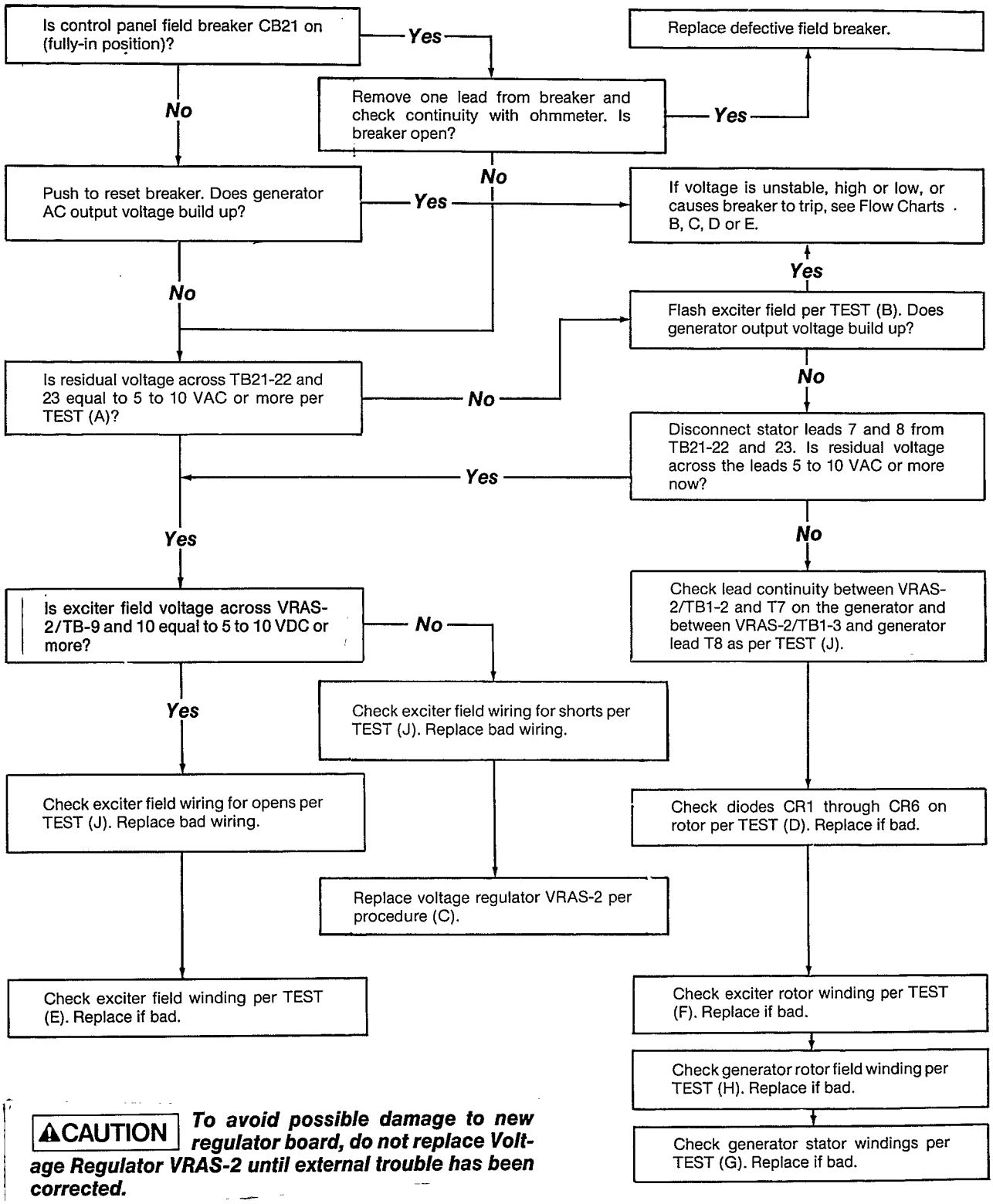


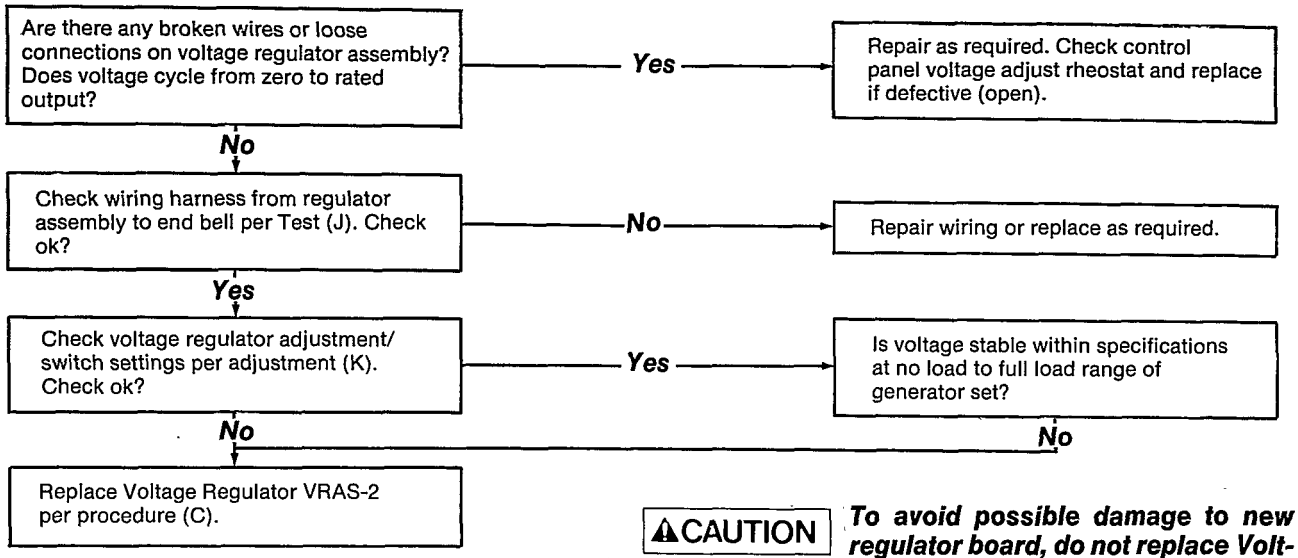
FIGURE 3-1. ELECTRICAL SCHEMATIC (Includes Detector AC Meter Option)

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



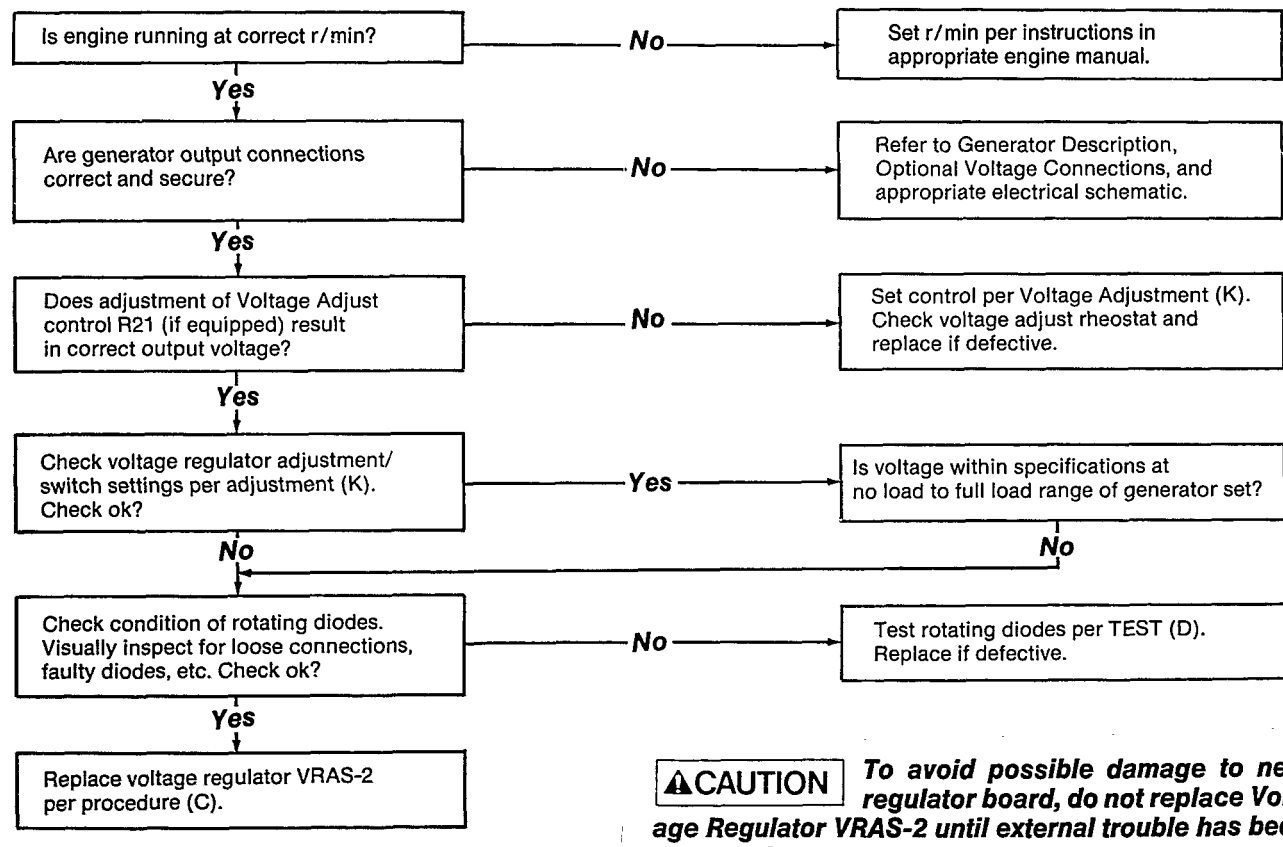
⚠CAUTION ***To avoid possible damage to new regulator board, do not replace Voltage Regulator VRAS-2 until external trouble has been corrected.***

FLOW CHART B. UNSTABLE VOLTAGE, ENGINE SPEED STABLE AT RATED SPEED.



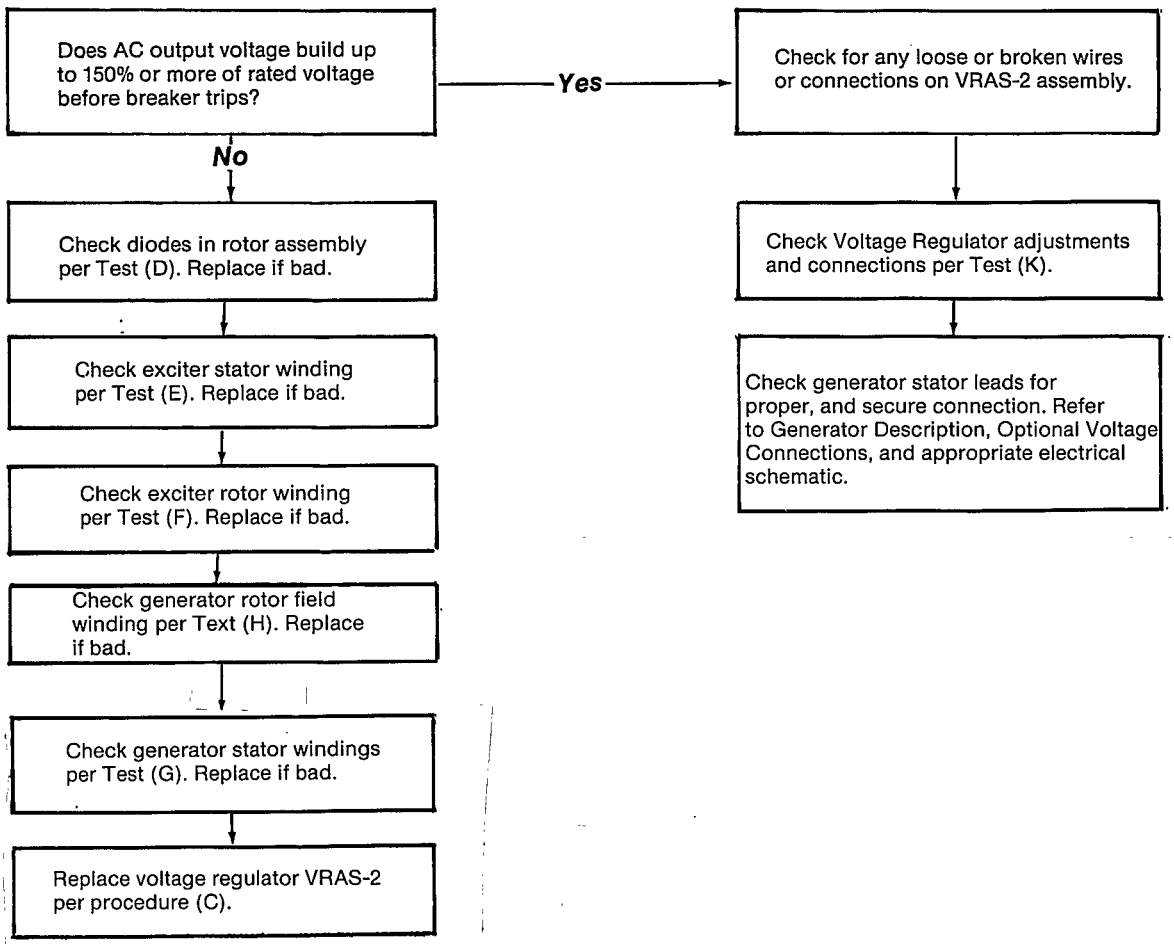
⚠CAUTION ***To avoid possible damage to new regulator board, do not replace Voltage Regulator VRAS-2 until external trouble has been corrected.***

FLOW CHART C. OUTPUT VOLTAGE TOO HIGH OR LOW.



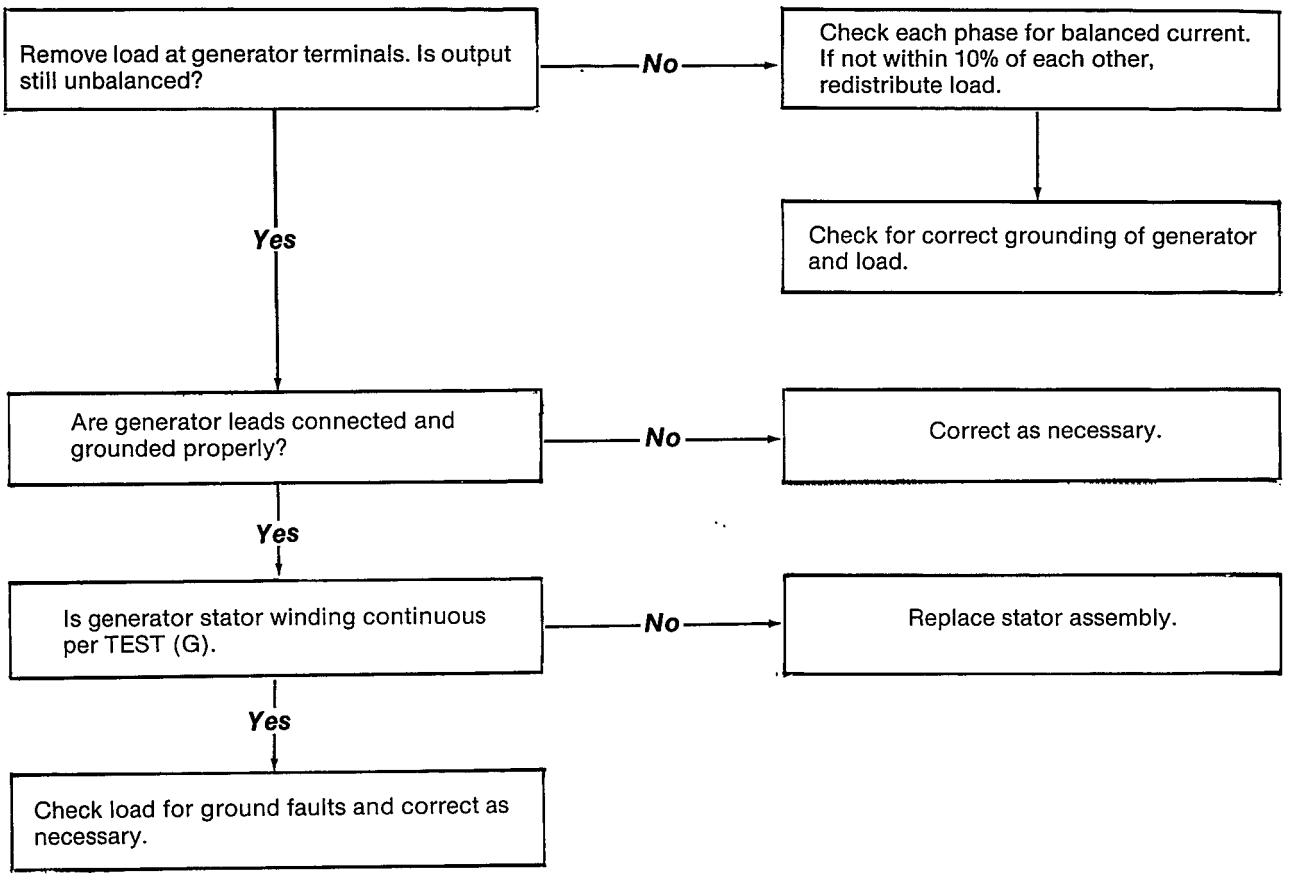
⚠CAUTION ***To avoid possible damage to new regulator board, do not replace Voltage Regulator VRAS-2 until external trouble has been corrected.***

FLOW CHART D. EXCITER FIELD BREAKER TRIPS.

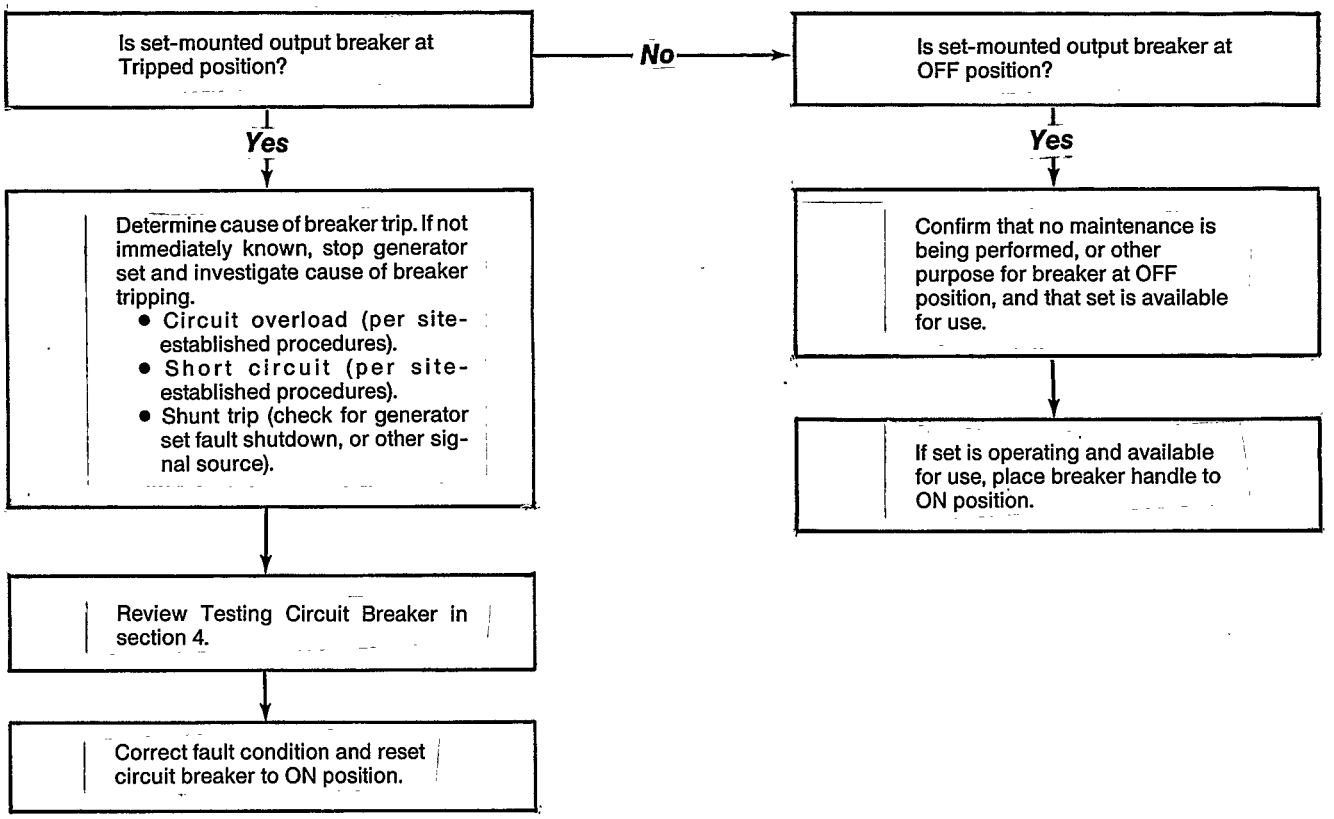


⚠CAUTION ***To avoid possible damage to new regulator board, do not replace Voltage Regulator VRAS-2 until external trouble has been corrected.***

FLOW CHART E. UNBALANCED GENERATOR OUTPUT VOLTAGE



FLOW CHART F. NO AC OUTPUT THROUGH SET MOUNTED CIRCUIT BREAKER.



Section 4. Generator/Regulator Tests/Adjustments

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. All ohmmeter tests must be made with the unit stopped to prevent meter damage.

(A)

TESTING AC RESIDUAL VOLTAGE

Generator residual AC voltage should be checked first if there is no AC power output. A good place to check is at terminal block TB21, across terminals 22 and 23. Residual voltage should be 5 to 10 VAC (no-load) at normal operating r/min. If none, flash the field following the instructions in Test B.

If residual voltage is present at TB21, then check the continuity of circuit breaker CB21. If CB21 is okay, proceed to voltage regulator VRAS-2 and check for residual voltage between terminal numbers 2 and 3. If none, check continuity between these points with the generator set shut down.

(B)

FLASHING THE FIELD

If output voltage does not build up, it may be necessary to restore residual magnetism by flashing the field. This requires a 6-volt battery and a 12-ampere 300-volt diode wired as shown in Figure 4-1.

A 3-volt source will also work, as will a 12- or 24-volt source. However, if a 12- or 24-volt source is used, a 2-watt, 20- or 40-ohm resistor, respectively, must be in series with the diode to drop the voltage to 6-volts.

Flashing the field can be accomplished with generator set operating or not. Either of the following procedures should be sufficient to restore residual magnetism.

With Generator Set in Operation

1. Start the generator set and operate at normal r/min.
2. Touch the positive battery lead to TB1-9 of VRAS-2, and the negative lead to TB1-10. Hold the leads in place just long enough for the voltage to build up to the normal operating level, then remove the leads.
3. Check generator voltage, and shut down generator set. Restart generator set and run at no load. Unit must build up voltage without field flashing. If not, shut down generator set and perform continuity check of all related wiring.

With Generator Set Shut Down

1. Touch the positive battery lead to TB1-9 and the negative lead to TB1-10 of VRAS-2.
2. Hold the leads in place for no longer than 5 seconds.
3. Start generator and run at no load. Unit must build up voltage without field flashing. If it does not, shut down generator set and perform continuity check of all related wiring.

⚠CAUTION ***Incorrect field flashing procedures can damage regulator. Do not maintain field flash connection to exciter circuit longer than 5 seconds.***

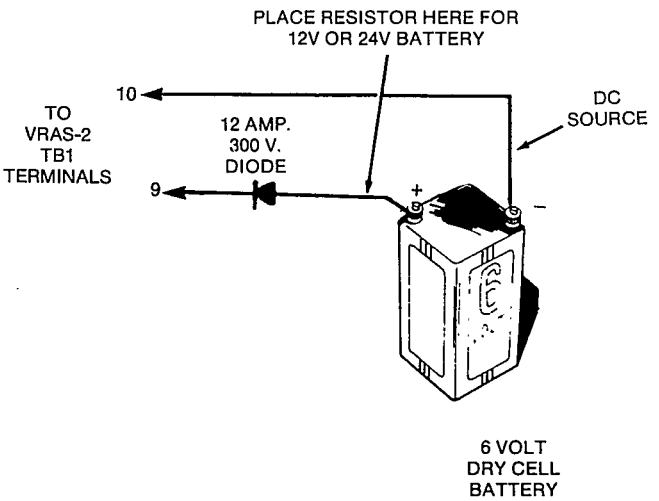


FIGURE 4-1. FIELD FLASHING CIRCUIT

(C)

VOLTAGE REGULATOR VRAS-2 REPLACEMENT

Use the following procedure for replacing the voltage regulator assembly:

1. Stop the engine, and disconnect starter batteries.
2. Disconnect, and if necessary label the wires from VRAS-2/TB1. Refer to AC control wiring diagram.
3. Remove the mounting screws, replace old VRAS-2 with new, and secure in place with mounting screws.
4. Reconnect wires removed in step 2 to proper terminals.
5. Perform voltage regulator adjustment/switch settings for specific voltage and method of regulation desired per procedure (K).

(D)

TESTING ROTATING RECTIFIERS (DIODES)

The six diodes mount on the rotating exciter assembly and are tested as follows:

1. Disconnect one diode at a time by removing diode from heatsink.
   A. Use proper size wrenches to hold the diode body while removing the nut.
   B. Push the diode free of the heatsink mounting hole.

⚠CAUTION ***Escessive dust or dirt on diodes and other components will cause overheating and eventual failure. Keep these assemblies clean!***

2. Test that diode before proceeding to the next one.
   A. Use an accurate ohmmeter to check the resistance of the diode. Connect one lead to the flag of the diode and the other lead to the stud. See Figure 4-2. Observe reading.
   B. Now reverse leads and again observe reading. A good diode should have a much higher reading in one direction than the other. If both readings are high or if both readings are low, diode is defective and must be replaced with a new, identical part.

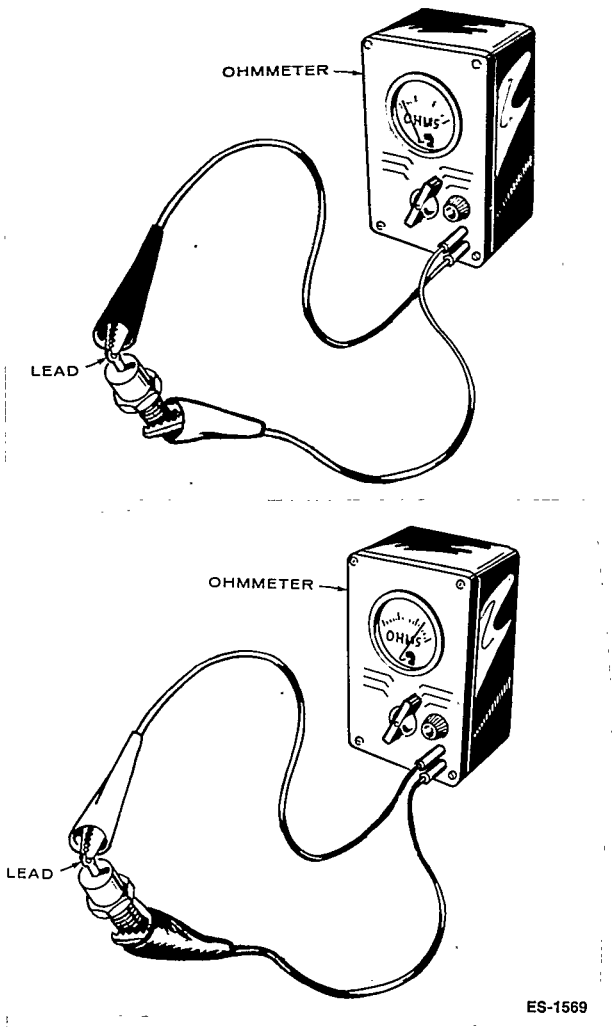


FIGURE 4-2. TESTING DIODES

3. To replace diodes, use the following procedure:
   A. Unsolder leadwires of defective diodes from flag terminals.
   B. Insert new diode into heatsink mounting hole. Using nut and washer provided, secure diode to heatsink.
   C. Use proper size wrenches to hold the diode body while tightening the nut. Torque diodes on rotating exciter assembly to 24 in-lb (2.7 N•m).
   D. Solder leadwires to new diode flag terminals.

⚠CAUTION ***Excessive heat on these rectifiers (diodes) will destroy them. Use a 40 watt soldering iron. Hold a needlenose pliers between diode and soldering point to prevent destructive heating.***

(E)

TESTING EXCITER STATOR

Testing for Grounds

Using an ohmmeter (R x 100 scale), measure the insulation resistance between either lead F1 or F2 and the laminations. A reading of less than one megohm indicates a ground.

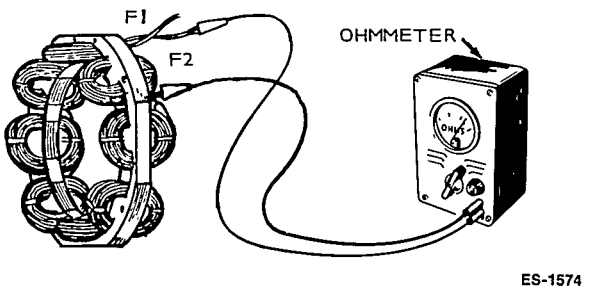


FIGURE 4-3. TESTING EXCITER FIELD

Testing Winding Resistance

Measure coil resistance between leads F1 and F2 with an ohmmeter (scale R x 1). Resistance should be approximately 20 ohms at 20°C (68°F).

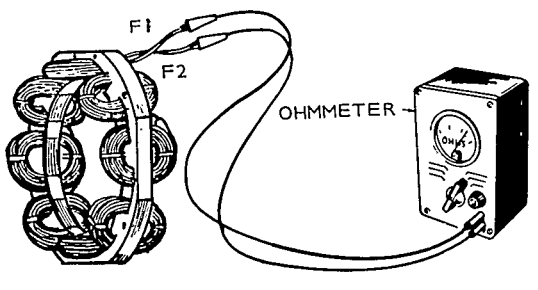


FIGURE 4-4. TESTING EXCITER FIELD

(F)

TESTING EXCITER ROTOR

Testing for Grounds

Remove diodes CR1, CR2, CR3, CR4, CR5, and CR6 from diode heat sink assemblies. Using an ohmmeter (R x 100 scale), measure insulation resistance between any of the leads and the laminations (exclude the diodes from the test circuit). A reading of less than one megohm indicates a ground.

Testing Winding Resistance

Using a Kelvin Bridge meter, measure resistance between leads pairs T1-T2, T2-T3, and T1-T3. Resistance should be 0.464 to 0.567 ohms at 20°C (68°F). See Figure 4-5.

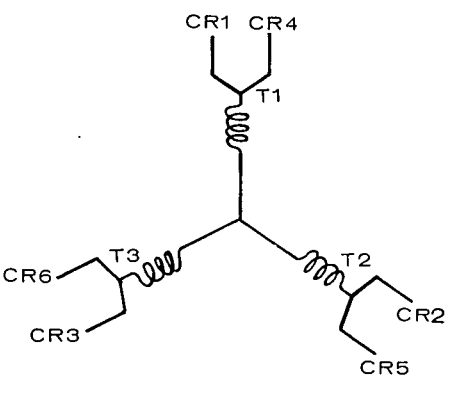


FIGURE 4-5. TESTING EXCITER ARMATURE

(G)

TESTING GENERATOR STATOR

Testing for Grounds

Before testing stator, disconnect control wire 4, 7, 8, 9, and 10 from TB21. Isolate from ground and each other.

Connect all stator output leads (T1-T12) together. Use an ohmmeter set on the R x 100 scale and measure the insulation resistance between these windings and the stator frame. A reading of less than one megohm indicates a ground. Field circuit breaker can be either open or closed for this test.

Testing for Shorts

To check for shorts between individual windings, first refer to electrical schematic to determine individual coil lead wires (T1-T4, T7-T10, etc.). Be sure to disconnect the instrumentation leads and stator leads T4, T7, T8, T9, and T10. Connect an ohmmeter, R x 100 scale, to one lead of a stator winding (leaving the other end of coil winding being tested open), and the other ohmmeter lead to all other stator leads connected together.

Example:

- Ohmmeter lead to: T1 coil winding lead.
- Ohmmeter lead to: T9, 12, 7, 10, 2, 5, 3, 6, 8, and 11 connected together.
- Coil windings lead T4: Open

A reading of less than infinity indicates a short. Repeat test for all six coils.

Measure resistance of windings using a Kelvin Bridge meter. Refer to Figure 4-6 and Table 4-1. If any windings are shorted, open, or grounded, replace the stator assembly. Before replacing the assembly, check the leads for broken wires or damaged insulation.

Stator output leads T4, T7, T8, T9 and T10 are interconnected (within the stator) to five stranded #10 aircraft control wires. These wires are labeled 4, 7, 8, 9, and 10 respectively and terminate at TB21 (terminals 22-26).

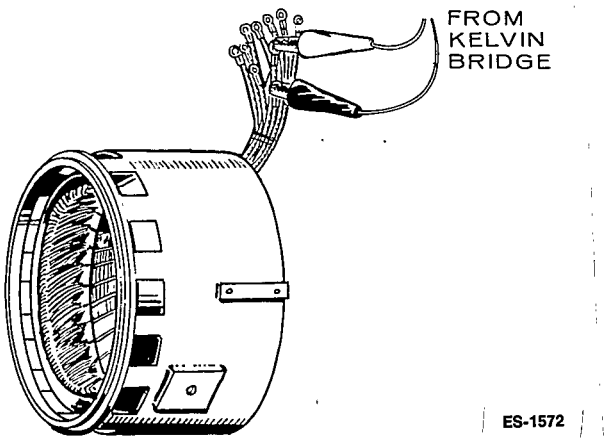


FIGURE 4-6. TESTING STATOR WINDINGS

TABLE 4-1.
RESISTANCE VALUES FOR STATORS*

kW RATING		VOLTAGE CODE (Resistance in Ohms)		
50 HERTZ	60 HERTZ	L,R,15, & 32	H & 9X	E & 6D
25.0	30.0	0.116-0.141	0.425-0.520	0.432-0.528
	40.0	0.047-0.058		0.284-0.348
37.0	45.0	0.047-0.058	0.193-0.236	0.202-0.248
40.0	50.0	0.047-0.058	0.193-0.236	0.150-0.184
	55.0	0.028-0.035		0.150-0.184
45.0	55.0	0.038-0.047	0.156-0.191	0.150-0.184
50.0	60.0	0.028-0.035	0.113-0.138	0.111-0.135
55.0	65.0	0.028-0.035	0.113-0.138	0.111-0.135
60.0	75.0	0.022-0.027	0.089-0.108	0.094-0.114
70.0	85.0	0.019-0.024	0.072-0.089	0.074-0.090
75.0	90.0	0.019-0.024	0.072-0.089	0.057-0.069
80.0	100.0	0.015-0.018	0.054-0.067	0.057-0.069
95.0	115.0	0.012-0.015	0.045-0.055	0.054-0.066
110.0	125.0	0.009-0.011	0.039-0.048	0.040-0.048
115.0	140.0	0.009-0.011	0.039-0.048	0.039-0.047
125.0	150.0	0.0075-0.0092	0.027-0.033	0.039-0.047
140.0	170.0	0.0059-0.0072	0.018-0.023	0.024-0.030
145.0	175.0	0.0059-0.0072	0.018-0.023	0.024-0.030

* - All resistances should be within the values shown at 20°C (68°F)
Use an accurate instrument such as a Kelvin Bridge for this test.
Test between the following coil leads:

T1-T4	T7-T10	T3-T6
T9-T12	T2-T5	T8-T11

(H)

TESTING GENERATOR ROTOR

Testing for Grounds

Use an ohmmeter (R x 100 scale) and measure as follows:

1. Disconnect F1 and F2 rotor leads from the rotating diodes.
2. Measure between either lead and the rotor shaft. See Figure 4-7.
3. A reading of less than one megohm indicates a ground.

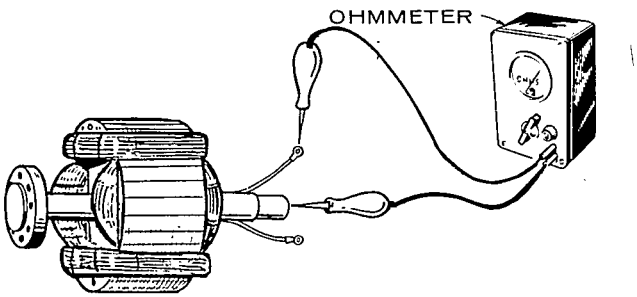


FIGURE 4-7. TESTING ROTOR FOR GROUNDS

Testing for an Open Circuit

1. Disconnect and test between F1 and F2 leads. See Figure 4-8.
2. Refer to resistance values given in Table 4-2.
3. Replace the rotor if it is grounded or has an open or short.

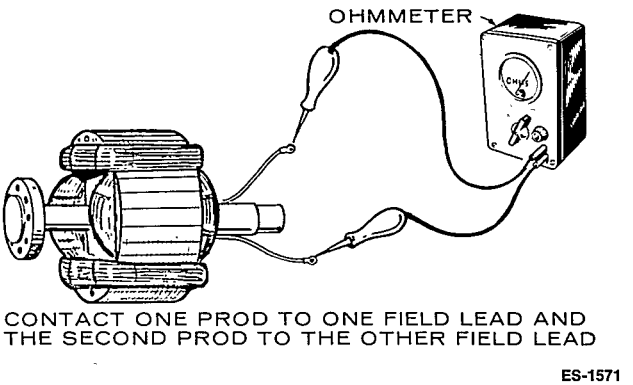


FIGURE 4-8. TESTING ROTOR FOR AN OPEN CIRCUIT

TABLE 4-2. RESISTANCE VALUES FOR ROTORS

kW RATING		RESISTANCE IN OHMS	
50 HERTZ	60 HERTZ	FROM	TO
25.0	30.0	3.32	4.06
	40.0	2.49	3.05
37.0	45.0	2.49	3.05
40.0	50.0	2.49	3.05
	55.0	2.76	3.38
45.0	55.0	2.76	3.38
50.0	60.0	3.02	3.70
55.0	65.0	3.02	3.70
60.0	75.0	3.16	3.86
70.0	85.0	2.76	3.38
75.0	90.0	2.76	3.38
80.0	100.0	3.19	3.90
95.0	115.0	3.26	3.99
110.0	125.0	3.96	4.40
115.0	140.0	3.96	4.40
125.0	150.0	3.09	3.78
140.0	170.0	3.42	4.18
145.0	175.0	3.42	4.18

All resistances should be within the values specified at 20°C (68°F) between field leads (with rectifiers disconnected). Use Wheatstone Bridge for testing.

(J)

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 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.

(K)

VOLTAGE REGULATOR (VRAS-2) ADJUSTMENT

After replacement, voltage regulator VRAS-2 adjustment is performed as follows:

1. Loosen locking nut of Voltage Adjust potentiometer R21. Locate adjustment screw to mid-position and retighten locking nut.
2. Open controller panel doors.

   ⚠WARNING ***High voltages in the control present an electrical shock hazard which can cause severe personal injury or death. Proceed with care!***

3. Refer to Figure 2-6 Voltage Regulator for proper Stability Range (S1) and Mode Selection (S2 and S3) switch settings.
4. Ensure that all connections are proper and secure.
5. **Controller with Detector AC meter option:** Refer also to adjustment (L).

   Controller without Detector AC meter option: Connect an accurate voltmeter to VRAS-2/TB1-2 and -3 terminals.
6. Start generator set.
7. Using a screwdriver, turn R32 potentiometer on printed circuit board VRAS-2 to increase or decrease the voltage as required to achieve proper setting. Observe voltmeter while making adjustment. Set voltage with no load connected to generator. (Example: For a 120/240 volt connection, set at no-load voltage for approximately 246 volts). If voltage is unstable or tends to hunt, refer to troubleshooting section.
8. Stop generator set, and prepare all installation and generator set controls for operation readiness.

Regulator Specifications

Input Power

Input voltage across terminals 2 and 4:
208 to 240 volts RMS +/-10%,
depending on wiring configuration
Input frequency: 45 to 65 Hz
Maximum burden: 800 VA

Output Power

Continuous Rating: 3.0A
One minute rating: 6.5A (in current limit)
Current limit: 6.5A +/-0.75A

Minimum Field Resistance

0.6 ohms @ 25°C copper winding exciter

Regulator Sensing

Single-phase average voltage directly proportional to generator frequency to breakpoint. Independent of frequency after breakpoint. Nominally set to 59 Hz (49 Hz for 50 Hz sets).

Operating Temperature

-40° to +80°C (-40° to 176°F)

(L)

GENERATOR VOLTAGE ADJUST (R21)

The following procedure pertains to generator sets equipped with Detector AC option only.

1. Start generator set.
2. Prepare installation equipment for Test Without Load.
3. Operate Phase Selector switch to read generator output current and voltage, while performing the following steps:

   A. Insert a screwdriver into the Voltage Adjust control on the front of the generator set control and carefully loosen the locking nut.

   B. Slowly turn the screwdriver clockwise to increase voltage, or counterclockwise to decrease voltage.

   C. When set at correct voltage, tighten the locking nut. Be careful not to change adjustment.

   If correct voltage cannot be attained by R21 adjustment refer to VRAS-2 adjustment procedure (K).

   Observe that ammeter does not register any output current. If output current is observed on the ammeter, contact an Onan representative.

4. Move the Phase Selector switch to the Off position.
5. Stop generator set, and prepare all installation and generator set controls for operation readiness.

(M)

TESTING CIRCUIT BREAKER

General

Common maintenance practices is normally all the attention the circuit breaker should require. Such as periodic exercise of breaker, and checking conductor connections cleanliness and security. Circuit breaker options vary by customer requirements. Review the Optional Circuit Breaker description in Section 2 and perform the following checks and adjustment as applicable to your specific breaker model.

When performing tests and adjustments of the circuit breaker, remove the generator set from available service by placing the Remote-Stop-Run switch to Stop position and disconnect the battery negative (-) cable to avoid accidental start-up of unit.

⚠WARNING ***Accidental generator set starting can result in severe personal injury or death during service procedures. Place the Remote-Stop-Run switch to Stop position, and disconnect battery cable before performing circuit breaker tests and adjustments.***

Exercising Breaker: Actuate the breaker handle to the ON and OFF positions several times. If the breaker is equipped with a Trip Test button, the breaker should be tripped, reset and actuated to ON several times. This will remove any dust accumulation on the mechanism and latch surfaces.

Checking Insulation Resistance: Disconnect the load and line conductors from the breaker, and place the breaker to the ON position. Using an ohmmeter (R x 10K scale), measure the insulation resistance between each pole and ground. Tests should be made between phases of opposite polarity as well as current carrying parts of the circuit breaker to ground. Also, a test should be made between the line and load terminals with the breaker in the OFF position. A resistance reading of less than one megohm indicates a ground. Investigation should be made for possible contamination on the case surfaces of the breaker.

Checking Contact Resistance: Extensive operations of the breaker under load conditions may cause deterioration of the contacts. Testing for contact deterioration can be accomplished by performing a resistance check or voltage drop check across the breaker poles.

1. Resistance Check.
   A. Isolate the breaker by placing the Remote-Stop-Run switch to Stop position, disconnecting the generator set starting battery, and disconnecting the line and load wires from circuit breaker.
   B. Place circuit breaker handle to ON position.
   C. Check resistance values across each pole (line to load).
   D. Resistance readings should be relatively equal for all three phases.
2. Voltage Drop Check.
   A. Ensure that line and load wire connections are proper and secure.
   B. Start generator set.
   C. Place breaker handle to Reset and then to ON position.
   D. Perform voltage check at line connection then load connection.
   E. Compare the voltage drop readings across each pole. The comparisons should show each poles voltage drop as being only slight variation. And also the comparisons of phase to phase should be relatively equal. Unequal or excessive millivolt drops across a complete breaker can be an indication of contaminated contacts or loose connections.

Checking Shunt-Trip Operation: The shunt-trip feature is available in varying AC or DC voltages. Proper circuit breaker model is selected and installed at the factory to meet customer requirements.

To check shunt-trip operation, perform the following:

1. Refer to original equipment order, installation wiring diagrams, and unit wire routing to identify and confirm proper AC or DC signal source connections.
2. Check that wire connections are secure.
3. Place circuit breaker to ON position.
4. Apply appropriate signal voltage (DC: 12-, 24-volts, etc.; or AC: 120/240-, 480-volts). The shunt-trip solenoid should energize, and trip open the breaker.
5. If breaker did not trip open, remove signal source and perform continuity check of interconnect wiring and shunt-trip solenoid lead wires. Replace interconnect wiring if defective. Replace shunt-trip solenoid if found to be shorted or open. Contact Onan distributor for assistance.

Checking Auxiliary Contacts: If equipped, the circuit breaker will have three leads for wiring interconnect of a set of internal contacts (form C; 1 -normally-open, and 1 - normally-closed). This feature provides for remote annunciator connections. Review installation wiring diagrams for specifics of interconnect. Perform continuity checks of wiring with breaker at ON and OFF position to confirm proper lead selection for interconnect. Replace internal contact circuits if shorted or open. Contact an Onan distributor for assistance.

Adjusting Magnetic Trip Operation: If equipped with front-adjustable magnetic trip controls, the short circuit protection feature for each pole of the circuit breaker can be adjusted equally or individually to best suit customer requirements. Any current surge above the trip settings will actuate the trip mechanism. These adjustors are set equally to the high position at the factory. Consult on-site requirements and adjust to proper position.

Section 5. Generator Disassembly/Assembly

If testing determines that the generator needs disassembly for service, use the following procedure. Note that Figure 5-2 shows a generator for 100 kW and larger. However, the smaller generators are very similar and differences of procedures are noted. This procedure covers disassembly of all major components.

GENERATOR DISASSEMBLY

1. Disconnect the negative (-) battery cable to prevent accidental starting of the generator set while servicing.

   ⚠WARNING ***Accidental starting of the generator set during this procedure presents the hazard of severe personal injury or death. Make sure to disconnect the negative battery cable before beginning.***

2. Disconnect and remove the load wires.

3. Disconnect lead wires from the control box. Check wire markings for legibility to ease assembly. Arrange leads so they can be withdrawn easily from the control box.

   Disconnect all engine and generator control wire leads from inside control box as follows:

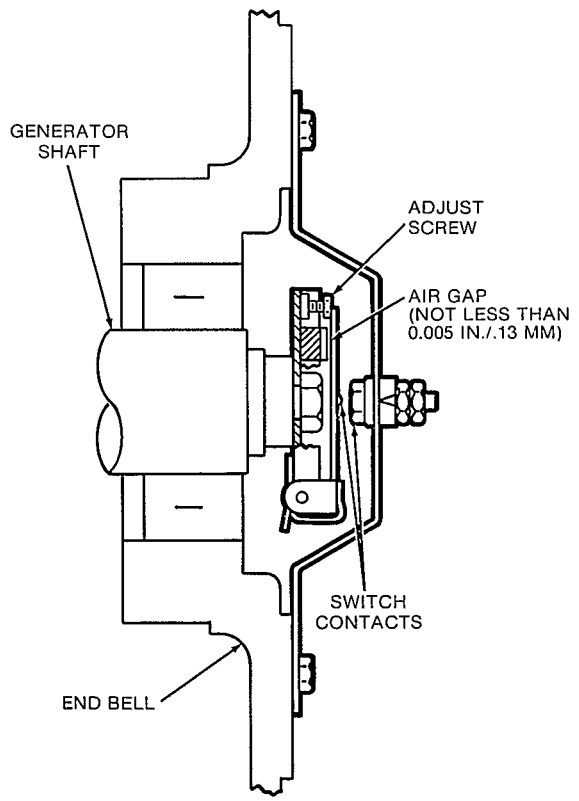
   DC Wiring

   - A11/TB1-8,-10, and terminals -1 through -7 as required.
   - Unplug A11/J1,J2.
   - Unplug P5, P6 (battery charge connections).

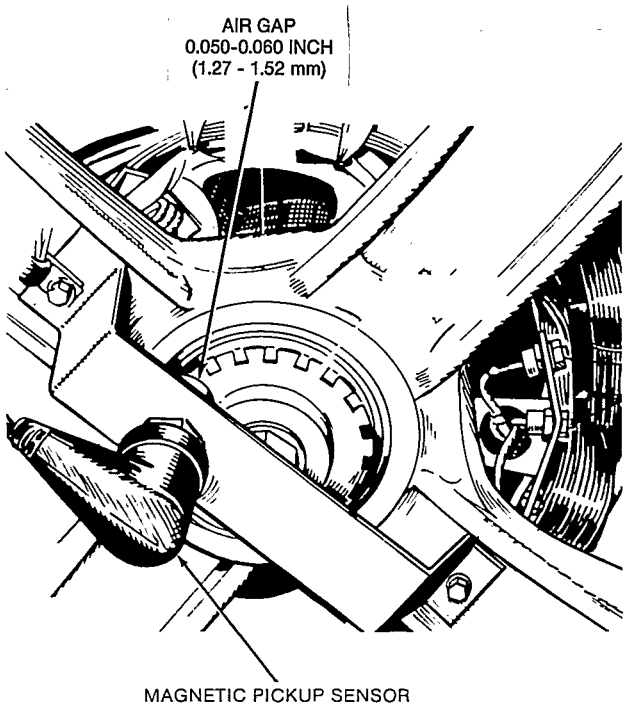
   AC Wiring

   - VRAS-2/TB1-9, and -10.
   - TB21-22 to -30.

4. Remove the sheet metal from around the generator.
5. Remove the overspeed switch and bracket from the end bell and rotor shaft. See Figure 5-1.



MECHANICAL OVERSPEED SWITCH (STANDARD)



MAGNETIC PICKUP OVERSPEED SENSING (OPTIONAL)

ES-1576

FIGURE 5-1. OVERSPEED SWITCH, AND MAGNETIC PICKUP SENSOR

6. Block the rear of the engine in place by supporting the flywheel housing.
7. Remove the four nuts and washers from the studs that secure the end bell.
8. Remove end bell with oil seal from stator assembly. It might be necessary to tap around end bell joint to separate end bell from stator.
9. Remove the four 1/4-inch bolts and lock washers securing the exciter stator to the end bell.
10. Remove the narrow generator air screen.
11. Remove the large capscrews securing the generator to the skid base.
12. Remove the bolts securing the stator to engine flywheel housing.
13. Using an overhead hoist and sling, slide the stator assembly off being careful not to touch or drag on the rotor. On generators below 100 kW, slide the stator off the long through-studs (note position of hose pieces on the studs, and proper orientation of the stator).

    The studs can be removed if you want to do so.

    ⚠WARNING ***To prevent personal injury, use adequate lifting devices to support heavy components. Keep hands and feet clear while lifting.***

    ⚠CAUTION ***Do not allow the rotor to hang unsupported for any extended period. Otherwise, drive disk damage can occur.***

14. Attach the hoist and sling to the rotor assembly and apply a slight lift to support the rotor. Remove the bolts securing the drive disk to the engine flywheel and remove the rotor from the engine. Set on wood blocks so fan is not supporting any of the rotor weight.
15. Remove bearing bolt, flat washer, and lock washer. Then remove bearing. If required, remove fan from the rotor.
16. Disconnect rotor field leads from heat sinks F1 and F2 on the exciter rotor. Remove exciter rotor.

GENERATOR ASSEMBLY

1. If any diodes are replaced in the exciter rotor, secure the new diode using a lock washer and nut, and tighten to a torque of 12 to 15 in.-lb (1.4 to 1.7 N•m).
2. Slide exciter rotor, sleeve spacer, and press ball bearing over the generator shaft. Install the modified hex head bolt, lock washer, and flat washer and tighten to a torque of 60 to 70 ft-lb (81 to 95 N•m).
3. Place the generator fan in position on the rotor shaft.
4. Install the drive disk on the end of the rotor shaft with the chamfer on the flywheel side. Tighten the placement bolts 200 to 240 ft-lb (271 to 325 N•m).
5. Using a hoist and sling to support the rotor, align the holes in the drive disk and fan with the corresponding holes in the flywheel.
6. Install the bolts that hold the drive disk to the engine flywheel and tighten to a torque of 85 ft-lb (115 N•m) for generators 100 kW and larger, 55 to 60 ft-lb (75 to 84 N•m) for generators less than 100 kW.

    ⚠CAUTION ***Do not allow the rotor to hang unsupported for any extended period. Otherwise, drive disk damage can occur.***

7. Using a hoist and safe lifting device, carefully move the stator into position over the rotor assembly. The stator leads should be at the 12 o'clock position when viewed from the end bell position. For generators under 100 kW with the long studs in the flywheel housing, make sure the short hose pieces are in place next to the flywheel housing before installing stator.
8. Align the holes of the stator with the engine flywheel housing and install the bolts. Use a torque of 35 ft-lb (47 N•m).
9. Install the exciter stator in the end bell using the 1/4-inch bolts and lock washers. Tighten to a torque of 7 ft-lb (8 N•m).
10. Apply a thin film of Molykote grease or equivalent to the mating surfaces of the end bearing and end bell bearing hole.
11. Install the end bell assembly, lock washers, and nuts on the studs. Tighten nuts to 35 ft-lb (47 N•m).
12. Using a lead hammer, tap the end bell at the horizontal and vertical plane to relieve stress. Retorque end bell stud nuts.
13. Install the generator air screen.
14. Refer to Figure 5-1. Mount and adjust Mechanical Overspeed Switch.

    When installing the overspeed switch assembly (capscrew, lock washer, switch, small flat washers, large flat washer, and spacer) on the rotor shaft, tighten to 53 ft-lb (72 N•m) torque.

    Install the overspeed switch assembly bracket and secure using two capscrews and lock washers. Tighten to 4.5 ft-lb (6 N•m) torque. Refer to Figure 5-2, and set to proper gap.

    Connect overspeed switch lead wire to terminal on overspeed switch bracket.

15. Install the control sheet metal back on the generator.
16. Reconnect generator output leads to load connections, and all control wire leads and plug-ins to proper terminals or plug-in jacks. Refer to proper wiring diagram, and Voltage Connections, Figure 2-2.
17. Verify that all connections are secure and then install the output box cover.
18. Connect the negative (-) battery cable and test the generator for operation.

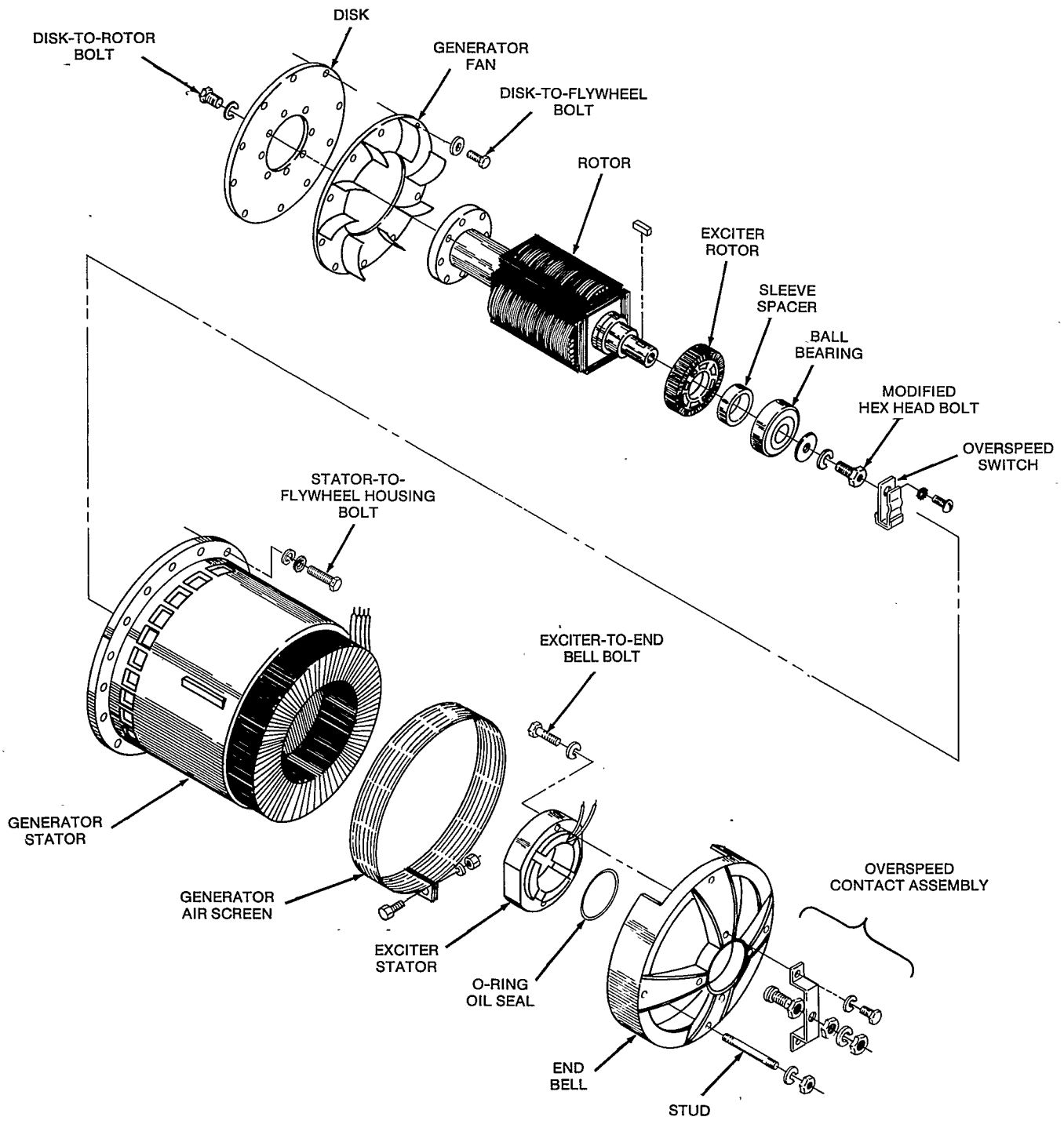
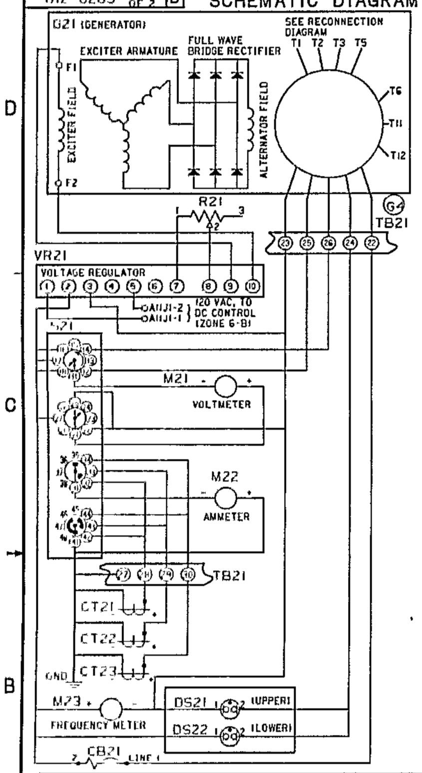


FIGURE 5-2. GENERATOR ASSEMBLY

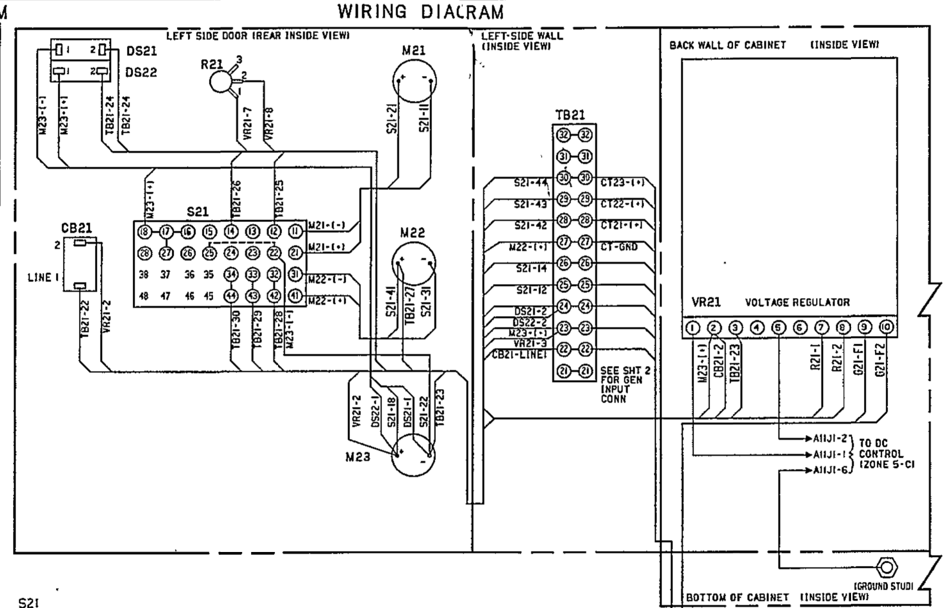
Section 6.
Wiring Diagrams

612-6269 SHT 1 OF 2 D

SCHEMATIC DIAGRAM



WIRING DIAGRAM



SEE DC WIRING DIAGRAM ZONE 5-B,C,D

S21

POSITION	CONTACTS CLOSED			
L1-L2 3PH	11-18	21-25	31-32	41-43-44
L2-L3 3PH	11-12	21-25	31-33	41-42-44
L3-L1 3PH	11-12	21-27	31-34	41-42-43
L1-L0 3PH	11-14	21-27	31-35	41-42-43-44
OFF	11-14	21-28	31-36	41-42-43-44
L1-L2 1PH	11-16	21-22	31-32	41-43-44
L1-L2 1PH	11-16	21-22	31-33	41-42-44

(C1)

DASH NUMBERS	-01	-02	-03	-04	-05	-06	-07	-08	-09
QTY ( ) CT21-23	302-0868 (1)	302-0869 (1)	302-0746 (1)	302-0747 (1)	302-0748 (1)	302-0908 (1)	302-0909 (1)	302-0910 (1)	302-0911 (1)
M22	302-1683	302-1684	302-1685	302-1724	302-1725	302-1726	302-1727	302-1728	302-1729
AMMETER SCALE (M22)	(0-100,0-200)	(0-150,0-300)	(0-200,0-400)	(0-250,0-500)	(0-375,0-750)	(0-400,0-800)	(0-500,0-1000)	(0-600,0-1200)	(0-750,0-1500)

(H1)

DASH NUMBERS	-11	-12	-13	-14	-15	-16	-17	-18	-19
QTY ( ) CT21-23	302-0876 (3)	302-0625 (3)	302-0589 (3)	302-0644 (3)		302-0643 (3)	302-0644 (3)	302-0645 (3)	302-1073 (3)
M22	302-1728	302-1729	302-1798	302-1799		302-1728	302-1729	302-1798	302-1799
AMMETER SCALE (M22)	(0-600,0-1200)	(0-750,0-1500)	(0-1000,0-2000)	(0-1500,0-3000)		(0-600,0-1200)	(0-750,0-1500)	(0-1000,0-2000)	(0-1500,0-3000)

DASH NUMBERS	-31	-32	-33	-34					
QTY ( ) CT21-23	302-0608 (3)	302-0547 (3)	302-1090 (3)	302-0963 (3)					
M22	302-1725	302-1727	302-1725	302-1727					
AMMETER SCALE (M22)	(0-375,0-750)	(0-500,0-1000)	(0-375,0-750)	(0-500,0-1000)					

(D1) (G1) (E-1)

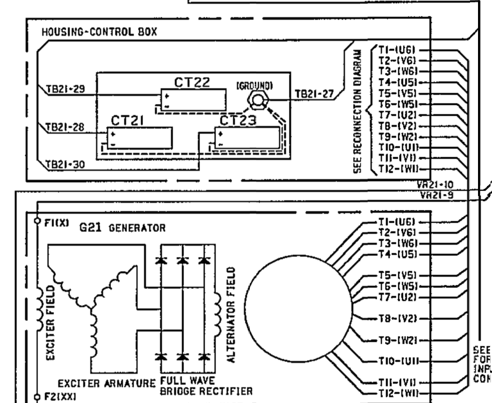
DASH NUMBERS	-51	-52	-53	-54	-55	-56	-57		
QTY ( ) CT21-23	302-1794-08 (3)	302-1794-09 (3)	302-1794-10 (3)	302-1794-11 (3)	302-1794-12 (3)	302-1794-13 (3)	302-1794-14 (3)		
M22	302-1726	302-1727	302-1728	302-1729	302-1798	302-1799	302-1800		
AMMETER SCALE (M22)	(0-400,0-800)	(0-500,0-1000)	(0-600,0-1200)	(0-750,0-1500)	(0-1000,0-2000)	(0-1500,0-3000)	(0-2000,0-4000)		

PARTS LIST

ILLUS NO.	REF DES	PART NO	SIZE	QTY	DESCRIPTION	DASH #
1		301-8065	C	1	BOX WLDMT-CONTROL	ALL
2		402-0527	B	4	ISOLATOR-VIBRATION	ALL
3		800-0045	-	4	SCREW-HHC (5/16-18 X 3/8)	ALL
4		850-0045	-	4	WASHER-LK (5/16)	ALL
5		508-0001	P	1	GROMMET (3/4")	ALL
6		508-0051	A	1	GROMMET (2")	ALL
7		406-0332	A	2	RECEPTACLE-FASTENER	ALL
8		406-0333	A	2	STUD-FASTENER	ALL
9		406-0334	A	2	WASHER-STUD RTNR	ALL
10		332-0052	P	1	CLIP-WIRE (5/8")	ALL
11		870-0131	-	1	NUT-HEX W/ET (10-32)	ALL
12		871-0015	A	1	NUT-HEX (1/4-20,UNC-2B)	ALL
13		853-0013	-	1	WASHER-ET LK (1/4)	ALL
14		337-0049	A	1	BOND STRAP	ALL
15		800-0024	-	1	SCREW-HHC (5/16-18 X 1/2)	ALL
17		856-0008	-	1	WASHER-EIT LK (5/16)	ALL
18		815-0544		6	SCREW RHM XREC W/IT (6-32 X 1/2)	ALL
20		821-0004	-	3	SCREW-LK H (10-32 X 5/16)	ALL
21		301-9054-02	C	1	DOOR WLDMT-CONTROL (LHV)	ALL
22		98-5298	D	1	SILKSCREEN PNL FR (AC,VERT)	ALL
23		98-5299	D	1	SILKSCREEN PNL REAR (AC,VERT)	ALL
25		338-1818	D	1	HARNESS-AC (VERT)	ALL
29	CB21	320-1121	B	1	CIRCUIT BREAKER-MAG (FIELD)	ALL
	CT21-23	SEE CHART	B	SEE TAB	TRANSFORMER ASSY-CUR	
30	DS21-22	322-0363	P	1	LAMP ASSY (UPPER/LOWER SCALE)	ALL
	G21	REF			GENERATOR	ALL
31	M21	302-1148	B	1	VOLTMETER-AC (0-300, 0-600)	ALL
32	M22	SEE CHART	C	1	AMMETER-AC (SEE CHART)	
33	M23	302-1720	B	1	METER-FREQUENCY (45-65 HZ)	ALL
38	R21	303-0261	P	1	RHEOSTAT (VOLTS ADJUST)	ALL
39		303-0032	A	1	KNOB-RHEOSTAT	ALL
40	S21	308-0284	B	1	SWITCH ROTARY (VOLT & AMMETER)	ALL
(25)	TB21	REF			PART OF AC HARNESS (ILLUS #25)	ALL
41		332-2723	A	1	MARKER STRIP	ALL
42		812-0065	-	2	SCREW-RHM (6-32 X 5/8)	ALL
43	VR21	REF			VOLTAGE REGULATOR	ALL
		98-5387	B	2	LABEL-DANGER	ALL
		546-2000	A	1	PARTS LIST-AC CONTROL	[illegible]

(B1) (F1)

NOTES:
1. ALL COMPONENTS SHOWN IN THE DE-ENERGIZED POSITION.
2. ILLUSTRATION NUMBERS REFER TO DRAWING 539-0741 (D)
3. (F2) LOCATE ONE (1) DANGER LABEL ON EXTERIOR AND ONE (1) ON INTERIOR OF LEFT SIDE DOOR IN ANY READILY VISIBLE AREA AVAILABLE



ER NO.	LTR	NO.	REVISION	DATE
28,311	H	1	ADD TAB FOR -11 THRU -19	[illegible]
		4	DEL "T" DESIGNATION	[illegible]
		3	SEE SHEET 3	[illegible]
		2	SEE SHEET 2	[illegible]
27,795	G	1	-31 SCALE WAS (0-400,0-800)	[illegible]
		2	ADD NOTE 3	[illegible]
27,841	F	1	98-5387 WAS QTY 1	[illegible]
		2	SEE SHEET 2	[illegible]
27,351	E	1	ADDED -33,-34,-56,-57	[illegible]
		2	SEE SHT 2	[illegible]
26,979	D	1	ADD MODEL BLOCKS -31,-32,-51 THRU -55	[illegible]
		2	ADDED SHEET 2	[illegible]
26,183	C	1	ADDED PART NOS. TO -06,-07,-08,-09	[illegible]
25,051	B	1	RHEO KNOB QTY WAS 2 [illegible]	[illegible]
24,354	A	1	PRODUCTION RELEASE	[illegible]

CADD SYSTEM DWG

	NAME	DATE
SIM TO 612-6267		
DR	MAUREEN C. MANN	5-15-84
CHKR	L L NELSON	5-16-84
APPROVED	S L SWENSON	5-16-84

MODEL FIRST USED ON: 50-250KW (50 & 60 HZ)

Onan — ONAN CORPORATION, MINNEAPOLIS, MINNESOTA

TITLE: WD-GEN SET AC CONT (VERT,MTD)

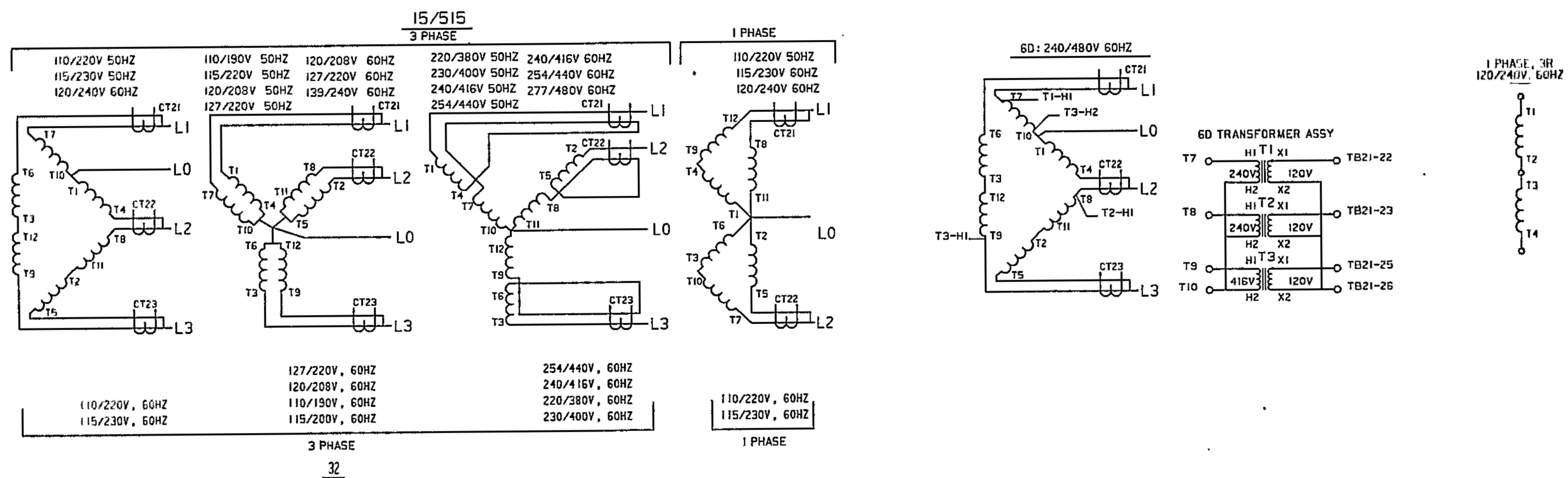
DWG NO: 612-6269 SHEET 1 of 3 SIZE D

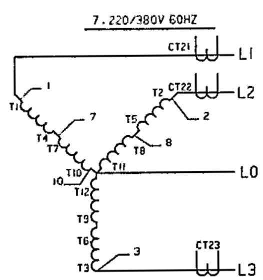
MICROFILMED

SHT 1 OF 2 612-6269 D

612-6269 D

UR GENERATORS





VOLTAGE CODE					
CONT INPUT TB21	15/515	6D	7	3R	32
22	T7	T1-X1	T7	T1	T7
23	T8	T2-X1	T8	T2	T8
24	T4	-	-	-	T4
25	T9	T3-X1	T9	-	T9
26	T10	T1,2,3-X2	T10	-	T10
JUMPER	-	22-24	-	23-24	

D 612-6269

CADD SYSTEM DWG

SIM TO 612-6267 D

DR D. YOUNG 1-21-86
CHKR E. ENGLE 4-1-86
APPROVED G. L. CARLSON 4-1-86

MODEL FIRST USED ON 50KW (60 HZ)

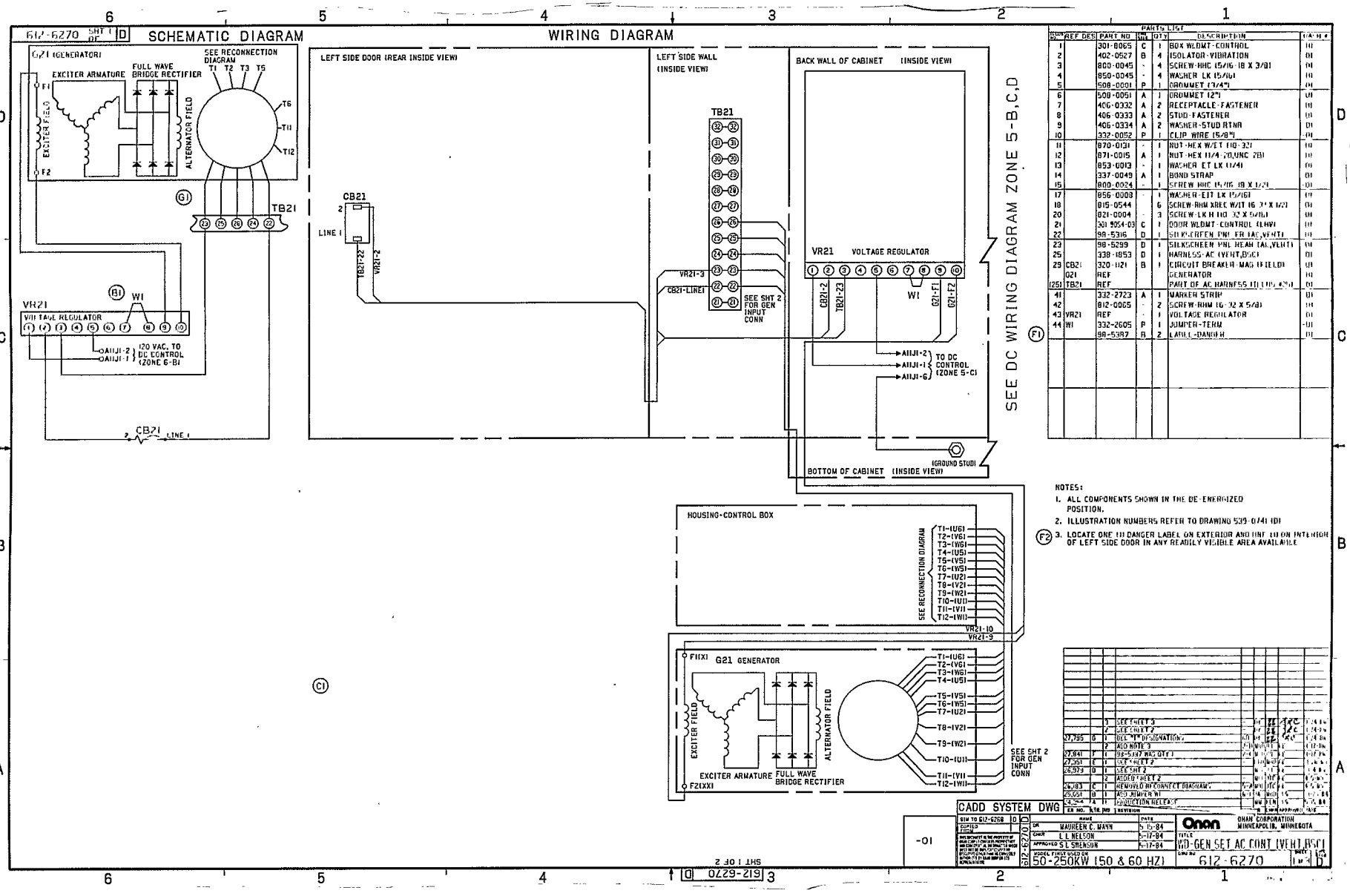
SHEET 2 REDRAWN WITH CHANGES

Onan — ONAN CORPORATION, MINNEAPOLIS, MINNESOTA

TITLE WD-GEN SET AC CONT (VERT.BSC)

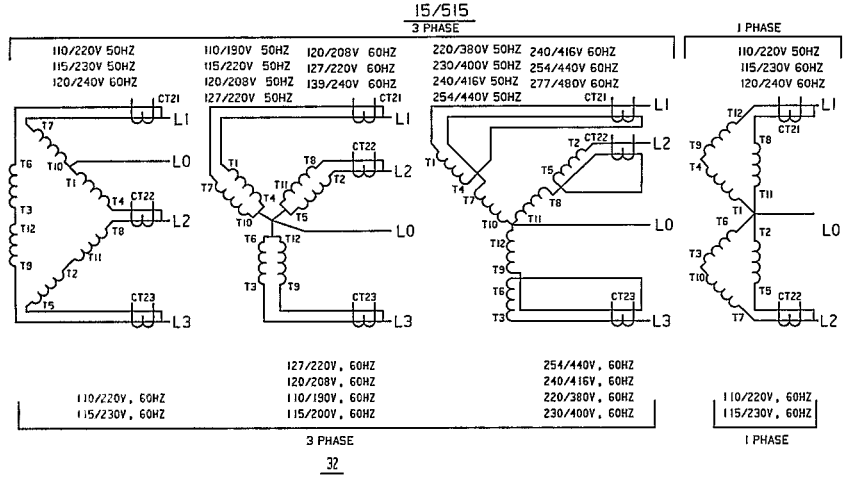
612-6269 D

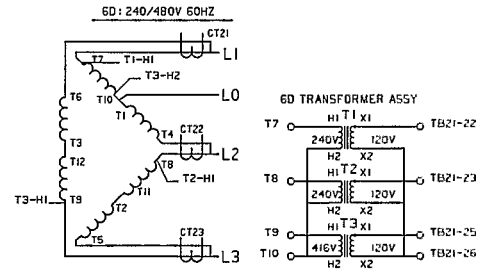
MICROFILMED

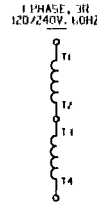


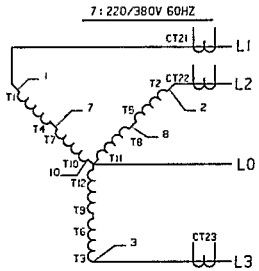
612-6270 D

UR GENERATORS





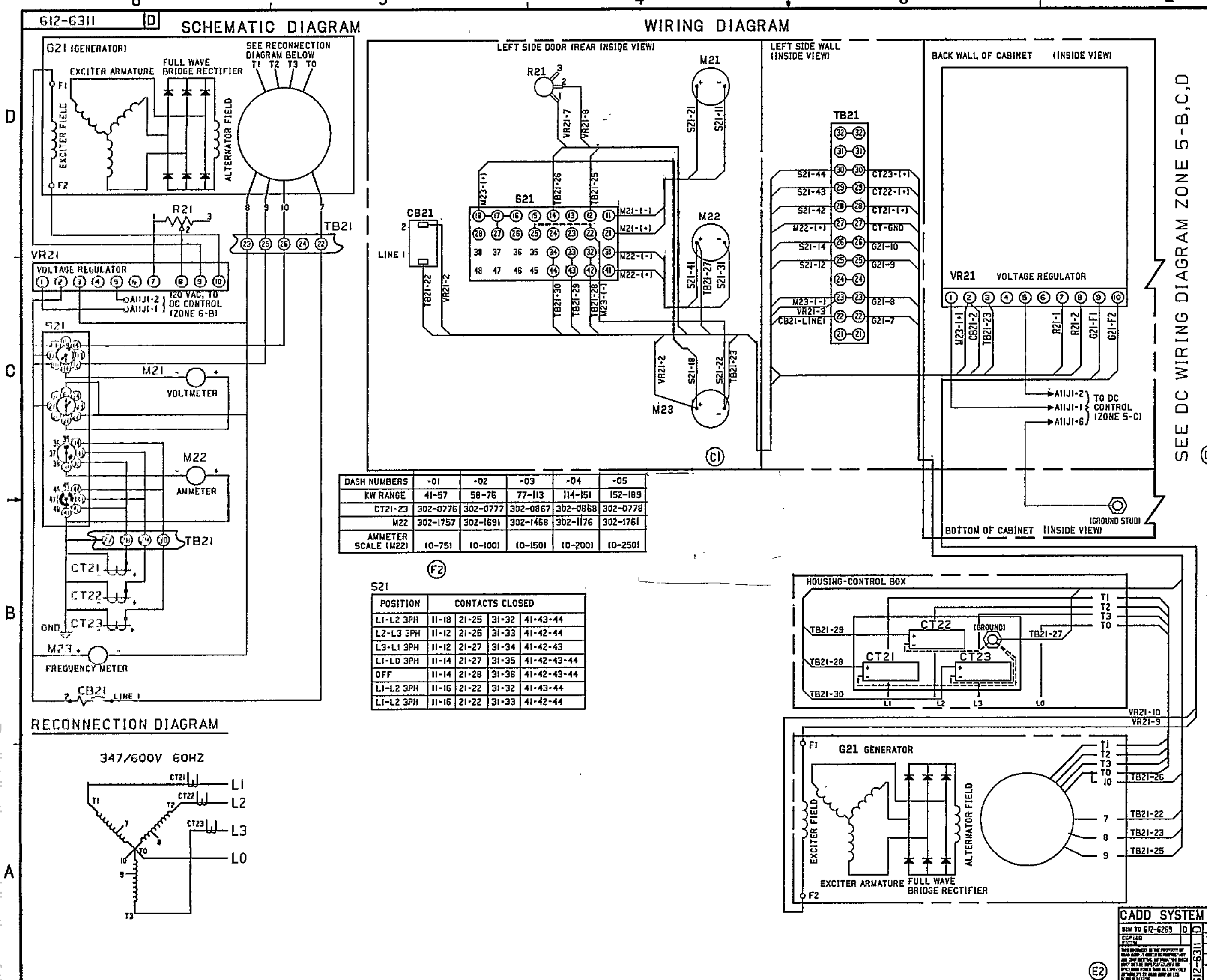




VOLTAGE CODE					
CONT INPUT TB21	15/515	6D	7	3R	32
22	T7	T1-X1	T7	T1	T7
23	T8	T2-X1	T8	T2	T8
24	T4	–	–	–	T4
25	T9	T3-X1	T9	–	T9
26	T10	T1,2,3-X2	T10	–	T10
JUMPER	–	22-24	–	23-24	

CADD SYSTEM DWG 0229-219

SIM TO 612-6270 D	NAME	DATE	Onan CUMMINS-ONAN MINNEAPOLIS, MINNESOTA
DRN	D. YOUNG	4-11-84	
CHK		4-1-86	TITLE WD-GEN SET AC CONT INVERTER CI
APPROVED		4-1-86	
MODEL FIRST USED ON	50KW (60 HZ)		612-6270 D



DASH NUMBERS	-01	-02	-03	-04	-05
KW RANGE	41-57	58-76	77-113	114-151	152-189
CT21-23	302-0776	302-0777	302-0867	302-0868	302-0778
M22	302-1757	302-1691	302-1468	302-1176	302-1761
AMMETER SCALE (M22)	(0-75)	(0-100)	(0-150)	(0-200)	(0-250)

S21

POSITION	CONTACTS CLOSED		
L1-L2 3PH	11-18	21-25	31-32	41-43-44
L2-L3 3PH	11-12	21-25	31-33	41-42-44
L3-L1 3PH	11-12	21-27	31-34	41-42-43
L1-L0 3PH	11-14	21-27	31-35	41-42-43-44
OFF	11-14	21-28	31-36	41-42-43-44
L1-L2 3PH	11-16	21-22	31-32	41-43-44
L1-L2 3PH	11-16	21-22	31-33	41-42-44

PARTS LIST

ILLUS NO.	REF DES	PART NO	DWG SIZE	QTY	DESCRIPTION	DASH #
1		301-8065	C	1	BOX WLDMT-CONTROL	ALL
2		402-0527	B	4	ISOLATOR-VIBRATION	ALL
3		800-0045	-	4	SCREW-HHC (5/16 18 X 3/8)	ALL
4		850-0045	-	4	WASHER-LK (5/16)	ALL
5		508-0001	P	1	GROMMET (3/4")	ALL
6		508-0051	A	1	GROMMET (2")	ALL
7		406-0332	A	2	RECEPTACLE FASTENER	ALL
8		406-0333	A	2	STUD-FASTENER	ALL
9		406-0334	A	2	WASHER-STUD RTNR	ALL
10		332-0052	P	1	CLIP-WIRE (5/8")	ALL
11		870-0131	-	1	NUT-HEX W/ET (10-32)	ALL
12		871-0015	A	1	NUT-HEX (1/4-20,UNC 2B)	ALL
13		853-0013	-	1	WASHER-ET LK (1/4)	ALL
14		337-0049	A	1	BOND STRAP	ALL
15		800-0024	-	1	SCREW-HHC (5/16-18 X 1/2)	ALL
17		856-0008	-	1	WASHER-EIT LK (5/16)	ALL
18		815-0544	-	6	SCREW-RHM XREC W/IT 10 32 X 1/2	ALL
20		821-0004	-	3	SCREW-LK H (10-32 X 5/16)	ALL
21		301-9054-02	C	1	DOOR WLDMT-CONTROL (LHV)	ALL
22		98-5298	D	1	SILKSCREEN PNL FR (AC,VERT)	ALL
23		98-5299	D	1	SILKSCREEN-PNL REAR (AC,VERT)	ALL
25		338-1818	D	1	HARNESS-AC (VERT) (SEE NOTE 3)	ALL
29	CB21	320-1121	B	1	CIRCUIT BREAKER MAG (FIELD)	ALL
	CT21-23	SEE CHART	B	1	TRANSFORMER ASSY CUR	
30	DS21-22	322-0371	P	1	LAMP ASSY	ALL
	G21	REF			GENERATOR	ALL
31	M21	302-1753	B	1	VOLTMETER-AC (0-750)	ALL
32	M22	SEE CHART	C	1	AMMETER AC (SEE CHART)	
33	M23	302-1720	B	1	METER-FREQUENCY	ALL
38	R21	303-0261	P	1	RHEOSTAT (VOLTS ADJUST)	ALL
39		303-0032	A	1	KNOB-RHEOSTAT	ALL
40	S21	308-0284	B	1	SWITCH-ROTARY (VOLT & AMMETER)	ALL
(25)	TB21	REF			PART OF AC HARNESS (ILLUS #25)	ALL
41		332-2723	A	1	MARKER STRIP	ALL
42		812-0065	-	2	SCREW-RHM (6-32 X 5/8)	ALL
43	VR21	REF			VOLTAGE REGULATOR	ALL
		98-5387	B	2	LABEL-DANGER	ALL

NOTES:

1. ALL COMPONENTS SHOWN IN THE DE-ENERGIZED POSITION.
2. ILLUSTRATION NUMBERS REFER TO DRAWING 539-0741 (D).
3. CLIP LEADS INTENDED TO GO TO DS21 AND DS22 AT BOTH ENDS OR REMOVE LEADS COMPLETELY FROM HARNESS (4 LEADS TOTAL).
4. LOCATE ONE (1) DANGER LABEL ON EXTERIOR AND ONE (1) ON INTERIOR OF LEFT SIDE DOOR IN ANY READILY VISIBLE AREA AVAILABLE.

CADD SYSTEM DWG

Onan — ONAN CORPORATION, MINNEAPOLIS, MINNESOTA

DR D. YOUNG 9-14-84 · CHKR E. ENGLE 9-21-84 · APPROVED D. KOENIG 9-19-84

TITLE: WD-GEN SET AC CONT (VERT MTR)

612-6311 D

MICROFILMED

Onan

Onan Corporation
1400 73rd Avenue N.E.
Minneapolis, MN 55432
Telex: 275477
Fax: 612-574-8087