Onan SERVICE BULLETIN
DIVISION OF ONAN CORPORATION
MINNEAPOLIS, MINNESOTA 55432
Control 7
3-73

SERVICING THE MAGNECITER

INTRODUCTION

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 of a change in load. Voltage regulation should be within ± 3 per cent.

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.

SCOPE

This bulletin covers troubleshooting procedures to follow if the alternator fails to produce output voltage or if the output voltage produced is abnormal. With the nature of the trouble established, consult the section on troubleshooting to determine the cause of the trouble and the corrective action to take. The section on testing briefly describes how to check various components and circuits and how to correct the trouble, once it is located.

Following is a list of components which are common to all models and are shown pictorially and schematically on the typical diagrams:

1. Four large Field Rectifiers identified by letters. W, X, Y, and Z.
2. One large Field Flashing Rectifier identified by the letter V.
3. Four small Control Rectifiers.
4. Two large Reactors identified by the letters A and B.
5. One small Control Reactor identified by name.
6. One small Stabilizing (or Control) Resistor identified by name.
7. One large Damping Resistor identified by name.

In addition to the above, a build-up relay is used in the voltage build-up circuit of O2SX1N1A Magneciters, as shown in the diagram in the back of this bulletin.

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, 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.

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 Magne-citer	Check AC voltage at E_1-E_2 with the plant operating*. Voltage should be 5 per cent of the rated voltage. If not, check continuity from E_1-E_2 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

* **WARNING** USE CAUTION WHEN [illegible] ELECTRICAL SHOCK [illegible]

NATURE OF TROUBLE	PROBABLE CAUSE	CORRECTIVE ACTION	METHOD
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 per cent 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 per cent above rated voltage after build up	Open in one Field Rectifier	Test rectifiers and replace if defective	A or B
	Open circuit in Gate winding G_1-G_2 of Reactor A or B	If Field Rectifiers Y and Z check okay, check continuities of Gate windings G_1-G_2	D or E
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 S_1-S_2 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 per cent above rated voltage after build up. Voltage regulation poor.	Compound winding S_1-S_2 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 per cent 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

2. 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:

1. CONTROL REACTOR IS GOOD if resistance is within 10-per cent of the value specified in Table 1.

2. 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:

1. RESISTOR IS GOOD if the measured resistance falls within ± 20-per cent either way of the value given in Table 3.

2. 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:

1. COIL IS GOOD if 525 ohms ± 10-per cent resistance is measured.
2. 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 plant 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 3)

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 plant 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

Some new units have an automatic field flashing circuit which uses the plant 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 plant 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)

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 305P238 & 305P239 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 such as 305P233 & 305P234 require 35 to 40-inch lbs. of torque.

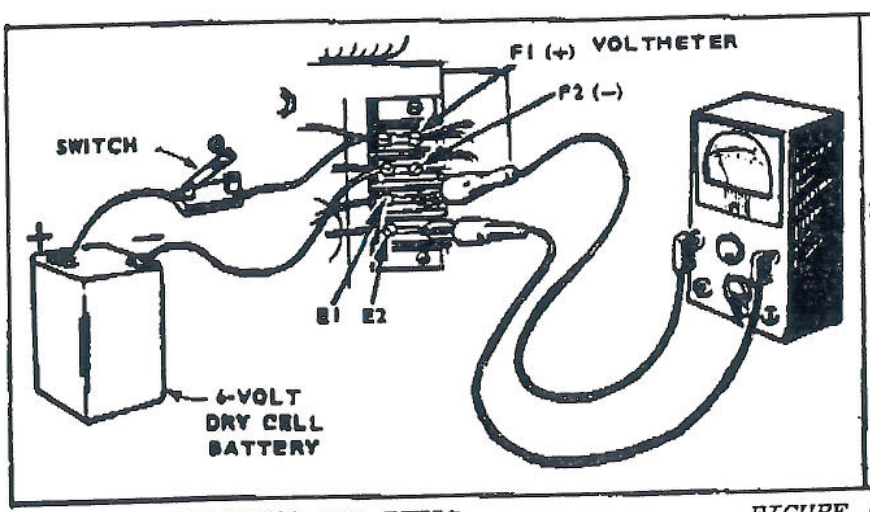


FIGURE 3. FLASHING THE FIELD

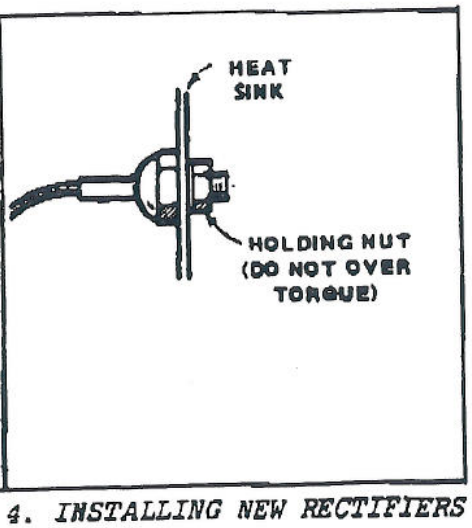


FIGURE 4. INSTALLING NEW RECTIFIERS

EXCITER VOLTAGE TEST

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.

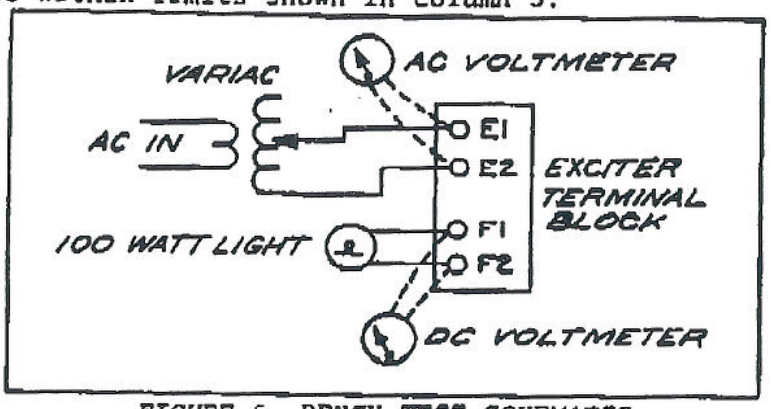


FIGURE 5. BENCH TEST SCHEMATIC

TABLE 1. VOLTAGE VALUES FOR BENCH TEST

EXCITER MODEL	1 NOMINAL EXCITER VOLTAGE	2 AC VOLTS AT FIRE DOWN *	3 DC VOLTS AT FIRE DOWN *
04SX1N	120	138-140	60-80
06SX1N	120	122-129	60-80
06SX51N	120	146-150	70-90
07SX1N	120	116-119	60-80
07SX51N	120	136-140	70-90
102SX1N	120	118-119	70-90
102SX51N	120	133-140	80-100
2SX1N	240	236-240	150-170
	208	208-210	130-150
2SX51N	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.

EXCITER VOLTAGE TEST (Continued)

B. Generator Running at No Load

1. Connect an AC voltmeter to exciter terminals E1 and E2 as shown in Figure 6.
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).

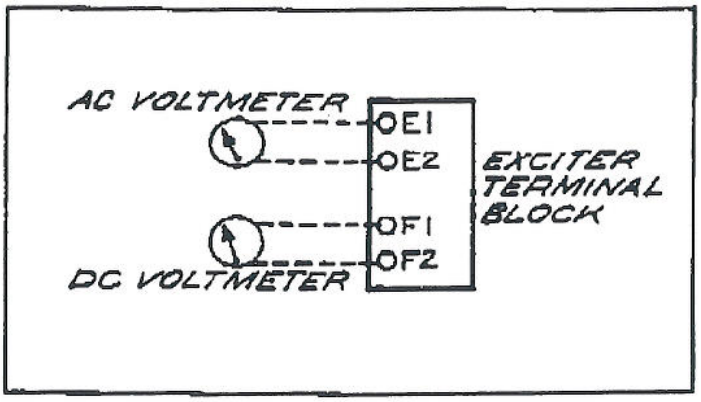


FIGURE 6. TEST SCHEMATIC (GENERATOR RUNNING AT NO LOAD)

TABLE 2. 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
04SX1N	120	124	21	1860
06SX1N	120	126	22	1860
07SX1N	120	123	21	1860
102SX1N	120	122	19	1860
2SX1N	240	253	39	1875
	208	215	36	1860

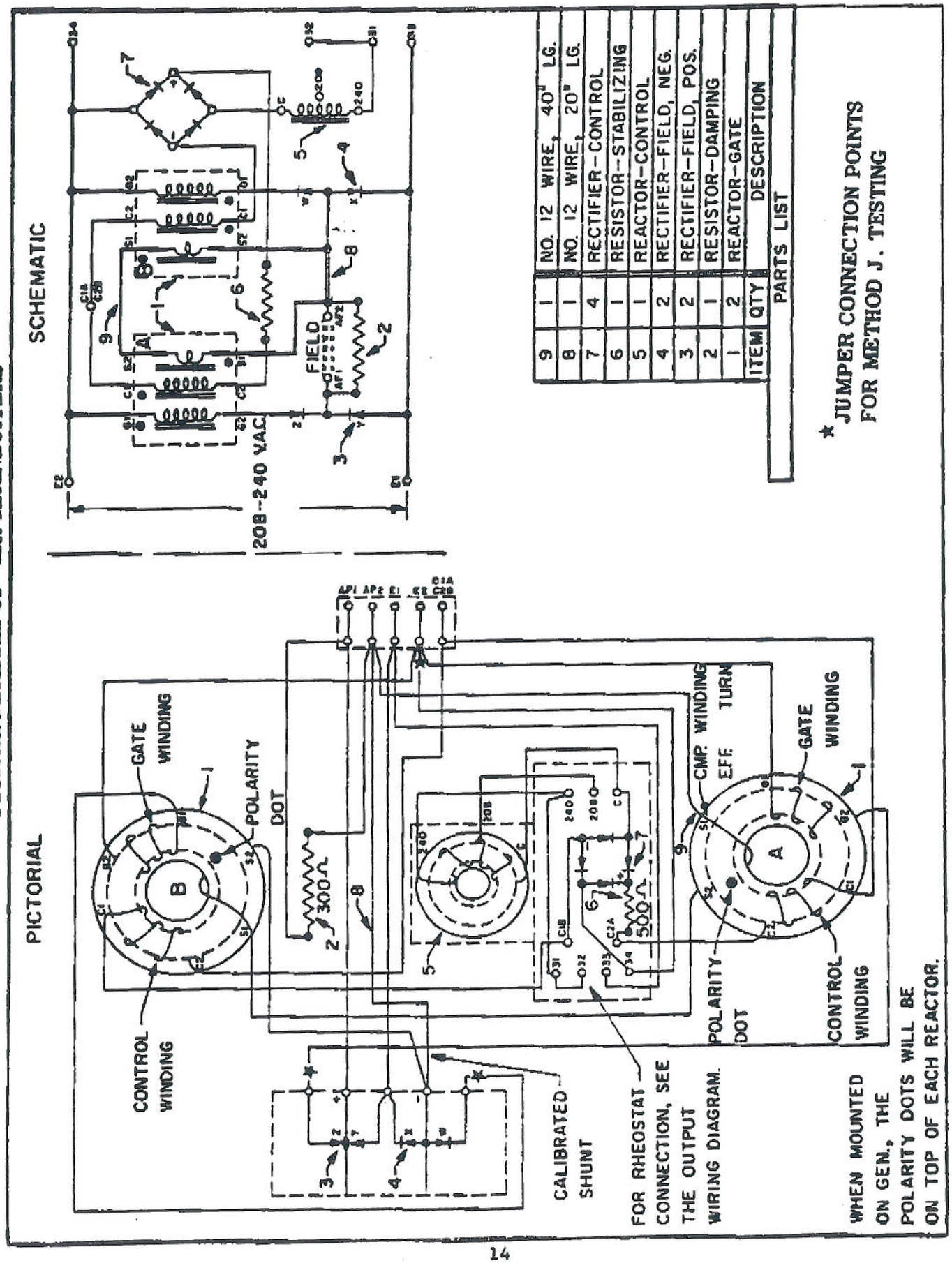
NOTE: Values will vary with engine speed and rheostat setting. All values at no load.

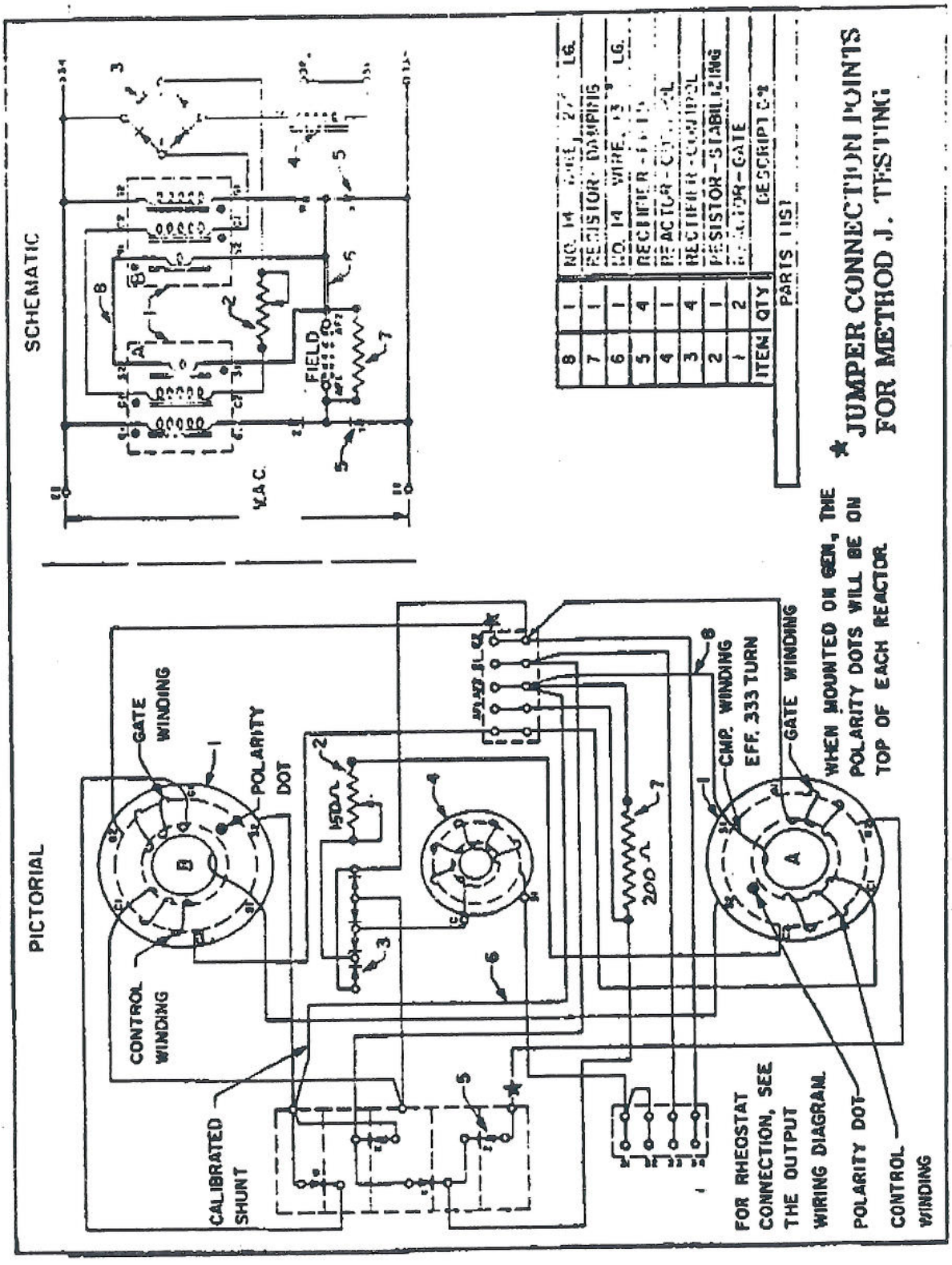
TABLE 3. RESISTANCE VALUES

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 C_1 to C_2	from G_1 to G_2	
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

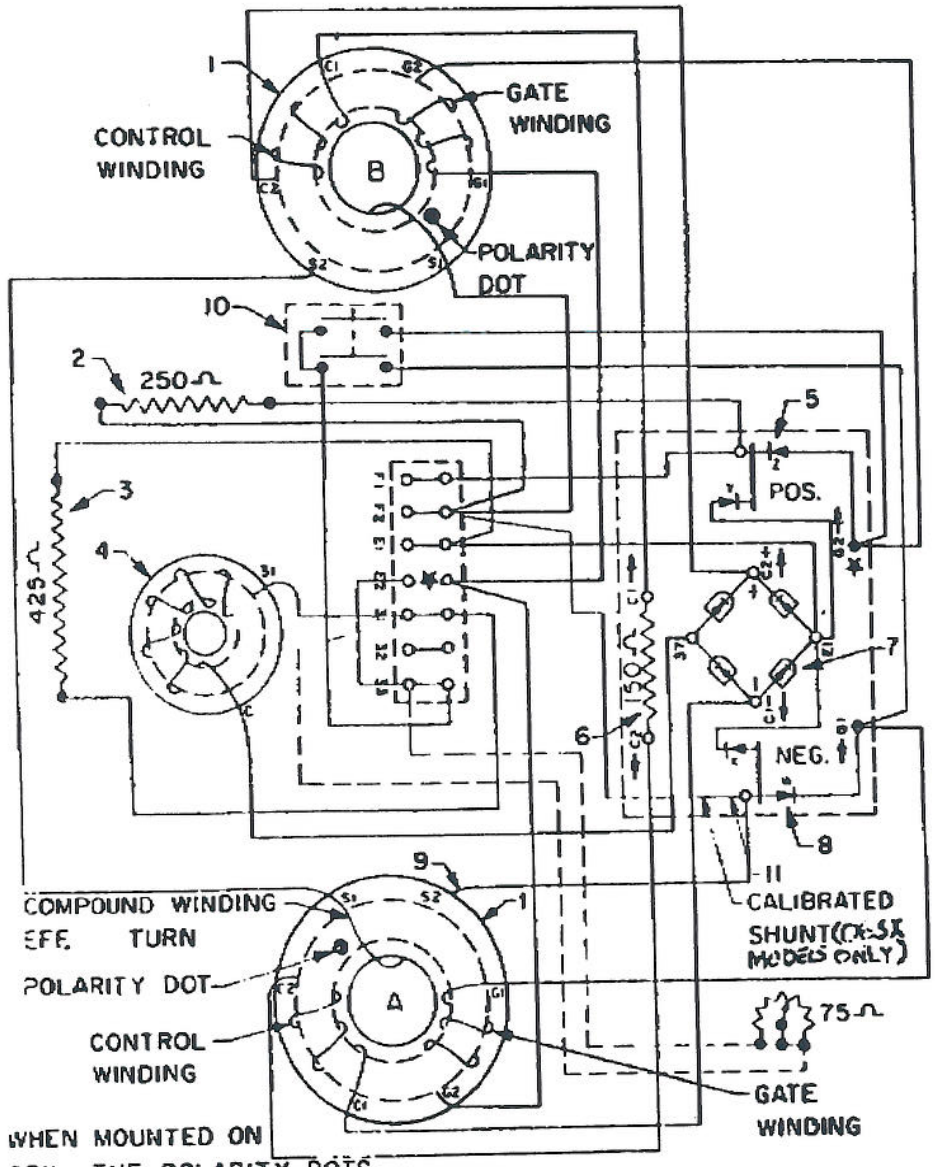
TYPICAL DIAGRAM OF 2SX MAGNECITERS



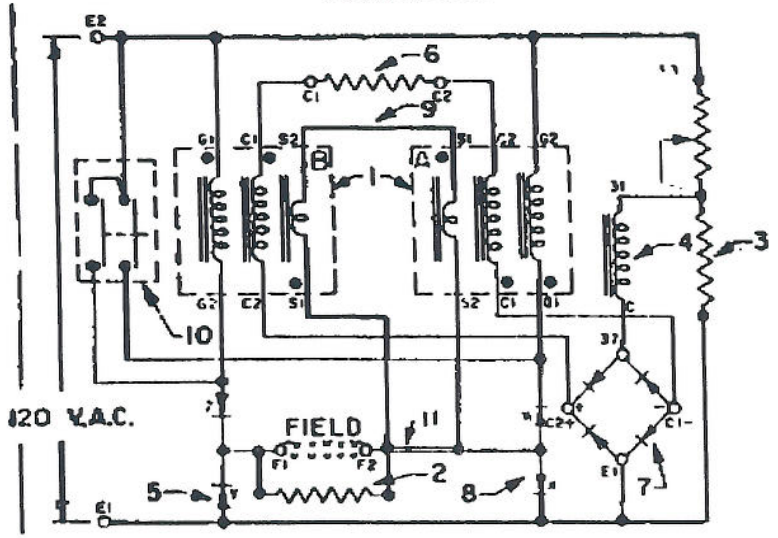

TYPICAL DIAGRAM OF 07SX AND 102SX MAGNECTTRS
SCHEMATIC
PICTORIAL
PARTS LIST
ITEM QTY DESCRIPTION
JUMPER CONNECTION POINTS FOR METHOD J. TESTING
WHEN MOUNTED ON GEN, THE POLARITY DOTS WILL BE ON TOP OF EACH REACTOR
GATE WINDING
POLARITY DOT
CONTROL WINDING
CALIBRATED SHUNT
FOR RHEOSTAT CONNECTION, SEE THE OUTPUT WIRING DIAGRAM
CMP. WINDING EFF. 333 TURN
200Ω
150Ω
FIELD
V.A.C.

TYPICAL DIAGRAM OF 04SX AND 06SX MAGNECITERS

PICTORIAL



SCHEMATIC

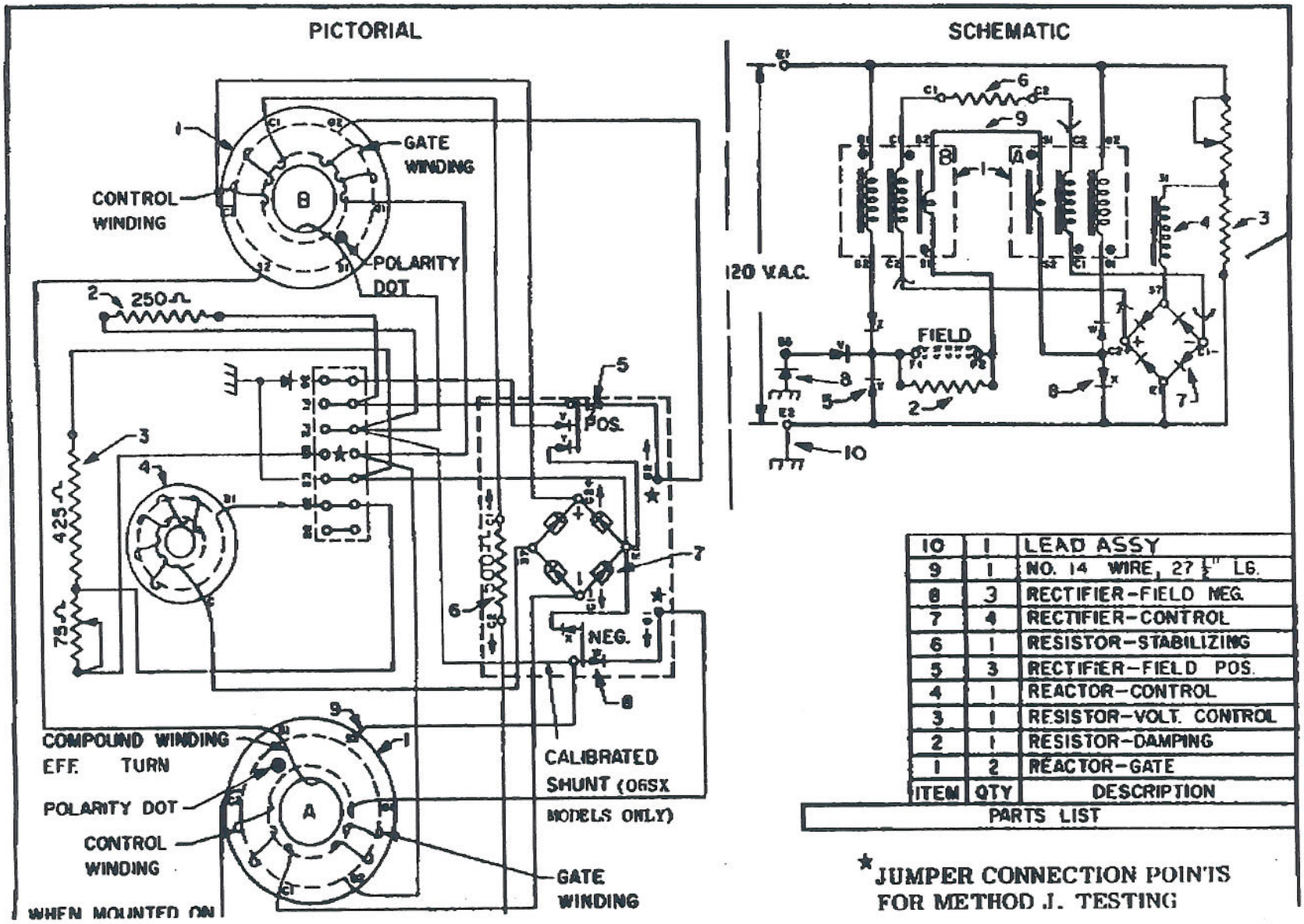


ITEM	QTY	DESCRIPTION
11	1	NO. 16 WIRE, 27½" LG.
10	1	SWITCH-RESIDUAL RESET
9	1	NO. 14 WIRE, 27½" LG
8	2	RECTIFIER-FIELD NEG.
7	4	RECTIFIER-CONTROL
6	1	RESISTOR-STABILIZING
5	2	RECTIFIER-FIELD POS.
4	1	REACTOR-CONTROL
3	1	RESISTOR-VOLT. CONTROL
2	1	RESISTOR-DAMPING
1	2	REACTOR-GATE

PARTS LIST

★JUMPER CONNECTION POINTS FOR METHOD J. TESTING

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



ITEM	QTY	DESCRIPTION
10	1	LEAD ASSY
9	1	NO. 14 WIRE, 27½" 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

PARTS LIST

★ JUMPER CONNECTION POINTS FOR METHOD J. TESTING

ENGINE. - Refer to the International Harvester manual for details of engine maintenance. Note, however, that the engine electrical system described therein does not apply - refer to the Onan wiring diagram instead.

Anti-dieseling Control. - The anti-dieseling control is a device to close the throttle during stopping of the plant. It counteracts the tendency of the governor to pull the throttle open as plant speed drops, and possible compression firing. The control spring tension must be sufficient to overcome the governor jointed lever spring but weaker than the pull of the solenoid.

GENERATOR. - The generator normally requires very little maintenance other than the periodic inspection service.

Generator Bearing. - The generator ball bearing is pre-lubricated and sealed. It requires no maintenance during its service life.

STATIONARY EXCITER. - The "static" exciter and regulator is used on units that have the separate automotive type starter and charging generator.

The exciter has no moving parts. Occasionally blow out any dust, etc. Check thoroughly to assure that all components are mechanically secure, and that all electrical connections are tight.

Generator Tests. - If the generator does not function properly, a few simple tests may isolate the cause.

1. Temporarily disconnect the two generator leads connected to the exciter terminals E1 and E2. Connect another source of 120 volt ac power (such as the normal line when the plant is used for standby) to the exciter terminals E1 and E2. Be sure the substitute power source is 120 volts.

   If there is no dc voltage across terminals AF1 (+) and AF2 (—), the exciter is not functioning.

2. If dc voltage at terminals AF1 and AF2 is 25 volts or higher (no load condition) but there is no ac output at the generator main output terminals, check the alternator for a grounded or open circuit, etc.

3. No terminal of the exciter should show a grounded circuit.