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INSTRUCTION MANUAL AND PARTS CATALOG

FOR



GENERATORS

**UF
SERIES**

0 *Bselete*

ALTERNATING CURRENT-1 PHASE-4 WIRE
and
ALTERNATING CURRENT-3 PHASE-4 WIRE

REVOLVING ARMATURE

INHERENTLY REGULATED

uf-action (rm)

ONAN

1400 73RD AVENUE N.E. • MINNEAPOLIS, MINNESOTA 55432

A DIVISION OF STUDEBAKER CORPORATION

N.Y. INTERNATIONAL OFFICE: Empire State Bldg.

new log

GENERAL INFORMATION

I

This instruction book contains information for the proper installation, operation, and maintenance of your equipment. We suggest that this book be kept handy so that it can be referred to when necessary.

This equipment is the result of proven engineering design, highest quality materials, and expert workmanship. Thorough inspection and testing assures you that this equipment will perform as expected.

If you wish to contact your dealer or the factory regarding this equipment, be sure to supply the complete MODEL and SPEC. NO., and the full serial number of the equipment as shown on the nameplate. This information is necessary to identify the equipment among the many basic and special optional types manufactured.

MANUFACTURER'S WARRANTY

The Manufacturer warrants, to the original user, that each product of its manufacture is free from defects in material and factory workmanship if properly installed, serviced and operated under normal conditions according to the Manufacturer's instructions.

Manufacturer's obligation under this warranty is limited to correcting without charge at its factory any part or parts thereof which shall be returned to its factory or one of its Authorized Service Stations, transportation charges prepaid, within one year after being put into service by the original user, and which upon examination shall disclose to the Manufacturer's satisfaction to have been originally defective. Correction of such defects by repair to, or supplying of replacements for defective parts, shall constitute fulfillment of all obligations to original user.

This warranty shall not apply to any of the Manufacturer's products which must be replaced because of normal wear, which have been subject to misuse, negligence or accident or which shall have been repaired or altered outside of the Manufacturer's factory unless authorized by the Manufacturer.

Manufacturer shall not be liable for loss, damage or expense directly or indirectly from the use of its product or from any other cause.

The above warranty supersedes and is in lieu of all other warranties, expressed or implied, and of all other liabilities or obligations on part of Manufacturer. No person, agent or dealer is authorized to give any warranties on behalf of the Manufacturer nor to assume for the Manufacturer any other liability in connection with any of its products unless made in writing and signed by an officer of the Manufacturer.

DATED August 1, 1963

IMPORTANT

RETURN WARRANTY CARD ATTACHED TO UNIT

I

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GENERATOR TABLE OF RATINGS

GENERATOR MODEL NO.	CY.	PH.	WIRE	VOLTS	GEN. WIRING DIA. NO.	†PARTS KEY NO.
205UF-3N/1A ^{2.5} 3N/1A ^S	60	1	4	120/240	620B52	1
3UF-53N/1A ^{3.0} 53N/1A ^S	50	1	4	120/240	620B52	2
4UF-3N/1A ^{4.0} 3N/1A ^S	60	1	4	120/240	620B52	2
5UF-53N/1A ^{5.0} 53N/1A ^S	50	1	4	120/240	620B52	3
7UF-3N/1A ^{7.0} 3N/1A ^S	60	1	4	120/240	620B52	3
7UF-4N/1A ^{7.0} 4N/1A ^S	60	3	4	120/240	620B54	4

Note † - Use the Parts Key No. in this column for your model when selecting parts from the list herein. Order only those parts with no Parts Key No. reference or those parts which refer to the Parts Key No. for your model.

** - New model designation beginning Spec E. Example:
Model 2.5UF-3^S/1 was 205UF-3N/1.*

SWITCHBOARD TABLE OF RATINGS

SWITCHBOARD MODEL NO. *	CYCLE	PHASE	WIRE	VOLTS	CONTROL WIRING DIA. NO.
4SA-3/1A	50 or 60	1	4	120/240	615B84
5SA-3/1A	50	1	4	120/240	615B84
7SA-3/1A	60	1	4	120/240	615B84

* - For all Switchboard Repair Parts refer to the wiring diagram furnished with the control.

NOTE: 120, 240 or 120/240 volt references herein apply also to 115, 230 or 115/230 volt ratings respectively.

GENERATOR. - This generator is inherently regulated and will maintain the output voltage within limits of 10% between no load and full load, when driven at its nameplate speed and at normal ambient temperature. The voltage will be somewhat higher when the generator is cold, and will vary with the driven speed. Frequency will vary 1 cycle for each 30 rpm of variation from rated speed according to the curves below.

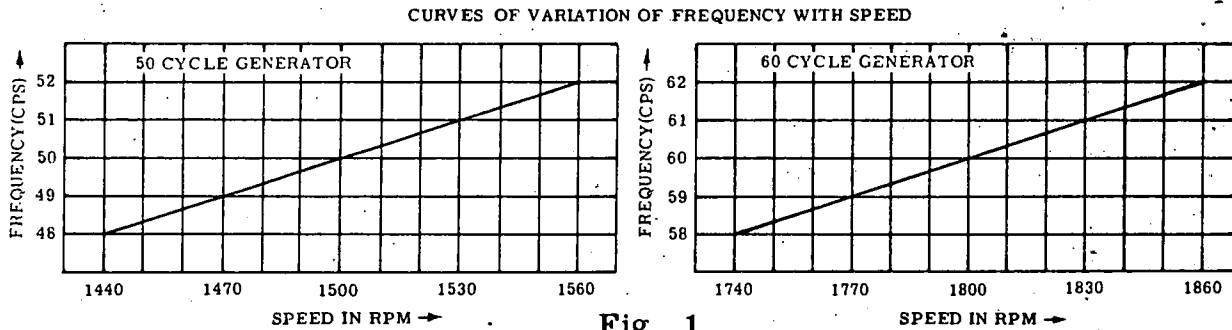


Fig. 1.

The power factor rating for all single phase models is 100%. The power factor rating of 3 phase models is 80%. The voltage regulation will not be greater than 10% at full load and rated power factor.

The generator may be driven in either a clockwise or counterclockwise direction, as installation requirements demand. The blower scroll must be reversed whenever the generator rotation is changed. See paragraph on REVERSING THE SCROLL. The generator is shipped from the factory with the scroll assembled for counterclockwise rotation. The direction of rotation of the generator is determined while looking at the end of the generator opposite to the drive end. The generator is drip proof in design, but reasonable precautions should be taken against excessive exposure to moisture.

The instruction manual covers both 1 phase 4 wire, and 3 phase 4 wire ONAN Ball Bearing Separate Generators.

A manual field rheostat can be used with the generator if it is necessary to operate above rated speed. It can be obtained, at added cost after the generator is received. See "PARTS LIST" for correct part number. It can also be used to reduce the voltage at light loads. The rheostat can not be used to increase the voltage above what it would be without it. See wiring diagram for proper connections.

SWITCHBOARDS. - Switchboards are optional equipment which can be purchased at added cost. Listed in the TABLE OF RATINGS are the Switchboard Model No.'s. They contain a voltmeter, ammeter, circuit breaker, generator and load terminals. The switchboard is generally used to check generator and load operation accurately and to prevent the generator from being overloaded. The operator can

check the following things by using a switchboard:

- (1) Generator voltage
- (2) Load current
- (3) Voltage regulation with varying load

The circuit breaker automatically disconnects the load from the generator when the load exceeds the generator kilowatt rating by approximately 25%. When the circuit breaker trips, it must be reset manually. The cause of the overload should be determined before resetting the breaker. The load current value at which the circuit breaker trips is affected somewhat by the ambient temperature. Do not mount the switchboard in a location where excessive temperatures can develop or on surfaces which vibrate. Excessive vibration may alter the trip current value of the circuit breaker.

When ordering repair parts for switchboards, obtain Part No's. and description of part from the wiring diagram which is supplied with the switchboard.

LOCATION. - Select a site for the generator with the following points in mind.

1. **Ventilation.** - The generator will warm up and create some heat when operating under load conditions. It is of vital importance that this heat be dissipated by proper ventilation. If the generator is installed in a small room or compartment, provide an opening for entry of fresh, cool air. Provide a separate opening for exhausting the air heated by the generator. Locate the exhaust opening above the inlet opening, for best air circulation. Heated air is discharged from the drive shaft end of the generator.

2. **Convenience to Driving Power.** - Locate the generator after considering the following points:

A. Driving unit location.

B. Desired direction of shaft rotation.

C. Pulley alignment, if used.

D. Shaft alignment of generator and driving unit if a flexible coupling is used.

A. Driving unit location. - Regardless of the type of driving unit it **MUST** be bolted securely to a heavy mounting base to maintain pulley and shaft alignment.

B. Desired direction of shaft rotation. - The direction of rotation will be determined by the direction of rotation of the driving unit. The generator direction of rotation is reversible and works equally well in either direction. However the generator lead wires and blower scroll must be properly installed for whatever direction of rotation is necessary. See wiring diagram for proper lead connections. See paragraph on **REVERSING THE SCROLL** for proper scroll installation.

C. Pulley alignment if used. - The shafts of the generator and driving unit must be parallel and the sides of the pulleys must be lined up. Correct belt tension must be permanently maintained. After the pulleys are in proper alignment, both generator and driving unit must be bolted down to a heavy rigid mounting base.

D. Shaft alignment. - If a flexible coupling is used, the shaft alignment of the generator and driving unit must be accurately made and permanently maintained. Incorrect shaft alignment will cause excessive wear on both generator and driving unit and unnecessary loss of power from the driving unit.

3. Dusty or Damp Conditions. - Avoid excessive dusty or damp conditions as much as possible. Rust and dirt are enemies of any piece of machinery. The generator is drip proof in design, but unnecessary exposure to moisture should be avoided. The generator should be mounted under cover or inside a building to protect it against the weather.
4. Servicing Convenience. - To permit easy access for servicing the bearings and brushes, allow at least 24 inches of space around the generator.
5. Wiring Convenience. - Locate the generator as near as possible to the electrical equipment it is to serve.

GENERATOR COOLING. - The generator blower system uses a reversible scroll. When the blower scroll is installed properly, a strong flow of air comes out of the generator at the generator drive shaft end. Lack of air flow indicates improper installation of the blower scroll. See paragraph on "REVERSING THE SCROLL".

MOUNTING THE GENERATOR. - The mounting surface must be flat so that the generator mounting base will not be sprung, when tightened into place. It should be possible to turn the generator shaft by hand after the generator is bolted down.

WIRING CONNECTIONS. - The generator external leads are not connected, and their manner of connection will depend upon whether a rheostat is to be used, and the DIRECTION OF ROTATION. Refer to the wiring diagram. A rheostat of the proper size should be installed if the speed variation will be too great, or if it is necessary to reduce the voltage at light loads. The addition of a rheostat will not raise the voltage above that which could be obtained without the rheostat. A circuit breaker between generator and load is recommended.

Follow specifications of local and national electrical codes for installing wiring and grounding the generator. Be sure to use wire large enough to avoid excessive drop in voltage between the generator and the load, depending upon the distance and the amount of the load.

The proper size and type of driving unit for the generator is important for satisfactory operation of the generator. When a gasoline or diesel engine is used the following factors should be considered:

1. Engine Power. - The engine must have a minimum of 2 horsepower for each 1000 watts of generator output. For example, if a 5000 watt generator is to be operated, the engine must deliver at least 10 horsepower at the drive shaft. If the engine has a considerable reserve of power the speed regulation and voltage regulation will be much better.

2. Engine Pulley Speed. - The engine may have a variable speed governor which regulates engine speed at about 8-1/2 to 12%. If so, governor operation is best at the maximum rated speed of the engine. When the generator is operating at or near its capacity, the tendency of the engine is to increase speed when the load is suddenly removed. The engine governor does not react fast enough at low speed to prevent momentary acceleration and high voltage. This may possibly cause serious damage to any electrical equipment left connected. Governor action is much better when the engine is operating at its rated speed, and the engine cannot increase its speed too much when the load is removed. If the engine has a constant speed governor, the speed regulation is 5% or less and the above effects are not present.

Low generator speed causes low voltage and frequency. If, for example, an 1800 rpm generator is slowed to 1500 rpm, the frequency of the current produced will be 50 cycles instead of 60 cycles. The combination of low voltage and frequency will almost certainly result in burned out windings of any motors connected to the generator.

3. Pulley Selection. - The rated speed of the engine or electric motor will determine the size of pulley to use on the generator... To determine the correct generator pulley size to use, proceed as follows, or refer to the PULLEY SELECTION TABLE.

- A. Multiply the DIAMETER of the driving unit pulley by its SPEED in rpm (revolutions per minute).
- B. Divide the above result by the nameplate speed of the generator (1800 rpm).

Example: A driving pulley 15 inches in diameter operates at 1200 rpm. Multiply 15 x 1200 getting a result of 18,000. Divide the 18,000 by 1800 rpm (generator pulley speed desired) and the final result is 10, which expresses the size of the pulley (in inches) required. If this same driving unit has an 8 inch pulley operating at 1200 rpm the generator pulley **would then** be 5.33" or approximately 5-3/8" (8 x 1200, divided by 1800 = 5.33).

USE THIS TABLE ONLY FOR GENERATORS STAMPED 1800 RPM ON THE GENERATOR NAMEPLATE.

The pulley sizes recommended in this table are approximate sizes only, in 1/2" steps. The sizes shown do not include any allowance for belt slippage. Belt slippage for flat belts may sometimes reduce the generator driven speed, under load, as much as 4 per cent.

To select a generator pulley size from the table, measure the DIA-METER (not the distance around) of the driving pulley. Select the line at the left side of the table for the driving pulley size. Follow this line across to the speed column that is nearest to the recommended speed of the driving pulley. The size in the square at this point is the approximate size of the generator pulley which will be required. If the recommended size pulley can not be obtained, select one size smaller pulley. This will help to offset belt slippage. Adjust throttle or governor as necessary to obtain proper speed.

Example:

If a 12 inch drive pulley operates at 1100 rpm, follow the 12 inch line across to the 1100 rpm column. The generator pulley size at the point of intersection is 7 inch. This example is outlined in heavy lines in the table.

DRIVING PULLEY SIZE	DRIVING PULLEY SPEED IN REVOLUTIONS PER MINUTE															
	600	700	800	900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	
	GENERATOR PULLEY SIZE REQUIRED (1800 R. P. M. GENERATOR)															
6	2	2	2½	3	3	3½	4	4	4½	5	5	5½	6	6	6½	
6½	2	2½	2½	3	3½	4	4	4½	5	5	5½	6	6½	6½	7	
7	2	2½	3	3½	4	4	4½	5	5½	5½	6	6½	7	7½	7½	
7½	2½	3	3	3½	4	4½	5	5½	5½	6	6½	7	7½	8	8	
8	2½	3	3½	4	4½	4½	5	5½	6	6½	7	7½	8	8½	9	
8½	2½	3	3½	4	4½	5	5½	6	6½	7	7½	8	8½	9	9½	
9	3	3½	4	4½	5	5½	6	6½	7	7½	8	8½	9	9½	10	
9½	3	3½	4	4½	5	5½	6	6½	7	8	8½	9	9½	10	10½	
10	3½	4	4½	5	5½	6	6½	7	7½	8	9	9½	10	10½	11	
10½	3½	4	4½	5½	5½	6½	7	7½	8	8½	9	10	10½	11	11½	
11	3½	4	4½	5½	6	6½	7	8	8½	9	9½	10	11	11½	12	
11½	4	4½	5	5½	6	7	7½	8	9	9½	10	10½	11½	12	12½	
12	4	4½	5	6	6½	7	8	8½	9	10	10½	11	12	12½	13	
12½	4	4½	5½	6	7	7½	8	9	9½	10½	11	11½	12½	13	13½	
13	4	5	5½	6½	7	8	8½	9	10	10½	11½	12	13	13½	14½	
13½	4½	5	6	6½	7½	8	9	9½	10½	11	12	12½	13½	14	15	
14	4½	5½	6	7	7½	8½	9½	10	11	11½	12½	13	14	14½	15½	
14½	5	5½	6½	7	8	8½	9½	10½	11	12	12½	13	14½	15	16	
15	5	5½	6½	7½	8	9	10	10½	11½	12½	13	14	15	15½	16½	
15½	5	6	6½	7½	8½	9½	10½	11	12	13	13½	14½	15½	16	17	
16	5½	6	7	8	9	10	11	11½	12½	13	14	15	16	16½	17½	

1500 RPM GENERATOR PULLEY SELECTION TABLE

USE THIS TABLE ONLY FOR GENERATORS STAMPED 1500 RPM ON THE GENERATOR NAMEPLATE.

The pulley sizes recommended in this table are approximate sizes only, in 1/2" Steps. The sizes shown do not include any allowance for belt slippage. Belt slippage for flat belts may sometimes reduce the generator driven speed, under load, as much as 5 percent.

To select a generator pulley size from the table, measure the DIAMETER (not the distance around) of the driving pulley. Select the line at the left side of the table for the driving pulley size. Follow this line across to the speed column that is nearest to the recommended speed of the driving pulley. The size in the square at this point is the approximate size of the generator pulley which will be required. If the recommended size pulley can not be obtained, select one size smaller pulley. This will help to offset belt slippage. Adjust throttle or governor as necessary to obtain proper speed.

Example: If a 12 inch drive pulley operates at 1100 rpm, follow the 12 inch line across to the 1100 rpm column. The generator pulley size at the point of intersection is 9 inch. This example is outlined in heavy lines in the table.

	DRIVING PULLEY SPEED IN REVOLUTIONS PER MINUTE															
DRIVING PULLEY SIZE	600	700	800	900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	
	GENERATOR PULLEY SIZE REQUIRED (1500 RPM GENERATOR)															
6	2½	3	3	3½	4	4½	5	5	5½	6	6½	7	7	7½	8	
6½	2½	3	3½	4	4½	5	5	5½	6	6½	7	7½	8	8	8½	
7	3	3	3½	4	4½	5	5½	6	6½	7	7½	8	8½	9	9½	
7½	3	3½	4	4½	5	5½	6	6½	7	7½	8	8½	9	9½	10	
8	3	3½	4	4½	5	6	6½	7	7½	8	8½	9	9½	10	10½	
8½	3½	4	4½	5	5½	6	6½	7½	8	8½	9	9½	10	10½	11½	
9	3½	4	4½	5½	6	6½	7	7½	8½	9	9½	10	11	11½	12	
9½	4	4½	5	5½	6	7	7½	8	9	9½	10	10½	11½	12	12½	
10	4	4½	5	6	6½	7½	8	8½	9½	10	10	11	12	12½	13½	
10½	4	5	5½	6	7	7½	8½	9	10	10½	11	12	12½	13	14	
11	4½	5	6	6½	7½	8	9	9½	10½	11	11½	12½	13	14	14½	
11½	4½	5½	6	7	7½	8½	9	10	10½	11½	12	13	14	14½	15½	
12	5	5½	6½	7	8	9	9½	10½	11	12	13	13½	14½	15	16	
12½	5	6	6½	7½	8½	9	10	11	11½	12½	13½	14	15	16	16½	
13	5	6	7	7½	8½	9½	10½	11	12	13	14	14½	15½	16½	17½	
13½	5½	6	7	8	9	10	11	11½	12½	13½	14½	15½	16	17	18	
14	5½	6½	7½	8½	9½	10	11	12	13	14	15	16	17	17½	18½	
14½	6	7	8	8½	9½	10½	11½	12½	13½	14½	15½	16½	17½	18½	19½	
15	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	
15½	6	7	8	9	10½	11½	12½	13½	14½	15½	16½	17½	18½	19½	20½	
16	6½	7½	8½	9½	10½	11½	12½	14	15	16	17	18	19	20	21	
16½	6½	7½	9	10	11	12	13	14½	15½	16½	17½	18½	20	21	22	
17	7	8	9	10	11½	12½	13½	14½	16	17	18	19	20	21½	22½	
17½	7	8	9½	10½	11½	13	14	15	16½	17½	18½	20	21	22	23	
18	7	8½	9½	10½	12	13	14½	15½	17	18	19	20	21½	23	24	

REVERSING THE SCROLL. - The generator is shipped from the factory with the blower scroll mounted for counterclockwise rotation. The direction of rotation is determined while looking at the end opposite the drive end. If a clockwise direction of rotation is desired, the blower scroll position must be reversed. The arrow which is printed on the scroll must be pointing in the direction of the rotation of the generator shaft.

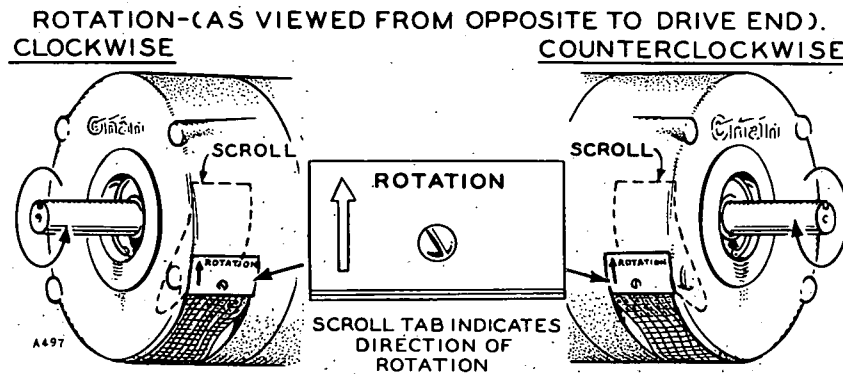


FIG. 2 - BLOWER SCROLL

To reverse the scroll, remove only the scroll with screen attached, turn it end for end and reinstall it so that the scroll will be at the opposite end of the air outlet hole, as illustrated.

POLARIZING THE GENERATOR FIELD. - The field is polarized at the factory. If rotation direction is reversed (scroll reversed and leads properly connected) and voltage does not automatically build-up the first time, "flash the field" to re-polarize the generator.

Connect an ac voltmeter across the generator output, run the generator in the desired direction, touch a battery positive (+) cable to generator field lead F1, and the battery negative (-) cable to generator field lead F2. If the voltmeter does not indicate voltage build-up, a larger battery or higher dc source may be required to kill the existing residual magnetism.

STARTING. - Be sure that the generator is connected for the direction of rotation being used. Start up the generator and check the voltage while running at no load and rated speed (1,500-rpm for 50-cycle generators and 1,800-rpm for 60-cycle generators). The generator voltage should be as follows:

Generator Nameplate Voltage Rating	Approximate Line to Line No Load Voltage at Rated Speed
120/240	252
120/208	220

If the generator voltage at no load is not as specified above, adjust the generator speed until no-load voltage is reached before proceeding.

Check the generator cooling air circulation. When the blower scroll is installed properly, a strong current of air comes out of the drive shaft end of the generator. See paragraph on **REVERSING THE SCROLL** for proper installation of the blower scroll.

OPERATING. - Connect the various electrical loads after the generator voltage is adjusted to the proper value at no load. It may be necessary to advance or retard the engine throttle control for engine drive units to control the output voltage. This may also be necessary when large changes in the electrical load are made.

Keep the electrical load on the generator within its nameplate rating. Overloading the generator will cause the voltage to be low, will shorten the life and void warranty.

Consider load and installation characteristics to determine the proper starting procedure which will assure voltage build-up each time. Failure of generator to build up voltage may occur when the starting load is too heavy. (This is not lost residual magnetism if the voltage builds up (1) when only partial load is connected, or (2) when load is connected after generator reaches speed.)

- A. When electric motor loads are connected, connect one at a time, begin with largest motor, allow each to reach running speed, then connect the next motor. Electric motors require much more current for starting than when running at normal speed.
- B. When a rheostat (to limit voltage at higher speed or at light load) is used, disconnect the load (turn switch or circuit breaker OFF) or turn rheostat to decrease resistance, until generator reaches speed to assure build up.
- C. Turn off the lights to attain partial load or no load until generator reaches speed. Incandescent light bulbs (lamps) draw as much as eight times their rating until filaments heat up.

GENERAL SERVICING. - The generator is designed to give long and satisfactory service when properly cared for. Regular servicing as outlined here will be well worth the effort required.

The ball bearings are the double-sealed pre-lubricated type and do not require future lubrication.

To lift brushes away from contact, first remove the brush spring (constant pressure type) from its holder, then remove the brush from its guide, as illustrated. Do not pull the brush out as may be done when spiral type springs are used. Do not unwind the spring past the end of its support plate. A spring so distorted or kinked must be replaced with a new one.

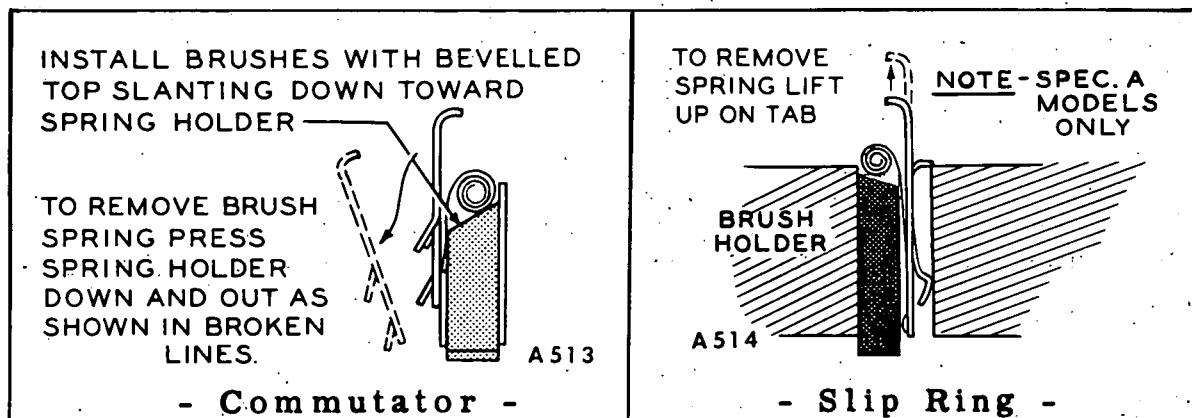


FIG. 3 - BRUSHES AND SPRINGS (Constant Pressure Type)

BRUSH CONTACT. - Maintain good electrical full brush contact at all times.

Each 200 hours of operation, or once a month, clean the commutator and slip rings with a dry, lint free cloth. Do not attempt to maintain a bright, newly machined appearance. A dark, glossy appearance is normal. Heavy deposits or slight roughness may be remedied by careful sanding with #00 sandpaper. Hold the sandpaper flat against the commutator, or slip ring, while the generator is operating. Use a flat wooden stick, with light pressure, to hold the sandpaper. Never use emery or carborundum cloth or paper. Wipe or blow out accumulations of brush dust, which may cause a short circuit.

It is not necessary to remove the brush rig or end bell when installing new brushes or cleaning the commutator. The brushes, commutator and slip rings are easily reached by removing the end bell cover.

Brushes eventually wear too short to perform their function. Brush wear will be more rapid under dusty operating conditions. Replace brushes with new ones only when worn to 5/8 inch in length. The brush springs provide equal pressure as the brushes wear shorter in use.

Each spring is permanently attached to a metal plate which snaps into place, as illustrated. To replace a commutator brush, first remove the spring by pushing the spring plate inward and away from the brush guide. To replace a collector ring brush, first remove the spring by pulling straight outward on the spring plate. When installing a new brush in its guide, be sure that the "low" or shorter side of the beveled top of the brush is toward the spring-plate side of the guide. Be sure each brush is free in its guide. Keep the brush rig and end bell cleaned of carbon dust, etc.

The surface of the commutator may become worn down level with the mica insulation between the bars. If the commutator is worn smooth, the mica between the bars may be cut down to $1/32$ " below the surface without removing the rotor. Remove the end bell only, carefully tagging or otherwise marking all leads disconnected.

Remove each spring and brush from its guide. Pull the end bell off carefully. An undercutting tool may be fashioned from a hack saw blade grinding the blade teeth to a thickness equal to the mica between the bars of the commutator. Use care not to scratch the surface of any bar while undercutting the mica. Remove any burrs formed along the edges of the bars.

If, due to unfavorable operating conditions, the commutator or slip rings become worn out of round, grooved, or pitted it will be necessary to remove the armature and turn the commutator smooth in a lathe.

After turning down the commutator, undercut the mica between bars as previously described.

BRUSH RIG "NEUTRAL" POSITION. - Each time brushes and springs are serviced, see that the brush rig witness mark is aligned, as illustrated.

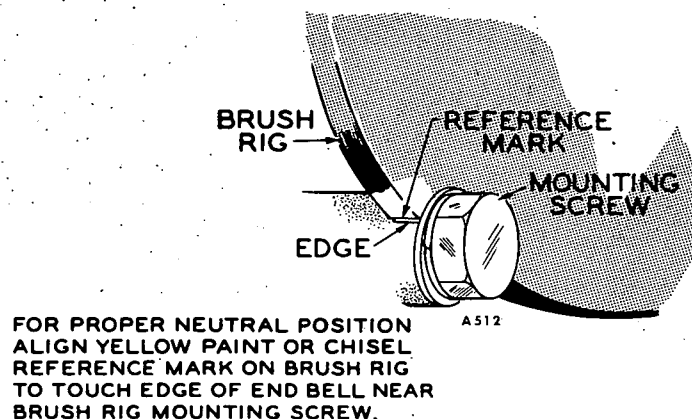


FIG. 4 - BRUSH RIG POSITION

The position of the brush rig assembly in the generator end bell is very important. The correct setting of the brush rig was determined at the

900-153 (2-12-71)

SUPPLEMENTARY INSTRUCTIONS
FOR ONAN TWO-BEARING GENERATORS

Beginning with the Spec. letters shown below, two-bearing generator model designation will change. The reason for this change is to identify single-bearing generators from two-bearing generators.

The two-bearing generators will change to letter "S" after the voltage code. The single-bearing generators will have the letters "C" or "N" after the voltage code.

EXAMPLE

2.5UD-1S/1D WAS 2.5UD-IN/1C

<u>NEW GENERATOR MODEL</u>	<u>EFFECTIVE SPEC.</u>	<u>INSTRUCTION MANUAL</u>
1.5UF-232S	B	943-3
2.0UF-232S/32	B	943-4
2.0UF-125S	B	943-9
2.0UG-1S/135	B	943-10
2.5UD-1S	D	937-5
2.5UF-1S	E	943-1
3.0UF-232S	B	943-3
3.5UD-1S	D	937-5
4.0UF-1S	E	943-1
5.0UF-210S	B	943-3
5.0UF-210S	B	943-9
7.0UF-1S	E	943-1
10.0UF-150S	B	943-5
12.0UF-3S	E	943-8
12.0UF-4S	E	943-8
15.0UB-150S	B	914-33
15.0UF-3S/104	E	943-7
25.0UT-3S/106	B	971-1
25.0UT-5DS/106	B	971-1

factory and is identified by a painted or chisel mark on the outer edge of the brush rig and must align with the edge of the end bell where the brush rig is mounted.

As long as the original brush rig and armature are continued in service, these alignment marks must be observed.

MAJOR GENERATOR REPAIR. - Consult a competent mechanic or electrician, familiar with a.c. generators, to locate any faulty windings and to perform any necessary major repair. Several tests for open or grounded circuits can be made without disassembling the generator. Before making tests, and before disassembling the generator, lift the brushes away from contact. After completing the maintenance, return the brushes to their operating position.

DISASSEMBLY. - If it should become necessary to disassemble the generator, lift all brushes from contact. Tag all leads which are disconnected, to insure correct replacement when the generator is reassembled.

When reassembling be sure the bearing stop clip is in place on the bearing opposite the drive end. Avoid possible damage to parts through careless disassembly and reassembly. Most other assembly procedures are self-evident.

ARMATURE GROUNDED. - See that all brushes are lifted out of their holders. Use a continuity type test lamp set. Place one test prod on the commutator, and the other prod on a bare clean part of the generator frame or armature shaft. The prods must make good electrical contact. The test set lamp should not light. If it does light up, the armature is grounded. Test the slip rings in the same manner. If the armature tests grounded, replace with a new one.

TESTING THE ARMATURE FOR AN OPEN CIRCUIT. - The AC winding of an alternating current generator may be tested for an open circuit by use of the test lamp set. Place one test prod on one slip ring, and the other test prod on a second ring. The test lamp should light. If it does not light, an open circuit is present. If there are three or four rings, test between each two in the same manner. Install a new armature if an open circuit is present.

To test the direct current winding of an armature for an open circuit, the use of an armature growler is necessary. Most electrical repair shops have such equipment. It will be necessary to remove the armature for testing. Proceed as follows.

- a. Place the armature in the growler which is connected to alternating current. Rub a smooth steel blade (back edge of a hacksaw blade)

across the segments of the commutator.

b. At some point around the commutator a spark should occur as the blade contacts the two adjacent segments. If a spark occurs, the circuit is complete (not open) between those two segments. Then it will be necessary to rotate the armature just enough to test the next two segments.

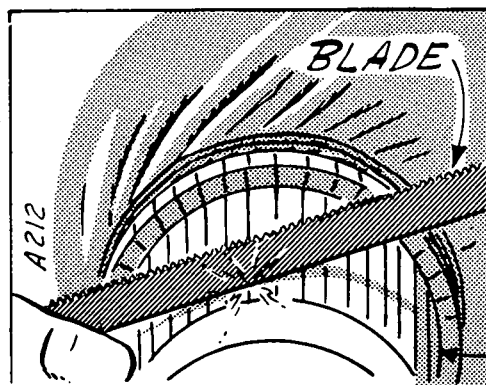


FIG. 5 - OPEN CIRCUIT TEST

Continue the rotating and testing until the commutator segments have been tested completely around. A good spark should occur between all adjacent segments when those segments and windings attached to them are in the correct position in the growler magnetic field. If no spark occurs, the winding between those two segments is open circuited. (There is a possibility that a short circuit of a winding might prevent the sparking, but then the armature would also be magnetized as described in the following paragraph.)

TESTING THE ARMATURE FOR SHORT CIRCUITS. - Place the armature in the growler (see figure) which is connected to alternating current. Hold a steel blade (or old hack-saw blade) 1/4 inch from the armature laminations. If the steel blade is attracted to any magnetized armature laminations, either the armature windings or commutator is short circuited. Do not test for magnetism at just one point of the armature laminations, but test all of the armature laminations from one side over to the other side (along the dotted line on figure). After testing the armature in one position, revolve the armature about 1/8 revolution and test for magnetism again. Continue the revolving and testing until the armature has been tested completely around.

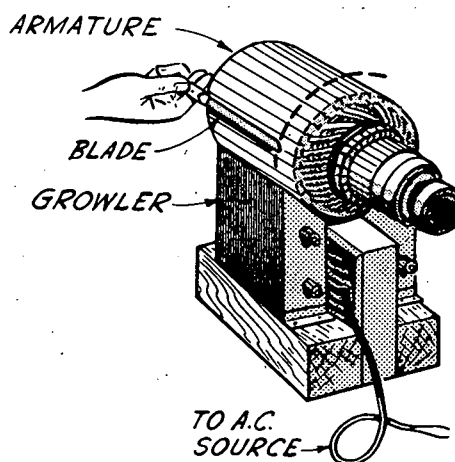


FIG. 6 - SHORT CIRCUIT TEST

FIELD WINDINGS, OPEN CIRCUIT. - A test

lamp set can be used to test field windings for an open circuit. Place one test prod on one of the terminal ends of the field windings, and the other test prod on the other terminal end of the winding. The test lamp should light. If it does not, an open circuit is indicated. Check carefully to see that the open circuit is not at the terminal leads or a loose terminal. An open circuit due to a broken lead or loose terminal is easily repaired. An open circuit within a coil requires replacement of the set of coils.

Following is a list of troubles that may be experienced in the operation of the generator. Also listed are the possible causes and usual remedies for getting the generator back into proper efficient operation.

POSSIBLE CAUSE	REMEDY
POOR COMMUTATION OR ARCING AT THE GENERATOR BRUSHES	
Brushes out of neutral position.	Turn brush ring until the identifying marks are aligned.
Brushes not seating properly.	Sand the brush to the proper contour.
Generator heavily overloaded.	If the AC or DC amperage is more than stated on the generator nameplate, remove part of the load.
Brushes binding in holder.	Clean each brush and holder.
Brush tension insufficient.	Replace brush springs.
Brushes worn too short.	Replace brushes.
Brush tension unequal.	Replace weak brush springs.
Wrong type brush.	Replace with correct type and make of brush and spring.
Loose commutator bars.	Replace with new armature.
High mica.	Undercut the mica.
Commutator out of round.	True the commutator in a lathe.
Commutator surface dirty or oily.	Clean the commutator.

OVERHEATING OF GENERATOR

Windings and parts covered with dirt and oil.	Clean generator.
Overloaded.	Check load or output of generator.
Short circuit or grounded circuit in the field winding or armature winding.	Replace defective parts.

POSSIBLE CAUSE

REMEDY.

OVERHEATING OF GENERATOR (Cont.)

- | | |
|--|---|
| Excessive arcing at the brushes. | See "Poor Commutation" above. |
| Unequal air gap between pole shoe and armature. | Shim up pole shoe until air gaps are equal. |
| Generator blower scroll installed in wrong position. | Reverse blower scroll position. |

GENERATOR NOISY

- | | |
|------------------------------|--------------------------------------|
| Generator loose on base. | Tighten mounting bolts. |
| Worn or defective bearing. | Replace worn parts. Check alignment. |
| Field pole rubbing armature. | Tighten field poles to frame. |

GENERATOR RUNS BUT DOES NOT PRODUCE CURRENT

- | | |
|---|---|
| Brushes not contacting commutator. | Free brushes in holders. Assemble brushes and springs correctly. |
| Open, short or grounded circuit in generator. | Test windings and repair or replace defective parts. |
| Generator line leads broken or loose. | Tighten connections and replace broken leads. |
| Generator armature rotating in the wrong direction. | 1. Correct direction of rotation.
2. Or, connect wires, polarize field and reinstall scroll to agree with direction of rotation. |

LOW VOLTAGE OUTPUT OF GENERATOR

- | | |
|---|--|
| Speed low because of loose, slipping belts. | Adjust belt tension. |
| Generator brushes not in neutral position. | Turn brush ring until the identifying marks are aligned correctly. |
| External short circuit on line. | Test generator with line wires disconnected. |

POSSIBLE CAUSE

REMEDY

LOW VOLTAGE OUTPUT OF GENERATOR (Cont.)

Open circuit of shunt field winding.

Make proper connections according to wiring diagram.

Short circuit of windings in the field or armature.

Replace defective part.

Manual field rheostat (if used) adjusted at minimum voltage.

Adjust manual rheostat.

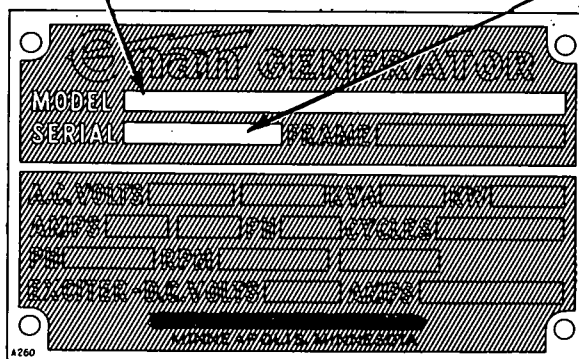
18 INSTRUCTIONS FOR ORDERING REPAIR PARTS

FOR PARTS OR SERVICE, CONTACT THE DEALER FROM WHOM YOU PURCHASED THE EQUIPMENT OR REFER TO YOUR NEAREST AUTHORIZED SERVICE STATION.

TO AVOID ERRORS OR DELAY IN FILLING YOUR ORDER, PLEASE FURNISH ALL INFORMATION REQUESTED.

REFER TO THE NAMEPLATE

1. Always give the Model No. ----- and Serial No. -----



2. Refer to the "Table of Ratings" near the front of this book to determine the "Parts Key No.", which agrees with your model, for selecting the correct part from the list. If your Model and Spec. No. is not shown use the list only as a guide and order by description.
3. Give the part number, description and quantity needed of each item. If an old part cannot be identified return the part prepaid to your dealer or nearest AUTHORIZED SERVICE STATION. Print your name and address plainly on the package. Write a letter to the same address stating the reason for returning the part.
4. State definite shipping instructions.

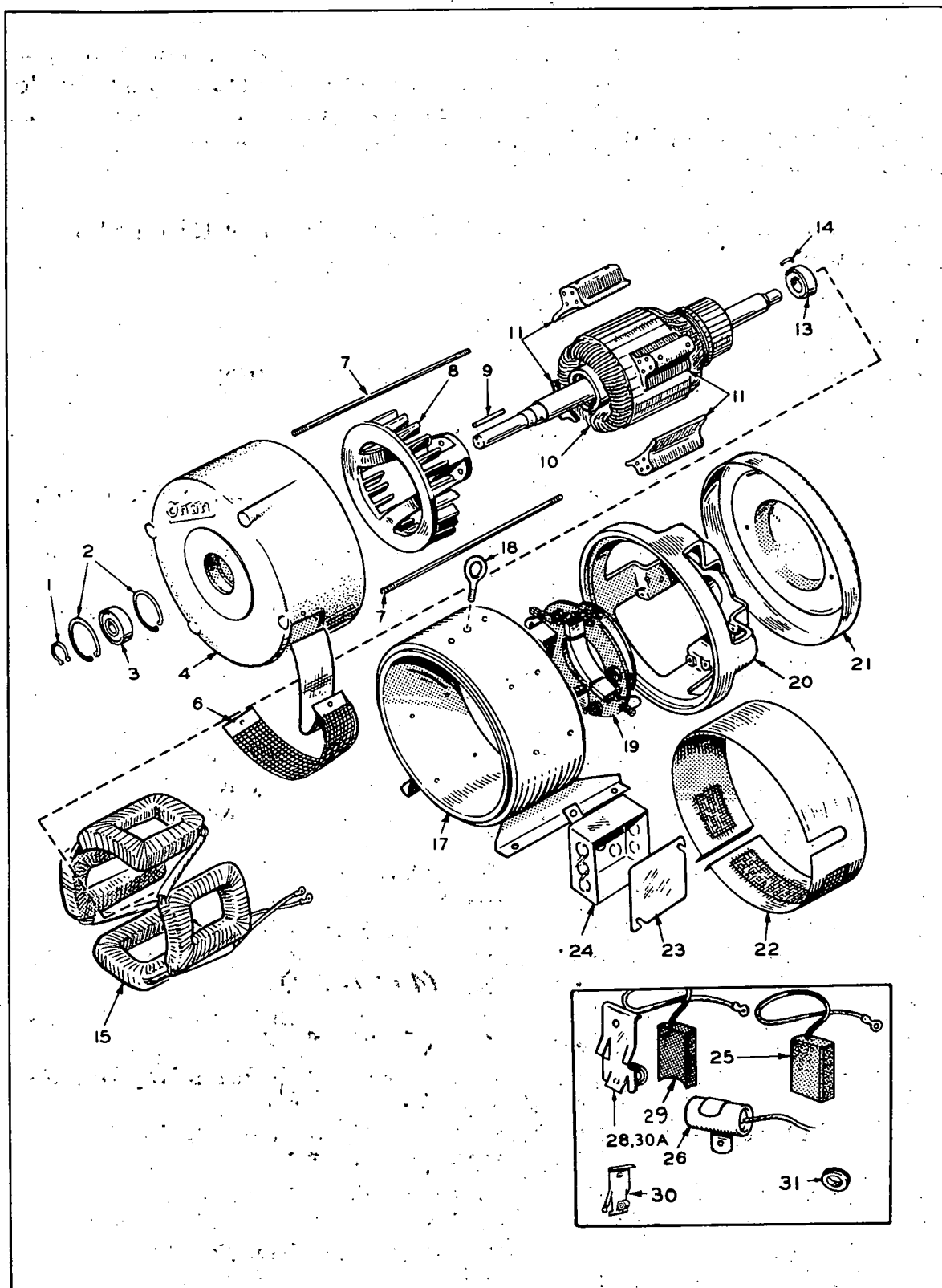
Any claim for loss or damage to your unit in transit should be filed promptly against the transportation company making the delivery. Shipments are complete unless the packing list indicates items are back ordered.

"Prices are purposely omitted from this Parts Catalog due to the confusion resulting from fluctuating costs, import duties, sales taxes, exchange rates, etc.

For Current parts prices, consult your Onan Dealer, Distributor or Parts and Service Center."

"En esta lista de partes los precios se omiten de proposito, ya que bastante confusion resultado de fluctuaciones de los precios, derechos aduanales, impuestos de venta, cambios extranjeros etc.

Consiga los precios vigentes de su distribuidor de productos ONAN".

**FIG. 7 - GENERATOR PARTS**

NOTE: If your generator nameplate carries a different model or Spec. No. than listed in this manual, order replacement parts by description only, not by the part numbers given in the Parts List. Always be sure to furnish the Model, Spec. and Serial No. of the generator as given on its nameplate.

For explanation of "Parts Key No." refer to "Table of Ratings" near the front of this book.

REF. NO.	PART NO.	QTY.	DESCRIPTION
FIG. 7 - GENERATOR PARTS			
1	518-12	1	Ring, Retaining - External - Drive End Bearing to Shaft.
2	518-166	2	Ring, Retaining - Internal - Drive End Bearing to End Bell.
3	510A52	1	Bearing, Ball - Armature Drive End - Double Shielded.
4	211E127	1	Bell, End - Drive End.
6	234A77	1	Scroll and Screen, Blower.
7			Stud, Generator Through -
	520A145	2	For models with Parts Key No. 1.
	520A340	2	For models with Parts Key No. 2.
	520A161	2	For models with Parts Key Nos. 3 and 4.
8	205C60	1	Blower, Air.
9	515A45	1	Key, Armature Shaft Drive (Was 515A91).
10			Armature Wound Assembly -
	201A945	1	For models with Parts Key No. 1.
	201A943	1	For 60 cycle models with Parts Key No. 2 - (4UF-3N). (4.0UF-3S).
	201A1005	1	For 50 cycle models with Parts Key No. 2 - (3UF-53N). (3.0UF-53S).
	201A939	1	For 60 cycle models with Parts Key No. 3 - (7UF-3N). (7.0UF-3S).
	201A1033	1	For 50 cycle models with Parts Key No. 3 - (5UF-53N). (5UF-53S).
	201A940	1	For models with Parts Key No. 4.
11			Shoe, Pole - Field -
	221A86	4	For models with Parts Key No. 1.
	221A91	4	For models with Parts Key No. 2.
	221A90	4	For models with Parts Key Nos. 3 and 4.
13	510A47	1	Bearing, Armature - Brush Rig End - Double Shielded.
14	232A596	1	Clip, Bearing Stop.

REF. NO.	PART NO.	QTY.	DESCRIPTION
-------------	-------------	------	-------------

FIG. 7 - GENERATOR PARTS (Cont.)

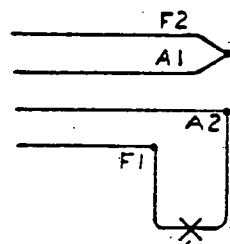
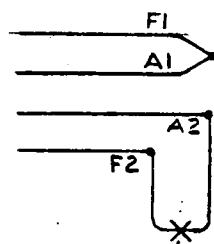
15			Coil Set, Field - Set of 4 Coils -
	222A1043	1	For models with Parts Key No. 1.
	222A1156	1	For models with Parts Key No. 2.
	222A1118	1	For models with Parts Key Nos. 3 and 4.
17			Frame, Generator -
	210C1646	1	For models with Parts Key No. 1.
	210C1642	1	For models with Parts Key No. 2.
	210C1645	1	For models with Parts Key Nos. 3 and 4.
18	403A95	1	Bolt, Eye - Lifting - 3/8-16(Replaces #410P228)
19	212C320	1	Rig Assembly, Brush - Includes Brushes and Springs (replaces #212C234 or #212C303)
20	211D98	1	Bell, End - Brush Rig End
21	234C47	1	Cover, End Bell
22	234C66	1	Band, End Bell
23	330-6	1	Cover, Junction Box
24	330B47	1	Box, Junction
25			Brush, Commutator (DC)
	214A61	4	Prior to Spec D
	214A88	4	Begin Spec D
26	312A17	1	Condenser - .5 mfd. - DC Brush
26			Condenser - .1 mfd. - AC Brush
	312A58	4	For models with Parts Key Nos. 1, 2 and 3.
	312A58	3	For models with Parts Key No. 4
28	212B1105	4	Spring, Commutator Brush
29			Brush, Collector Ring (Spip Ring, AC)
	214A56	4	Prior to Spec D
	214A50	8	Begin Spec D
			Spring, Collector Ring Brush -
30	212A1123	4	Spec A and B Only
30A	212B1105	4	Spec C Only
30A	212B1105	8	Begin Spec D
31	508-1	1	Grommet - For 1-1/16" Hole

620B52

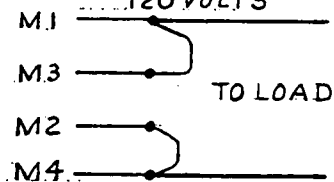
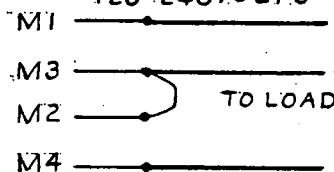
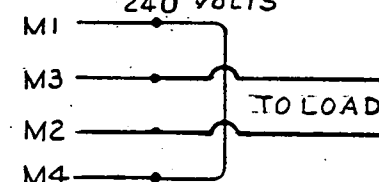
SINGLE PHASE GENERATOR

STD. REV.
ARM. GEN.

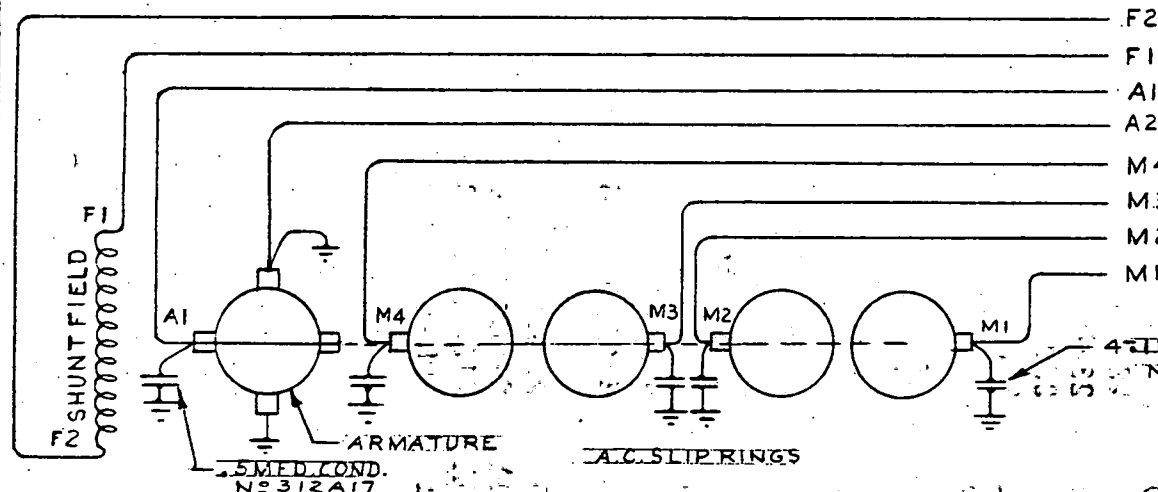
22

EXTERNAL WIRING CONNECTIONS
FOR ROTATION DIRECTION.NOTE: DIRECTION OF ROTATION
IS TAKEN WHEN FACING END
OPPOSITE DRIVE SHAFT.FOR CLOCKWISE
ROTATIONFOR COUNTER-
CLOCKWISE ROTATIONINSERT RHEOSTAT
HERE, WHEN USED.

A.C. LOAD CONNECTIONS

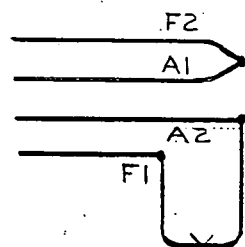
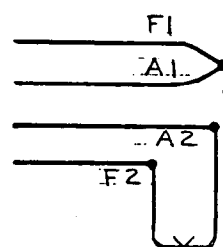
1 PHASE 2 WIRE
120 VOLTS1 PHASE 3 WIRE
120-240 VOLTS1 PHASE 2 WIRE
240 VOLTS

FOR MODELS

205UF-3N/1A.
4UF-3N/1A.
7UF-3N/1A.
3UF-53N/1A

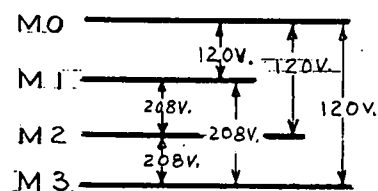
B			
A			
REVISION	INT.	DATE	
MATH. WIRING DIAGRAM			
MINNEAPOLIS MINNESOTA			
DR. C.K.H.	CH. G.F.T.	SC.	
STANDARD 4-WIRE REVOLVING ARM. GEN.			
DWG. NO.			620B52

620B54

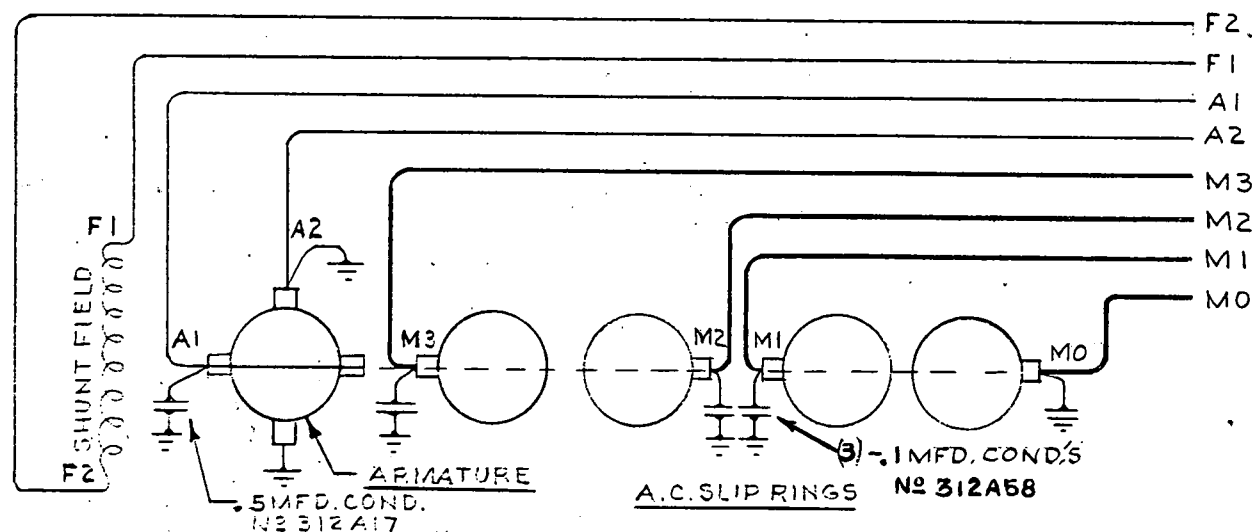
STD. REV.
ARM. GEN.EXTERNAL WIRING CONNECTIONS
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OPPOSITE DRIVE SHAFT.FOR CLOCKWISE
ROTATION.FOR COUNTER-
CLOCKWISE ROTATION.INSERT RHEOSTAT
HERE WHEN USED.

A.C. LOAD CONNECTIONS

3 PHASE 4 WIRE



THREE PHASE GENERATOR

FOR MODEL'S
7UF-4N SPEC 1A

REV.	REVISION	INIT.	DATE
MATERIAL WIRING DIAGRAM			
ONAN			
MINNEAPOLIS, MINNESOTA			
DR. J. E. H.	CH. 120	SC. 1	
STD. 3PH. 4W. REVOLVING ARM. GEN.			
DATE	DWG. NO.	620B54	

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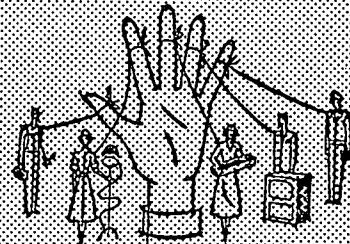
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FOR



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INHERENTLY REGULATED

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A DIVISION OF ONAN CORPORATION

MANUFACTURER'S WARRANTY

The Manufacturer warrants, to the original user, that each product of its manufacture is free from defects in material and factory workmanship if properly installed, serviced and operated under normal conditions according to the Manufacturer's instructions.

Manufacturer's obligation under this warranty is limited to correcting without charge at its factory any part or parts thereof which shall be returned to its factory or one of its Authorized Service Stations, transportation charges prepaid, within one year after being put into service by the original user, and which upon examination shall disclose to the Manufacturer's satisfaction to have been originally defective. Correction of such defects by repair to, or supplying of replacements for defective parts, shall constitute fulfillment of all obligations to original user.

This warranty shall not apply to any of the Manufacturer's products which must be replaced because of normal wear, which have been subject to misuse, negligence or accident or which shall have been repaired or altered outside of the Manufacturer's factory unless authorized by the Manufacturer.

Manufacturer shall not be liable for loss, damage or expense directly or indirectly from the use of its product or from any other cause.

The above warranty supersedes and is in lieu of all other warranties, expressed or implied, and of all other liabilities or obligations on part of Manufacturer. No person, agent or dealer is authorized to give any warranties on behalf of the Manufacturer nor to assume for the Manufacturer any other liability in connection with any of its products unless made in writing and signed by an officer of the Manufacturer.

DATED August 1, 1963

IMPORTANT

RETURN WARRANTY CARD ATTACHED TO UNIT

1500 RPM Pulley Selection Table	8
Reversing the Scroll	9
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Starting	10
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GENERATOR TABLE OF RATINGS

GENERATOR MODEL NO. *	CY.	PH.	WIRE	VOLTS	GEN. WIRING DIA. NO.	†PARTS KEY NO.
2.5UF-3S/1	60	1	4	120/240	620B52	1
3.0UF-53S/1 <i>212-303</i>	50	1	4	120/240	620B52	2
4.0UF-3S/1 <i>212-0234</i>	60	1	4	120/240	620B52	2
5.0UF-53S/1 <i>234 303 320</i>	50	1	4	120/240	620B52	3
7.0UF-3S/1 <i>234 303 320</i>	60	1	4	120/240	620B52	3
7.0UF-4S/1 <i>234 303 320</i>	60	3	4	120/240	620B54	4

Note † - Use the Parts Key No. in this column for your model when selecting parts from the list herein. Order only those parts with no Parts Key No. reference or those parts which refer to the Parts Key No. for your model.

* - New model designation beginning with Spec E. Example: Model 2.5UF-3S/1 was 205UF-3N/1.

SWITCHBOARD TABLE OF RATINGS

SWITCHBOARD MODEL NO. *	CYCLE	PHASE	WIRE	VOLTS	CONTROL WIRING DIA. NO.
4SA-3/1A	50 or 60	1	4	120/240	615B84
5SA-3/1A	50	1	4	120/240	615B84
7SA-3/1A	60	1	4	120/240	615B84

* - For all Switchboard Repair Parts refer to the wiring diagram furnished with the control.

NOTE: 120, 240 or 120/240 volt references herein apply also to 115, 230 or 115/230 volt ratings respectively.

GENERATOR. - This generator is inherently regulated and will maintain the output voltage within limits of 10% between no load and full load, when driven at its nameplate speed and at normal ambient temperature. The voltage will be somewhat higher when the generator is cold, and will vary with the driven speed. Frequency will vary 1 cycle for each 30 rpm of variation from rated speed according to the curves below.

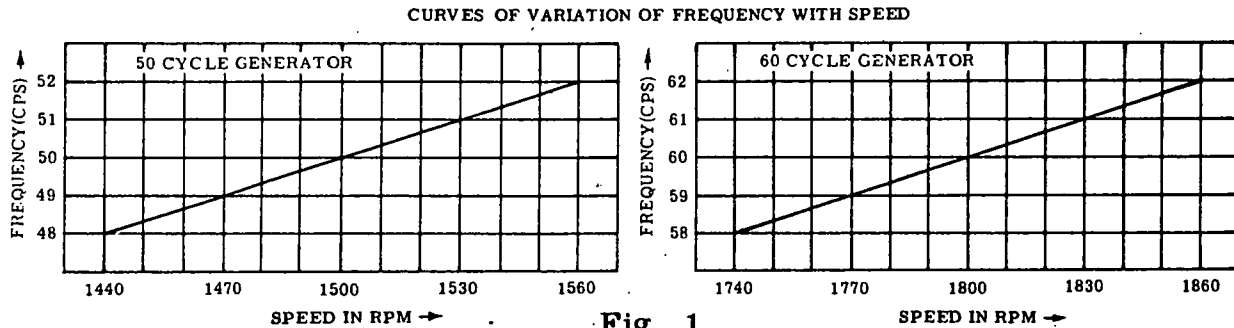


Fig. 1.

The power factor rating for all single phase models is 100%. The power factor rating of 3 phase models is 80%. The voltage regulation will not be greater than 10% at full load and rated power factor.

The generator may be driven in either a clockwise or counterclockwise direction, as installation requirements demand. The blower scroll must be reversed whenever the generator rotation is changed. See paragraph on REVERSING THE SCROLL. The generator is shipped from the factory with the scroll assembled for counterclockwise rotation. The direction of rotation of the generator is determined while looking at the end of the generator opposite to the drive end. The generator is drip proof in design, but reasonable precautions should be taken against excessive exposure to moisture.

The instruction manual covers both 1 phase 4 wire, and 3 phase 4 wire ONAN Ball Bearing Separate Generators.

A manual field rheostat can be used with the generator if it is necessary to operate above rated speed. It can be obtained, at added cost after the generator is received. See "PARTS LIST" for correct part number. It can also be used to reduce the voltage at light loads. The rheostat can not be used to increase the voltage above what it would be without it. See wiring diagram for proper connections.

SWITCHBOARDS. - Switchboards are optional equipment which can be purchased at added cost. Listed in the TABLE OF RATINGS are the Switchboard Model No.'s. They contain a voltmeter, ammeter, circuit breaker, generator and load terminals. The switchboard is generally used to check generator and load operation accurately and to prevent the generator from being overloaded. The operator can

check the following things by using a switchboard:

- (1) Generator voltage
- (2) Load current
- (3) Voltage regulation with varying load

The circuit breaker automatically disconnects the load from the generator when the load exceeds the generator kilowatt rating by approximately 25%. When the circuit breaker trips, it must be reset manually. The cause of the overload should be determined before resetting the breaker. The load current value at which the circuit breaker trips is affected somewhat by the ambient temperature. Do not mount the switchboard in a location where excessive temperatures can develop or on surfaces which vibrate. Excessive vibration may alter the trip current value of the circuit breaker.

When ordering repair parts for switchboards, obtain Part No's. and description of part from the wiring diagram which is supplied with the switchboard.

LOCATION. - Select a site for the generator with the following points in mind.

1. **Ventilation.** - The generator will warm up and create some heat when operating under load conditions. It is of vital importance that this heat be dissipated by proper ventilation. If the generator is installed in a small room or compartment, provide an opening for entry of fresh, cool air. Provide a separate opening for exhausting the air heated by the generator. Locate the exhaust opening above the inlet opening, for best air circulation. Heated air is discharged from the drive shaft end of the generator.

2. **Convenience to Driving Power.** - Locate the generator after considering the following points:

- A. Driving unit location.
- B. Desired direction of shaft rotation.
- C. Pulley alignment, if used.
- D. Shaft alignment of generator and driving unit if a flexible coupling is used.

A. **Driving unit location.** - Regardless of the type of driving unit it **MUST** be bolted securely to a heavy mounting base to maintain pulley and shaft alignment.

B. **Desired direction of shaft rotation.** - The direction of rotation will be determined by the direction of rotation of the driving unit. The generator direction of rotation is reversible and works equally well in either direction. However the generator lead wires and blower scroll must be properly installed for whatever direction of rotation is necessary. See wiring diagram for proper lead connections. See paragraph on **REVERSING THE SCROLL** for proper scroll installation.

C. **Pulley alignment if used.** - The shafts of the generator and driving unit must be parallel and the sides of the pulleys must be lined up. Correct belt tension must be permanently maintained. After the pulleys are in proper alignment, both generator and driving unit must be bolted down to a heavy rigid mounting base.

D. **Shaft alignment.** - If a flexible coupling is used, the shaft alignment of the generator and driving unit must be accurately made and permanently maintained. Incorrect shaft alignment will cause excessive wear on both generator and driving unit and unnecessary loss of power from the driving unit.

3. Dusty or Damp Conditions. - Avoid excessive dusty or damp conditions as much as possible. Rust and dirt are enemies of any piece of machinery. The generator is drip proof in design, but unnecessary exposure to moisture should be avoided. The generator should be mounted under cover or inside a building to protect it against the weather.
4. Servicing Convenience. - To permit easy access for servicing the bearings and brushes, allow at least 24 inches of space around the generator.
5. Wiring Convenience. - Locate the generator as near as possible to the electrical equipment it is to serve.

GENERATOR COOLING. - The generator blower system uses a reversible scroll. When the blower scroll is installed properly, a strong flow of air comes out of the generator at the generator drive shaft end. Lack of air flow indicates improper installation of the blower scroll. See paragraph on "REVERSING THE SCROLL".

MOUNTING THE GENERATOR. - The mounting surface must be flat so that the generator mounting base will not be sprung, when tightened into place. It should be possible to turn the generator shaft by hand after the generator is bolted down.

WIRING CONNECTIONS. - The generator external leads are not connected, and their manner of connection will depend upon whether a rheostat is to be used, and the DIRECTION OF ROTATION. Refer to the wiring diagram. A rheostat of the proper size should be installed if the speed variation will be too great, or if it is necessary to reduce the voltage at light loads. The addition of a rheostat will not raise the voltage above that which could be obtained without the rheostat. A circuit breaker between generator and load is recommended.

Follow specifications of local and national electrical codes for installing wiring and grounding the generator. Be sure to use wire large enough to avoid excessive drop in voltage between the generator and the load, depending upon the distance and the amount of the load.

The proper size and type of driving unit for the generator is important for satisfactory operation of the generator. When a gasoline or diesel engine is used the following factors should be considered:

1. Engine Power. - The engine must have a minimum of 2 horsepower for each 1000 watts of generator output. For example, if a 5000 watt generator is to be operated, the engine must deliver at least 10 horsepower at the drive shaft. If the engine has a considerable reserve of power the speed regulation and voltage regulation will be much better.

2. Engine Pulley Speed. - The engine may have a variable speed governor which regulates engine speed at about 8-1/2 to 12%. If so, governor operation is best at the maximum rated speed of the engine. When the generator is operating at or near its capacity, the tendency of the engine is to increase speed when the load is suddenly removed. The engine governor does not react fast enough at low speed to prevent momentary acceleration and high voltage. This may possibly cause serious damage to any electrical equipment left connected. Governor action is much better when the engine is operating at its rated speed, and the engine cannot increase its speed too much when the load is removed. If the engine has a constant speed governor, the speed regulation is 5% or less and the above effects are not present.

Low generator speed causes low voltage and frequency. If, for example, an 1800 rpm generator is slowed to 1500 rpm, the frequency of the current produced will be 50 cycles instead of 60 cycles. The combination of low voltage and frequency will almost certainly result in burned out windings of any motors connected to the generator.

3. Pulley Selection. - The rated speed of the engine or electric motor will determine the size of pulley to use on the generator. To determine the correct generator pulley size to use, proceed as follows, or refer to the PULLEY SELECTION TABLE.

- A. Multiply the DIAMETER of the driving unit pulley by its SPEED in rpm (revolutions per minute).
- B. Divide the above result by the nameplate speed of the generator (1800 rpm).

Example: A driving pulley 15 inches in diameter operates at 1200 rpm. Multiply 15 x 1200 getting a result of 18,000. Divide the 18,000 by 1800 rpm (generator pulley speed desired) and the final result is 10, which expresses the size of the pulley (in inches) required. If this same driving unit has an 8 inch pulley operating at 1200 rpm the generator pulley **would then** be 5.33" or approximately 5-3/8" (8 x 1200, divided by 1800 = 5.33).

USE THIS TABLE ONLY FOR GENERATORS STAMPED 1800 RPM ON THE GENERATOR NAMEPLATE.

The pulley sizes recommended in this table are approximate sizes only, in 1/2" steps. The sizes shown do not include any allowance for belt slippage. Belt slippage for flat belts may sometimes reduce the generator driven speed, under load, as much as 4 per cent.

To select a generator pulley size from the table, measure the DIA-METER (not the distance around) of the driving pulley. Select the line at the left side of the table for the driving pulley size. Follow this line across to the speed column that is nearest to the recommended speed of the driving pulley. The size in the square at this point is the approximate size of the generator pulley which will be required. If the recommended size pulley can not be obtained, select one size smaller pulley. This will help to offset belt slippage. Adjust throttle or governor as necessary to obtain proper speed.

Example:

If a 12 inch drive pulley operates at 1100 rpm, follow the 12 inch line across to the 1100 rpm column. The generator pulley size at the point of intersection is 7 inch. This example is outlined in heavy lines in the table.

DRIVING PULLEY SIZE	DRIVING PULLEY SPEED IN REVOLUTIONS PER MINUTE														
	600	700	800	900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000
GENERATOR PULLEY SIZE REQUIRED (1800 R. P. M. GENERATOR)															
6	2	2	2½	3	3	3½	4	4	4½	5	5	5½	6	6	6½
6½	2	2½	2½	3	3½	4	4	4½	5	5	5½	6	6½	6½	7
7	2	2½	3	3½	4	4	4½	5	5½	5½	6	6½	7	7½	7½
7½	2½	3	3	3½	4	4½	5	5½	5½	6	6½	7	7½	8	8
8	2½	3	3½	4	4½	4½	5	5½	6	6½	7	7½	8	8½	9
8½	2½	3	3½	4	4½	5	5½	6	6½	7	7½	8	8½	9	9½
9	3	3½	4	4½	5	5½	6	6½	7	7½	8	8½	9	9½	10
9½	3	3½	4	4½	5	5½	6	6½	7	8	8½	9	9½	10	10½
10	3½	4	4½	5	5½	6	6½	7	7½	8	9	9½	10	10½	11
10½	3½	4	4½	5½	5½	6½	7	7½	8	8½	9	10	10½	11	11½
11	3½	4	4½	5½	6	6½	7	8	8½	9	9½	10	11	11½	12
11½	4	4½	5	5½	6	7	7½	8	9	9½	10	10½	11½	12	12½
12	4	4½	5	6	6½	7	8	8½	9	10	10½	11	12	12½	13
12½	4	4½	5½	6	7	7½	8	9	9½	10½	11	11½	12½	13	13½
13	4	5	5½	6½	7	8	8½	9	10	10½	11½	12	13	13½	14½
13½	4½	5	6	6½	7½	8	9	9½	10½	11	12	12½	13½	14	15
14	4½	5½	6	7	7½	8½	9½	10	11	11½	12½	13	14	14½	15½
14½	5	5½	6½	7	8	8½	9½	10½	11	12	12½	13	14½	15	16
15	5	5½	6½	7½	8	9	10	10½	11½	12½	13	14	15	15½	16½
15½	5	6	6½	7½	8½	9½	10½	11	12	13	13½	14½	15½	16	17
16	5½	6	7	8	9	10	11	11½	12½	13	14	15	16	16½	17½

1500 RPM GENERATOR PULLEY SELECTION TABLE

USE THIS TABLE ONLY FOR GENERATORS STAMPED 1500 RPM ON THE GENERATOR NAMEPLATE.

The pulley sizes recommended in this table are approximate sizes only, in 1/2" Steps. The sizes shown do not include any allowance for belt slippage. Belt slippage for flat belts may sometimes reduce the generator driven speed, under load, as much as 5 percent.

To select a generator pulley size from the table, measure the DIAMETER (not the distance around) of the driving pulley. Select the line at the left side of the table for the driving pulley size. Follow this line across to the speed column that is nearest to the recommended speed of the driving pulley. The size in the square at this point is the approximate size of the generator pulley which will be required. If the recommended size pulley can not be obtained, select one size smaller pulley. This will help to offset belt slippage. Adjust throttle or governor as necessary to obtain proper speed.

Example: If a 12 inch drive pulley operates at 1100 rpm, follow the 12 inch line across to the 1100 rpm column. The generator pulley size at the point of intersection is 9 inch. This example is outlined in heavy lines in the table.

DRIVING PULLEY SIZE	DRIVING PULLEY SPEED IN REVOLUTIONS PER MINUTE														
	600	700	800	900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000
GENERATOR PULLEY SIZE REQUIRED (1500 RPM GENERATOR)															
6	2½	3	3	3½	4	4½	5	5	5½	6	6½	7	7	7½	8
6½	2½	3	3½	4	4½	5	5	5½	6	6½	7	7½	8	8	8½
7	3	3	3½	4	4½	5	5½	6	6½	7	7½	8	8½	9	9½
7½	3	3½	4	4½	5	5½	6	6½	7	7½	8	8½	9	9½	10
8	3	3½	4	4½	5	6	6½	7	7½	8	8½	9	9½	10	10½
8½	3½	4	4½	5	5½	6	6½	7½	8	8½	9	9½	10	10½	11½
9	3½	4	4½	5½	6	6½	7	7½	8½	9	9½	10	11	11½	12
9½	4	4½	5	5½	6	7	7½	8	9	9½	10	10½	11½	12	12½
10	4	4½	5	6	6½	7½	8	8½	9½	10	10	11	12	12½	13½
10½	4	5	5½	6	7	7½	8½	9	10	10½	11	12	12½	13	14
11	4½	5	6	6½	7½	8	9	9½	10½	11	11½	12½	13	14	14½
11½	4½	5½	6	7	7½	8½	9	10	10½	11½	12	13	14	14½	15½
12	5	5½	6½	7	8	9	9½	10½	11	12	13	13½	14½	15	16
12½	5	6	6½	7½	8½	9	10	11	11½	12½	13½	14	15	16	16½
13	5	6	7	7½	8½	9½	10½	11	12	13	14	14½	15½	16½	17½
13½	5½	6	7	8	9	10	11	11½	12½	13½	14½	15½	16	17	18
14	5½	6½	7½	8½	9½	10	11	12	13	14	15	16	17	17½	18½
14½	6	7	8	8½	9½	10½	11½	12½	13½	14½	15½	16½	17½	18½	19½
15	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
15½	6	7	8	9	10½	11½	12½	13½	14½	15½	16½	17½	18½	19½	20½
16	6½	7½	8½	9½	10½	11½	12½	14	15	16	17	18	19	20	21
16½	6½	7½	9	10	11	12	13	14½	15½	16½	17½	18½	20	21	22
17	7	8	9	10	11½	12½	13½	14½	16	17	18	19	20	21½	22½
17½	7	8	9½	10½	11½	13	14	15	16½	17½	18½	20	21	22	23
18	7	8½	9½	10½	12	13	14½	15½	17	18	19	20	21½	23	24

REVERSING THE SCROLL. - The generator is shipped from the factory with the blower scroll mounted for counterclockwise rotation. The direction of rotation is determined while looking at the end opposite the drive end. If a clockwise direction of rotation is desired, the blower scroll position must be reversed. The arrow which is printed on the scroll must be pointing in the direction of the rotation of the generator shaft.

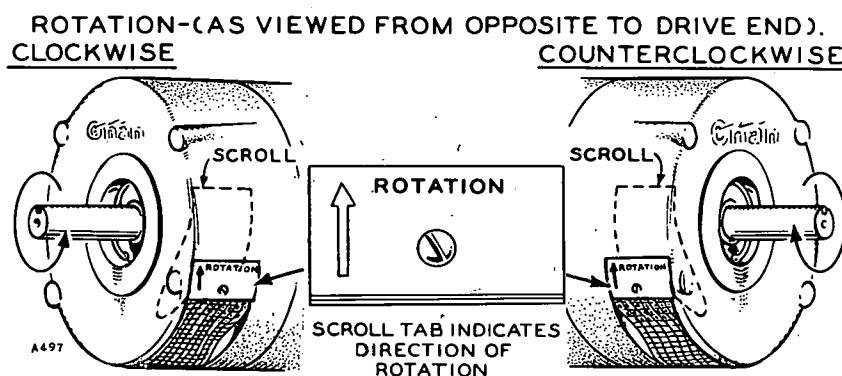


FIG. 2 - BLOWER SCROLL

To reverse the scroll, remove only the scroll with screen attached, turn it end for end and reinstall it so that the scroll will be at the opposite end of the air outlet hole, as illustrated.

POLARIZING THE GENERATOR FIELD. - The field is polarized at the factory. If rotation direction is reversed (scroll reversed and leads properly connected) and voltage does not automatically build-up the first time, "flash the field" to repolarize the generator.

Connect an ac voltmeter across the generator output, run the generator in the desired direction, touch a battery positive (+) cable to generator field lead F1, and the battery negative (-) cable to generator field lead F2. If the voltmeter does not indicate voltage build-up, a larger battery or higher dc source may be required to kill the existing residual magnetism.

STARTING. - Be sure that the generator is connected for the direction of rotation being used. Start up the generator and check the voltage while running at no load and rated speed (1,500-rpm for 50-cycle generators and 1,800-rpm for 60-cycle generators). The generator voltage should be as follows:

Generator Nameplate Voltage Rating	Approximate Line to Line No Load Voltage at Rated Speed
120/240	252
120/208	220

If the generator voltage at no load is not as specified above, adjust the generator speed until no-load voltage is reached before proceeding.

Check the generator cooling air circulation. When the blower scroll is installed properly, a strong current of air comes out of the drive shaft end of the generator. See paragraph on **REVERSING THE SCROLL** for proper installation of the blower scroll.

OPERATING. - Connect the various electrical loads after the generator voltage is adjusted to the proper value at no load. It may be necessary to advance or retard the engine throttle control for engine drive units to control the output voltage. This may also be necessary when large changes in the electrical load are made.

Keep the electrical load on the generator within its nameplate rating. Overloading the generator will cause the voltage to be low, will shorten the life and void warranty.

Consider load and installation characteristics to determine the proper starting procedure which will assure voltage build-up each time. Failure of generator to build up voltage may occur when the starting load is too heavy. (This is not lost residual magnetism if the voltage builds up (1) when only partial load is connected, or (2) when load is connected after generator reaches speed.)

- A. When electric motor loads are connected, connect one at a time, begin with largest motor, allow each to reach running speed, then connect the next motor. Electric motors require much more current for starting than when running at normal speed.
- B. When a rheostat (to limit voltage at higher speed or at light load) is used, disconnect the load (turn switch or circuit breaker OFF) or turn rheostat to decrease resistance, until generator reaches speed to assure build up.
- C. Turn off the lights to attain partial load or no load until generator reaches speed. Incandescent light bulbs (lamps) draw as much as eight times their rating until filaments heat up.

GENERAL SERVICING. - The generator is designed to give long and satisfactory service when properly cared for. Regular servicing as outlined here will be well worth the effort required.

The ball bearings are the double-sealed pre-lubricated type and do not require future lubrication.

To lift brushes away from contact, first remove the brush spring (constant pressure type) from its holder, then remove the brush from its guide, as illustrated. Do not pull the brush out as may be done when spiral type springs are used. Do not unwind the spring past the end of its support plate. A spring so distorted or kinked must be replaced with a new one.

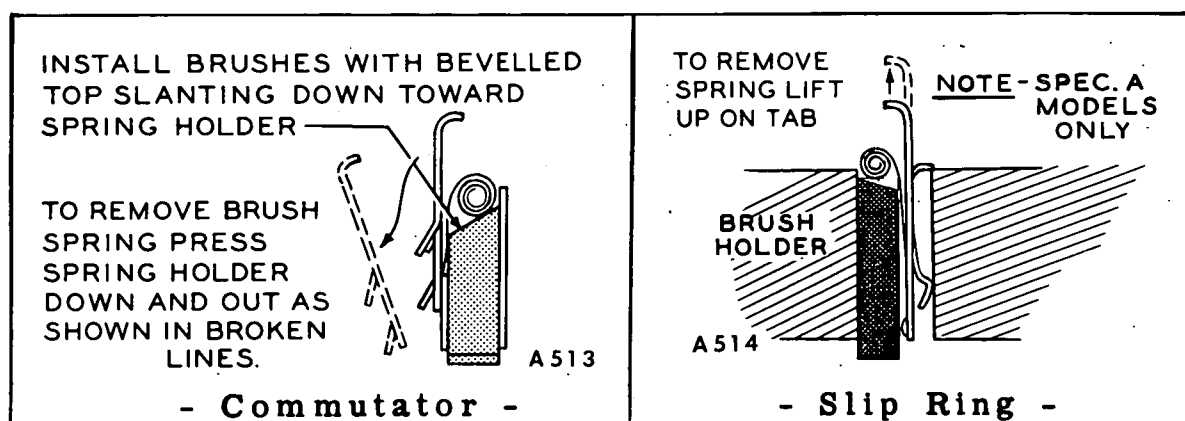


FIG. 3 - BRUSHES AND SPRINGS (Constant Pressure Type)

BRUSH CONTACT. - Maintain good electrical full brush contact at all times.

Each 200 hours of operation, or once a month, clean the commutator and slip rings with a dry, lint free cloth. Do not attempt to maintain a bright, newly machined appearance. A dark, glossy appearance is normal. Heavy deposits or slight roughness may be remedied by careful sanding with #00 sandpaper. Hold the sandpaper flat against the commutator, or slip ring, while the generator is operating. Use a flat wooden stick, with light pressure, to hold the sandpaper. Never use emery or carborundum cloth or paper. Wipe or blow out accumulations of brush dust, which may cause a short circuit.

It is not necessary to remove the brush rig or end bell when installing new brushes or cleaning the commutator. The brushes, commutator and slip rings are easily reached by removing the end bell cover.

Brushes eventually wear too short to perform their function. Brush wear will be more rapid under dusty operating conditions. Replace brushes with new ones only when worn to 5/8 inch in length. The brush springs provide equal pressure as the brushes wear shorter in use.

Each spring is permanently attached to a metal plate which snaps into place, as illustrated. To replace a commutator brush, first remove the spring by pushing the spring plate inward and away from the brush guide. To replace a collector ring brush, first remove the spring by pulling straight outward on the spring plate. When installing a new brush in its guide, be sure that the "low" or shorter side of the beveled top of the brush is toward the spring-plate side of the guide. Be sure each brush is free in its guide. Keep the brush rig and end bell cleaned of carbon dust, etc.

The surface of the commutator may become worn down level with the mica insulation between the bars. If the commutator is worn smooth, the mica between the bars may be cut down to $1/32$ " below the surface without removing the rotor. Remove the end bell only, carefully tagging or otherwise marking all leads disconnected.

Remove each spring and brush from its guide. Pull the end bell off carefully. An undercutting tool may be fashioned from a hack saw blade grinding the blade teeth to a thickness equal to the mica between the bars of the commutator. Use care not to scratch the surface of any bar while undercutting the mica. Remove any burrs formed along the edges of the bars.

If, due to unfavorable operating conditions, the commutator or slip rings become worn out of round, grooved, or pitted it will be necessary to remove the armature and turn the commutator smooth in a lathe.

After turning down the commutator, undercut the mica between bars as previously described.

BRUSH RIG "NEUTRAL" POSITION. - Each time brushes and springs are serviced, see that the brush rig witness mark is aligned, as illustrated.

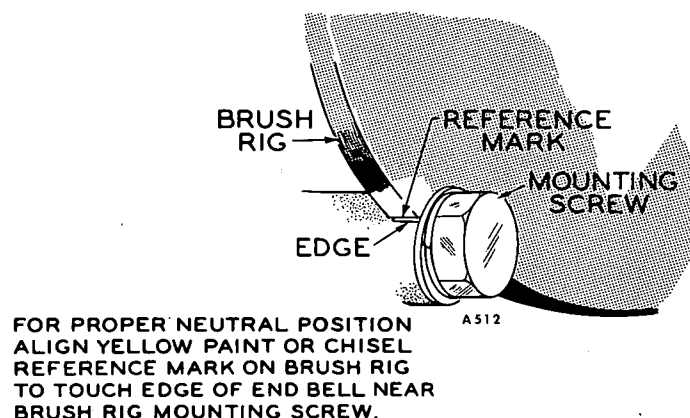


FIG. 4 - BRUSH RIG POSITION

The position of the brush rig assembly in the generator end bell is very important. The correct setting of the brush rig was determined at the

factory and is identified by a painted or chisel mark on the outer edge of the brush rig and must align with the edge of the end bell where the brush rig is mounted.

As long as the original brush rig and armature are continued in service, these alignment marks must be observed.

MAJOR GENERATOR REPAIR. - Consult a competent mechanic or electrician, familiar with a.c. generators, to locate any faulty windings and to perform any necessary major repair. Several tests for open or grounded circuits can be made without disassembling the generator. Before making tests, and before disassembling the generator, lift the brushes away from contact. After completing the maintenance, return the brushes to their operating position.

DISASSEMBLY. - If it should become necessary to disassemble the generator, lift all brushes from contact. Tag all leads which are disconnected, to insure correct replacement when the generator is reassembled.

When reassembling be sure the bearing stop clip is in place on the bearing opposite the drive end. Avoid possible damage to parts through careless disassembly and reassembly. Most other assembly procedures are self-evident.

ARMATURE GROUNDED. - See that all brushes are lifted out of their holders. Use a continuity type test lamp set. Place one test prod on the commutator, and the other prod on a bare clean part of the generator frame or armature shaft. The prods must make good electrical contact. The test set lamp should not light. If it does light up, the armature is grounded. Test the slip rings in the same manner. If the armature tests grounded, replace with a new one.

TESTING THE ARMATURE FOR AN OPEN CIRCUIT. - The AC winding of an alternating current generator may be tested for an open circuit by use of the test lamp set. Place one test prod on one slip ring, and the other test prod on a second ring. The test lamp should light. If it does not light, an open circuit is present. If there are three or four rings, test between each two in the same manner. Install a new armature if an open circuit is present.

To test the direct current winding of an armature for an open circuit, the use of an armature growler is necessary. Most electrical repair shops have such equipment. It will be necessary to remove the armature for testing. Proceed as follows.

- a. Place the armature in the growler which is connected to alternating current. Rub a smooth steel blade (back edge of a hacksaw blade)

across the segments of the commutator.

b. At some point around the commutator a spark should occur as the blade contacts the two adjacent segments. If a spark occurs, the circuit is complete (not open) between those two segments. Then it will be necessary to rotate the armature just enough to test the next two segments.

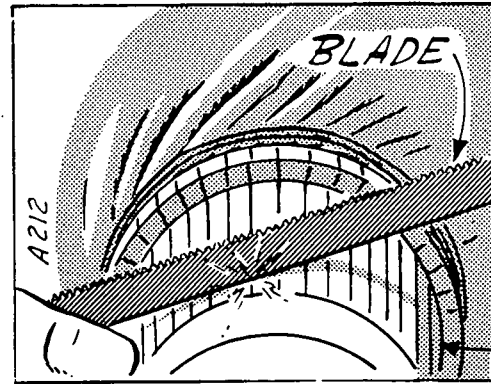


FIG. 5 - OPEN CIRCUIT TEST

Continue the rotating and testing until the commutator segments have been tested completely around. A good spark should occur between all adjacent segments when those segments and windings attached to them are in the correct position in the growler magnetic field. If no spark occurs, the winding between those two segments is open circuited. (There is a possibility that a short circuit of a winding might prevent the sparking, but then the armature would also be magnetized as described in the following paragraph.)

TESTING THE ARMATURE FOR SHORT CIRCUITS. - Place the armature in the growler (see figure) which is connected to alternating current. Hold a steel blade (or old hack-saw blade) 1/4 inch from the armature laminations. If the steel blade is attracted to any magnetized armature laminations, either the armature windings or commutator is short circuited. Do not test for magnetism at just one point of the armature laminations, but test all of the armature laminations from one side over to the other side (along the dotted line on figure). After testing the armature in one position, revolve the armature about 1/8 revolution and test for magnetism again. Continue the revolving and testing until the armature has been tested completely around.

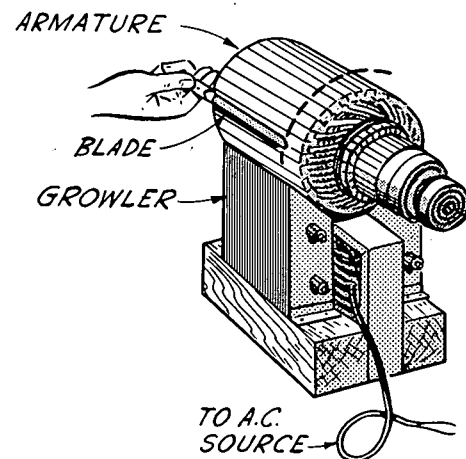


FIG. 6 - SHORT CIRCUIT TEST

FIELD WINDINGS, OPEN CIRCUIT. - A test

lamp set can be used to test field windings for an open circuit. Place one test prod on one of the terminal ends of the field windings, and the other test prod on the other terminal end of the winding. The test lamp should light. If it does not, an open circuit is indicated. Check carefully to see that the open circuit is not at the terminal leads or a loose terminal. An open circuit due to a broken lead or loose terminal is easily repaired. An open circuit within a coil requires replacement of the set of coils.

Following is a list of troubles that may be experienced in the operation of the generator. Also listed are the possible causes and usual remedies for getting the generator back into proper efficient operation.

POSSIBLE CAUSE

REMEDY

POOR COMMUTATION OR ARCING AT THE GENERATOR BRUSHES

Brushes out of neutral position.	Turn brush ring until the identifying marks are aligned.
Brushes not seating properly.	Sand the brush to the proper contour.
Generator heavily overloaded.	If the AC or DC amperage is more than stated on the generator nameplate, remove part of the load.
Brushes binding in holder.	Clean each brush and holder.
Brush tension insufficient.	Replace brush springs.
Brushes worn too short.	Replace brushes.
Brush tension unequal.	Replace weak brush springs.
Wrong type brush.	Replace with correct type and make of brush and spring.
Loose commutator bars.	Replace with new armature.
High mica.	Undercut the mica.
Commutator out of round.	True the commutator in a lathe.
Commutator surface dirty or oily.	Clean the commutator.

OVERHEATING OF GENERATOR

Windings and parts covered with dirt and oil.	Clean generator.
Overloaded.	Check load or output of generator.
Short circuit or grounded circuit in the field winding or armature winding.	Replace defective parts.

POSSIBLE CAUSE

REMEDY

OVERHEATING OF GENERATOR (Cont.)

Excessive arcing at the brushes.	See "Poor Commutation" above.
Unequal air gap between pole shoe and armature.	Shim up pole shoe until air gaps are equal.
Generator blower scroll installed in wrong position.	Reverse blower scroll position.

GENERATOR NOISY

Generator loose on base.	Tighten mounting bolts.
Worn or defective bearing.	Replace worn parts. Check alignment.
Field pole rubbing armature.	Tighten field poles to frame.

GENERATOR RUNS BUT DOES NOT PRODUCE CURRENT

Brushes not contacting commutator.	Free brushes in holders. Assemble brushes and springs correctly.
Open, short or grounded circuit in generator.	Test windings and repair or replace defective parts.
Generator line leads broken or loose.	Tighten connections and replace broken leads.
Generator armature rotating in the wrong direction.	<ol style="list-style-type: none"> 1. Correct direction of rotation. 2. Or, connect wires, polarize field and reinstall scroll to agree with direction of rotation.

LOW VOLTAGE OUTPUT OF GENERATOR

Speed low because of loose, slipping belts.	Adjust belt tension.
Generator brushes not in neutral position.	Turn brush ring until the identifying marks are aligned correctly.
External short circuit on line.	Test generator with line wires disconnected.

POSSIBLE CAUSE

REMEDY

LOW VOLTAGE OUTPUT OF GENERATOR (Cont.)

Open circuit of shunt field winding.

Make proper connections according to wiring diagram.

Short circuit of windings in the field or armature.

Replace defective part.

Manual field rheostat (if used) adjusted at minimum voltage.

Adjust manual rheostat.

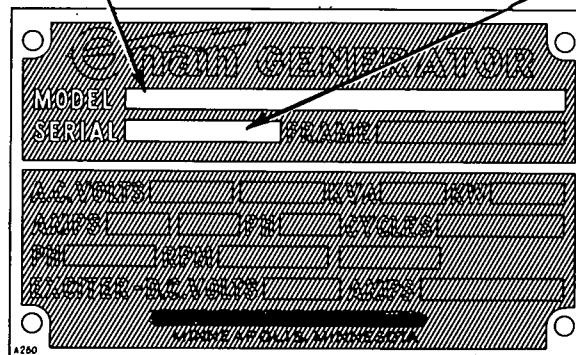
18 INSTRUCTIONS FOR ORDERING REPAIR PARTS

FOR PARTS OR SERVICE, CONTACT THE DEALER FROM WHOM YOU PURCHASED THE EQUIPMENT OR REFER TO YOUR NEAREST AUTHORIZED SERVICE STATION.

TO AVOID ERRORS OR DELAY IN FILLING YOUR ORDER, PLEASE
FURNISH ALL INFORMATION REQUESTED.

REFER TO THE NAMEPLATE

1. Always give the Model No. ----- and Serial No. -----



2. Refer to the "Table of Ratings" near the front of this book to determine the "Parts Key No.", which agrees with your model, for selecting the correct part from the list. If your Model and Spec. No. is not shown use the list only as a guide and order by description.
3. Give the part number, description and quantity needed of each item. If an old part cannot be identified return the part prepaid to your dealer or nearest AUTHORIZED SERVICE STATION. Print your name and address plainly on the package. Write a letter to the same address stating the reason for returning the part.
4. State definite shipping instructions.

Any claim for loss or damage to your unit in transit should be filed promptly against the transportation company making the delivery. Shipments are complete unless the packing list indicates items are back ordered.

"Prices are purposely omitted from this Parts Catalog due to the confusion resulting from fluctuating costs, import duties, sales taxes, exchange rates, etc.

For Current parts prices, consult your Onan Dealer, Distributor or Parts and Service Center."

"En esta lista de partes los precios se omiten de proposito, ya que bastante confusion resulto de fluctuaciones de los precios, derechos aduanales, impuestos de venta, cambios extranjeros etc.

Consiga los precios vigentes de su distribuidor de productos ONAN".

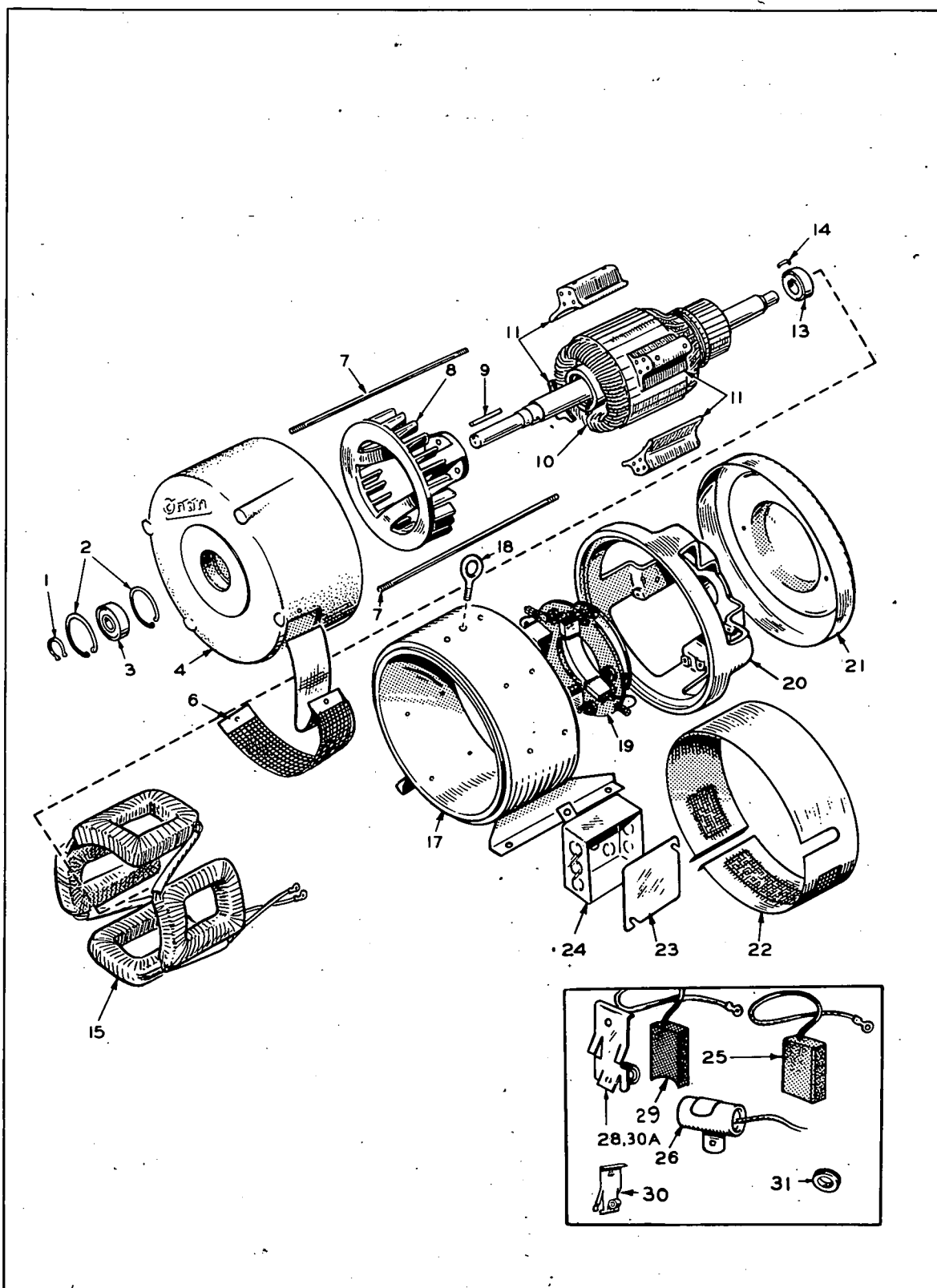


FIG. 7 - GENERATOR PARTS

NOTE: If your generator nameplate carries a different model or Spec. No. than listed in this manual, order replacement parts by description only, not by the part numbers given in the Parts List. Always be sure to furnish the Model, Spec. and Serial No. of the generator as given on its nameplate.

For explanation of "Parts Key No." refer to "Table of Ratings" near the front of this book.

REF. NO.	PART NO.	QTY.	DESCRIPTION
FIG. 7 - GENERATOR PARTS			
1	518-12	1	Ring, Retaining - External - Drive End Bearing to Shaft.
2	518-166	2	Ring, Retaining - Internal - Drive End Bearing to End Bell.
3	510A52	1	Bearing, Ball - Armature Drive End - Double Shielded.
4	211E127	1	Bell, End - Drive End.
6	234A77	1	Scroll and Screen, Blower.
7			Stud, Generator Through -
	520A145	2	For models with Parts Key No. 1.
	520A340	2	For models with Parts Key No. 2.
	520A161	2	For models with Parts Key Nos. 3 and 4.
8	205C60	1	Blower, Air.
9	515A45	1	Key, Armature Shaft Drive (Was 515A91).
10			Armature Wound Assembly -
	201A945	1	For models with Parts Key No. 1.
	201A943	1	For 60 cycle models with Parts Key No. 2 - (4.0UF-3S).
	201A1005	1	For 50 cycle models with Parts Key No. 2 - (3.0UF-53S).
	201A939	1	For 60 cycle models with Parts Key No. 3 - (7.0UF-3S).
	201A1033	1	For 50 cycle models with Parts Key No. 3 - (5.0UF-53S).
	201A940	1	For models with Parts Key No. 4.
11			Shoe, Pole - Field -
	221A86	4	For models with Parts Key No. 1.
	221A91	4	For models with Parts Key No. 2.
	221A90	4	For models with Parts Key Nos. 3 and 4.
13	510A47	1	Bearing, Armature - Brush Rig End - Double Shielded.
14	232A596	1	Clip, Bearing Stop.

REF. NO.	PART NO.	QTY.	DESCRIPTION
----------	----------	------	-------------

FIG. 7 - GENERATOR PARTS (Cont.)

15			Coil Set, Field - Set of 4 Coils -
	222A1043	1	For models with Parts Key No. 1.
	222A1156	1	For models with Parts Key No. 2.
	222A1118	1	For models with Parts Key Nos. 3 and 4.
17			Frame, Generator -
	210C1646	1	For models with Parts Key No. 1.
	210C1642	1	For models with Parts Key No. 2.
	210C1645	1	For models with Parts Key Nos. 3 and 4.
18	403A95	1	Bolt, Eye - Lifting - 3/8-16(Replaces #410P228)
19	212C320	1	Rig Assembly, Brush - Includes Brushes and Springs (replaces #212C234 or #212C303)
20	211D98	1	Bell, End - Brush Rig End
21	234C47	1	Cover, End Bell
22	234C66	1	Band, End Bell
23	330-6	1	Cover, Junction Box
24	330B47	1	Box, Junction
25			Brush, Commutator (DC)
	214A61	4	Prior to Spec D
	214A88	4	Begin Spec D
26	312A17	1	Condenser - .5 mfd. - DC Brush
26			Condenser - .1 mfd. - AC Brush
	312A58	4	For models with Parts Key Nos. 1, 2 and 3.
	312A58	3	For models with Parts Key No. 4
28	212B1105	4	Spring, Commutator Brush
29			Brush, Collector Ring (Spip Ring, AC)
	214A56	4	Prior to Spec D
	214A50	8	Begin Spec D
			Spring, Collector Ring Brush -
30	212A1123	4	Spec A and B Only
30A	212B1105	4	Spec C Only
30A	212B1105	8	Begin Spec D
31	508-1	1	Grommet - For 1-1/16" Hole

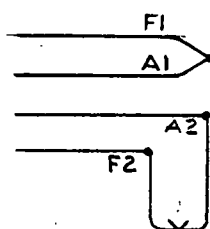
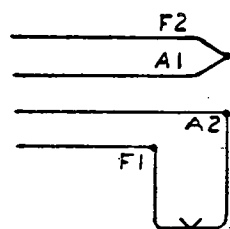
{ 212-303 1 Brush Rig - *Parts Key No. 1 and 2.*
 212-320 1 *Brush Rig - for 2.5, 3.0 and 4.0*
Parts Key No. 3 and 4.

620B52

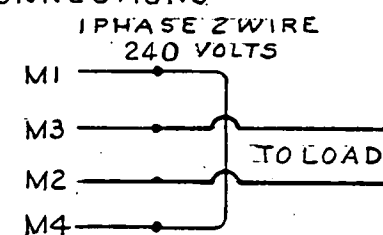
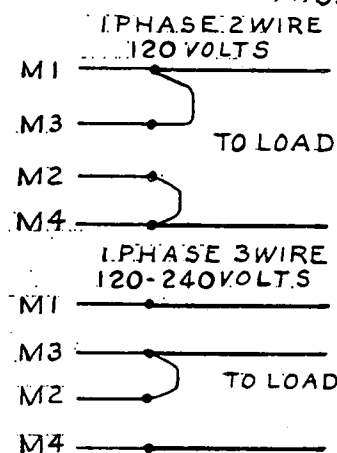
STD. REV.
ARM. GEN.

22

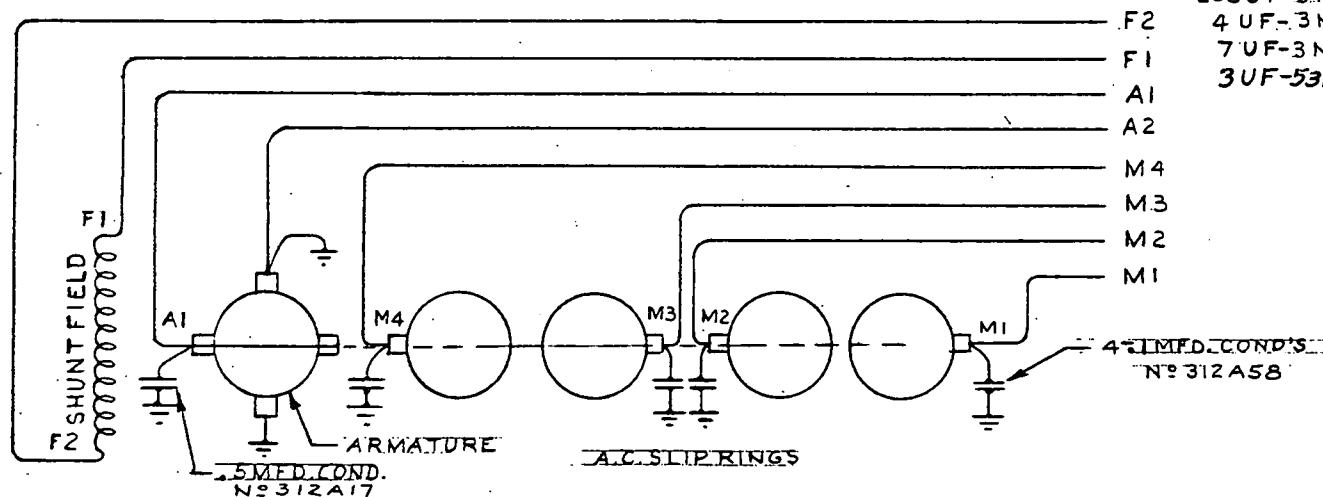
SINGLE PHASE GENERATOR

EXTERNAL WIRING CONNECTIONS
FOR ROTATION DIRECTION.NOTE: DIRECTION OF ROTATION
IS TAKEN WHEN FACING END
OPPOSITE DRIVE SHAFT.FOR CLOCKWISE
ROTATIONFOR COUNTER-
CLOCKWISE ROTATIONINSERT RHEOSTAT
HERE, WHEN USED.

A.C. LOAD CONNECTIONS

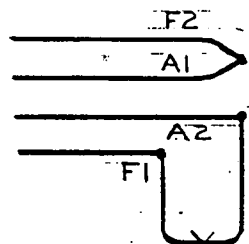
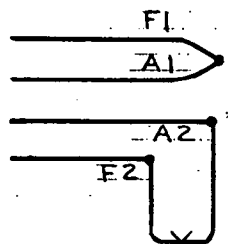


FOR MODELS

205DF-3N/1A.
4UF-3N/1A.
7UF-3N/1A.
3UF-53N/1A.

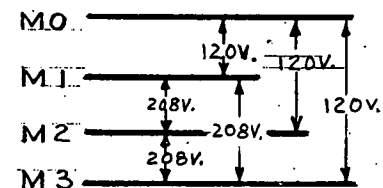
B			
A			
REV.	REVISION	INIT.	DATE
MAT'L WIRING DIAGRAM			
ONAN			
MINNEAPOLIS MINNESOTA			
DR. C.K.H.	CH. G.F.T.	SC.	~
STANDARD 4 WIRE REVOLVING ARM. GEN.			
DWG. NO. 620B52			

620B54

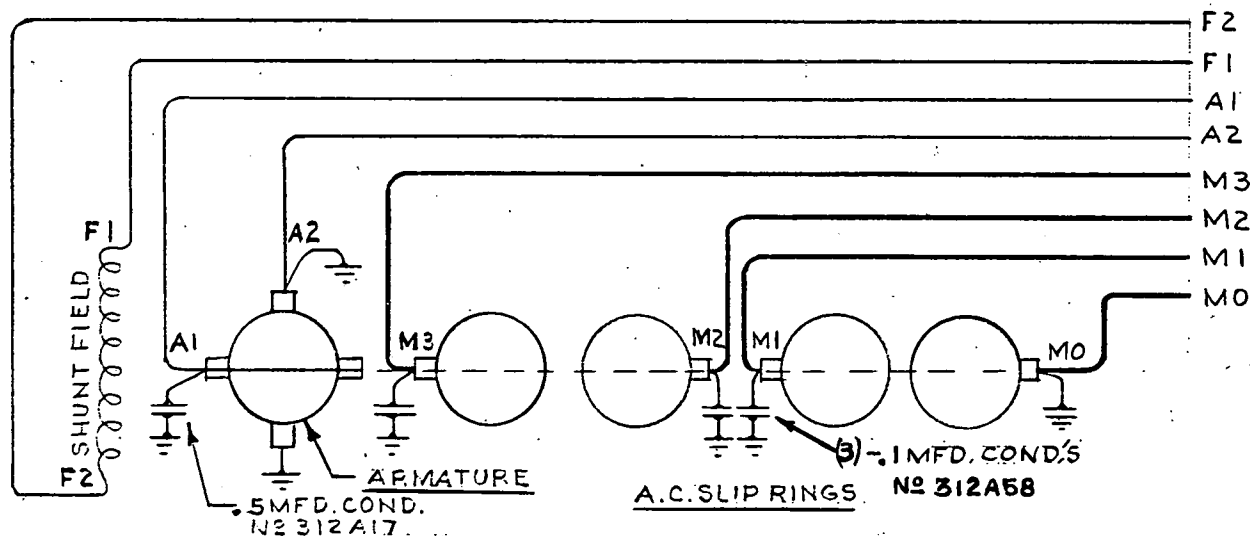
STD. REV.
ARM. GEN.EXTERNAL WIRING CONNECTIONS
FOR ROTATION DIRECTION.NOTE: DIRECTION OF ROTATION
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OPPOSITE DRIVE SHAFT.FOR CLOCKWISE
ROTATION.FOR COUNTER-
CLOCKWISE ROTATION.INSERT RHEOSTAT
HERE, WHEN USED.

A.C. LOAD CONNECTIONS

3 PHASE 4 WIRE



THREE PHASE GENERATOR

FOR MODEL'S
7UF-4N SPEC. 1A

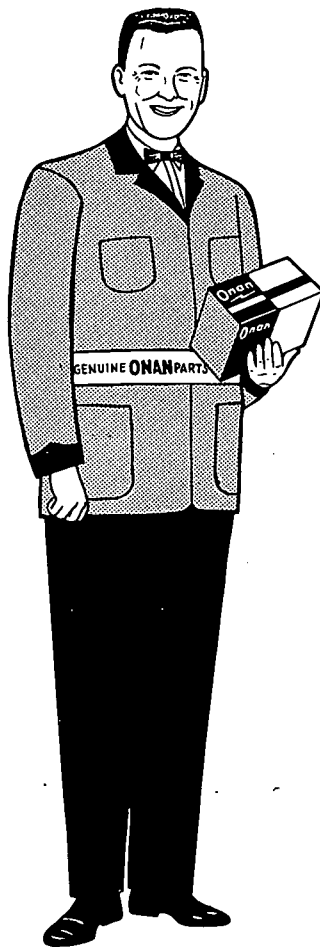
REVISION	INIT.	DATE
MATERIAL WIRING DIAGRAM		
ONAN		
MINNEAPOLIS MINNESOTA		
DR. C. R. H.	CH. 1106	SC. ~
STD. 3PH. 4W. REVOLVING ARM. GEN.		
DATE	DWG. NO.	620B54

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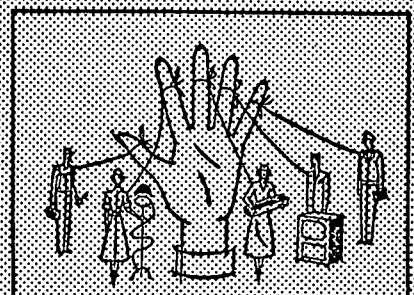
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GENERAL INFORMATION

I

This instruction book contains information for the proper installation, operation, and maintenance of your equipment. We suggest that this book be kept handy so that it can be referred to when necessary.

This equipment is the result of proven engineering design, highest quality materials, and expert workmanship. Thorough inspection and testing assures you that this equipment will perform as expected.

If you wish to contact your dealer or the factory regarding this equipment, be sure to supply the complete MODEL and SPEC. NO., and the full serial number of the equipment as shown on the nameplate. This information is necessary to identify the equipment among the many basic and special optional types manufactured.

MANUFACTURER'S WARRANTY

The Manufacturer warrants, to the original user, that each product of its manufacture is free from defects in material and factory workmanship if properly installed, serviced and operated under normal conditions according to the Manufacturer's instructions.

Manufacturer's obligation under this warranty is limited to correcting without charge at its factory any part or parts thereof which shall be returned to its factory or one of its Authorized Service Stations, transportation charges prepaid, within one year after being put into service by the original user, and which upon examination shall disclose to the Manufacturer's satisfaction to have been originally defective. Correction of such defects by repair to, or supplying of replacements for defective parts, shall constitute fulfillment of all obligations to original user.

This warranty shall not apply to any of the Manufacturer's products which must be replaced because of normal wear, which have been subject to misuse, negligence or accident or which shall have been repaired or altered outside of the Manufacturer's factory unless authorized by the Manufacturer.

Manufacturer shall not be liable for loss, damage or expense directly or indirectly from the use of its product or from any other cause.

The above warranty supersedes and is in lieu of all other warranties, expressed or implied, and of all other liabilities or obligations on part of Manufacturer. No person, agent or dealer is authorized to give any warranties on behalf of the Manufacturer nor to assume for the Manufacturer any other liability in connection with any of its products unless made in writing and signed by an officer of the Manufacturer.

DATED August 1, 1963

IMPORTANT

RETURN WARRANTY CARD ATTACHED TO UNIT

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GENERATOR TABLE OF RATINGS

GENERATOR MODEL NO.	CY.	PH.	WIRE	VOLTS	GEN. WIRING DIA. NO.	†PARTS KEY NO.
205UF-3N/1A, C ✓	60	1	4	120/240	620B52	1
3UF-53N/1A	50	1	4	120/240	620B52	2
4UF-3N/1A, C ✓	60	1	4	120/240	620B52	2
5UF-53N/1A, OD	50	1	4	120/240	620B52	3
7UF-3N/1A, OD	60	1	4	120/240	620B52	3
7UF-4N/1A, C ✓	60	3	4	120/240	620B54	4

Note † - Use the Parts Key No. in this column for your model when selecting parts from the list herein. Order only those parts with no Parts Key No. reference or those parts which refer to the Parts Key No. for your model.

SWITCHBOARD TABLE OF RATINGS

SWITCHBOARD MODEL NO. *	CYCLE	PHASE	WIRE	VOLTS	CONTROL WIRING DIA. NO.
4SA-3/1A	50 or 60	1	4	120/240	615B84
5SA-3/1A	50	1	4	120/240	615B84
7SA-3/1A	60	1	4	120/240	615B84

* - For all Switchboard Repair Parts refer to the wiring diagram furnished with the control.

NOTE: 120, 240 or 120/240 volt references herein apply also to 115, 230 or 115/230 volt ratings respectively.

GENERATOR. - This generator is inherently regulated and will maintain the output voltage within limits of 10% between no load and full load, when driven at its nameplate speed and at normal ambient temperature. The voltage will be somewhat higher when the generator is cold, and will vary with the driven speed. Frequency will vary 1 cycle for each 30 rpm of variation from rated speed according to the curves below.

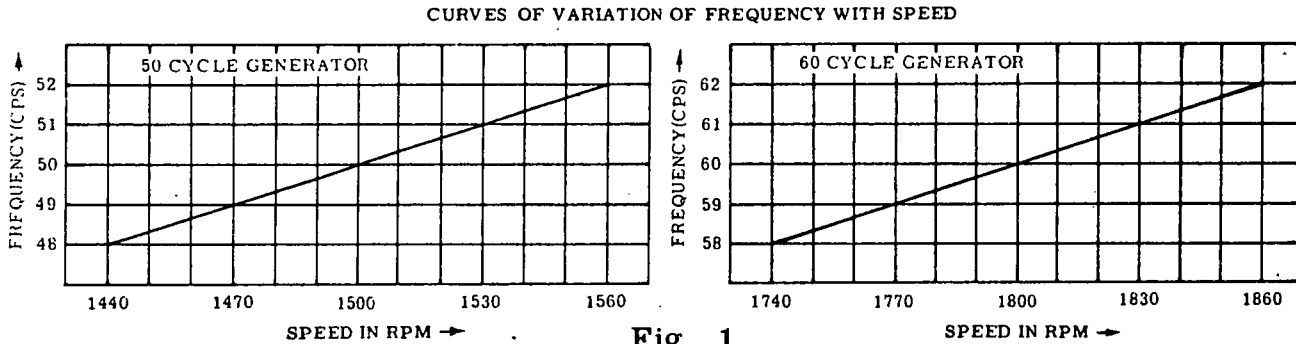


Fig. 1.

The power factor rating for all single phase models is 100%. The power factor rating of 3 phase models is 80%. The voltage regulation will not be greater than 10% at full load and rated power factor.

The generator may be driven in either a clockwise or counterclockwise direction, as installation requirements demand. The blower scroll must be reversed whenever the generator rotation is changed. See paragraph on REVERSING THE SCROLL. The generator is shipped from the factory with the scroll assembled for counterclockwise rotation. The direction of rotation of the generator is determined while looking at the end of the generator opposite to the drive end. The generator is drip proof in design, but reasonable precautions should be taken against excessive exposure to moisture.

The instruction manual covers both 1 phase 4 wire, and 3 phase 4 wire ONAN Ball Bearing Separate Generators.

A manual field rheostat can be used with the generator if it is necessary to operate above rated speed. It can be obtained, at added cost after the generator is received. See "PARTS LIST" for correct part number. It can also be used to reduce the voltage at light loads. The rheostat can not be used to increase the voltage above what it would be without it. See wiring diagram for proper connections.

SWITCHBOARDS. - Switchboards are optional equipment which can be purchased at added cost. Listed in the TABLE OF RATINGS are the Switchboard Model No.'s. They contain a voltmeter, ammeter, circuit breaker, generator and load terminals. The switchboard is generally used to check generator and load operation accurately and to prevent the generator from being overloaded. The operator can

check the following things by using a switchboard:

- (1) Generator voltage
- (2) Load current
- (3) Voltage regulation with varying load

The circuit breaker automatically disconnects the load from the generator when the load exceeds the generator kilowatt rating by approximately 25%. When the circuit breaker trips, it must be reset manually. The cause of the overload should be determined before resetting the breaker. The load current value at which the circuit breaker trips is affected somewhat by the ambient temperature. Do not mount the switchboard in a location where excessive temperatures can develop or on surfaces which vibrate. Excessive vibration may alter the trip current value of the circuit breaker.

When ordering repair parts for switchboards, obtain Part No's. and description of part from the wiring diagram which is supplied with the switchboard.

LOCATION. - Select a site for the generator with the following points in mind.

1. **Ventilation.** - The generator will warm up and create some heat when operating under load conditions. It is of vital importance that this heat be dissipated by proper ventilation. If the generator is installed in a small room or compartment, provide an opening for entry of fresh, cool air. Provide a separate opening for exhausting the air heated by the generator. Locate the exhaust opening above the inlet opening, for best air circulation. Heated air is discharged from the drive shaft end of the generator.

2. **Convenience to Driving Power.** - Locate the generator after considering the following points:

- A. Driving unit location.
- B. Desired direction of shaft rotation.
- C. Pulley alignment, if used.
- D. Shaft alignment of generator and driving unit if a flexible coupling is used.

A. **Driving unit location.** - Regardless of the type of driving unit it **MUST** be bolted securely to a heavy mounting base to maintain pulley and shaft alignment.

- B: **Desired direction of shaft rotation.** - The direction of rotation will be determined by the direction of rotation of the driving unit. The generator direction of rotation is reversible and works equally well in either direction. However the generator lead wires and blower scroll must be properly installed for whatever direction of rotation is necessary. See wiring diagram for proper lead connections. See paragraph on REVERSING THE SCROLL for proper scroll installation.

C. **Pulley alignment if used.** - The shafts of the generator and driving unit must be parallel and the sides of the pulleys must be lined up. Correct belt tension must be permanently maintained. After the pulleys are in proper alignment, both generator and driving unit must be bolted down to a heavy rigid mounting base.

D. **Shaft alignment.** - If a flexible coupling is used, the shaft alignment of the generator and driving unit must be accurately made and permanently maintained. Incorrect shaft alignment will cause excessive wear on both generator and driving unit and unnecessary loss of power from the driving unit.

3. Dusty or Damp Conditions. - Avoid excessive dusty or damp conditions as much as possible. Rust and dirt are enemies of any piece of machinery. The generator is drip proof in design, but unnecessary exposure to moisture should be avoided. The generator should be mounted under cover or inside a building to protect it against the weather.
4. Servicing Convenience. - To permit easy access for servicing the bearings and brushes, allow at least 24 inches of space around the generator.
5. Wiring Convenience. - Locate the generator as near as possible to the electrical equipment it is to serve.

GENERATOR COOLING. - The generator blower system uses a reversible scroll. When the blower scroll is installed properly, a strong flow of air comes out of the generator at the generator drive shaft end. Lack of air flow indicates improper installation of the blower scroll. See paragraph on 'REVERSING THE SCROLL'.

MOUNTING THE GENERATOR. - The mounting surface must be flat so that the generator mounting base will not be sprung, when tightened into place. It should be possible to turn the generator shaft by hand after the generator is bolted down.

WIRING CONNECTIONS. - The generator external leads are not connected, and their manner of connection will depend upon whether a rheostat is to be used, and the DIRECTION OF ROTATION. Refer to the wiring diagram. A rheostat of the proper size should be installed if the speed variation will be too great, or if it is necessary to reduce the voltage at light loads. The addition of a rheostat will not raise the voltage above that which could be obtained without the rheostat. A circuit breaker between generator and load is recommended.

Follow specifications of local and national electrical codes for installing wiring and grounding the generator. Be sure to use wire large enough to avoid excessive drop in voltage between the generator and the load, depending upon the distance and the amount of the load.

The proper size and type of driving unit for the generator is important for satisfactory operation of the generator. When a gasoline or diesel engine is used the following factors should be considered:

1. Engine Power. - The engine must have a minimum of 2 horsepower for each 1000 watts of generator output. For example, if a 5000 watt generator is to be operated, the engine must deliver at least 10 horsepower at the drive shaft. If the engine has a considerable reserve of power the speed regulation and voltage regulation will be much better.

2. Engine Pulley Speed. - The engine may have a variable speed governor which regulates engine speed at about 8-1/2 to 12%. If so, governor operation is best at the maximum rated speed of the engine. When the generator is operating at or near its capacity, the tendency of the engine is to increase speed when the load is suddenly removed. The engine governor does not react fast enough at low speed to prevent momentary acceleration and high voltage. This may possibly cause serious damage to any electrical equipment left connected. Governor action is much better when the engine is operating at its rated speed, and the engine cannot increase its speed too much when the load is removed. If the engine has a constant speed governor, the speed regulation is 5% or less and the above effects are not present.

Low generator speed causes low voltage and frequency. If, for example, an 1800 rpm generator is slowed to 1500 rpm, the frequency of the current produced will be 50 cycles instead of 60 cycles. The combination of low voltage and frequency will almost certainly result in burned out windings of any motors connected to the generator.

3. Pulley Selection. - The rated speed of the engine or electric motor will determine the size of pulley to use on the generator. To determine the correct generator pulley size to use, proceed as follows, or refer to the PULLEY SELECTION TABLE.

- A. Multiply the DIAMETER of the driving unit pulley by its SPEED in rpm (revolutions per minute).
- B. Divide the above result by the nameplate speed of the generator (1800 rpm).

Example: A driving pulley 15 inches in diameter operates at 1200 rpm. Multiply 15 x 1200 getting a result of 18,000. Divide the 18,000 by 1800 rpm (generator pulley speed desired) and the final result is 10, which expresses the size of the pulley (in inches) required. If this same driving unit has an 8 inch pulley operating at 1200 rpm the generator pulley **would then** be 5.33" or approximately 5-3/8" (8 x 1200, divided by 1800 = 5.33).

USE THIS TABLE ONLY FOR GENERATORS STAMPED 1800 RPM ON THE GENERATOR NAMEPLATE.

The pulley sizes recommended in this table are approximate sizes only, in 1/2" steps. The sizes shown do not include any allowance for belt slippage. Belt slippage for flat belts may sometimes reduce the generator driven speed, under load, as much as 4 per cent.

To select a generator pulley size from the table, measure the DIAMETER (not the distance around) of the driving pulley. Select the line at the left side of the table for the driving pulley size. Follow this line across to the speed column that is nearest to the recommended speed of the driving pulley. The size in the square at this point is the approximate size of the generator pulley which will be required. If the recommended size pulley can not be obtained, select one size smaller pulley. This will help to offset belt slippage. Adjust throttle or governor as necessary to obtain proper speed.

Example:

If a 12 inch drive pulley operates at 1100 rpm, follow the 12 inch line across to the 1100 rpm column. The generator pulley size at the point of intersection is 7 inch. This example is outlined in heavy lines in the table.

DRIVING PULLEY SIZE	DRIVING PULLEY SPEED IN REVOLUTIONS PER MINUTE														
	600	700	800	900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000
GENERATOR PULLEY SIZE REQUIRED (1800 R. P. M. GENERATOR)															
6	2	2	2½	3	3	3½	4	4	4½	5	5	5½	6	6	6½
6½	2	2½	2½	3	3½	4	4	4½	5	5	5½	6	6½	6½	7
7	2	2½	3	3½	4	4	4½	5	5½	5½	6	6½	7	7½	7½
7½	2½	3	3	3½	4	4½	5	5½	5½	6	6½	7	7½	8	8
8	2½	3	3½	4	4½	4½	5	5½	6	6½	7	7½	8	8½	9
8½	2½	3	3½	4	4½	5	5½	6	6½	7	7½	8	8½	9	9½
9	3	3½	4	4½	5	5½	6	6½	7	7½	8	8½	9	9½	10
9½	3	3½	4	4½	5	5½	6	6½	7	8	8½	9	9½	10	10½
10	3½	4	4½	5	5½	6	6½	7	7½	8	9	9½	10	10½	11
10½	3½	4	4½	5½	5½	6½	7	7½	8	8½	9	10	10½	11	11½
11	3½	4	4½	5½	6	6½	7	8	8½	9	9½	10	11	11½	12
11½	4	4½	5	5½	6	7	7½	8	9	9½	10	10½	11½	12	12½
12	4	4½	5	6	6½	7	8	8½	9	10	10½	11	12	12½	13
12½	4	4½	5½	6	7	7½	8	9	9½	10½	11	11½	12½	13	13½
13	4	5	5½	6½	7	8	8½	9	10	10½	11½	12	13	13½	14½
13½	4½	5	6	6½	7½	8	9	9½	10½	11	12	12½	13½	14	15
14	4½	5½	6	7	7½	8½	9½	10	11	11½	12½	13	14	14½	15½
14½	5	5½	6½	7	8	8½	9½	10½	11	12	12½	13	14½	15	16
15	5	5½	6½	7½	8	9	10	10½	11½	12½	13	14	15	15½	16½
15½	5	6	6½	7½	8½	9½	10½	11	12	13	13½	14½	15½	16	17
16	5½	6	7	8	9	10	11	11½	12½	13	14	15	16	16½	17½

1500 RPM GENERATOR PULLEY SELECTION TABLE

USE THIS TABLE ONLY FOR GENERATORS STAMPED 1500 RPM ON THE GENERATOR NAMEPLATE.

The pulley sizes recommended in this table are approximate sizes only, in 1/2" Steps. The sizes shown do not include any allowance for belt slippage. Belt slippage for flat belts may sometimes reduce the generator driven speed, under load, as much as 5 percent.

To select a generator pulley size from the table, measure the DIAMETER (not the distance around) of the driving pulley. Select the line at the left side of the table for the driving pulley size. Follow this line across to the speed column that is nearest to the recommended speed of the driving pulley. The size in the square at this point is the approximate size of the generator pulley which will be required. If the recommended size pulley can not be obtained, select one size smaller pulley. This will help to offset belt slippage. Adjust throttle or governor as necessary to obtain proper speed.

Example: If a 12 inch drive pulley operates at 1100 rpm, follow the 12 inch line across to the 1100 rpm column. The generator pulley size at the point of intersection is 9 inch. This example is outlined in heavy lines in the table.

DRIVING PULLEY SIZE	DRIVING PULLEY SPEED IN REVOLUTIONS PER MINUTE														
	600	700	800	900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000
GENERATOR PULLEY SIZE REQUIRED (1500 RPM GENERATOR)															
6	2½	3	3	3½	4	4½	5	5	5½	6	6½	7	7	7½	8
6½	2½	3	3½	4	4½	5	5	5½	6	6½	7	7½	8	8	8½
7	3	3	3½	4	4½	5	5½	6	6½	7	7½	8	8½	9	9½
7½	3	3½	4	4½	5	5½	6	6½	7	7½	8	8½	9	9½	10
8	3	3½	4	4½	5	6	6½	7	7½	8	8½	9	9½	10	10½
8½	3½	4	4½	5	5½	6	6½	7½	8	8½	9	9½	10	10½	11½
9	3½	4	4½	5½	6	6½	7	7½	8½	9	9½	10	11	11½	12
9½	4	4½	5	5½	6	7	7½	8	9	9½	10	10½	11½	12	12½
10	4	4½	5	6	6½	7½	8	8½	9½	10	10	11	12	12½	13½
10½	4	5	5½	6	7	7½	8½	9	10	10½	11	12	12½	13	14
11	4½	5	6	6½	7½	8	9	9½	10½	11	11½	12½	13	14	14½
11½	4½	5½	6	7	7½	8½	9	10	10½	11½	12	13	14	14½	15½
12	5	5½	6½	7	8	9	9½	10½	11	12	13	13½	14½	15	16
12½	5	6	6½	7½	8½	9	10	11	11½	12½	13½	14	15	16	16½
13	5	6	7	7½	8½	9½	10½	11	12	13	14	14½	15½	16½	17½
13½	5½	6	7	8	9	10	11	11½	12½	13½	14½	15½	16	17	18
14	5½	6½	7½	8½	9½	10	11	12	13	14	15	16	17	17½	18½
14½	6	7	8	8½	9½	10½	11½	12½	13½	14½	15½	16½	17½	18½	19½
15	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
15½	6	7	8	9	10½	11½	12½	13½	14½	15½	16½	17½	18½	19½	20½
16	6½	7½	8½	9½	10½	11½	12½	14	15	16	17	18	19	20	21
16½	6½	7½	9	10	11	12	13	14½	15½	16½	17½	18½	20	21	22
17	7	8	9	10	11½	12½	13½	14½	16	17	18	19	20	21½	22½
17½	7	8	9½	10½	11½	13	14	15	16½	17½	18½	20	21	22	23
18	7	8½	9½	10½	12	13	14½	15½	17	18	19	20	21½	23	24

REVERSING THE SCROLL. - The generator is shipped from the factory with the blower scroll mounted for counterclockwise rotation. The direction of rotation is determined while looking at the end opposite the drive end. If a clockwise direction of rotation is desired, the blower scroll position must be reversed. The arrow which is printed on the scroll must be pointing in the direction of the rotation of the generator shaft.

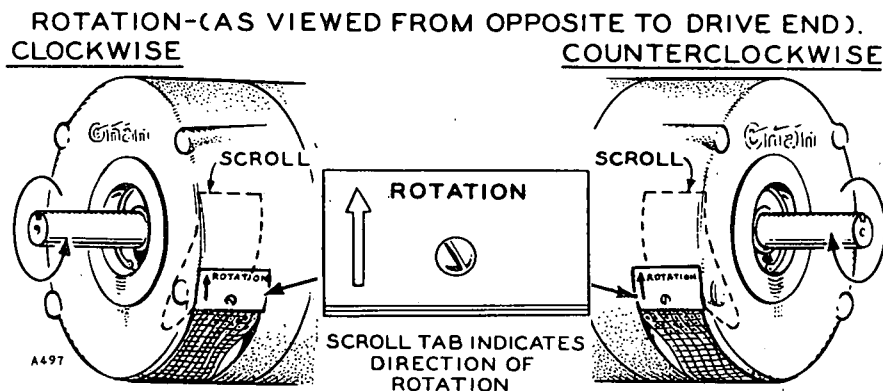


FIG. 2 - BLOWER SCROLL

To reverse the scroll, remove only the scroll with screen attached, turn it end for end and reinstall it so that the scroll will be at the opposite end of the air outlet hole, as illustrated.

POLARIZING THE GENERATOR FIELD. - The field is polarized at the factory. If rotation direction is reversed (scroll reversed and leads properly connected) and voltage does not automatically build-up the first time, "flash the field" to repolarize the generator.

Connect an ac voltmeter across the generator output, run the generator in the desired direction, touch a battery positive (+) cable to generator field lead F1, and the battery negative (-) cable to generator field lead F2. If the voltmeter does not indicate voltage build-up, a larger battery or higher dc source may be required to kill the existing residual magnetism.

STARTING. - Be sure that the generator is connected for the direction of rotation being used. Start up the generator and check the voltage while running at no load and rated speed (1,500-rpm for 50-cycle generators and 1,800-rpm for 60-cycle generators). The generator voltage should be as follows:

Generator Nameplate Voltage Rating	Approximate Line to Line No Load Voltage at Rated Speed
120/240	252
120/208	220

If the generator voltage at no load is not as specified above, adjust the generator speed until no-load voltage is reached before proceeding.

Check the generator cooling air circulation. When the blower scroll is installed properly, a strong current of air comes out of the drive shaft end of the generator. See paragraph on **REVERSING THE SCROLL** for proper installation of the blower scroll.

OPERATING. - Connect the various electrical loads after the generator voltage is adjusted to the proper value at no load. It may be necessary to advance or retard the engine throttle control for engine drive units to control the output voltage. This may also be necessary when large changes in the electrical load are made.

Keep the electrical load on the generator within its nameplate rating. Overloading the generator will cause the voltage to be low, will shorten the life and void warranty.

Consider load and installation characteristics to determine the proper starting procedure which will assure voltage build-up each time. Failure of generator to build up voltage may occur when the starting load is too heavy. (This is not lost residual magnetism if the voltage builds up (1) when only partial load is connected, or (2) when load is connected after generator reaches speed.)

- A. When electric motor loads are connected, connect one at a time, begin with largest motor, allow each to reach running speed, then connect the next motor. Electric motors require much more current for starting than when running at normal speed.
- B. When a rheostat (to limit voltage at higher speed or at light load) is used, disconnect the load (turn switch or circuit breaker OFF) or turn rheostat to decrease resistance, until generator reaches speed to assure build up.
- C. Turn off the lights to attain partial load or no load until generator reaches speed. Incandescent light bulbs (lamps) draw as much as eight times their rating until filaments heat up.

GENERAL SERVICING. - The generator is designed to give long and satisfactory service when properly cared for. Regular servicing as outlined here will be well worth the effort required.

The ball bearings are the double-sealed pre-lubricated type and do not require future lubrication.

To lift brushes away from contact, first remove the brush spring (constant pressure type) from its holder, then remove the brush from its guide, as illustrated. Do not pull the brush out as may be done when spiral type springs are used. Do not unwind the spring past the end of its support plate. A spring so distorted or kinked must be replaced with a new one.

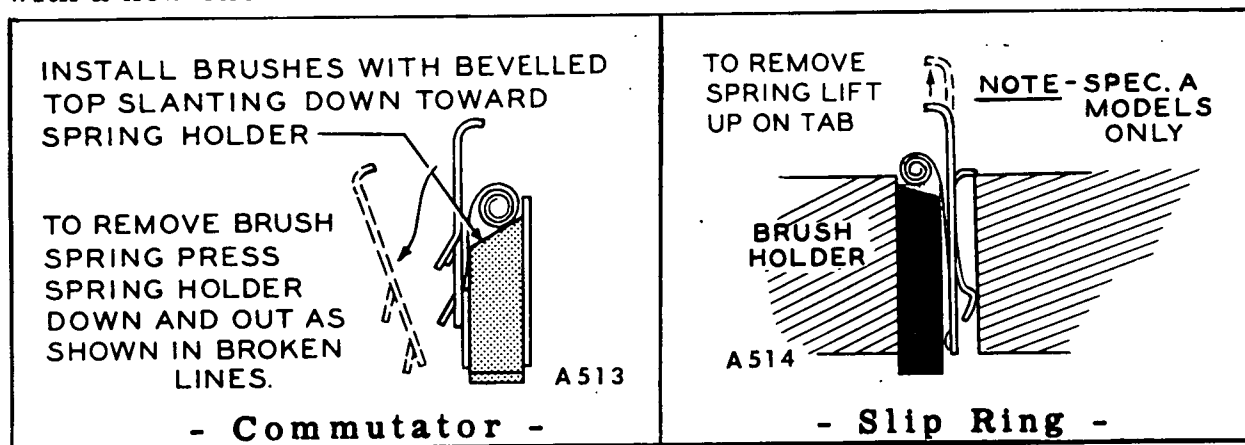


FIG. 3 - BRUSHES AND SPRINGS (Constant Pressure Type)

BRUSH CONTACT. - Maintain good electrical full brush contact at all times.

Each 200 hours of operation, or once a month, clean the commutator and slip rings with a dry, lint free cloth. Do not attempt to maintain a bright, newly machined appearance. A dark, glossy appearance is normal. Heavy deposits or slight roughness may be remedied by careful sanding with #00 sandpaper. Hold the sandpaper flat against the commutator, or slip ring, while the generator is operating. Use a flat wooden stick, with light pressure, to hold the sandpaper. Never use emery or carborundum cloth or paper. Wipe or blow out accumulations of brush dust, which may cause a short circuit.

It is not necessary to remove the brush rig or end bell when installing new brushes or cleaning the commutator. The brushes, commutator and slip rings are easily reached by removing the end bell cover.

Brushes eventually wear too short to perform their function. Brush wear will be more rapid under dusty operating conditions. Replace brushes with new ones only when worn to 5/8 inch in length. The brush springs provide equal pressure as the brushes wear shorter in use.

Each spring is permanently attached to a metal plate which snaps into place, as illustrated. To replace a commutator brush, first remove the spring by pushing the spring plate inward and away from the brush guide. To replace a collector ring brush, first remove the spring by pulling straight outward on the spring plate. When installing a new brush in its guide, be sure that the "low" or shorter side of the beveled top of the brush is toward the spring-plate side of the guide. Be sure each brush is free in its guide. Keep the brush rig and end bell cleaned of carbon dust, etc.

The surface of the commutator may become worn down level with the mica insulation between the bars. If the commutator is worn smooth, the mica between the bars may be cut down to $1/32$ " below the surface without removing the rotor. Remove the end bell only, carefully tagging or otherwise marking all leads disconnected.

Remove each spring and brush from its guide. Pull the end bell off carefully. An undercutting tool may be fashioned from a hack saw blade grinding the blade teeth to a thickness equal to the mica between the bars of the commutator. Use care not to scratch the surface of any bar while undercutting the mica. Remove any burrs formed along the edges of the bars.

If, due to unfavorable operating conditions, the commutator or slip rings become worn out of round, grooved, or pitted it will be necessary to remove the armature and turn the commutator smooth in a lathe.

After turning down the commutator, undercut the mica between bars as previously described.

BRUSH RIG "NEUTRAL" POSITION. - Each time brushes and springs are serviced, see that the brush rig witness mark is aligned, as illustrated.

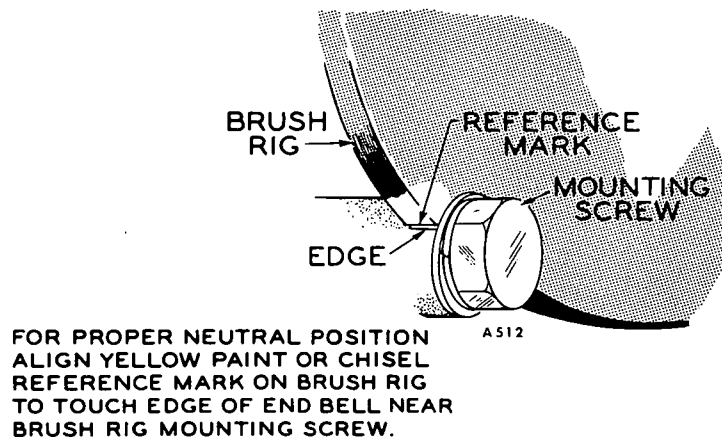


FIG. 4 - BRUSH RIG POSITION

The position of the brush rig assembly in the generator end bell is very important. The correct setting of the brush rig was determined at the

factory and is identified by a painted or chisel mark on the outer edge of the brush rig and must align with the edge of the end bell where the brush rig is mounted.

As long as the original brush rig and armature are continued in service, these alignment marks must be observed.

MAJOR GENERATOR REPAIR. - Consult a competent mechanic or electrician, familiar with a.c. generators, to locate any faulty windings and to perform any necessary major repair. Several tests for open or grounded circuits can be made without disassembling the generator. Before making tests, and before disassembling the generator, lift the brushes away from contact. After completing the maintenance, return the brushes to their operating position.

DISASSEMBLY. - If it should become necessary to disassemble the generator, lift all brushes from contact. Tag all leads which are disconnected, to insure correct replacement when the generator is reassembled.

When reassembling be sure the bearing stop clip is in place on the bearing opposite the drive end. Avoid possible damage to parts through careless disassembly and reassembly. Most other assembly procedures are self-evident.

ARMATURE GROUNDED. - See that all brushes are lifted out of their holders. Use a continuity type test lamp set. Place one test prod on the commutator, and the other prod on a bare clean part of the generator frame or armature shaft. The prods must make good electrical contact. The test set lamp should not light. If it does light up, the armature is grounded. Test the slip rings in the same manner. If the armature tests grounded, replace with a new one.

TESTING THE ARMATURE FOR AN OPEN CIRCUIT. - The AC winding of an alternating current generator may be tested for an open circuit by use of the test lamp set. Place one test prod on one slip ring, and the other test prod on a second ring. The test lamp should light. If it does not light, an open circuit is present. If there are three or four rings, test between each two in the same manner. Install a new armature if an open circuit is present.

To test the direct current winding of an armature for an open circuit, the use of an armature growler is necessary. Most electrical repair shops have such equipment. It will be necessary to remove the armature for testing. Proceed as follows.

- a. Place the armature in the growler which is connected to alternating current. Rub a smooth steel blade (back edge of a hacksaw blade)

across the segments of the commutator.

- b. At some point around the commutator a spark should occur as the blade contacts the two adjacent segments. If a spark occurs, the circuit is complete (not open) between those two segments. Then it will be necessary to rotate the armature just enough to test the next two segments.

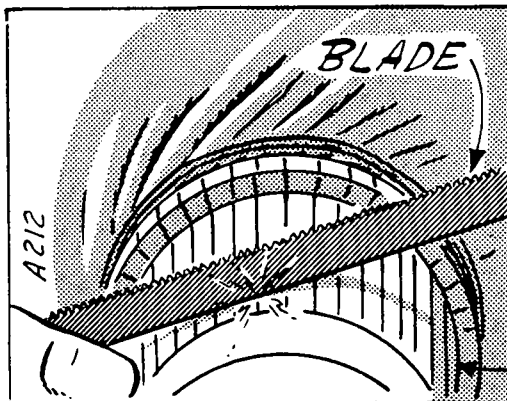


FIG. 5 - OPEN CIRCUIT TEST

Continue the rotating and testing until the commutator segments have been tested completely around. A good spark should occur between all adjacent segments when those segments and windings attached to them are in the correct position in the growler magnetic field. If no spark occurs, the winding between those two segments is open circuited. (There is a possibility that a short circuit of a winding might prevent the sparking, but then the armature would also be magnetized as described in the following paragraph.)

TESTING THE ARMATURE FOR SHORT CIRCUITS. - Place the armature in the growler (see figure) which is connected to alternating current. Hold a steel blade (or old hack-saw blade) 1/4 inch from the armature laminations. If the steel blade is attracted to any magnetized armature laminations, either the armature windings or commutator is short circuited. Do not test for magnetism at just one point of the armature laminations, but test all of the armature laminations from one side over to the other side (along the dotted line on figure). After testing the armature in one position, revolve the armature about 1/8 revolution and test for magnetism again. Continue the revolving and testing until the armature has been tested completely around.

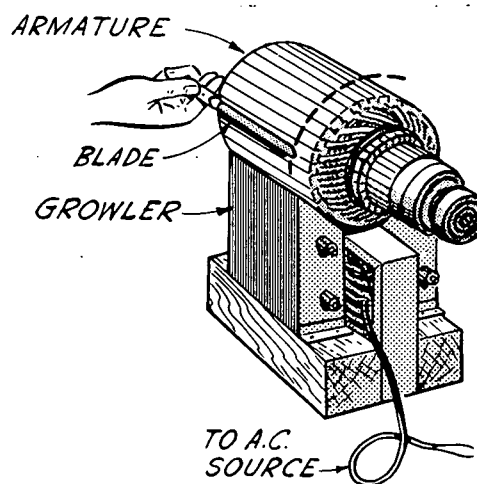


FIG. 6 - SHORT CIRCUIT TEST

FIELD WINDINGS, OPEN CIRCUIT. - A test

lamp set can be used to test field windings for an open circuit. Place one test prod on one of the terminal ends of the field windings, and the other test prod on the other terminal end of the winding. The test lamp should light. If it does not, an open circuit is indicated. Check carefully to see that the open circuit is not at the terminal leads or a loose terminal. An open circuit due to a broken lead or loose terminal is easily repaired. An open circuit within a coil requires replacement of the set of coils.

Following is a list of troubles that may be experienced in the operation of the generator. Also listed are the possible causes and usual remedies for getting the generator back into proper efficient operation.

POSSIBLE CAUSE	REMEDY
POOR COMMUTATION OR ARCING AT THE GENERATOR BRUSHES	
Brushes out of neutral position.	Turn brush ring until the identifying marks are aligned.
Brushes not seating properly.	Sand the brush to the proper contour.
Generator heavily overloaded.	If the AC or DC amperage is more than stated on the generator nameplate, remove part of the load.
Brushes binding in holder.	Clean each brush and holder.
Brush tension insufficient.	Replace brush springs.
Brushes worn too short.	Replace brushes.
Brush tension unequal.	Replace weak brush springs.
Wrong type brush.	Replace with correct type and make of brush and spring.
Loose commutator bars.	Replace with new armature.
High mica.	Undercut the mica.
Commutator out of round.	True the commutator in a lathe.
Commutator surface dirty or oily.	Clean the commutator.

OVERHEATING OF GENERATOR

Windings and parts covered with dirt and oil.	Clean generator.
Overloaded.	Check load or output of generator.
Short circuit or grounded circuit in the field winding or armature winding.	Replace defective parts.

POSSIBLE CAUSE

REMEDY

OVERHEATING OF GENERATOR (Cont.)

Excessive arcing at the brushes.	See "Poor Commutation" above.
Unequal air gap between pole shoe and armature.	Shim up pole shoe until air gaps are equal.
Generator blower scroll installed in wrong position.	Reverse blower scroll position.

GENERATOR NOISY

Generator loose on base.	Tighten mounting bolts.
Worn or defective bearing.	Replace worn parts. Check alignment.
Field pole rubbing armature.	Tighten field poles to frame.

GENERATOR RUNS BUT DOES NOT PRODUCE CURRENT

Brushes not contacting commutator.	Free brushes in holders. Assemble brushes and springs correctly.
Open, short or grounded circuit in generator.	Test windings and repair or replace defective parts.
Generator line leads broken or loose.	Tighten connections and replace broken leads.
Generator armature rotating in the wrong direction.	1. Correct direction of rotation. 2. Or, connect wires, polarize field and reinstall scroll to agree with direction of rotation.

LOW VOLTAGE OUTPUT OF GENERATOR

Speed low because of loose, slipping belts.	Adjust belt tension.
Generator brushes not in neutral position.	Turn brush ring until the identifying marks are aligned correctly.
External short circuit on line.	Test generator with line wires disconnected.

POSSIBLE CAUSE

REMEDY

LOW VOLTAGE OUTPUT OF GENERATOR (Cont.)

Open circuit of shunt field winding.

Make proper connections according to wiring diagram.

Short circuit of windings in the field or armature.

Replace defective part.

Manual field rheostat (if used) adjusted at minimum voltage.

Adjust manual rheostat.

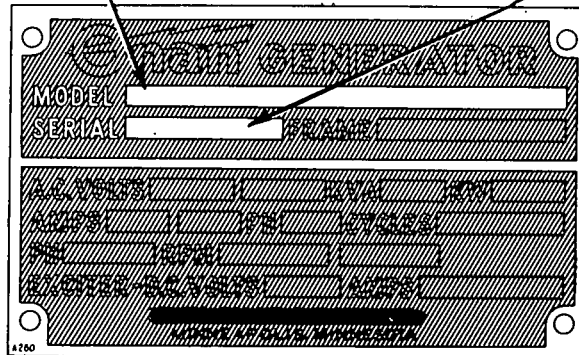
18 INSTRUCTIONS FOR ORDERING REPAIR PARTS

FOR PARTS OR SERVICE, CONTACT THE DEALER FROM WHOM YOU PURCHASED THE EQUIPMENT OR REFER TO YOUR NEAREST AUTHORIZED SERVICE STATION.

TO AVOID ERRORS OR DELAY IN FILLING YOUR ORDER, PLEASE
FURNISH ALL INFORMATION REQUESTED.

REFER TO THE NAMEPLATE

1. Always give the Model No. ----- and Serial No. -----



2. Refer to the "Table of Ratings" near the front of this book to determine the "Parts Key No.", which agrees with your model, for selecting the correct part from the list. If your Model and Spec. No. is not shown use the list only as a guide and order by description.
3. Give the part number, description and quantity needed of each item. If an old part cannot be identified return the part prepaid to your dealer or nearest AUTHORIZED SERVICE STATION. Print your name and address plainly on the package. Write a letter to the same address stating the reason for returning the part.
4. State definite shipping instructions.

Any claim for loss or damage to your unit in transit should be filed promptly against the transportation company making the delivery. Shipments are complete unless the packing list indicates items are back ordered.

"Prices are purposely omitted from this Parts Catalog due to the confusion resulting from fluctuating costs, import duties, sales taxes, exchange rates, etc.

For Current parts prices, consult your Onan Dealer, Distributor or Parts and Service Center."

"En esta lista de partes los precios se omiten de proposito, ya que bastante confusion resulto de fluctuaciones de los precios, derechos aduanales, impuestos de venta, cambios extranjeros etc.

Consiga los precios vigentes de su distribuidor de productos ONAN".

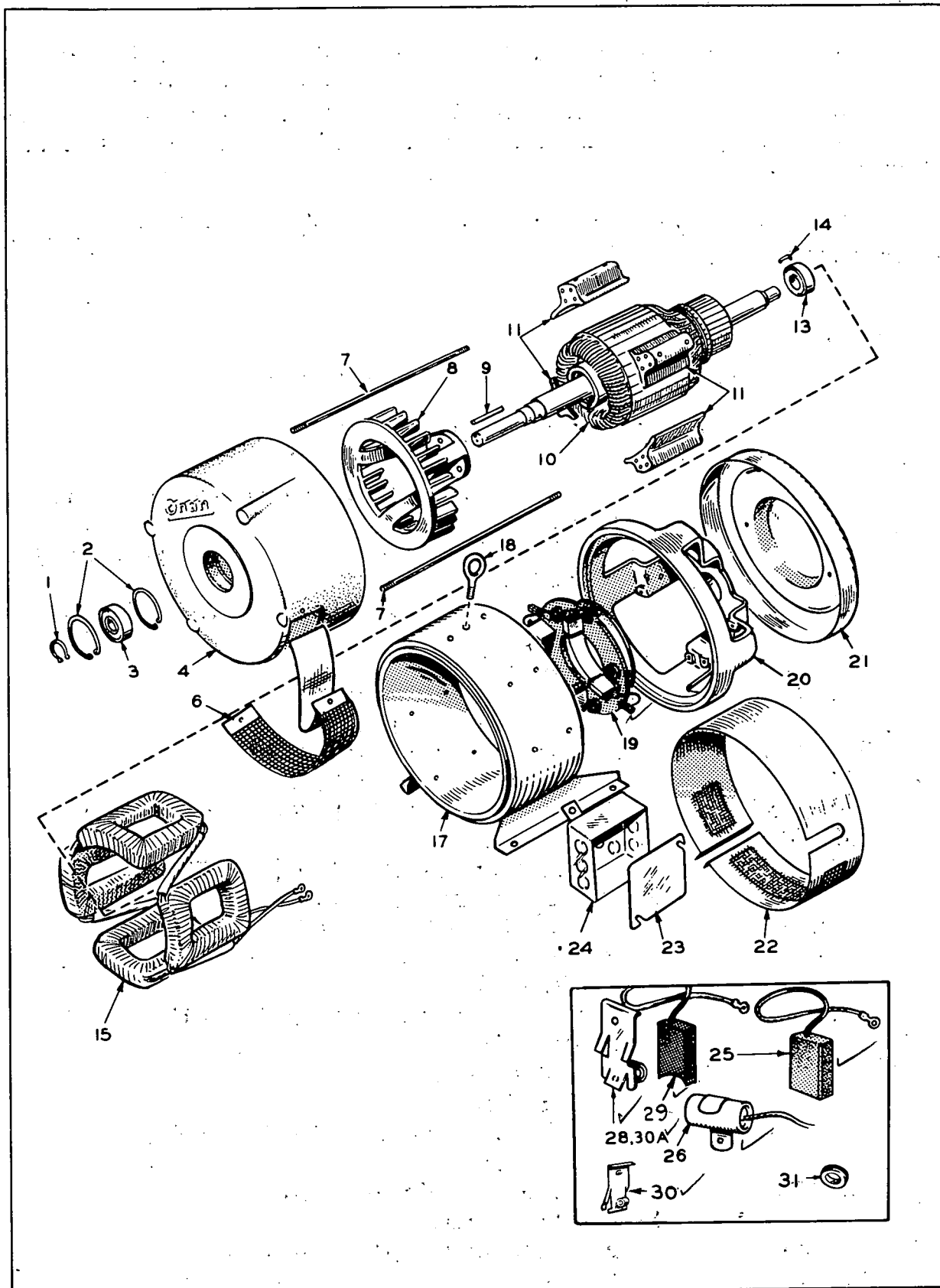


FIG. 7 - GENERATOR PARTS

NOTE: If your generator nameplate carries a different model or Spec. No. than listed in this manual, order replacement parts by description only, not by the part numbers given in the Parts List. Always be sure to furnish the Model, Spec. and Serial No. of the generator as given on its nameplate.

For explanation of "Parts Key No." refer to "Table of Ratings" near the front of this book.

REF. NO.	PART NO.	QTY.	DESCRIPTION
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FIG. 7 - GENERATOR PARTS

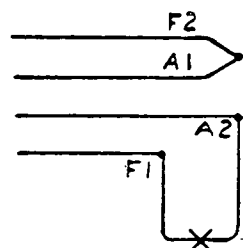
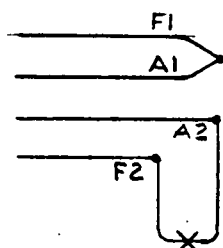
1	518-12	1	Ring, Retaining - External - Drive End Bearing to Shaft.
2	518-166	2	Ring, Retaining - Internal - Drive End Bearing to End Bell.
3	510A52	1	Bearing, Ball - Armature Drive End - Double Shielded.
4	211E127	1	Bell, End - Drive End.
6	234A77	1	Scroll and Screen, Blower.
7			Stud, Generator Through -
	520A145	2	For models with Parts Key No. 1.
	520A340	2	For models with Parts Key No. 2.
	520A161	2	For models with Parts Key Nos. 3 and 4.
8	205C60	1	Blower, Air.
9	515A45	1	Key, Armature Shaft Drive (Was 515A91).
10			Armature Wound Assembly -
	201A945	1	For models with Parts Key No. 1.
	201A943	1	For 60 cycle models with Parts Key No. 2 - (4UF-3N).
	201A1005	1	For 50 cycle models with Parts Key No. 2 - (3UF-53N).
	201A939	1	For 60 cycle models with Parts Key No. 3 - (7UF-3N).
	201A1033	1	For 50 cycle models with Parts Key No. 3 - (5UF-53N).
	201A940	1	For models with Parts Key No. 4.
11			Shoe, Pole - Field -
	221A86	4	For models with Parts Key No. 1.
	221A91	4	For models with Parts Key No. 2.
	221A90	4	For models with Parts Key Nos. 3 and 4.
13	510A47	1	Bearing, Armature - Brush Rig End - Double Shielded.
14	232A596	1	Clip, Bearing Stop.

REF. NO.	PART NO.	QTY.	DESCRIPTION
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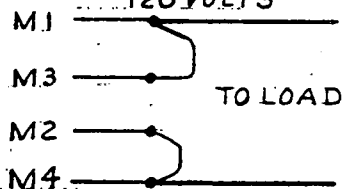
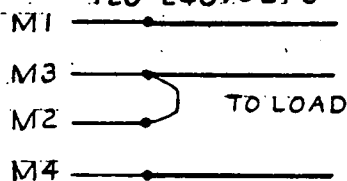
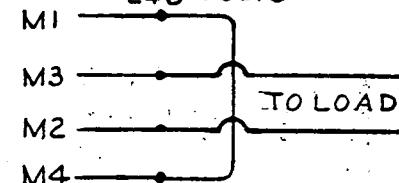
FIG. 7 - GENERATOR PARTS (Cont.)

15			Coil Set, Field - Set of 4 Coils -
	222A1043	1	For models with Parts Key No. 1.
	222A1156	1	For models with Parts Key No. 2.
	222A1118	1	For models with Parts Key Nos. 3 and 4.
17			Frame, Generator -
	210C1646	1	For models with Parts Key No. 1.
	210C1642	1	For models with Parts Key No. 2.
	210C1645	1	For models with Parts Key Nos. 3 and 4.
18	403A95	1	Bolt, Eye - Lifting - 3/8-16 (Replaces #410 P228)
19	212C308 320	1	Rig Assembly, Brush - Includes Brushes and Springs (Replaces #212C234, or #212C303)
20	211D98	1	Bell, End - Brush Rig End.
21	234C47	1	Cover, End Bell.
22	234C66	1	Band, End Bell.
23	330-6	1	Cover, Junction Box.
24	330B47	1	Box, Junction.
25	214A61 214A58	4	Brush, Commutator (DC). <i>Prior Spec D Begin Spec D</i>
26	312A17	1	Condenser - .5 Mfd. - DC Brush.
26			Condenser - .1 Mfd. - AC Brush -
	312A58	4	For models with Parts Key Nos. 1, 2 and 3.
	312A58	3	For models with Parts Key No. 4.
28	212B1105	4	Spring, Commutator Brush.
29	214A56 214A50	4	Brush, Collector Ring (Slip Ring, AC). <i>Prior Spec D Begin Spec D</i>
30, A		8	Spring, Collector Ring Brush.
30	212A1123	4	Spec A Only
30A	212B1105	4	Begin Spec C Spec C Only
31	508-1	1	Grommet - For 1-1/16" Hole.

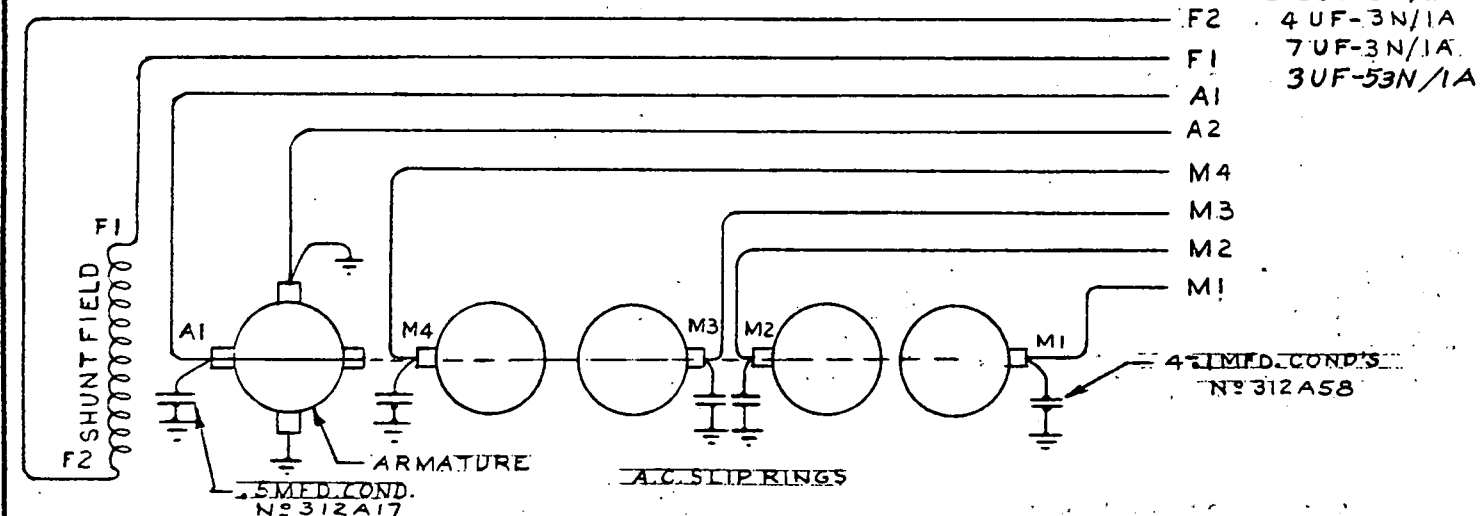
SINGLE PHASE GENERATOR

EXTERNAL WIRING CONNECTIONS
FOR ROTATION DIRECTION.NOTE: DIRECTION OF ROTATION
IS TAKEN WHEN FACING END
OPPOSITE DRIVE SHAFT.FOR CLOCKWISE
ROTATIONFOR COUNTER-
CLOCKWISE ROTATIONINSERT RHEOSTAT
HERE, WHEN USED.

A.C. LOAD CONNECTIONS

1 PHASE 2 WIRE
120 VOLTS1 PHASE 3 WIRE
120-240 VOLTS1 PHASE 2 WIRE
240 VOLTS

FOR MODELS

205UF-3N/1A
4UF-3N/1A
7UF-3N/1A
3UF-53N/1A

B	REVISION	DATE
A		
MATH WIRING DIAGRAM		
ONAN		
MINNEAPOLIS MINNESOTA		
DR. C.K.H.	CH. G.F.T.	SC. ~
STANDARD 4 WIRE REVOLVING ARM. GEN.		
DWG. NO. 620B52		

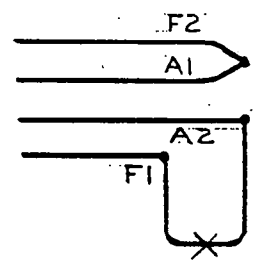
620B54

STD. REV.
ARM. GEN.

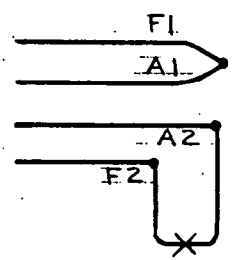
EXTERNAL WIRING CONNECTIONS FOR ROTATION DIRECTION.

NOTE: DIRECTION OF ROTATION
IS TAKEN WHEN FACING END
OPPOSITE DRIVE SHAFT.

FOR CLOCKWISE
ROTATION.



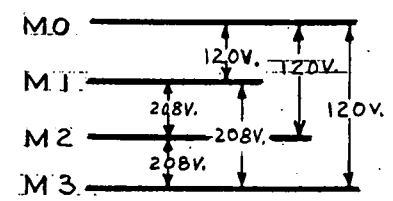
FOR COUNTER-
CLOCKWISE ROTATION.



INSERT RHEOSTAT
HERE, WHEN USED.

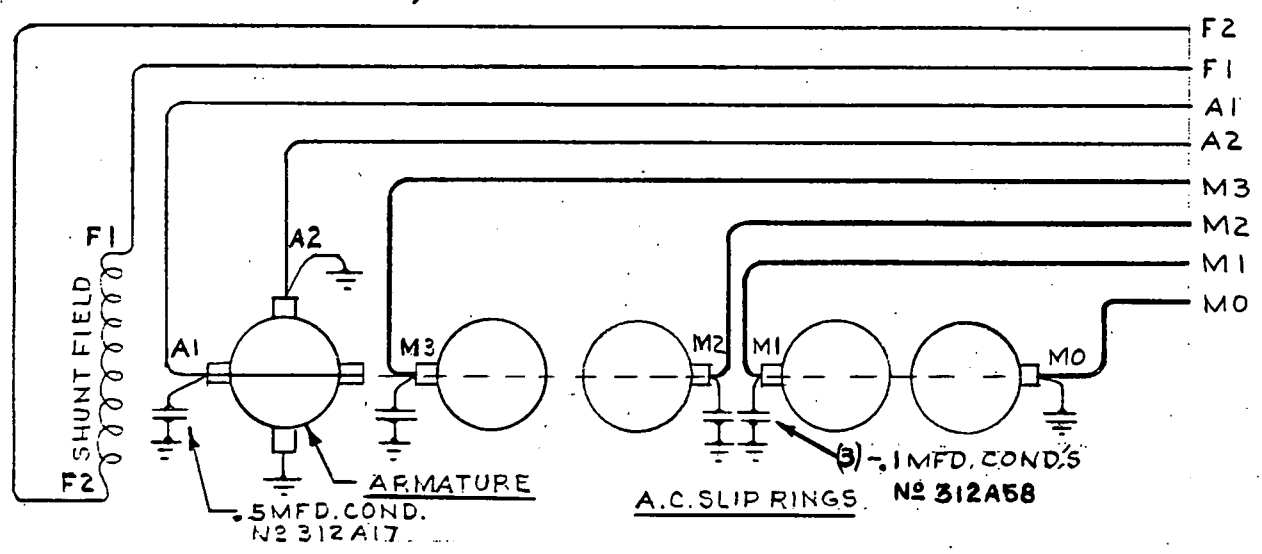
A.C. LOAD CONNECTIONS

3 PHASE 4 WIRE



THREE PHASE GENERATOR

FOR MODELS
7UF-4N SPEC 1A



REVISION		INIT.	DATE
MATERIAL WIRING DIAGRAM			
ONAN			
MINNEAPOLIS MINNESOTA			
DR. C. N. H.	CH. 1406	SC	~
STD. 3 PH. 4 W. REVOLVING ARM. GEN.			
DATE	DWG. NO. 620B54		

For Genuine Onan Parts and Service, see your Onan Parts and Service Center. In most major cities they are listed in the classified section of the telephone directory. See Generators-Electric.

