

# **INSTRUCTION MANUAL AND PARTS CATALOG**

FOR



## **TRACTOR DRIVE GENERATORS**

**INHERENTLY REGULATED**

### **UF SERIES**

NOTE: Although this Instruction Manual does not make specific reference to 15UF-3N104, a wiring diagram pertaining to this Model is included on page 32. Information on Model 15UF-3N104 will be added at next printing.

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**ONAN**

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**A DIVISION OF STUDEBAKER CORPORATION**

**IN CANADA: ONAN GENERATORS CANADA LTD., P. O. BOX 652, GUELPH, ONTARIO**

# GENERAL INFORMATION

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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## MODEL IDENTIFICATION TABLE

AC, 120/240 VOLT, 3 WIRE, 1 PHASE, 60 CYCLE			
MODEL NO.	TYPE OF DRIVE	WIRING DIAGRAM	†PARTS KEY
4UF-3N41/	GEAR	PAGE 30	1
4UF-3N42/	BELT	PAGE 31	2
4UF-3N61/	GEAR	PAGE 30	1
7UF-3N41/	GEAR	PAGE 30	3
7UF-3N42/	BELT	PAGE 31	4
7UF-3N61/	GEAR	PAGE 30	3

† The Parts Key No. is referred to in the Parts List Description column of parts that are not interchangeable between various models. Some parts descriptions may include other qualifying information that must be observed when ordering parts.

**GENERATOR DESCRIPTION.** - This generator is specially designed for use with a tractor as the driving power and is a self excited, inherently regulated, alternating current type. It produces 120/240 volt, 3 wire, 60 cycle, single phase, alternating current. It is rated in kilowatts continuous duty according to the nameplate rating on the generator at 100% power factor.

This generator is inherently regulated. It is designed to maintain the output voltage within limits of 10% between no load and full load conditions at 1.0 power factor (lighting load) when driven at its rated speed and at normal ambient temperature. The voltage will be somewhat high when the generator is first started up and is still cold. The voltage will vary with the speed at which the generator is driven. The frequency of the current (which is particularly important when motors are used) will vary in direct proportion to the generator speed.

The power take-off driven generator is equipped with a speed step-up gear box. The generator having the number 41 in its model (7UF-3N41/) is equipped with a 4.12 to 1 gear ratio. The generator having the number 61 in its model (7UF-3N61/) is equipped with a 3.32 to 1 gear ratio. Thus the "41" driven speed must be approximately 437 rpm, and the "61" driven speed must be approximately 542 rpm.

The generator having the number 42 in its model (7UF-3N42/) is belt driven and its driven speed must be approximately 1800 rpm.

The gear drive generator may be driven in only one direction. (DO NOT reverse the scroll).

The belt drive generator may be driven in either direction but proper lead connections must be made for the desired rotation. The blower scroll must be installed in the proper position for each direction of rotation. See paragraph on REVERSING THE SCROLL for proper installation of the scroll.

**SPECIAL SELF ADJUSTING MOUNTING BASE.** - The special self adjusting mounting base automatically adjusts for varying conditions of load and belt stretch. A heavy spring mounted in the mounting base maintains uniform belt tension regardless of generator load or stretching of the belt.

**FLAT BELT PULLEY.** - The 5 inch diameter flat belt pulley is suitable for use with most standard tractors. This pulley must be used with the right size driving pulley which must be driven at the right speed. See pulley chart for proper driving pulley sizes and driving pulley speeds.

**CONTROL.** - The control box, containing the circuit breaker and the voltmeter, is mounted on the side of the generator. The circuit breaker, mounted in the control box, operates automatically whenever excessive overloading occurs.

**MANUAL TRANSFER SWITCH.** - The 2 pole or 3 pole, double throw 60 ampere manual transfer switch is enclosed in a raintight cabinet with connectors at the top and bottom. The 3 pole switch is for installations requiring that the neutral be switched. The 2 pole switch has a solid neutral that is not switched. Either switch is used so that the load can be readily switched from the main power line to the tractor drive generator. The use of this switch when properly installed, makes it impossible to connect the tractor drive generator to the high line. See sketch of Typical Farm Installation for recommended installation details.

**WARNING:**

If the **MANUAL TRANSFER SWITCH** is not used, it is possible to energize the transformer from the tractor drive generator which could cause great discomfort to an electrician working on the unit or power line.

5. Servicing Convenience. - Allow at least 24 inches of space on all sides of the generator so that it can be serviced conveniently.
6. Wiring Convenience. - Do not locate the generator in a location difficult to service or which would have poor ventilation, to save a few feet of wiring. Install the generator as close to the load transfer switch as possible. Do not move the load transfer switch to the generator. See the paragraph, INSTALLING THE LOAD TRANSFER SWITCH.

**MOUNTING THE GENERATOR.** - The generator mounting base may be made of concrete or heavy timber. The surface of the mounting base should be flat so that the generator mounting brackets will not be sprung, when tightening into place. It should be possible to turn the generator shaft by hand after the generator is bolted down.

Be sure that the generator is properly aligned with the driving mechanism and that it will stay in alignment.

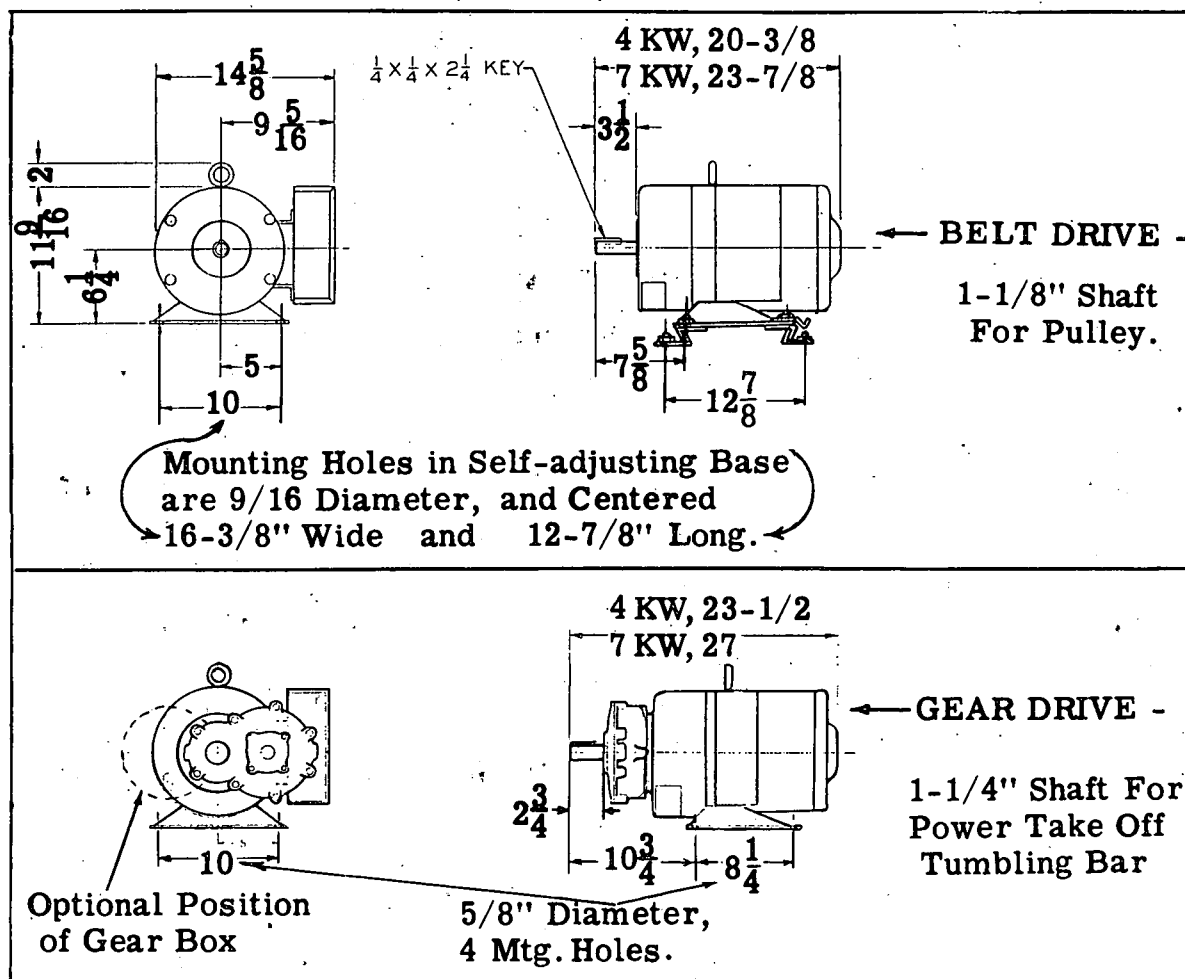
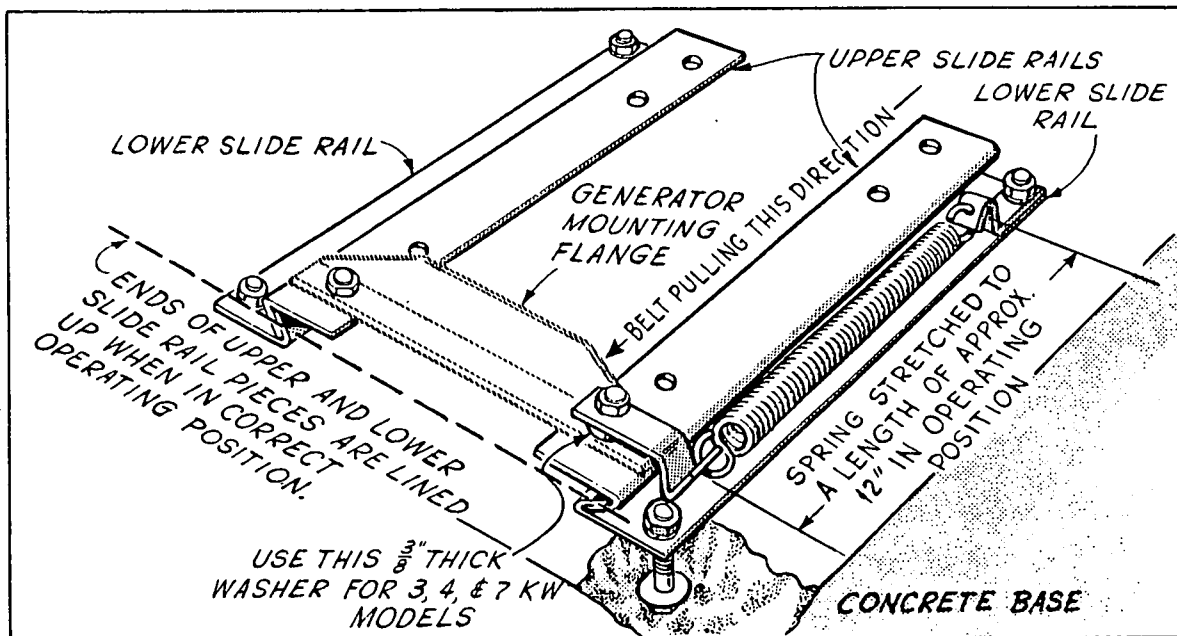


FIG. 2 - DIMENSIONAL OUTLINE

**MOUNTING THE BELT DRIVE GENERATOR.** - The special self-adjusted mounting base is furnished separately as seven separate items plus hardware. The correct mounting hole dimensions for the lower slide rails are shown on page 5. The lower slide rails should be mounted securely to a substantial base of concrete or heavy timber construction. Mount the generator so that the pulley belt is on the opposite side of the circuit breaker box for reasons of safety if possible. Easy access is then made to the control side of the generator, while it is operating, without coming near the generator pulley or belt. To mount the generator proceed as follows:



**FIG. 3 - MOUNTING BASE**

The upper slide rail pieces are identified by four punched holes in each piece. The lower slide rail pieces are identified by two punched holes in each piece.

1. Bolt upper slide rails to generator mounting base, using four 1/2" machine screws, nuts and lock washers supplied. Insert machine screws from the bottom so that the nuts are located on top.
2. Apply ordinary bearing or axle grease lightly to mating surfaces of upper and lower sliding rails.
3. Place one of the spring brackets over rear mounting hole of lower slide rail and bolt in place.
4. Hook heavy spring into remaining hole of spring bracket.
5. Bolt lower slide rail pieces in place.
6. Fit upper slide rails into lower rails and push generator into position so that the hook of the heavy spring lines up with the mounting bolt on left side of generator base facing pulley end. (Pulley side of generator must be on same side as the heavy spring).
7. Hook remaining spring bracket into heavy spring and secure under generator mounting bolt nut as shown, after placing flat spacer washer 3/8" thick over the bolt first.

8. Install belt on pulley and move tractor to apply belt tension. Proper tension will be attained when the ends of the upper and lower slide rails are lined up.

**CONNECTING THE GENERATOR WIRES.** - Connect the generator leads inside the control box before putting the generator into operation. THE PROPER CONNECTIONS FOR THE A1 and F1 LEADS DEPEND UPON DIRECTION OF GENERATOR ROTATION. Note that direction of generator rotation is determined when facing the end OPPOSITE the drive or pulley end. Be sure that connections are made according to the rotation which will be used. See wiring diagram and also connection sketches. Connect the lower circuit breaker terminals to the load transfer switch with a flexible conduit, cable, or some other type of flexible lead wire so that no damage will be done to the load transfer switch when adjusting the belt tension of the generator. See Typical Farm Installation.

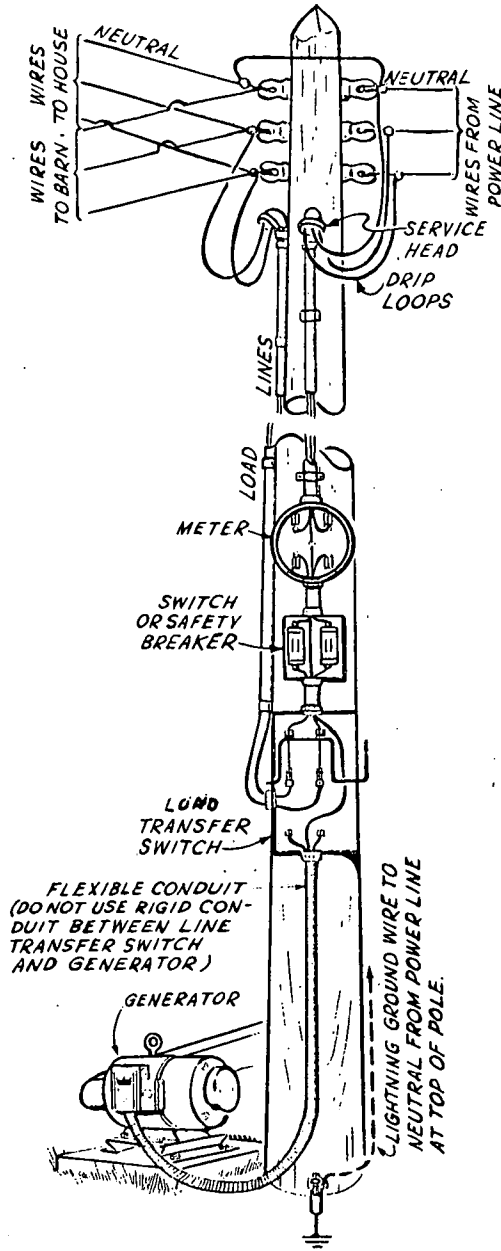
**INSTALLING THE LOAD TRANSFER SWITCH.** - Before the generator can be used for emergency purposes, a DOUBLE THROW LOAD TRANSFER SWITCH MUST BE INSTALLED. The switch must have an ampere rating large enough to carry the total load when the main source of power is in use. Follow the local electrical code. The load transfer switch should always be installed close to the main line switch, and between the main line switch and the load. When properly installed, the load transfer switch in one position will connect the electrical load to the highline. When the load transfer switch is thrown to the other position, the load is first disconnected from the main source of power, and then connected to the tractor generator. Using the load transfer switch makes it impossible to connect the generator to the main source of power. The load lines must connect to the center terminals of the transfer switch. The generator leads and the main power source leads must be connected at OPPOSITE ends of the switch. See Typical Farm Installation.

**POWER RETURN SIGNAL.** - When the generator is used for emergency applications, a pilot light or alarm signal should be installed to indicate when the power is restored and the generator can be disconnected. A signal light can be connected across the regular power line, just ahead of the load transfer switch. Install an on-off switch and a fuse for the signal light. When a power failure occurs, snap the signal switch to the ON position before putting the generator into operation. When the normal power returns, the signal will operate, and the generator can then be disconnected. See Typical Farm Installation.

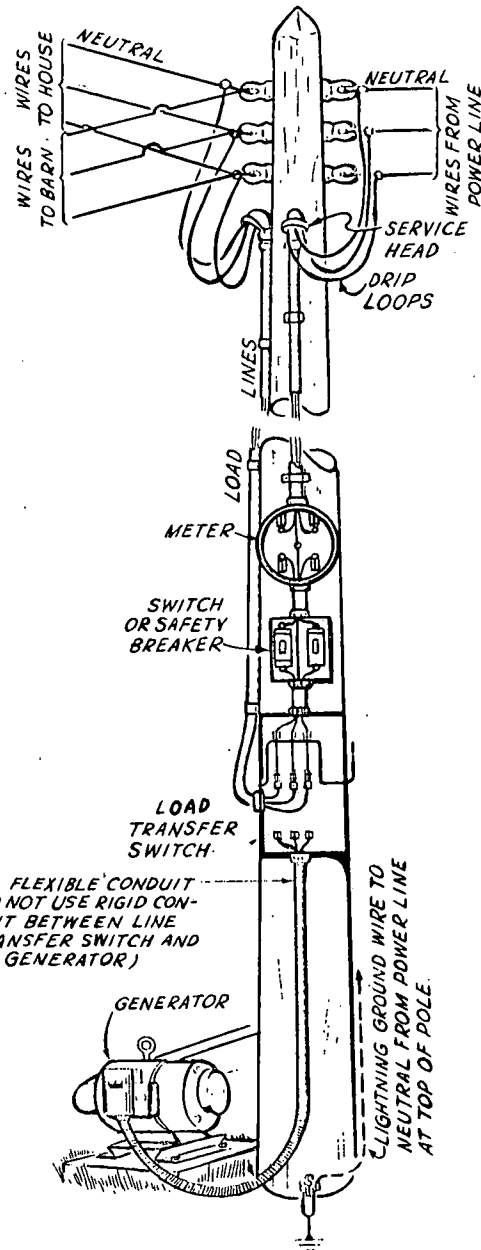
**REVERSING THE SCROLL.** - The generator is shipped from the factory with the blower scroll mounted for counterclockwise rotation. The direction of rotation is always taken while looking at the end opposite to the drive end. If a clockwise dir-



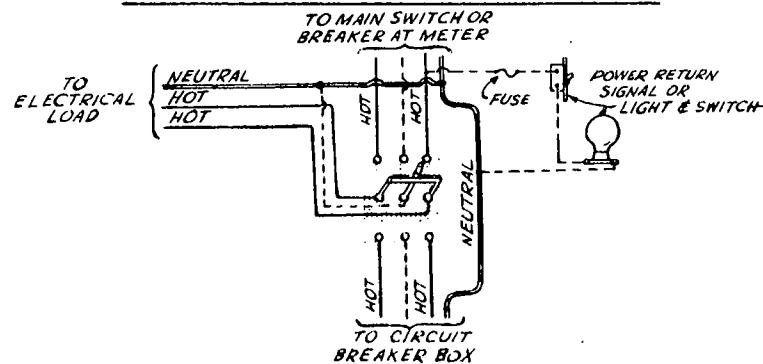
Use this diagram if neutral  
IS NOT switched.



Use this diagram if neutral  
IS switched.



#### LOAD TRANSFER SWITCH CONNECTIONS



#### TYPICAL FARM INSTALLATION

Fig. 4.

ection 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. CAUTION: The gear drive generator rotation must not be reversed.

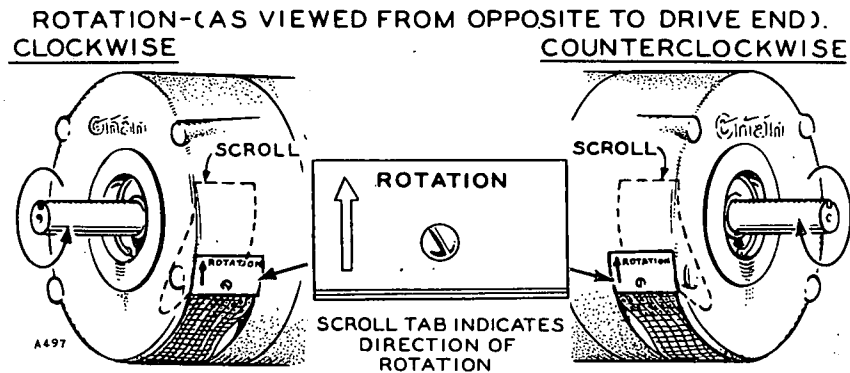


FIG. 5 - BLOWER SCROLL

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. Run the generator and check for a strong flow of exhausted air to give proper cooling.

**DRIVING THE GENERATOR.** - The generator should be driven at rated speed, 1800 rpm. In the average tractor installation, however, it is not possible to maintain the speed precisely at the desired value. The average tractor has a variable speed governor which allows considerable variation in the pulley speed. There are several factors affecting the speed regulation of a tractor which must be considered.

1. Tractor Governor Guaranteed Speed Regulation.
2. Effect on Governor Regulation of Ratio of Tractor Horsepower to Generator Kilowatt Capacity.
3. Tractor Engine Operating Speed.
4. Relation Between Tractor Brake Horsepower to Tractor Operating Speed.

Most farm tractors have the following operating data:

	Gasoline Engine Driven Tractor	Diesel Engine Driven Tractor
Maximum Rated Speed	1400 or 1500 RPM	1500 RPM
Variable Speed Governor Regulation	10%	8-1/2%
Variable Speed Governor Range	900-1500 RPM	425-1500 RPM

The maximum rated power of a tractor is always rated at the maximum rated speed. The power that the tractor will deliver at speeds less than the maximum rated speed is much less. For example the tractor delivers about half rated power at half rated speed.

The tractor manufacturer will rate the belt pulley at some specified speed while the engine is running at its maximum rated speed. Since the governor will regulate the tractor engine and the belt drive speed in direct proportion to the load, a generator which loads the tractor at only 50% of its maximum rated load will therefore cause the governor to regulate over only half of its specified range of regulation. For instance a 10% governor regulation would be 5% etc. The tractor variable speed governor regulates at a specified % over a specified range of speeds but its operation is most stable at the maximum rated speed.

To summarize: To obtain the best operation from your tractor, choose the correct pulley size so that your tractor engine is operating at its maximum rated speed when driving the tractor drive generator.

When a tractor drive is used, several other things must be considered:

1. Tractor Power. - The tractor must deliver at the belt pulley 2 HP. for every 1000 watts of generator output. For example, if a 5,000 watt generator is to be operated, the tractor must deliver at least 10 horsepower at the power take-off or belt drive pulley. If the tractor has a considerable reserve of power (for example 20 horsepower for a 5,000 watt generator) the voltage regulation will be much better.

2. Tractor Pulley Speed. - The tractor engine should be run at its maximum rated speed. DO NOT RUN AT A LOWER SPEED, thinking to save on fuel, or to use a pulley on hand. Generator performance will suffer. Governor action at the recommended speed is better than at lower speeds. For example, if the generator is being operated at near its capacity, and then a large part of the electrical load is suddenly removed, the natural tendency of the engine is to increase speed. If the engine speed is low to begin with, the governor will not act fast enough to prevent the engine from accelerating and causing the generator voltage to rise high enough to cause possible serious damage to any electrical equipment left connected. If the tractor is operating at its recommended speed (usually close to top speed), the engine can not increase greatly its speed when load is removed, and governor action is much better. Another factor enters into the question of speed control of the generator. If the generator speed is too low, the frequency of the current produced will also be low. If, for example, an 1800 rpm

generator is slowed to 1500 rpm, the frequency of the current produced will then be only 50 cycles, when it should be close to 60 cycles. The voltage will also be low, due to the lower speed. The combination of low voltage and frequency will almost certainly result in burned out windings of any motors in use.

3. Pulley Selection. - Because the tractor engine will be running at its maximum speed, the generator pulley size must be selected to give the proper generator speed. A 5" diameter flat belt pulley is supplied with the generator. Tractor pulley sizes range all the way from 6" to 25" and speed from 535 rpm to 2,000 rpm. It is obvious that no one pulley will be satisfactory for all installations. 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 tractor pulley by its SPEED in rpm (revolutions per minute).
- b. Divide the above result by 1800 rpm (nameplate speed of the generator).

Example: A tractor 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 tractor had 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).

4. Gear Drive Generator. - A 10 horsepower tumble rod can be used for the 4000 watt generator. Use a 20 horsepower tumble rod for the 7000 watt generator. Driving speed for the 4.12 to 1 ratio generator must be approximately 437 rpm, and for the 3.32 gear ratio generator must be approximately 542 rpm.

**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

**STARTING.** - When a power failure takes place, the generator should be ready to put in service and to take over the load. Set up the tractor and install the belt or the tumble rod properly. When the driving machine is properly set up, aligned, and anchored in place, throw the LOADTRANSFER SWITCH to disconnect the highline or other source of power. Throw the switch to the generator-connected position. Turn on the power return signal, if one has been installed. Start up the generator, making sure that the generator circuit breaker is at the OFF position. Check the generator voltage, as shown on the voltmeter. The voltage should be approximately 126 volts (120/240 volt generator) if no electrical load is connected, and the generator is running at 1800 RPM (nameplate rated speed).

**OPERATING.** - Throw the generator circuit breaker to the ON position. The various electrical loads can then be connected.

When motor loads are connected, connect one at a time, allowing each to reach running speed before connecting the next one. Motors require much more current for starting than when running at normal speed. If several motors are started at the same instant, the total electrical load may overload the generator, causing the circuit breaker to operate.

If the generator voltage is not at the proper point, it may be necessary to advance or retard the engine throttle control. In some cases, it may be necessary to change the engine throttle setting when large changes in the electrical load are made.

Keep the generator load within its nameplate rating. If the generator is seriously overloaded the circuit breaker will automatically trip, disconnecting the entire electrical load. Reduce the load before throwing the circuit breaker back to the ON position.

If the tractor engine has very little reserve power, considerable care must be exercised in operating the generator. For example, if a 20 or 25 horsepower (at the drive pulley) engine is used to drive a 10,000 watt generator the engine throttle will be wide open at full generator load. If most of the electrical load is suddenly removed, the governor can not act quickly and smoothly enough to prevent a surge of speed and high voltage. Any electrical equipment left connected may be damaged by the resulting high voltage.

When disconnecting large portions of the load, disconnect one piece of equipment at a time; or first disconnect that part of the load which is to be left on. Then remove the rest of the load. Wait until the generator voltage has stabilized and then reconnect that part of the load which is to be left on. The generator voltage will remain relatively stable, and the tractor engine speed will not change or surge enough to cause any damage if this procedure is followed.

**PULLEY ALIGNMENT.** - The tractor drive pulleys and the generator pulleys must be kept in alignment to prevent the belt from slipping off.

**BELT TENSION.** - The special self-adjusting base automatically maintains the belt tension under all conditions of load. It also compensates for any belt stretch which may occur.

**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.

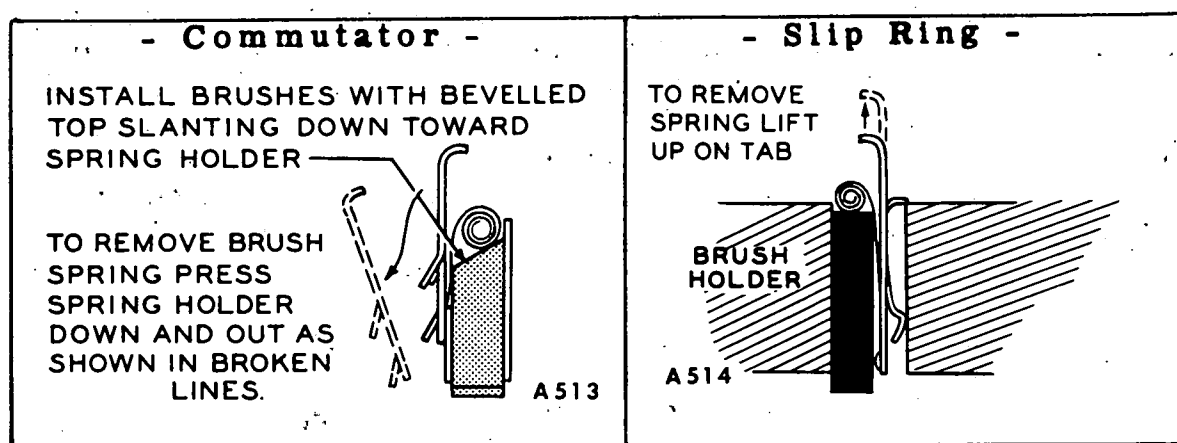


FIG. 6 - BRUSHES AND SPRINGS (Constant Pressure Type)

**GEAR BOX LUBRICATION.** - On these models, use only SAE #50 motor oil or SAE #90 Mineral Gear Oil. DO NOT USE LUBRICANTS COMMONLY KNOWN AS EXTREME PRESSURE LUBRICANTS, HYPOID LUBRICANTS, ETC.

Every six months, drain the gear box and refill with fresh oil of the grade recommended.

Maintain the oil level between changes. Remove the breather plug on top of the case and the oil level plug below the shaft from the face of the case and fill the case until the oil just begins to flow from the oil level plug hole. Gear box holds 1/2 pint U.S. Measure. Replace plugs.

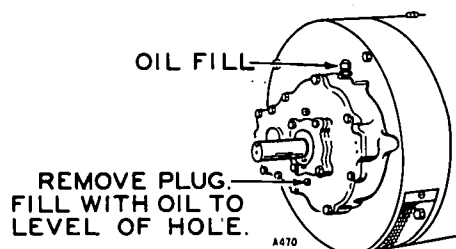


FIG. 7 - GEAR BOX



**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 commutator 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.

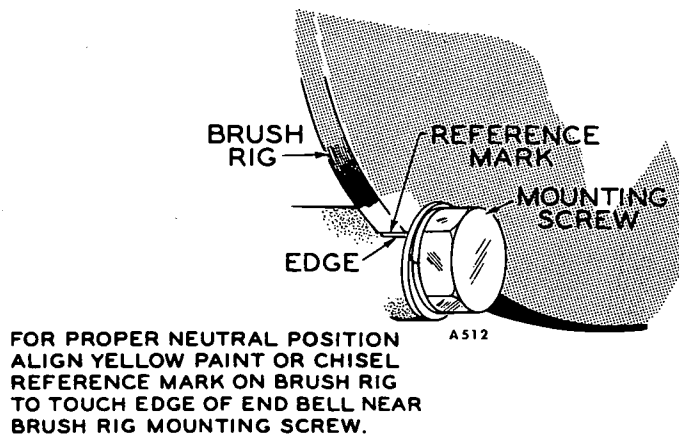
The surface of the commutator may become worn down level with the mica insulation between the bars. If the commutator is worn smooth, the mica between the bars may be cut down to 1/32" below the surface without removing the rotor. Remove the end bell only, carefully tagging or otherwise marking all leads 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. 8 - BRUSH RIG POSITION**

The position of the brush rig assembly in the generator end bell is important. The correct setting of the brush rig was determined at the factory and is identified by a chisel mark on the outer edge of the brush rig, which mark must align with the painted edge of one of the brush rig mounting bosses inside the end bell.

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.

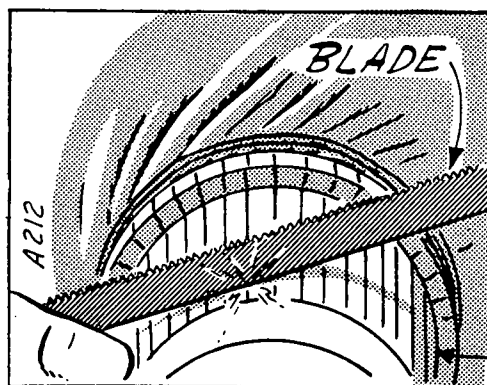


FIG. 9 - OPEN CIRCUIT TEST

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.

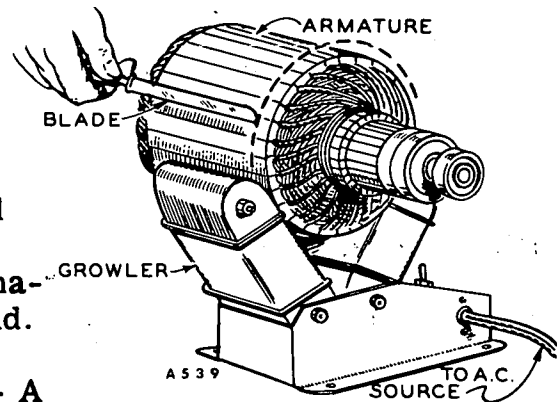


FIG. 10 - SHORT CIRCUIT TEST

**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 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. (Gear drive generator must not be reversed.)	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.





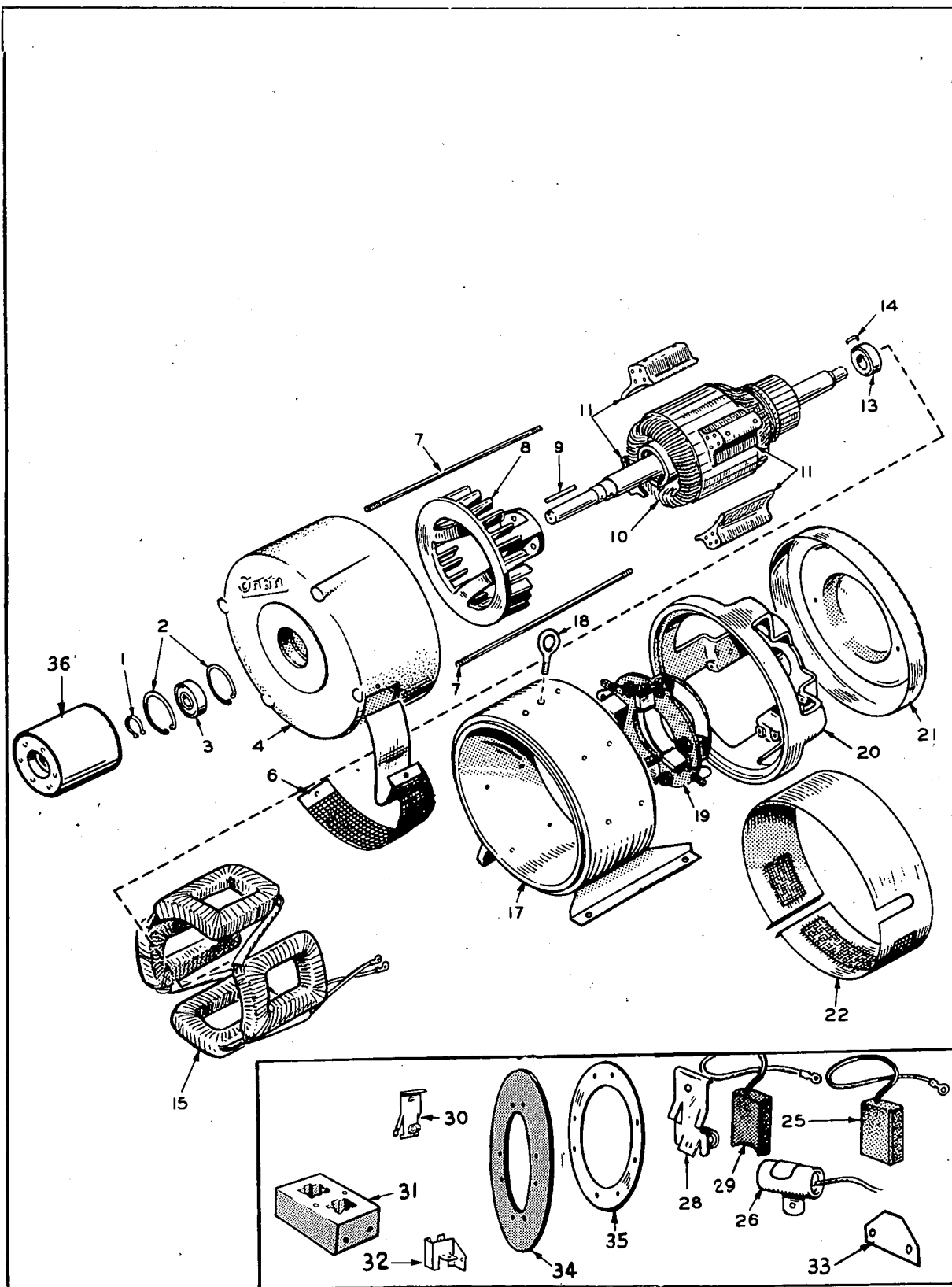


FIG. 11 - GENERATOR PARTS

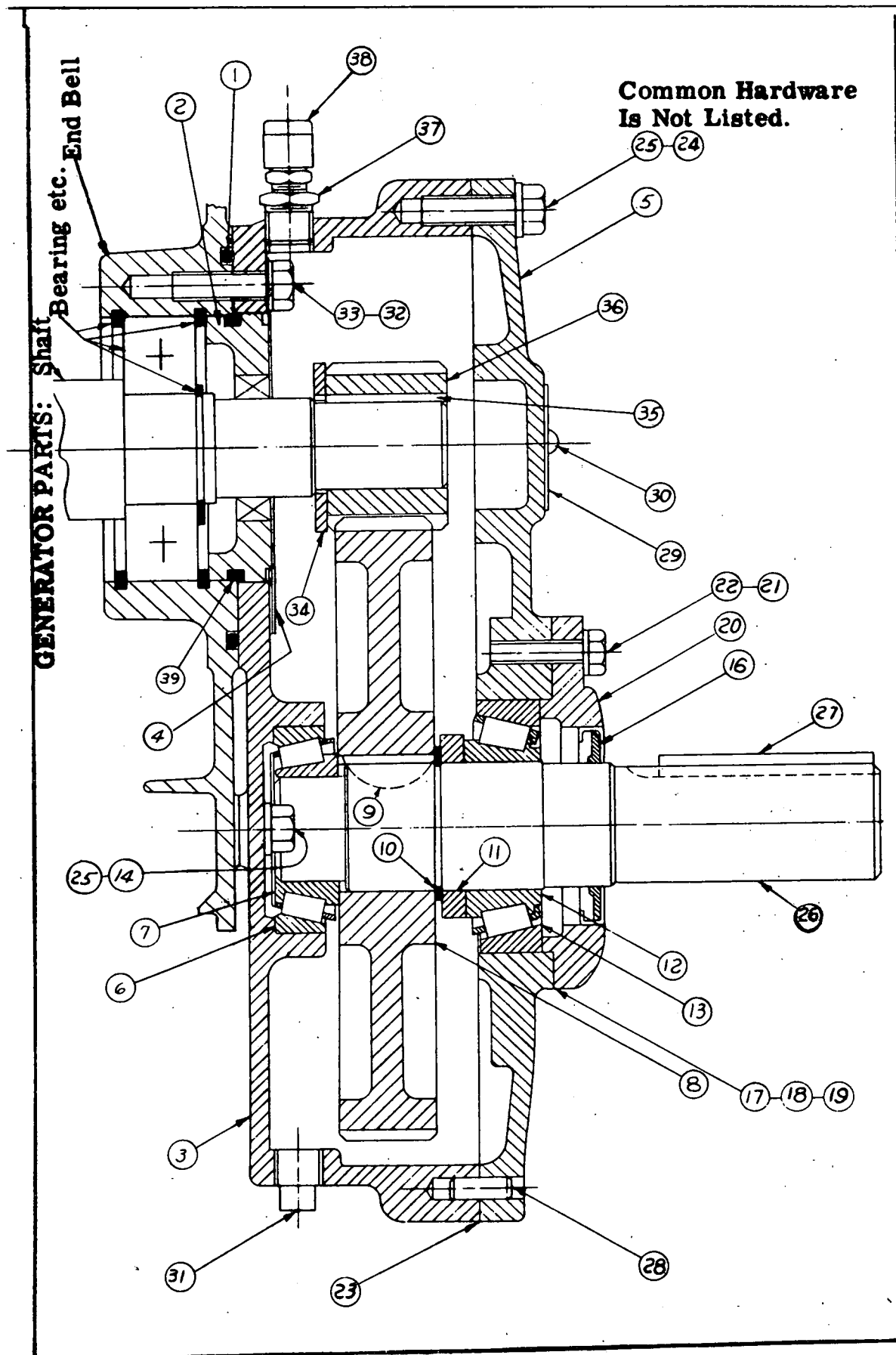


FIG. 12 - REDUCTION GEAR BOX

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.

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

## FIG. 11 - GENERATOR PARTS

NOTE: For explanation of "Parts Key No." refer to "identification table" near the front of this book.

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, Armature - Drive End.
4			Bell, End - Drive End -
	211E127	1	For models with Parts Key Nos. 2 and 4 (Belt Drive).
	211E128	1	For models with Parts Key Nos. 1 and 3 (Gear Drive).
6	234A77	1	Scroll and Screen, Blower.
7			Stud, Generator Through -
	520A161	2	For models with Parts Key Nos. 3 and 4 - 5/16 x 14-1/4.
	520A340	2	For models with Parts Key Nos. 1 and 2 - 5/16 x 10-3/4.
8	205C60	1	Blower, Air.
9	515A91	1	Key, Armature Shaft Drive - <b>Parts Key #2&amp;4.</b>
10			Armature Wound Assembly -
	201A944	1	For models with Parts Key No. 1.
	201A943	1	For models with Parts Key No. 2.
	201A941	1	For models with Parts Key No. 3.
	201A939	1	For models with Parts Key No. 4.
11			Shoe, Pole - Field -
	221A91	4	For models with Parts Key Nos. 1 and 2.
	221A90	4	For models with Parts Key Nos. 3 and 4.
13	510A47	1	Bearing, Armature - Brush Rig End.
14	232A596	1	Clip, Bearing.
15			Coil Set, Field -
	222A1460	1	For models with Parts Key No. 1.
	222A1156	1	For models with Parts Key No. 2.
	222A1529	1	For models with Parts Key No. 3.
	222A1118	1	For models with Parts Key No. 4.

REF. NO.	PART NO.	QTY.	DESCRIPTION
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## FIG. 11 - GENERATOR PARTS (Cont.)

17			Frame, Generator -
	210C1642	1	For models with Parts Key Nos. 1 and 2.
	210C1645	1	For models with Parts Key Nos. 3 and 4.
18	410P228	1	Bolt, Eye - Lifting - 3/8-16.
19	212C234	1	Rig Assembly, Brush - Includes Brushes and Springs.
20	211D98	1	Bell, End - Brush Rig End.
21	234C47	1	Cover, End Bell.
22	234C66	1	Band, End Bell.
25	214A61	4	Brush, Commutator (DC).
26	312A17	1	Condenser - .5 Mfd. - DC Brush.
26	312A58	4	Condenser - .1 Mfd. - AC Brush.
28	212A1105	4	Spring, Commutator Brush.
29	214A56	4	Brush, Collector Ring (Slip Ring, AC).
30	212A1123	4	Spring, Collector Ring Brush.
31	212B1135	2	Holder, AC Brush.
32	212A1151	4	Guide, DC Brush.
33	212A1132	4	Backplate, DC Brush Guide.
34	213B121	1	Ring, Insulator - Brush Guide.
35	213A122	1	Ring, AC Brush Holder.
36	512P22	1	Pulley, Flat Belt - 5" Dia. x 3-1/2" Face x 1-1/8" Bore - For models with Parts Key No. 2.
36	512P23	1	Pulley, Flat Belt-5" Dia. x 5-1/2" Face x 1-1/8" Bore - For models with Parts Key No. 4.
	508-1	1	Grommet - 1-1/16 Hole.

## FIG. 12 - REDUCTION GEAR BOX (For Models with Parts Key Nos. 1 and 3)

			Box Assembly, Gear Drive - Complete.
	190C207	1	For "41" Models - 4.12 to 1 ratio.
	190C226	1	For "61" Models - 3.32 to 1 ratio.
1	509P77	1	"O" Ring.
2	509A12	1	Seal, Oil.
2A	190B217	1	Adapter, Gear Box.
3 & 5	190C209	1	Housing and Cover, Gear Reduction - Matched Set - Includes 516A12 Dowel Pin.
4	190C218	1	Plate, Gear Box Adapter.

REF. NO.	PART NO.	QTY.	DESCRIPTION
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## FIG. 12 - GEAR DRIVE BOX - Parts Key Nos. 1 &amp; 3.

6	510-22	1	Cup, Roller Bearing.
7	510-21	1	Cone, Roller Bearing.
8			Gear, Driven
	190B190	1	For "41" Models - 4.12 to 1 ratio.
	190B224	1	For "61" Models - 3.32 to 1 ratio.
9	515-141	1	Key.
10	518-13	1	Ring, Retainer.
11	190A202	1	Spacer, Gear.
12	510-23	1	Cone, Roller Bearing.
13	510-24	1	Cup, Roller Bearing.
16	509-16	1	Seal, Oil.
17	190-17	1	Shim - .009 - Select shim here to give .001 to .004 End Play.
18	190-18	1	Shim - .012 - Select shim here to give .001 to .004 End Play.
19	190-19	1	Shim - .016 - Select shim here to give .001 to .004 End Play.
20	190B16	1	Plate, Bearing Retainer.
22	526-63	4	Washer, Flat - Copper - 1/4".
23	190B21	1	Gasket, Gear Housing Cover.
25	526-65	10	Washer, Flat - Copper - 5/16".
26	190A192	1	Shaft, Gear Reduction.
27	515A103	1	Key.
31	505-54	3	Plug, Pipe - 1/4" - Sq. Head.
34	190A195	1	Washer, Pinion Gear.
35	515A142	1	Key.
36			Gear, Pinion
	190A191		For "41" Models - 4.12 to 1 ratio.
	190A225		For "61" Models - 3.32 to 1 ratio.
37	505-7	1	Bushing, Pipe Reducer - 1/4 x 1/8.
38	518P172	1	Fitting, Vent.
39	509P62	1	"O" Ring.

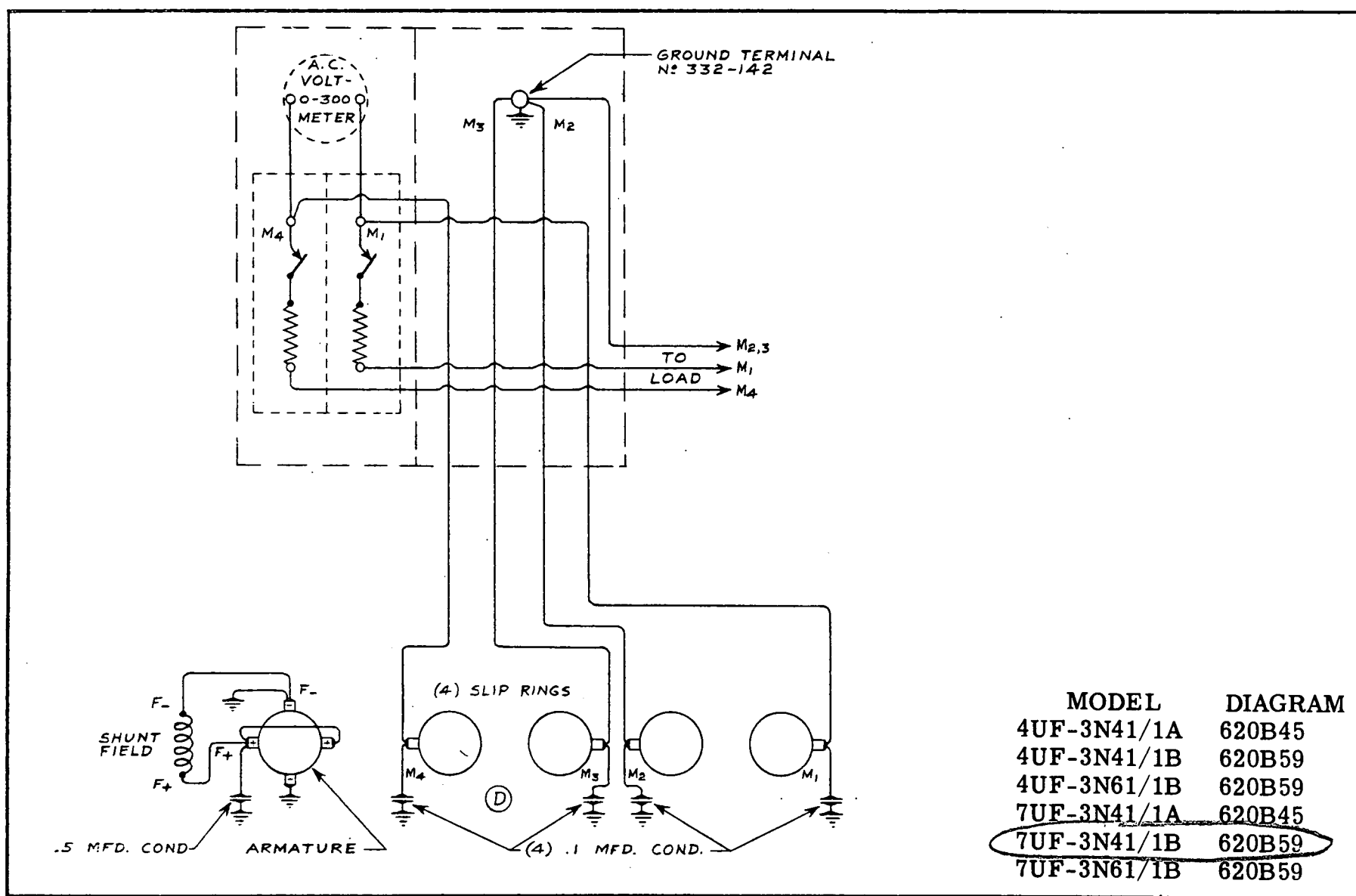
MOUNTING BASE GROUP (For Models with Parts Key Nos. 2 & 4)  
(Not Illustrated)

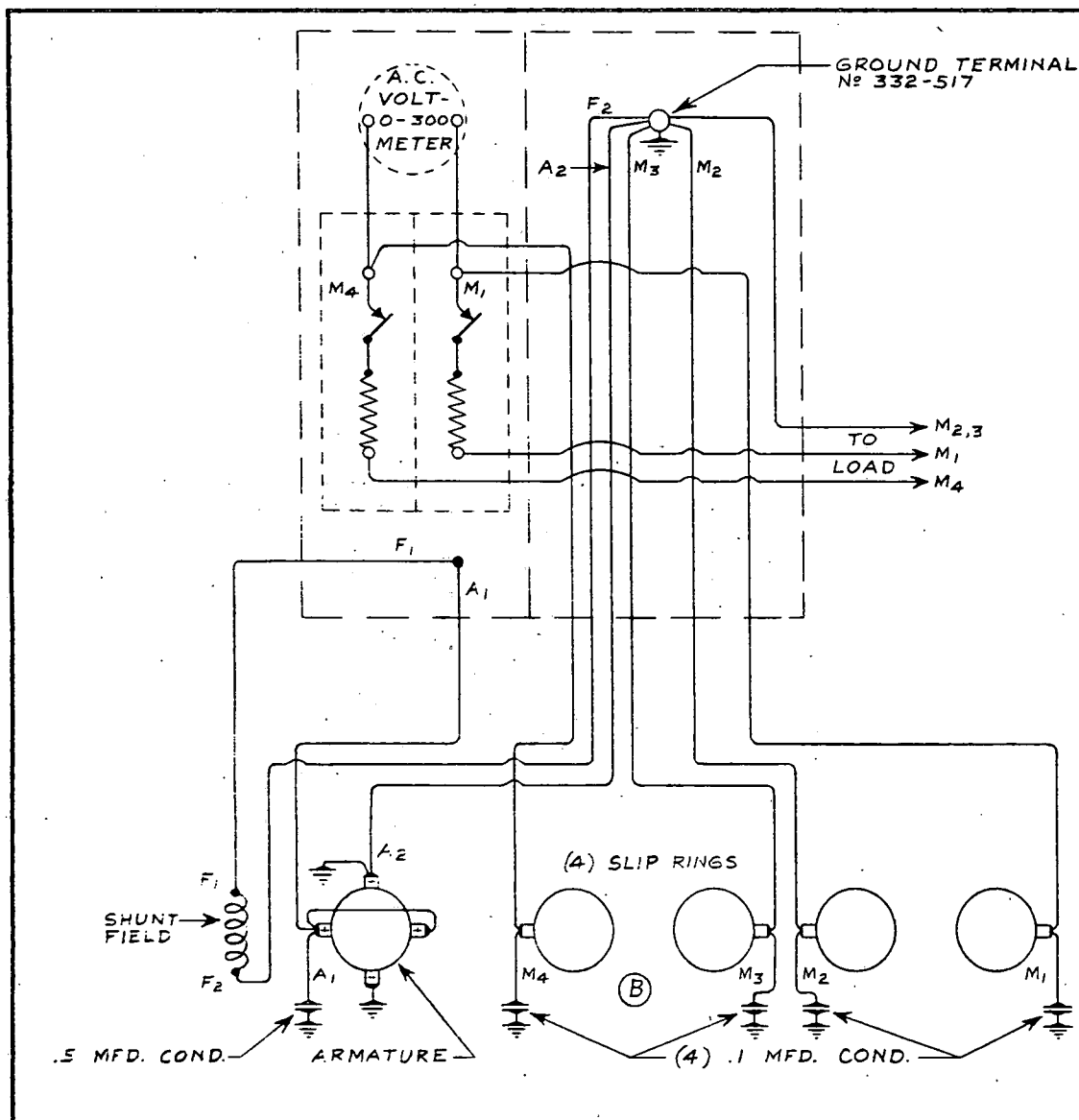
401A53	1	Base, Mounting - Complete.
401A49	1	Spring, Extension.
401A50	2	Bracket, Spring.
401A51	2	Bracket, Generator Mounting Slide - (4 holes).
401B52	2	Rail, Generator Mounting Slide Guide - (2holes).
526A161	2	Spacer, Flatwasher.

REF. NO.	PART NO.	QTY.	DESCRIPTION
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## CONTROL GROUP (Not Illustrated)

			Box, Control -
301C1538	1		Spec Letter A
301C1749	1		Begin Spec Letter B
301C1539	1		Cover, Control Box
301B1540	1		Bracket, Mounting - Upper
301B1541	1		Bracket, Mounting - Lower
			Breaker, Circuit
320B18	2		20 Amp, Parts Key Nos. 1 & 2.
320B20	2		35 Amp, Parts Key Nos. 3 & 4.
			Voltmeter - 0-300 volt
302-248	1		Spec Letter A
302-314	1		Begin Spec Letter B
			Terminal, Ground
332-142	1		Parts Key Nos. 1 & 3.
332-517	1		Parts Key Nos. 2 & 4.



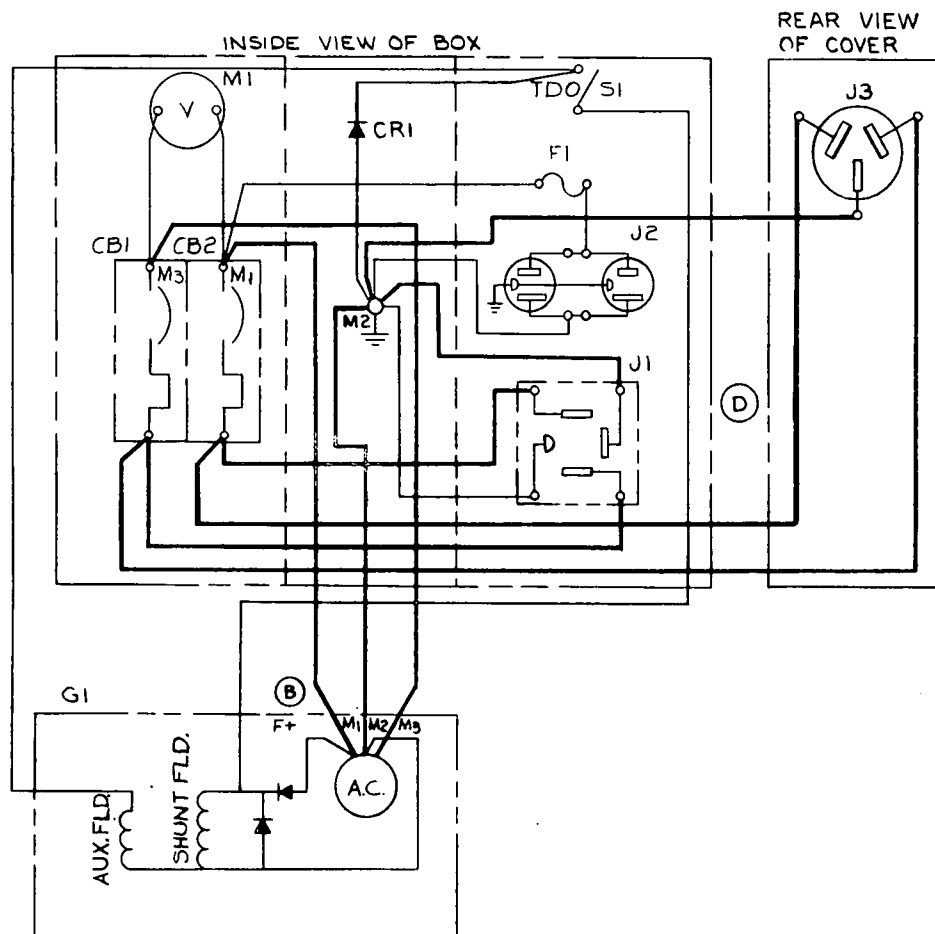


DIRECTIONS FOR  
ROTATION REVERSAL:  
GENERATOR IS CONNECTED AT  
FACTORY FOR COUNTER-CLOCKWISE  
ROTATION AS SHOWN IN DIAGRAM.  
FOR CLOCKWISE ROTATION:  
REMOVE F<sub>2</sub> FROM GROUND STUD.  
CONNECT F<sub>1</sub> TO GROUND STUD.  
CONNECT F<sub>2</sub> TO A<sub>1</sub>.  
(ALSO CHANGE POSITION OF  
SCROLL IN END BELL.)  
NOTE:  
DIRECTION OF ROTATION IS  
TAKEN WHEN FACING END  
OPPOSITE DRIVE SHAFT.

MODEL	DIAGRAM
4UF-3N42/1A	620B50
4UF-3N42/1B	620B61
7UF-3N42/1A	620B50
7UF-3N42/1B	620B61



G20B95



G20B95

PARTS LIST			
REF.	DES.	PART NO.	QTY
CB1/CB2		320P148	2
			CIRCUIT BREAKER - 70 AMP
G1			1
			GENERATOR
M1		302P314	1
			VOLTMETER - AC, 0-300
S1		308A252	1
			SWITCH - TIME 5 MIN
F1		321-127	1
			FUSE - 15 AMP
		321P104	1
			HOLDER - FUSE
J1		323P635	1
			RECEPTACLE - OUTPUT
J2		323-184	1
			RECEPTACLE - DUPLEX, 120V.
CRI		305P240	1
			RECTIFIER - 1 AMP., 400 PIV
J3		323-207	1
			RECEPTACLE - 50 AMP
		301D2892	1
			CONTROL BOX
		301C2893	1
			CONTROL BOX COVER
		301B1540	1
			MOUNTING BRACKET (UPPER)
		301B1541	1
			MOUNTING BRACKET (LOWER)
		B15-190	4
			SCREW - #8-32x3/8 LG. R.H.S.T.
		50B-1	1
			GROMMET
		99A413	1
			NAMEPLATE - CSA
		98B1993	1
			SILKSCREEN

F	ADDED	99A413	6/17-11-67
E	ADDED	323-207	6/17-11-67
D	ROTATED	J1 180°	5/16-30-67
D	ROTATED	J1 180°	6/16-26-67
C	ADDED	CRI	6/15-12-67
B	REVERSED 1 DIODE IN GEN.		6/15-12-67
A	WAS	323P625	6/14-4-67

LET.	REVISION	CHK	DATE
DIVISION OF STUDEBAKER CORPORATION			
Minneapolis, Minnesota			
MODEL NO.	DATE	BY	CHK
15UF-3N104/1A	3-15-67	FESTE	GFT. WJB
NAME WIRING DIAGRAM			
GEN. CONTROL			
DWG. NO.	G20B95		

# For GENUINE PARTS AND SERVICE see your ONAN PARTS AND SERVICE CENTER.

In most major cities they are listed  
in the classified section of the tele-  
phone directory.

See Generators—Electric

.....



Write the factory for our 7115  
directory listing current Onan  
Authorized World Wide Parts  
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Exchanged, New And Rebuilt Alternators  
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Missouri Auto Parts 1711 Wash Av N  
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Walt Electric Co 110 E Lake

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B & N Serv Inc 1585 Wash Av N 521-3990  
Berl's 66 Serv 3752 Hawthorn Av 724-9975

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Quality Workmanship over 25 Yrs

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Plants, Magnet Chargers, Separate Generators  
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Geological Drilling Co 4509 W 113 St 881-4999

Hickox Eugene A & Associates  
Ground-Water & Geophysical Surveys

1415 E Hwy Blvd Weymouth 473-4324

Rasca Engineering Inc  
Natural Resource Development—Aerial

Telephotographs  
Lakota 286-2161

Kindgren & Lehmann Inc  
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Donald W. Lindgren Res 473-6786

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World Fruit Market 21 S Y St 335-0513

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thoughtfulness in having an  
extension phone in their  
room.

