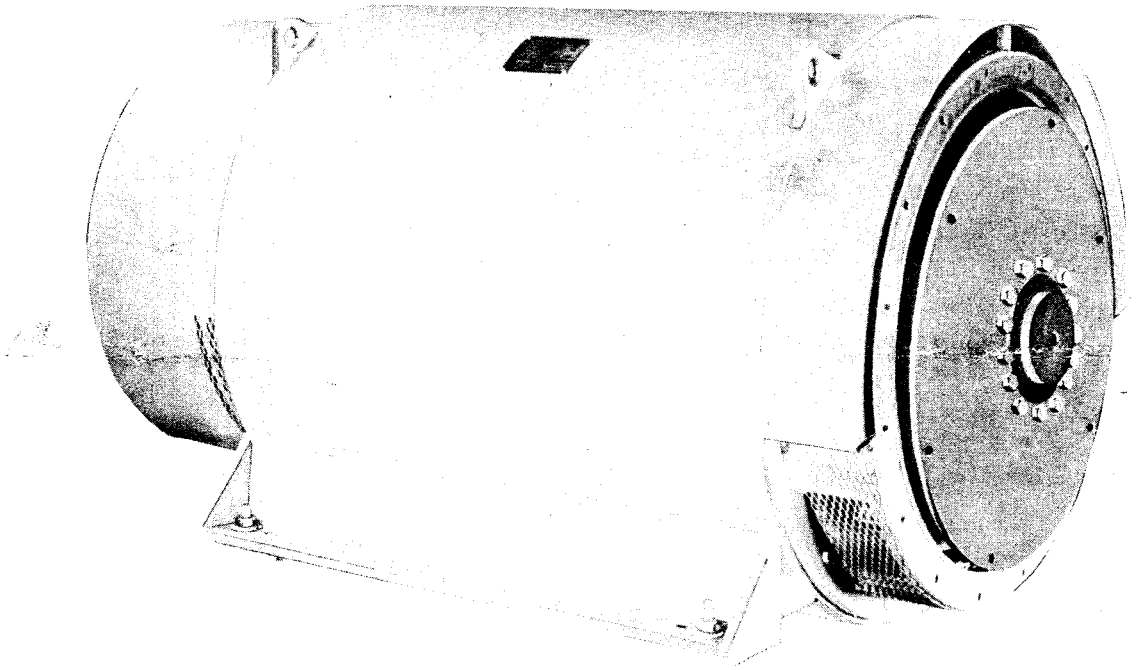
INSTRUCTIONS FOR ASSEMBLING KATO ENGINEERING COMPANY BRUSHLESS GENERATORS TO ENGINES

PUBLICATIONS NO. INS-3-70
PUBLICATIONS DATE—MARCH 1970
Supersedes INS-18-68 and INS-4-68B



NOTE: KEEP THIS INSTRUCTION WITH GENERATOR SERIAL NUMBER 70613-1

KATO ENGINEERING COMPANY
1415 First Avenue, Mankato, Minnesota 56001
Phone: 507-387-4011

CONTENTS

CHAPTER 1 RECEIVING INSPECTION AND SITE SELECTION

1.1 RECEIVING INSPECTION

1.1.1 The generator was carefully packed and crated for shipment, and can withstand most shocks incurred during transit. Before accepting shipment from the transportation company, examine the crating carefully to determine if any damage has occured during shipment. Unpack the unit as described in paragraph 1.2 and then carefully examine the sheet metal frame and exciter cover for signs of damage. Remove the exciter cover and examine the inside of the generator for signs of damage to wiring and components. Inspect for loosely mounted components and the presence of moisture. Inspect to make certain foreign material such as crating nails, loose bolts or packing material which may have fallen into the machine during unpacking are removed. If damage is noted, determine the extent of damage and immediately notify the transportation company claims office and KATO Engineering Company. Be sure to give complete and accurate details when reporting damage.

1.1.2 If the generator is to be placed in storage repackage and crate the generator set. Recommended procedures for storage are contained in paragraph 1.2..

1.2 UNPACKING AND STORAGE

1.2.1 If the generator is received during cold weather, let the crated unit slowly warm to room temperature before removing the protective crating and packing material. This precaution will minimize the condensation of moisture on coil surfaces, eliminating the possibilities of wet windings and insulating materials which could cause early malfunctions of the generator.

1.2.2 Unpack the generator with care to avoid damage to the unit. Move the generator to the mounting location by attaching an overhead hoist to the eyebolts installed in the generator frame. Determine that the hoist, when used is of sufficient strength to adequately support the weight of the generator. Hoist and hoist cables should have a rating of not less than 1½ times the weight of the generator

CAUTION

ALWAYS MAKE CERTAIN EXTREME CARE IS TAKEN WHEN MOVING THE GENERATOR TO PREVENT ITS STRIKING OTHER OBJECTS OR PERSONNEL. NEVER APPLY A LIFTING FORCE TO STRUCTURAL POINTS OTHER THAN THOSE PROVIDED FOR THAT PURPOSE.

1.2.3 If the generator is not to be installed in its operating location as soon as received, it should be stored in a clean dry area, not subject to sudden temperature or humidity changes. If possible, storage should be in an ambient temperature of approximately normal room temperature. Units which cannot be stored in a temperature and humidity controlled area and which are to be stored for a period of longer than six months should be prepared for storage as follows:

1. Place dessicant bags inside the exciter cover and vacuum seal the unit in a covering of polyethelene.

2. Adequately tag the unit to ensure that desiccant bags are removed before generator is placed in operation.

1.3 LOCATION

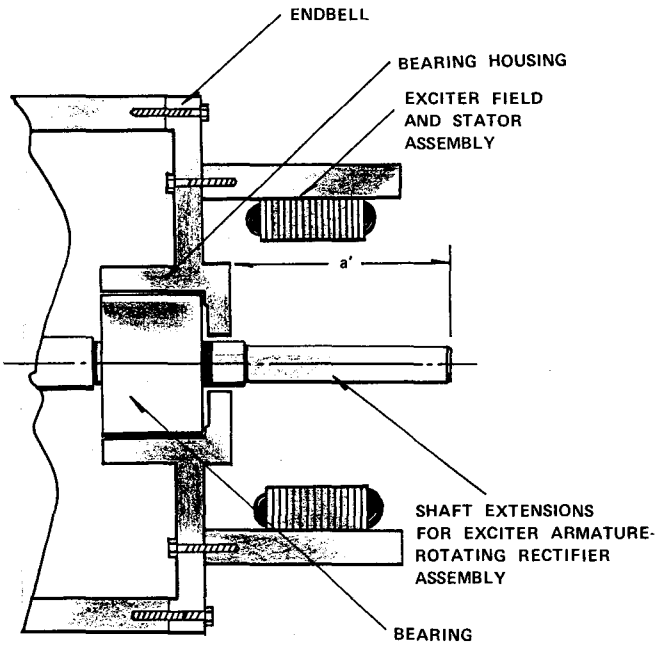
1.3.1 The brushless generator can be installed in any well ventilated area which affords sufficient accessibility for operation and maintenance of the unit and allows a sufficient unobstructed flow of coolant air. Avoid locations which subject the generator to excessive moisture, dust, steam or the fumes from acids, alkalines or other corrosive chemicals. If such exposure cannot be avoided, establish a rigid periodic preventive maintenance schedule. The adverse effect of excessive moisture can usually be eliminated or at least greatly lessened by the use of space or strip heaters. If the generator windings have become wet, check winding insulating resistance and if low, dry windings before operating generator. Refer to generator operating manual.

1.3.2 The foundation or supports which mount the generator and prime mover must be rigid, level and of ample size and strength to support the weight of the generator and prime mover. Although a reinforced concrete foundation usually makes the best foundation for heavy machinery, the generator and prime mover may be placed on any concrete, steel or other structural material which will adequately support the weight of the unit. Bearing loads of structural materials can be obtained by referring to engineering handbooks.

1.3.3 When vibration isolators are used, bolt engine and generator onto base and use vibration isolators between base and foundation.

CHAPTER 2 PRE-ASSEMBLY INSTRUCTIONS

THIS INSTRUCTION CONTAINS CRITICAL DIMENSIONS WHICH MUST BE MAINTAINED AND PROCEDURES WHICH MUST BE FOLLOWED WHEN ASSEMBLING GENERATOR. BEARING ENDCLEARANCE AND ROTOR ALIGNMENT MUST BE MAINTAINED.



Distance from bearing housing to generator shaft [a'] was * inch with generator bearing endclearance set at 1/8 inch.

"Y" dimension when measured at factory with generator bearing endclearance set at 1/8 inch was 2 7/16 inches.

NOTE: [a'] is measured from outside of bearing housing to the end of the generator shaft.

* CHECK BRUSHES

FIGURE 2-1 CUTAWAY VIEW, EXCITER AND GENERATOR BEARING HOUSING SHOWN WITH EXCITER ARMATURE REMOVED

2.1 CHECKING BEARING ENDCLEARANCE

2.1.1 The generator rotor was set at the factory with a bearing end clearance of 1/8 inch. Bearing end clearance should not be less than 1/16 inch. If engine crankshaft endplay is such that due to lateral movement of the crankshaft less than the specified minumum bearing end clearance could result, the generator bearing end clearance may be increased to 3/16 inch, providing satisfactory alignment of generator field and armature is maintained.

2.1.2 The generator rotor was set for 1/8 inch bearing endclearance at the factory. After adjusting endclearance, the distance from the outside of the bearing housing of the endbell to the end of the generator shaft as shown in figure 2-1 was measured. Before assembling generator to engine, check endclearance and if necessary, reset rotor as follows:

1. Remove exciter cover.

NOTE: If exciter armature, rotating rectifier assembly is installed, disconnect generator field leads (+) and (-) at rotating rectifier heat sinks, remove assembly retaining bolt and washer and pull exciter armature assembly off generator shaft.

2. Use an accurate machinists scale and measure from end of generator shaft to bearing housing section of endbell (See figure 2-1). Distance should be as indicated in dimension a'. If measured distance does not coincide with dimensions recorded at factory, rotor has probably moved laterally during shipment. Move rotor to position where a' equals dimension recorded at factory.

3. Consult engine manual for engine crankshaft endplay. If engine endplay exceeds 1/16 inch, the generator must be moved toward the engine as total generator bearing endplay must be the total engine crankshaft endplay + 1/16 inch. In order to accurately check movement of the generator rotor, check measurement from outside of bearing well on endbell to the end of the generator shaft (procedure listed in step 2 above), this was 1/8 inch endclearance. Then using the same points of measurement pull rotor toward drive end the distance necessary to ensure minimum generator bearing endclearance of: Total engine crankshaft endclearance + 1/16 inch.

   Then record the distance from bearing housing to end of generator shaft (dimensions a', figure 1-1).

4. Following adjustment of bearing endclearance, visually inspect to make certain clearance exists between rotating and stationary parts of generators. With drive end of generator shaft blocked and parallel with generator frame, temporarily slide exciter armature rotating rectifier assembly onto generator shaft. Visually inspect alignment of exciter field with exciter armature. Excessive mechanical alignment will result in magnetic misalignment which could result in low output voltage. Following inspection, remove exciter armature rotating rectifier assembly. DO NOT re-install exciter armature-rotating rectifier assembly until after generator is "bolted" to engine.

2.2 CHECKING ENGINE FLYWHEEL, FLYWHEEL HOUSING, GENERATOR DRIVE DISKS AND ADAPTOR

2.2.1 After checking generator bearing endclearance but before assembling generator to engine make the following "checks".

NOTE: Clean all accumulations of dirt or grease from mounting surfaces before checking dimensions or assembling the generator to engine.

1. Remove screen surrounding generator cooling fan.

2. Check the distance from the engine bell housing mounting surface and the drive disks recess (dimension C, figure 2-2) and check the distance from the generator endring mounting surface to the outside surface of the drive disks (dimension "Y", figure 2-2). Dimension "Y" should equal dimension "C".

NOTE: The generator rotor shaft should be parallel with the generator frame when checking dimension "Y". See figure 2-3.

   If "C" is more than "Y" install additional spacers between the generator drive hub and the drive disks.

NOTE: Additional spacer is normally supplied with generator.

3. Check the diameter of the drive disks and the flywheel drive disks recess, dimensions S and S' figure 2-2. If the drive disks are over or under size return them to the factory. Do not attempt to grind the drive disks.

4. Check to make certain drive disk and flywheel drive disk recess bolt hole centers are equal, dimensions B and B", figure 2-2. Return drive disks and give flywheel data if disks do not "match" flywheel dimensions. Never attempt to drill out drive disks holes.

5. With indicator base mounted on the flywheel and the indicator finger on the flywheel housing as shown in figure 2-4, turn the engine through one revolution. Maximum total indicator reading should not exceed .003 inch per foot diameter of flywheel housing. See Table A. If runout exceeds limits, contact KATO Engineering Company and engine manufacturer for recommendations. State flywheel housing size and runout recorded.

6. With indicator base mounted on the flywheel housing and the indicator finger on the drive disk recess as shown in figure 2-5, turn the engine through one revolution and check runout. Maximum total indicator reading should not exceed .003 inch per each foot diameter of flywheel. Refer to Table A. If runout exceeds limits, contact KATO Engineering Company and engine manufacturer for recommendations. State flywheel size and runout recorded.

2.2.2 When dimensions are satisfactory, assembly the generator to the engine as described in Chapter 3.

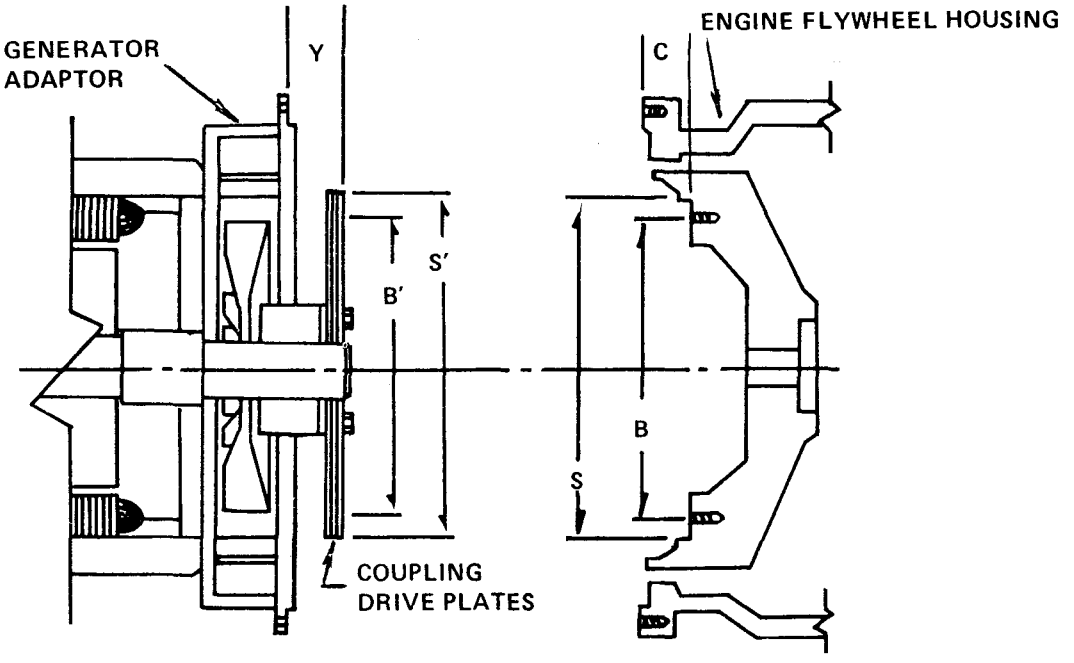


FIGURE 2-2 ENGINE AND GENERATOR COUPLING DIMENSIONS

NOTE:
Measure at two places approximately 180° apart. Point A & Point B. Add the two dimensions and divide by two. Measure from machined surface with bolt holes to the inside edge of straight edge.

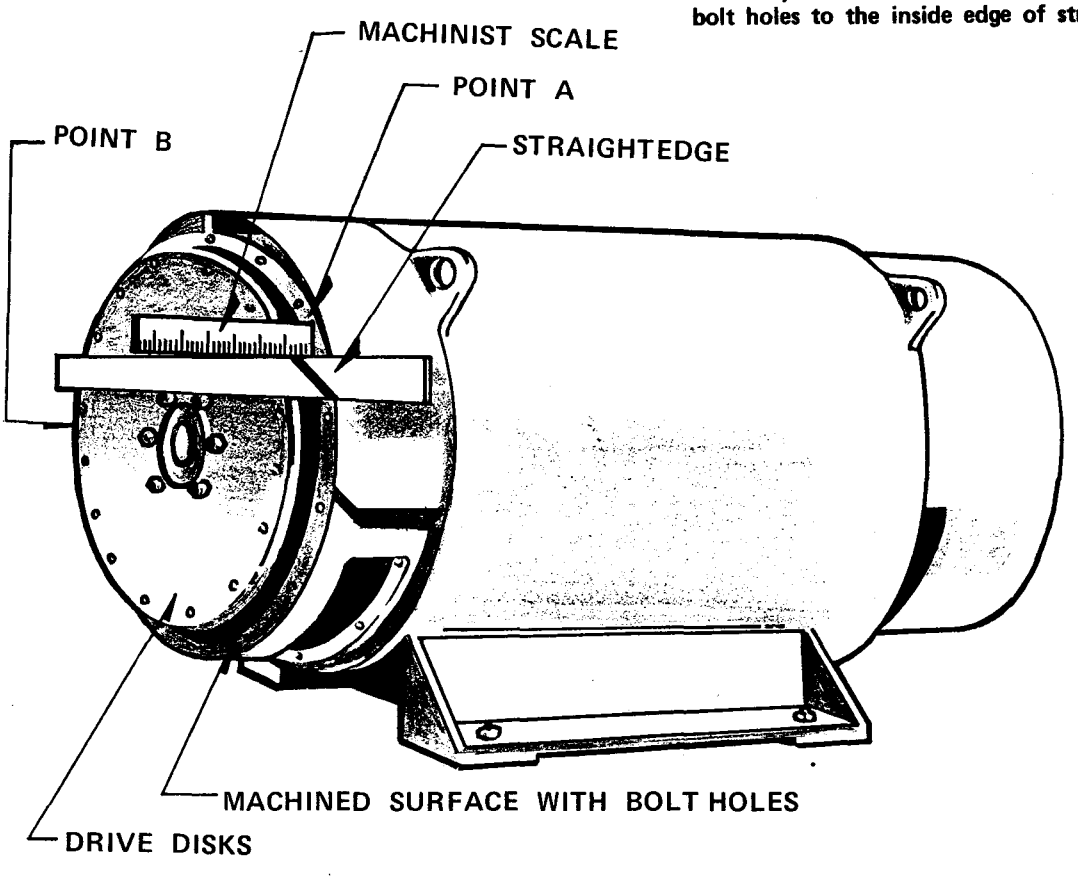


FIGURE 2-3 MEASURING DISTANCE FROM GENERATOR ADAPTER TO DRIVE DISKS, DIMENSION "Y"

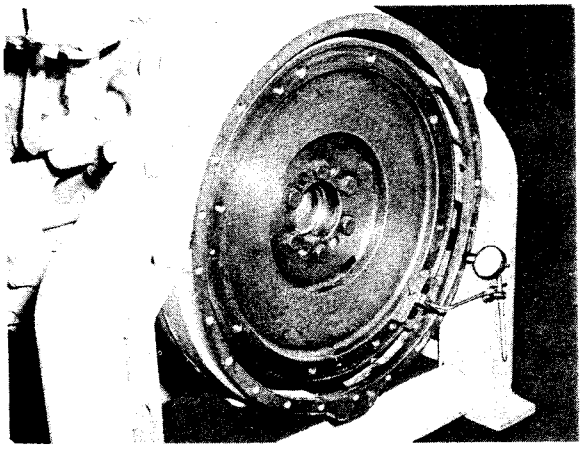


FIGURE 2-4 CHECKING ENGINE FLYWHEEL HOUSING RUNOUT

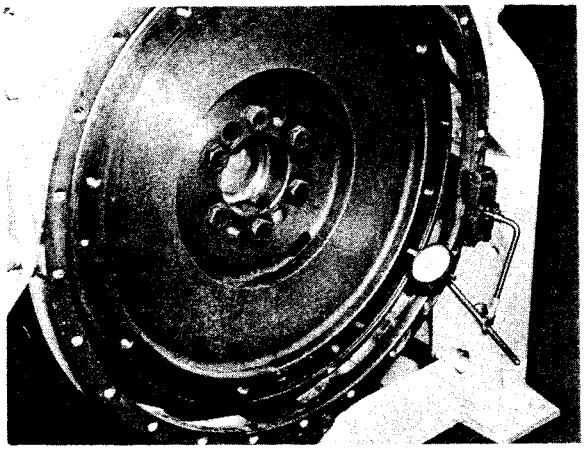


FIGURE 2-5 CHECKING ENGINE FLYWHEEL RUNOUT

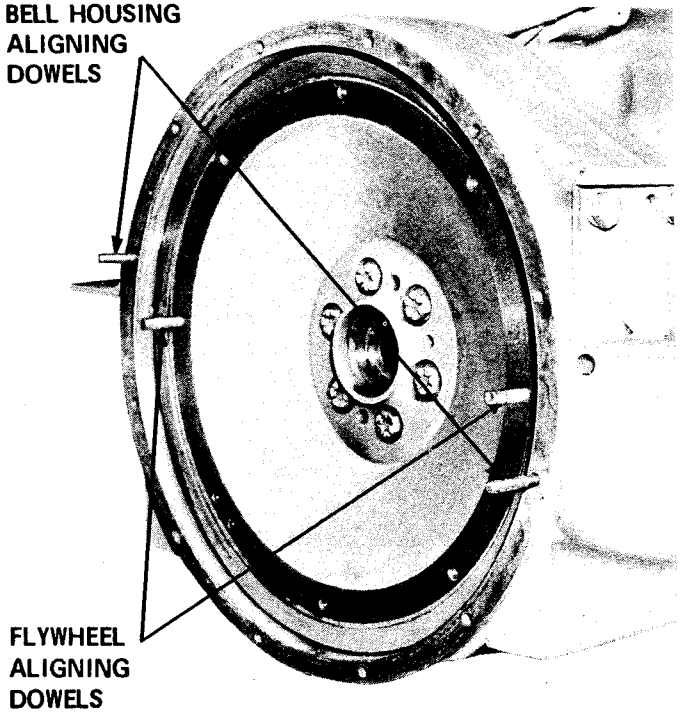


FIGURE 3-1 ALIGNING GENERATOR TO ENGINE WITH PILOT BOLTS

TABLE A

ALLOWABLE FLYWHEEL AND DRIVE DISK RECESS RUNOUT

FLYWHEEL DRIVE DISK RECESS		
Pilot Diameter	Nominal Clutch Dia.	Allowable Run Out (Total Indicator Reading)
6½	8.500	.002
7½	9.500	.002
8	10.375	.002
10	12.375	.003
11½	13.375	.003
14	18.375	.004
16	20.375	.005
18	22.500	.005
21	26.500	.006
24	28.875	.007

FLYWHEEL HOUSING		
SAE Housing Number	Housing Inside Dia.	Allowable Run Out (Total Indicator Reading)
6	10.500	.002
5	12.375	.003
4	14.250	.003
3	16.125	.004
2	17.625	.004
1	20.125	.005
½	23.000	.005
0	25.500	.006
00	31.000	.007

CHAPTER 3 ASSEMBLY INSTRUCTIONS

3.1 ASSEMBLING GENERATOR TO ENGINE

3.1.1 When checks described in previous paragraphs have been completed and dimensions are satisfactory, assemble generator to engine as follows:

NOTE: The generator is connected to the engine by inserting bolts from the generator side and tightening them into the threaded holes in the engine flywheel and flywheel housing. Bolts must be of sufficient length to assure adequate threading into the holes in the engine flywheel and flywheel housing.

1. Loosen engine mount bolts.
2. Make four pilot bolts by removing heads of bolts and starting them into the holes in the engine flywheel and flywheel housing on a horizontal line across the center of the mounting surfaces as shown in figure 3-1.
3. Install lockwashers on the generator adapter endring to bell housing bolts. Install lockwashers on the drive disk to flywheel bolts.

NOTE: If there is not sufficient clearance in the flywheel to permit tightening of the bolts which secure the drive disks to the flywheel, the use of spacers as shown in figure 3-4 will usually alleviate the problem. maximum efficiency. Marking the shaft as described above will provide a means of knowing where the fan was positioned at the factory when it is reassembled.

4. The generator cooling fan can be taken apart and moved to provide more working space. Fans are either cast in two sections which can be taken apart or of the sheet metal type which is bolted to a fan hub. If cast fan is loosened and moved or if the hub of a sheet metal type fan is moved on generator shaft, mark position of fan on generator shaft before loosening fan.

NOTE: The fan was set at the factory with clearance between fan and fan baffle that would provide maximum efficiency. Marking the shaft as described above will provide a means of knowing where the fan was positioned at the factory when it is reassembled.

5. Support the generator from an overhead hoist and move the generator horizontally into place. Make certain drive disks fit completely into the drive disk recess in the flywheel.
6. Install the bolts which secure the drive disks to the flywheel. Remove the two pilot bolts and install and tighten the remaining two bolts.
7. Install and tighten alternately and evenly the bolts which secure the adapter to the flywheel housing. See figure 3-2. Remove the two pilot bolts and install the remaining two bolts.
8. Retighten each bolt completely around the mounting c both the coupling and adapter endring.
9. Tighten engine mount bolts.
10. Use a feeler gage to see if there is a gap between the generator mounting feet and the generator mounting base. Add shims as necessary between the generator mounting feet and the base and then bolt the generator to the base.
11. Attach a dial indicator to the generator adapter with the dial indicator point on the generator shaft as shown in figure 3-3. Turn the engine through one revolution maximum total indicator reading should not exceed .005 inch.

NOTE: It may be necessary to move fan to permit access for dial indicator. See step 4.

12. When alignment checks are satisfactory, reposition and tighten fan. Install fan to its original position on shaft and tighten all bolts. Original position of fan should have been indicated by marking the shaft before moving or removing the fan.
13. Visually inspect clearance between generator stationary and rotating parts.
14. Slide exciter armature-rotating rectifier assembly onto generator shaft. Make certain pin or woodruff key, when used, is in place. Install retaining bolt and washer and connect (+) and (-) generator field leads to terminals on heat sinks.
15. Visually inspect alignment of exciter armature lamination with exciter field laminations (poles). Excessive mechanical mis-alignment can result in low output voltage.

3.1.2 After coupling and alignment of generator is complete, turn engine slowly through a few revolutions. Listen for any unusual noises such as could be caused by rotating parts rubbing on stationary parts. Visually inspect clearance between stationary and rotating parts. When satisfactory assembly has been determined, replace all covers and guards.

3.1.3 Move engine generator to its operating site. If vibration isolation is desired, place vibration isolators between base and foundation. Leave sufficient room around all sides of unit for air flow and removal of covers.

NOTE: If engine develops high torsional load which has twisting effect on base, bolt base to foundation.

3.1.4 During operation check for excessive vibration.

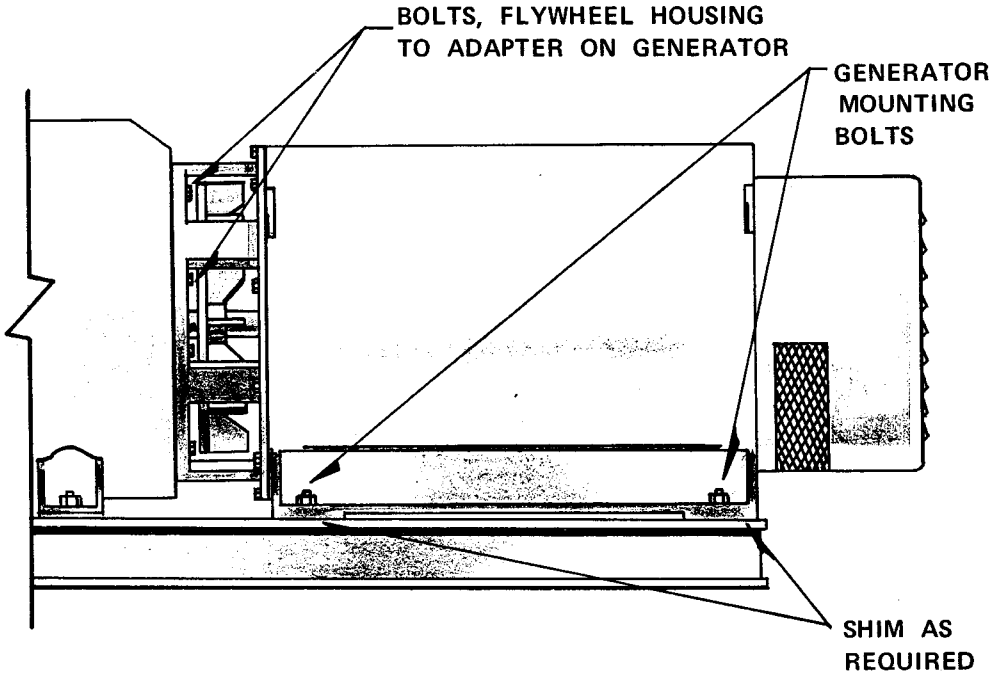
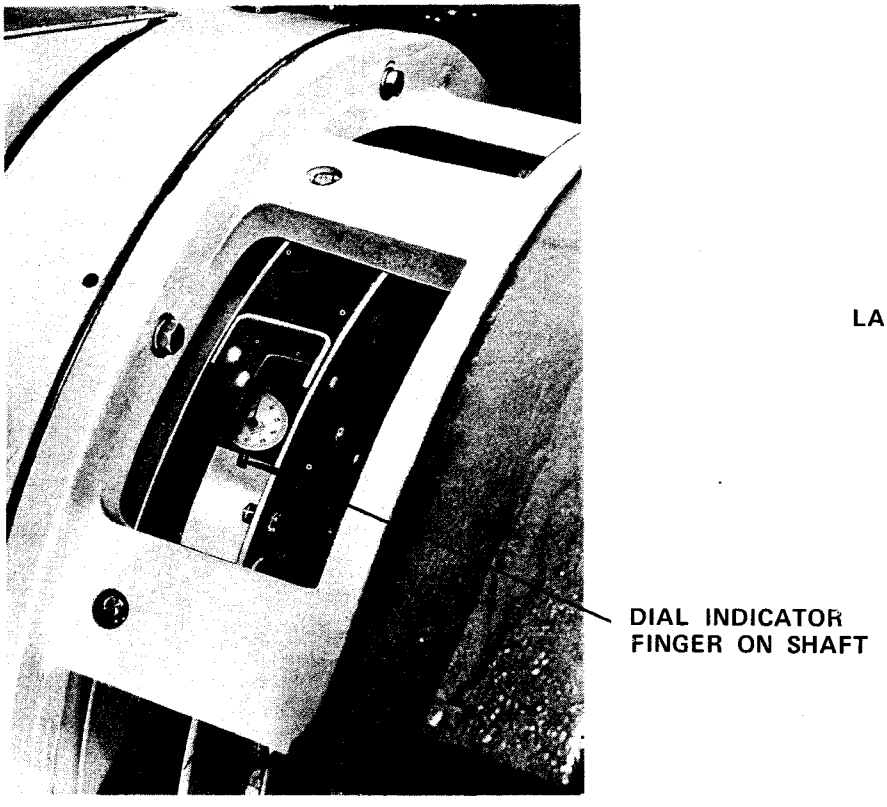


FIGURE 3-2 MOUNTING GENERATOR TO BASE



IGURE 3-3 CHECKING GENERATOR SHAFT RUNOUT

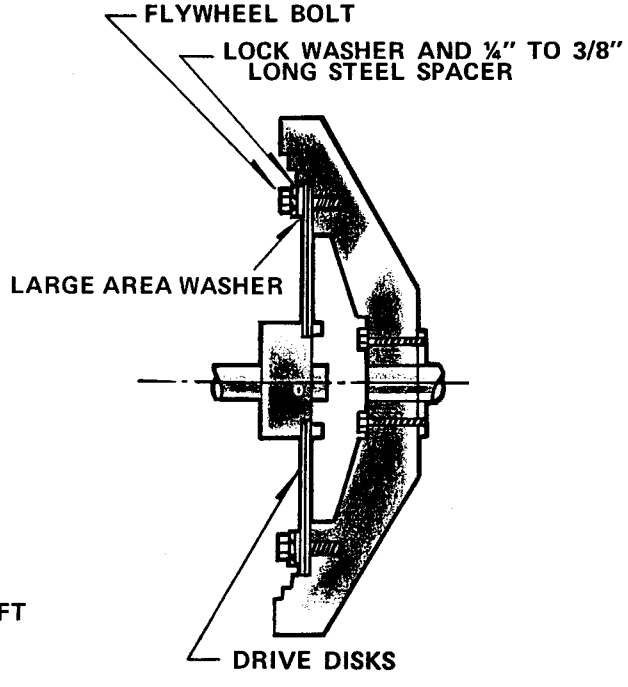


FIGURE 3-4 CROSS SECTIONAL VIEW – DRIVE DISKS AND FLYWHEEL