Special Instruction

i01787382

Alignment of Single-Bearing Generators

SMCS Code: 4471-024

Engine

3114 (S/N: 5JG1-Up; 6AF1-Up)
3116 (S/N: 1NJ1-Up; 2SG1-Up)
3208 (S/N: 29A1-Up; 30A1-Up; 5YF1-Up)
3304 (S/N: 83Z1-Up; 04B4555-Up; 02B4226-Up)
3304B (S/N: 9HK1-Up)
3306 (S/N: 66D8891-Up; 85Z1-Up)
3306B (S/N: 2AJ1-Up; 2TM1-Up; 8JJ1-Up; LRW1-Up; B8D1-Up)
3406 (S/N: 75Z1-Up; 90U1-Up)
3406B (S/N: 2WB1-11475; 4RG1-1501; 4JK1-98; 4PM1-Up)
3406C (S/N: 2WB11476-Up; 4RG1502-Up; 4JK99-Up; LRX1-Up)
3408 (S/N: 67U1-11134; 78Z1-1143)
3408B (S/N: 67U11135-16070; 78Z1144-4866)
3408C (S/N: 67U16071-Up; 78Z4867-Up)
3412 (S/N: 2WJ1-Up; 38S1-16483; 81Z1-14500)
3412C (S/N: 38S16484-Up; 81Z14501-Up; LRY1-Up)
3508 (S/N: 1ZF1-Up; 23Z1-Up; 70Z1-Up)
3508B (S/N: 3DM1-Up; 4GM1-Up; 6PN1-Up)
3512 (S/N: 24Z1-Up; 3YF1-Up; 67Z1-Up)
3512B (S/N: 6WN1-Up; 8EM1-Up; 8RM1-Up)
3516 (S/N: 25Z1-Up; 4XF1-Up; 5SJ1-Up; 73Z1-Up)
3516B (S/N: 6HN1-Up; 7RN1-Up; 9AN1-Up)
D330A (S/N: 29F1-Up; 56B1-Up; 85B1-Up)
D330C (S/N: 04B1-4554; 02B1-4225)
D333A (S/N: 34F1-Up; 87B1-Up)
D333C (S/N: 66D1-8890)
D334 (S/N: 92B1-Up)
D336 (S/N: 55B1-Up)
D342 (S/N: 31B1-2477)
D342C (S/N: 31B2478-Up; 49B1-Up)
D343A (S/N: 62B1-Up)
D346 (S/N: 39J1-Up)
D348 (S/N: 36J1-Up)
D349 (S/N: 61P1-Up)
D353C (S/N: 46B1-669)
D353D (S/N: 46B670-2436)
D353E (S/N: 46B2437-Up; 77B1-Up)
D379A (S/N: 68B1-1615)
D379B (S/N: 34Z1-Up; 68B1616-Up; 76B1-Up)
D398A (S/N: 66B1-2048)
D398B (S/N: 35Z1-Up; 66B2049-Up; 75B1-Up)
D399 (S/N: 35B1-Up; 36Z1-Up)
G3304 (S/N: 37Y1-Up)
G3306 (S/N: 07Y1-Up)
G3406 (S/N: 4FD1-Up)
G3408 (S/N: 6NB1-Up)
G3412 (S/N: 7DB1-Up)
G333C (S/N: 68D1-Up)
G342C (S/N: 71B1-Up)
G343 (S/N: 97N1-Up)
G348 (S/N: 92R1-Up)
G349 (S/N: 93R1-Up)
G3508 (S/N: 2JF1-Up; 4WD1-Up; 9TG1-Up)
G3512 (S/N: 4KC1-Up; 5JD1-Up; 7NJ1-Up)
G3516 (S/N: 3RC1-Up; 4EK1-Up; 8LD1-Up)
G353D (S/N: 64B1-Up)
G379A (S/N: 72B1-Up)
G398A (S/N: 73B1-Up)
G399 (S/N: 49C1-Up)

Table of Contents

Introduction

This instruction shows the installation procedure for electric sets with single-bearing generators. Two different procedures for installation of the generator are given. One procedure is for all generators that do not use engines from the 3500 family. The other procedure is only for generators that utilize the 3500 engine family.

Do not start the alignment procedure until the electric set is permanently installed. If the electric set is moved to a different location, check the alignment and make any corrections necessary. Alignment between the generator and the engine must be correct to get the maximum performance and the longest life from the electric set. The different locations of generator support mounts require two categories of generator alignment. One procedure is for alignment of electric sets without supports at the flywheel housing. The other alignment procedure is for alignment of electric sets with supports at the flywheel housing.

Installation Of The Generator For Generator Sets That Are Not Equipped With A 3500 Engine

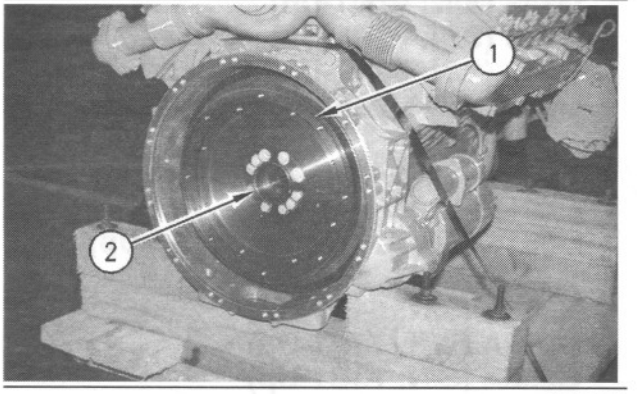

Illustration 1 g00295966

1. Remove all dirt, burrs and paint from the contact surfaces of the generator supports and the base. Remove the protective material from flywheel pilot bearing bore (2). Remove the protective material from surface (1) that contacts the coupling as well. All contact surfaces of the engine, the coupling and the generator must be completely clean.

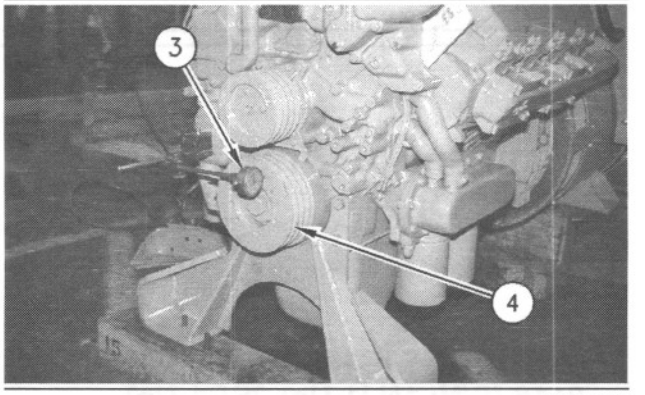

Illustration 2 g00295967

2. Remove the cover from the timing pointer on the flywheel housing. Install the indicator assembly (3) on the front of the engine. The tip of the indicator must contact the face of crankshaft pulley (4). Place a bar between the flywheel and the flywheel housing in order to push the crankshaft toward the flywheel. This is done in order to remove all the end play. Put the dial indicator in the zero position. Move the crankshaft to the most forward position. Record the total indicator reading (TIR). The TIR is the end play of the crankshaft.

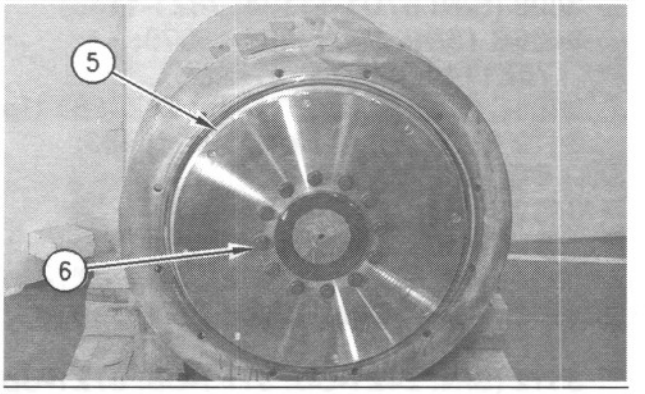

Illustration 3 g00295968

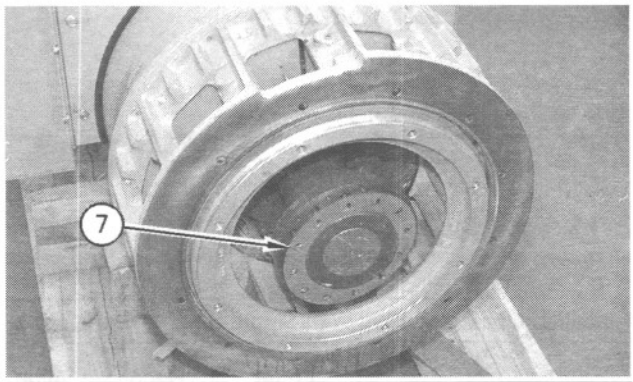

Illustration 4 g00295969

Note: Damage to the engine and the generator can result if the electric set is operated with a plate assembly that does not have the proper clearance. See Step 3.

3. Position the plate assembly (5) in the bore of the flywheel in order to check for clearance. A clearance must exist between the plate assembly's outside diameter (5) and the bore's inside diameter in the flywheel.

4. Install a full shim pack (7) and the plate assembly (5) on the generator with bolts (6). Tighten bolts (7) to a torque of 525 ± 45 N·m (390 ± 30 lb ft).

Note: Incorrect torquing of the bolts (6) can distort the shims which may reduce the rotor bearing's end play. When the shims are being assembled to the hub of the generator, the bolts (6) must be tightened to the specified torque.

Note: The total thickness of shims (7) must not cause a reduction of crankshaft end play. See Step 2. The total thickness of shims (7) must not cause any bending of the plate assembly (5) when the generator is installed.

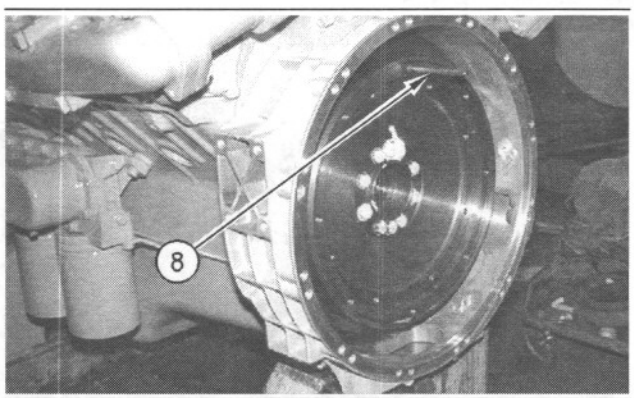

Illustration 5 g00295970

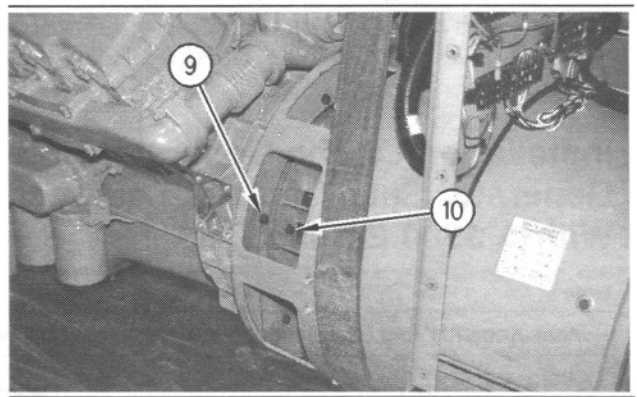

Illustration 6 g00295971

5. Install guide bolt (8) in the flywheel. Put the generator in position on the engine. Install bolts (9) and (10). Tighten bolts (9) and (10) but do not bend the locks under bolts (8) at this time.

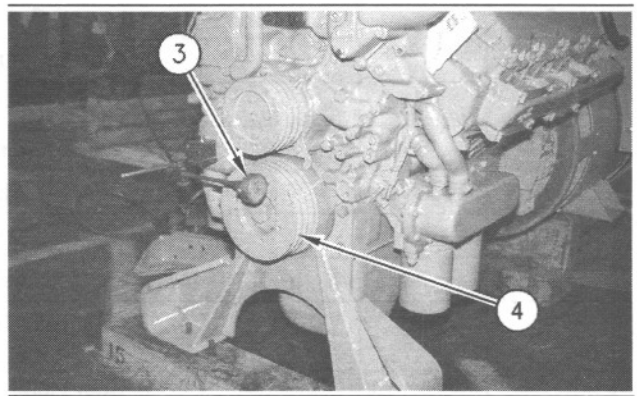

Illustration 7 g00295967

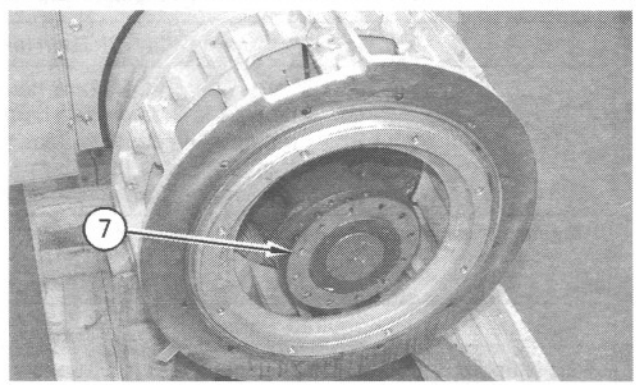

Illustration 8 g00295969

6. Use dial indicator (3) to check crankshaft end play . Do not use force in order to hold the crankshaft in position. If the indicator's reading is different from the initial reading, remove the generator. Remove only enough shims (6) in order to get the original amount of end play. See Step 2.

7. Install the generator and again check the crankshaft end play. After the correct amount of shims have been installed, bend the locks under bolts (8).

Installation Of The Generator For Generator Sets That Are Equipped With A 3500 Engine

Table 1

Measurements And Calculations That Are Necessary For The Installation Of Electric Sets With Single-Bearing Generators				
Item Number	Step	Description	Letter	Recorded Value
1	2	Crankshaft End Play	A	-
2	2	A ÷ 2 =	B	-
3	3	Surface Of The Flywheel Housing	C	-
4	3	Surface Of The Flywheel Pilot	D	-
5	3	C – D =	E	-
6	4	End Play Of The Rotor	F	-
7	4	F ÷ 2 =	G	-
8	6	Mounting Ring	H	-
9	6	Hub	I	-
10	6	I – H =	J	-
11	7	Average Thickness Of The Plates	K	-
12	8	Gap In The Shims J – B – E – G – K =	L	-
13	8	Total Number Of Shims L ÷ 0.8 mm (0.03 inch) =(1)	M	-
14	13	Crankshaft End Play After Assembly	N	-
15	13	End Play Of The Heat Sink After Assembly	O	-
16	13	Compare Item 14 to Item 1. If Item 14 is greater than Item 1, the installation is complete. If Item 14 is equal to Item 1, the installation is complete. If Item 14 is less than Item 1, repeat the installation. Check for errors in calculations and measurements.	P	-

(1) Round this value up to the nearest whole number.

Table 2

Required Parts		
Part Number	Description	Quantity
5N-4479	Shim	6
5N-4478	Plate	1

1. Ensure that the generator is disengaged from the engine.

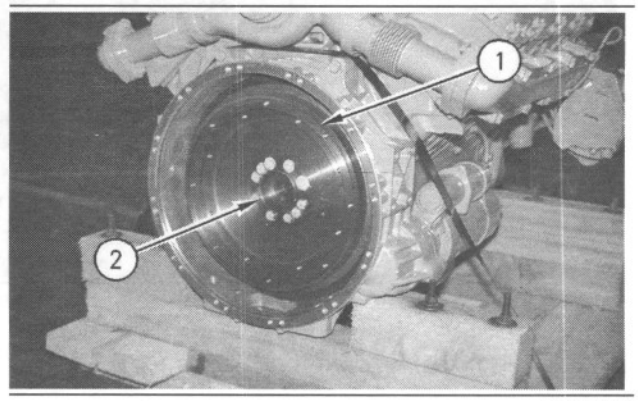

Illustration 9 g00295966

2. Remove all dirt, burrs and paint from the contact surfaces of the generator supports and the base. Remove the protective material from the flywheel pilot bearing bore (2) and from the surface (1) that makes contact with the coupling. All contact surfaces of the engine, the coupling and the generator must be completely clean.

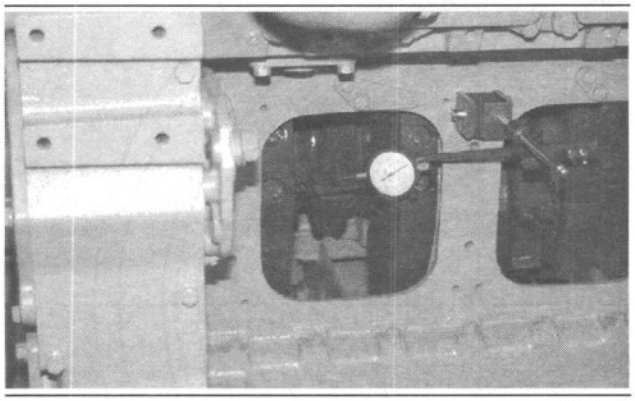

Illustration 10 g00295974

3. Remove two of the engine side covers. Rotate the engine until the number one crankshaft throw is perpendicular to the opening in the side cover. Place a dial indicator on the perpendicular surface of the throw. Place a bar between the engine block and the number one crankshaft throw. Push the crankshaft toward the flywheel in order to remove all end play. Zero the dial indicator. Push the crankshaft to the forward position. The amount of crankshaft end play that is shown on the dial indicator should be .178 to .635 mm (0.0070 to .0250 inch).

   a. Record the measured value of crankshaft end play as Letter "A" of Table 1.

   b. Divide the value of Letter "A" by two. Record your answer as Letter "B" on Table 1 (A ÷ 2 = B).

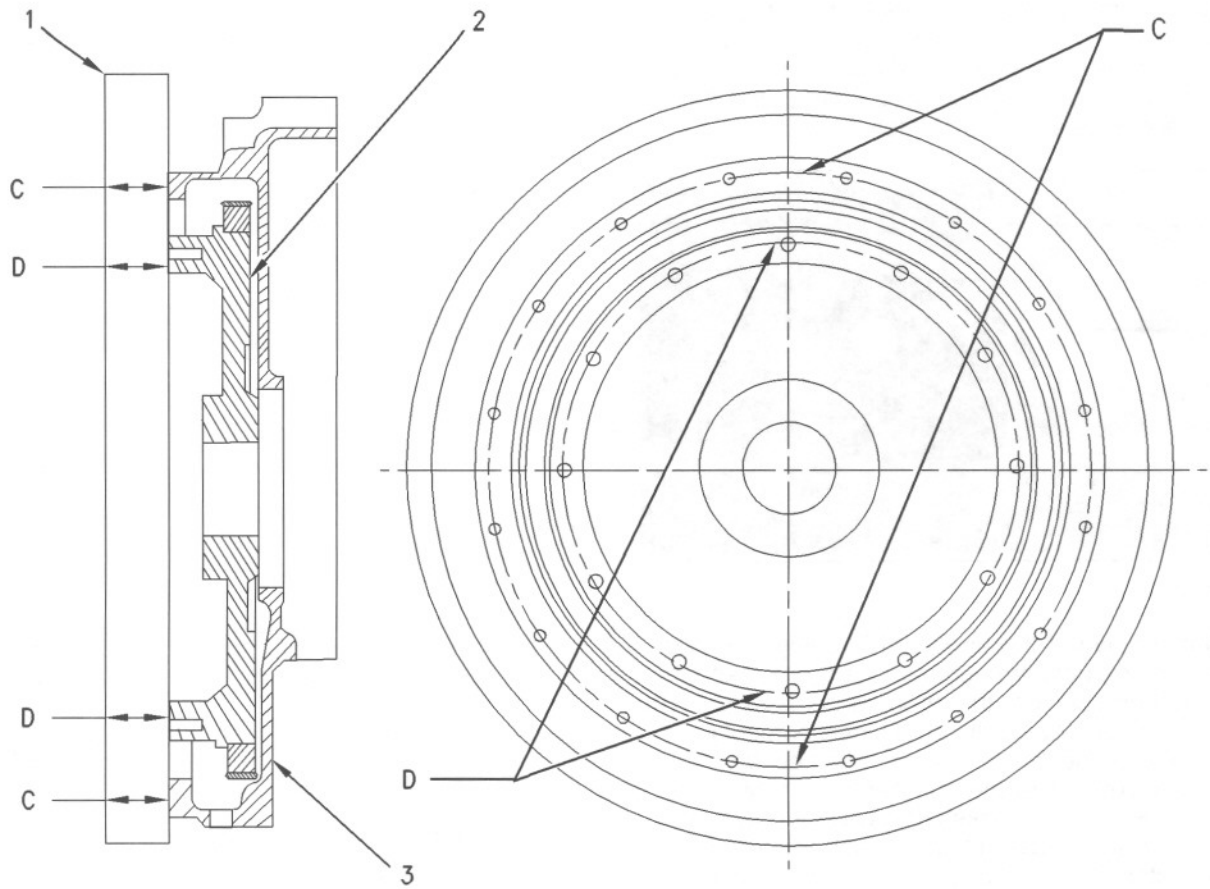

Illustration 11 g00295975

4. Place the engine crankshaft at the extreme forward position. Position a straight edge across the face of the flywheel. See Illustration 11.

   a. Measure the distance from the top of the straight edge to the mounting surface of the flywheel housing (C). Record the value as Letter "C" on Table 1.

   b. Measure the distance from the top of the straight edge to the surface of the flywheel pilot (D). Record the value as Letter "D" on Table 1.

   c. Subtract Letter "D" from Letter "C". Record your answer as Letter "E" on Table 1 (C – D = E).

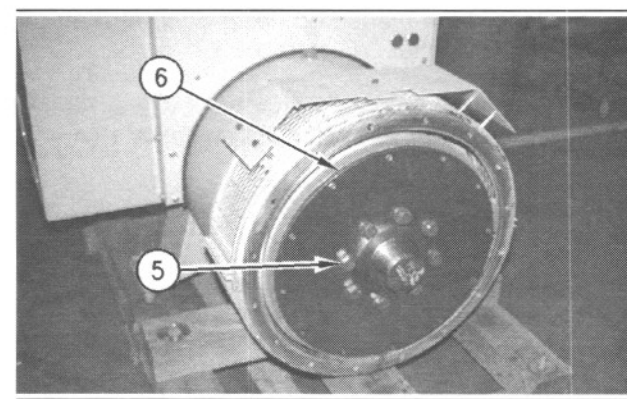

Illustration 12 g00295976

5. Remove the coupling's bolts (5) and washers. Remove the plates (6), the shims, and the exhaust fan. Use the rotor shaft to lift the rotor assembly. Locate the rotor so that the air space between the rotor and the stator is equal. Move the rotor to the extreme rear position.

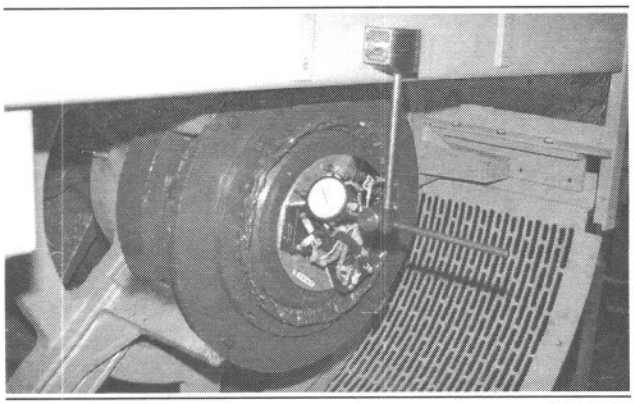

Illustration 13 g00295977

6. Place a dial indicator on the vertical surface of the heat sink assembly at the rear of the generator's rotor shaft. The dial indicator's plunger should be preloaded so that the forward movement of the rotor can be measured. Use the hub of the generator to move the rotor forward. The amount of end play that is displayed on the dial indicator should be approximately 3.81 to 7.62 mm (.150 to .300 inch).

   a. Record the measured value of end play in the rotor as Letter "F" on Table 1.

   b. Divide the value of Letter "F" by two. Record your answer as Letter "G" on Table 1 (F ÷ 2 = G).

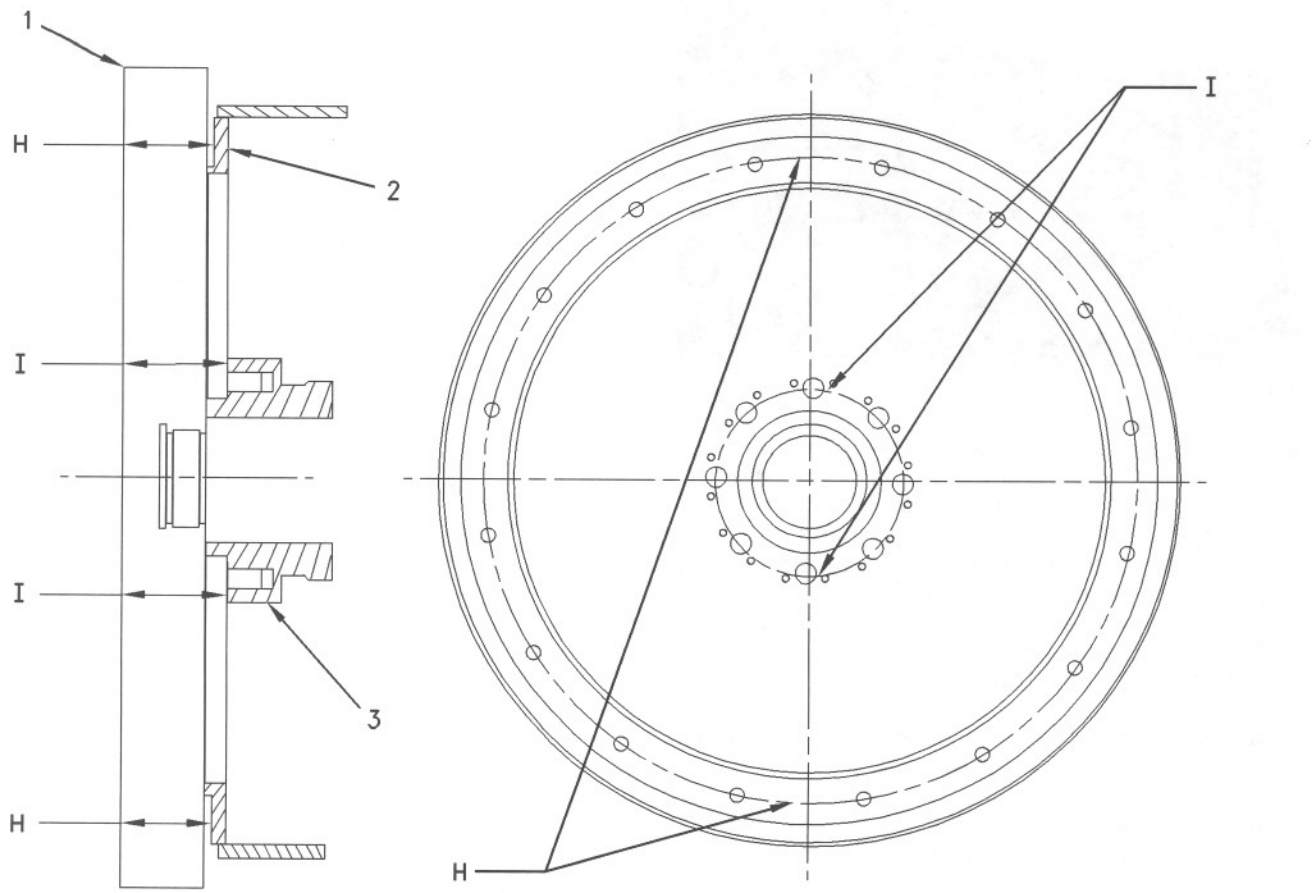

Illustration 14 g00295978

7. Move the rotor assembly to the extreme rear position. Before you proceed, ensure that the air gap between the rotor assembly and the stator is equal. Position a straight edge across the diameter of the mounting ring. See Illustration 14.

   a. Measure the distance from the top of the straight edge to the mounting ring's surface (H). Record the value as Letter "H" on Table 1.

   b. Measure the distance from the top of the straight edge to the mounting surface of the hub (I). Record the value as Letter "I" on Table 1.

   c. Subtract Letter "H" from Letter "I". Record your answer as Letter "J" on Table 1 (I – H = J).

Note: Use the two magnetic bases from the dial indicator in order to locate the straight edge.

8. Use the mounting holes in the flywheel to bolt a standard set of 17 **5N-4478** Plates together. The bolts should be tight, but not tightened to the final torque. Measure the thickness of the plates in two locations along the contour.

   a. Average the two measurements from Step 8. Record your answer as Letter "K" on Table 1.

9. In order to determine the number of shims that are required for proper axial alignment, perform the calculations in Item 12 and Item 13 of Table 1.

   a. Subtract Letters "B", "E", "G" and "K" from the Letter "J". Record this new value as Letter "L" on Table 1 (J – B – E – G – K = L). Letter "L" is the gap between the shims.

   b. Divide the value of Letter "L" by 0.8 mm (0.03 inch). Record this new value as Letter "M" on Table 1 (L ÷ 0.8 mm (0.03 inch) = M). Letter "M" is the total number of shims. Round this number up to the nearest whole number.

10. Put the coupling plate in position at the flywheel bore in order to check for clearance. There must be clearance between the coupling plate's outside diameter and the flywheel bore's inside diameter.

Note: Damage to the engine and the generator can result if the electric set is operated with a plate assembly that does not have the proper clearance.

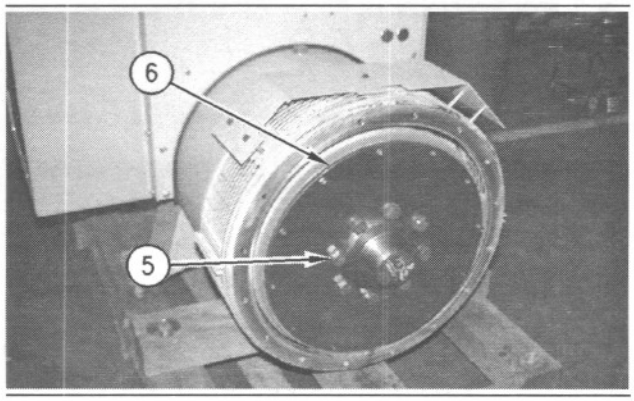

Illustration 15 g00295976

11. Install the coupling plate assembly, bolts (6) and the total number of shims as calculated as Letter "M" on Table 1. Tighten the bolts (5) in 180 degree intervals in three stages. Tighten the bolts (5) to a torque of 525 ± 25 N·m (390 ± 20 lb ft).

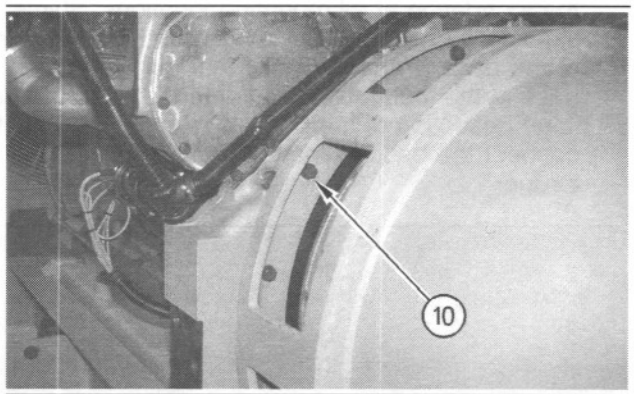

Illustration 16 g00295979

12. Install guide bolts in the flywheel in order to assist in reassembly of the generator to the engine. Put the generator in position on the engine and install the bolts (10). Tighten the bolts (10) to a torque of 100 N·m (75 lb ft). Tighten the bolts in pairs at 180 degree intervals in three stages.

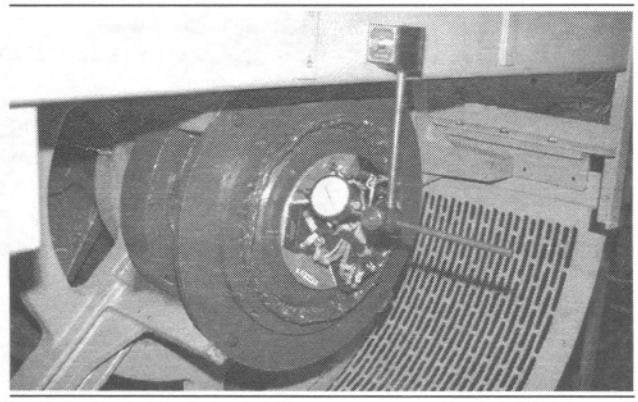

Illustration 17 g00295977

13. While the generator is still supported by the crane, place the crankshaft and the generator's rotor in the extreme rear positions. Place a dial indicator on the vertical surface of the heat sink assembly at the rear of the generator's rotor shaft. The plunger of the dial indicator should be preloaded so that forward movement of the rotor can be measured. Push the generator forward within ± 0.50 mm (± 0.0200 inch) of the midpoint of the end play.

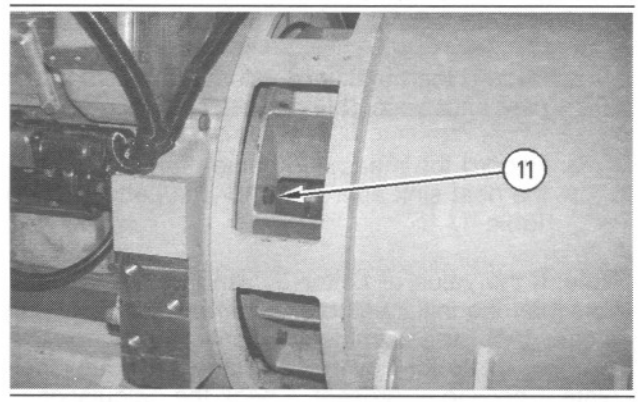

Illustration 18 g00295982

14. Install the fan's mounting bolts (11) into the flywheel and tighten the bolts to a torque of 200 N·m (150 lb ft). Tighten the bolts in pairs at 180 degree intervals in three stages.

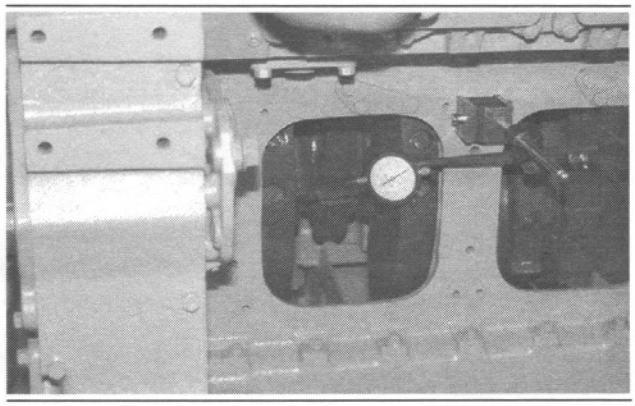

Illustration 19 g00295974

15. While the crane is still supporting the generator, place a dial indicator on the vertical surface of the number one crankshaft throw. Place another dial indicator on the vertical surface of the heat sink assembly. Push the crankshaft forward in order to determine the amount of end play. The amount of crankshaft end play that is shown on the dial indicator should be 0.178 to 0.635 mm (0.0070 to 0.0250 inch). The amount of end play at the heat sink that is shown on the dial indicator should be 0.076 to 0.635 mm (0.0030 to 0.0250 inch).

a. Record the measured value of crankshaft end play after assembly as Letter "N" on Table 1.

b. Record the measured value of end play at the heat sink after assembly as Letter "O" on Table 1.

Note: If the value of Letter "N" and Letter "O" is less than the initial value of the crankshaft end play (Letter "A"), disassemble the generator. Check the coupling plate for bowing. Replace the coupling plate if bowing is present. Check the calculations and measurements of these procedures for errors.

16. Install the generator and again repeat Steps 13 and 15. After the correct amount of shims have been installed and all measurements are within limits, proceed with installation. Align the generator to the engine.

Alignment Of Electric Sets Without Supports At The Flywheel Housing

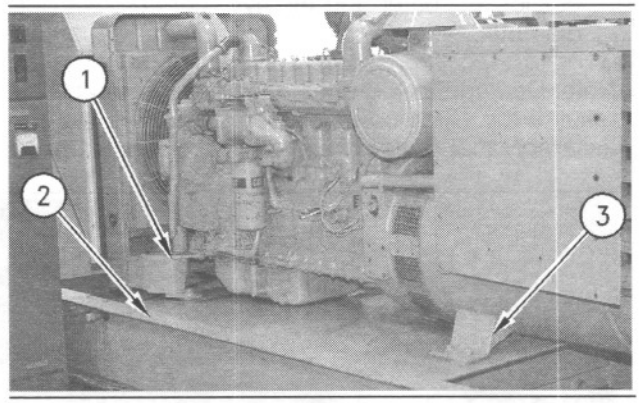

Illustration 20 g00295983

1. If the base (2) of the electric set is fastened to a foundation, loosen all the bolts that connect the base to the foundation. Loosen all bolts that fasten the generator supports (3) and engine supports (1) to the base (2).

2. Ensure that there is clearance between the bolts and the bolt holes in the base, the engine supports and the generator supports at all locations.

3. Check the clearance between the base (2) and the foundation at all mounting locations. Shims should be used in order to prevent the deflection of the base (2) as the bolts that connect the base to the foundation are tightened. When there is no deflection of the base, tighten all bolts that connect the base to the foundation to the final torque.

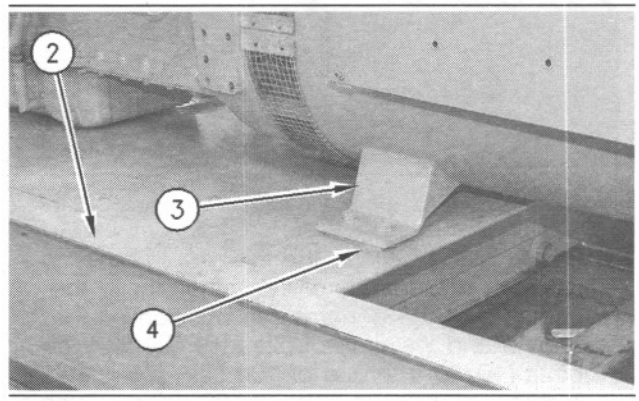

Illustration 21 g00295984

4. Check the clearance between the base (2) and the engine. Check the clearance between the base (2) and the engine supports (1). Check the clearance between base (2) and the generator supports (3). Check the clearance over the entire length of the supports. This is especially important on generators with long supports (4), since some of the surfaces may not be square or parallel. Shims should be used in order to prevent the deflection of the supports as the bolts are tightened. After all the necessary shims have been installed, finish tightening all mounting bolts to the final torque.

Alignment Of Electric Sets With Supports At The Flywheel Housing

Installation Of A New Generator Or Flexible Plates

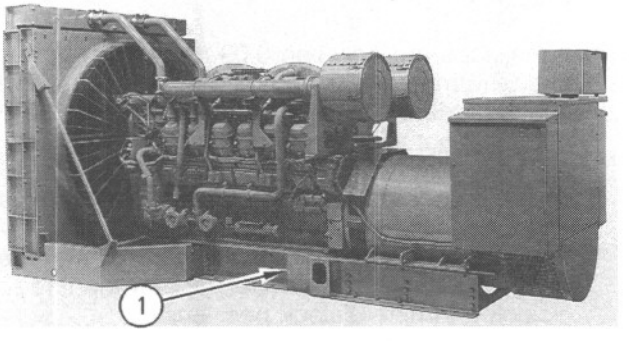

Illustration 22 g00295994

1. If base (1) of the electric set is fastened to a foundation, loosen all bolts that connect the base to the foundation. Loosen all bolts that fasten the engine supports and generator supports to the base.

2. Ensure that there is enough clearance between the bolts and the bolt holes in the base, engine supports and generator supports at all locations.

3. Check the clearance between the base (1) and the foundation at all mounting locations. Shims should be used in order to prevent the deflection of the base as the bolts that connect the base to the foundation are tightened. When there is no deflection in the base, tighten all bolts that connect the base to the foundation to the final torque.

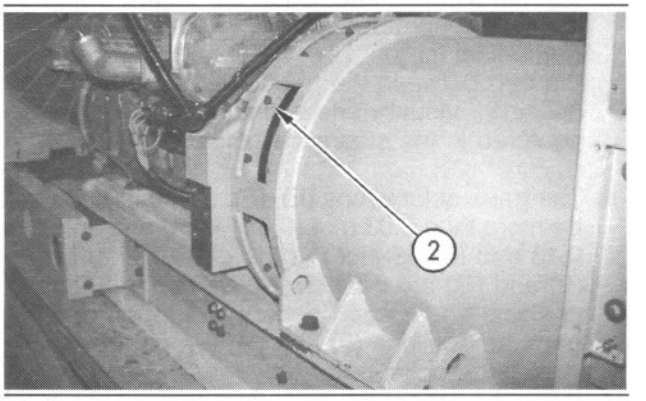

Illustration 23 g00295995

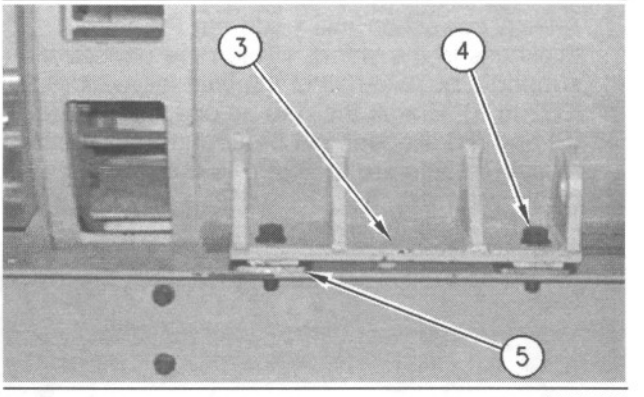

Illustration 24 g00295996

4. While the generator is still supported by the crane, loosen all bolts (2) that fasten the generator to the flywheel housing. Tighten alternate bolts to the final torque. Check the clearance between the base and the engine and generator supports at all four locations. Check the clearance over the entire length of the supports. This is especially important on generators with long supports (3). Shims (4) should be installed until all of the mounting surfaces are flat and parallel.

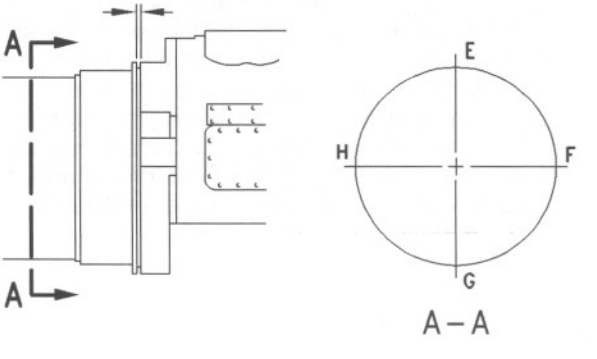

Illustration 25 g00295997

5. Tighten all bolts that fasten the engine supports and the generator supports to the base to half of the final torque. Loosen all bolts (2). Measure the gap between the generator and the flywheel housing . Visually ensure that the bolts (2) are centered in the clearance holes.

6. The gaps at locations (E), (F), (G) and (H) should be more than 0.03 mm (0.001 inch) and less than 0.13 mm (0.005 inch). If the gaps at locations (E) and (G) are not correct, adjust the number of shims under each generator support. If the gaps at locations (F) and (H) are not correct, loosen the bolts in the generator supports and move the rear of the generator to the right or left accordingly.

7. After a correction has been made to the thickness in the shims, tighten the generator support's bolts to half of the final torque 450 N·m (332 lb ft). Check the gap at locations (E), (G), (F) and (H). Repeat this procedure until the gap measurements are 0.13 mm (0.005 inch) or less. Begin with Step **5**.

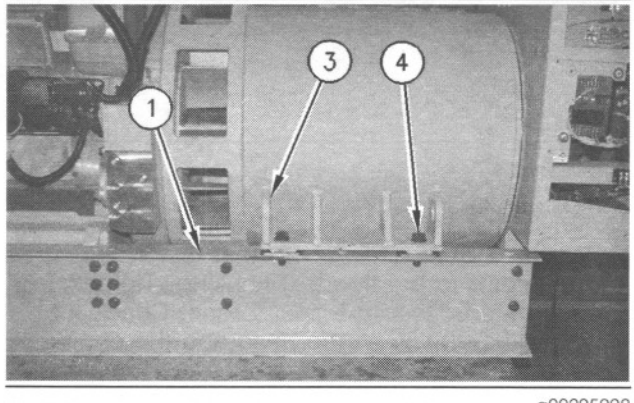

Illustration 26 g00295998

8. Install a dial indicator on the base (1) with the indicator tip next to a support mounting bolt (4). Put the indicator tip on the support (3). Check the indicator while you are tightening the bolt to the final torque. If the indicator moves more than 0.13 mm (0.005 inch), the thickness of the shim is incorrect under that bolt. Install the necessary amount of shims. Repeat this procedure until all the mounting bolts for the engine support and the mounting bolts for the generator support have been tightened to the final torque and the support deflection is within the specification.

Rechecking The Alignment

This outlines the actions that are necessary for a realignment in the field. It is possible that the alignment could have been altered from the original alignment due to the handling during shipment and different mounting conditions. It is necessary to check the alignment after the set has been placed in the permanent position in order to minimize any possible stresses from installation.

1. Loosen the sixteen close coupled adapter bolts (2). Visually ensure that these bolts are centered in the clearance holes.

2. Check the gaps at the three o'clock, the six o'clock, the nine o'clock, and the twelve o'clock positions.

Note: The two o'clock, four o'clock, eight o'clock, and ten o'clock positions will be adequate if the twelve o'clock, and six o'clock positions are inaccessible.

3. If the gaps are between 0.03 mm (0.001 inch) and 0.13 mm (0.005 inch), tighten all of the bolts. The alignment check is complete. If any of the gaps are not within the correct range, loosen the bolts that fasten the generator to the base frame. If necessary, adjust the amount of shims under each mount. It may be necessary to move the rear of the generator to the right or left. The direction will depend on the gaps at the three o'clock and nine o'clock positions.

4. After any adjustment of the generator's position, tighten the generator mounting bolts to one half of the standard torque 450 N·m (332 lb ft). Repeat the procedure starting with Step **1**.

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