CATERPILLAR®

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April 2002

Systems Operation Testing and Adjusting Disassembly and Assembly

SR4B Generator

Important Safety Information

Most accidents that involve product operation, maintenance and repair are caused by failure to observe basic safety rules or precautions. An accident can often be avoided by recognizing potentially hazardous situations before an accident occurs. A person must be alert to potential hazards. This person should also have the necessary training, skills and tools to perform these functions properly.

Improper operation, lubrication, maintenance or repair of this product can be dangerous and could result in injury or death.

Do not operate or perform any lubrication, maintenance or repair on this product, until you have read and understood the operation, lubrication, maintenance and repair information.

Safety precautions and warnings are provided in this manual and on the product. If these hazard warnings are not heeded, bodily injury or death could occur to you or to other persons.

The hazards are identified by the “Safety Alert Symbol” and followed by a “Signal Word” such as “DANGER”, “WARNING” or “CAUTION”. The Safety Alert “WARNING” label is shown below.

⚠ WARNING

The meaning of this safety alert symbol is as follows:

Attention! Become Alert! Your Safety is Involved.

The message that appears under the warning explains the hazard and can be either written or pictorially presented.

Operations that may cause product damage are identified by “NOTICE” labels on the product and in this publication.

Caterpillar cannot anticipate every possible circumstance that might involve a potential hazard. The warnings in this publication and on the product are, therefore, not all inclusive. If a tool, procedure, work method or operating technique that is not specifically recommended by Caterpillar is used, you must satisfy yourself that it is safe for you and for others. You should also ensure that the product will not be damaged or be made unsafe by the operation, lubrication, maintenance or repair procedures that you choose.

The information, specifications, and illustrations in this publication are on the basis of information that was available at the time that the publication was written. The specifications, torques, pressures, measurements, adjustments, illustrations, and other items can change at any time. These changes can affect the service that is given to the product. Obtain the complete and most current information before you start any job. Caterpillar dealers have the most current information available.

⚠ WARNING

When replacement parts are required for this product Caterpillar recommends using Caterpillar replacement parts or parts with equivalent specifications including, but not limited to, physical dimensions, type, strength and material.

Failure to heed this warning can lead to premature failures, product damage, personal injury or death.

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General Information

SMCS Code: 4450

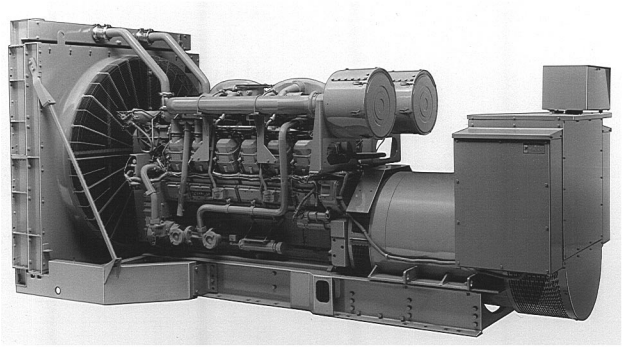

Illustration 1 g00611770
Generator Set

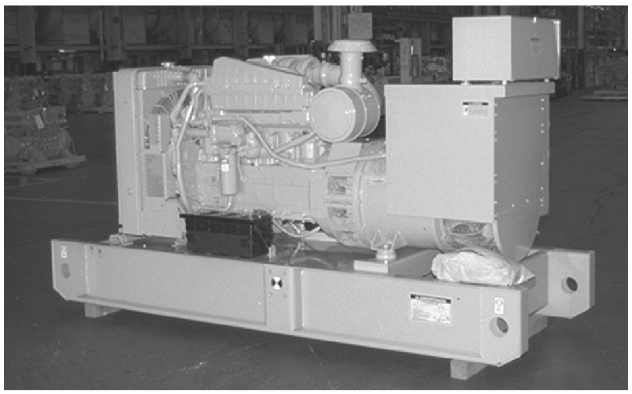

Illustration 2 g00611772
Generator Set

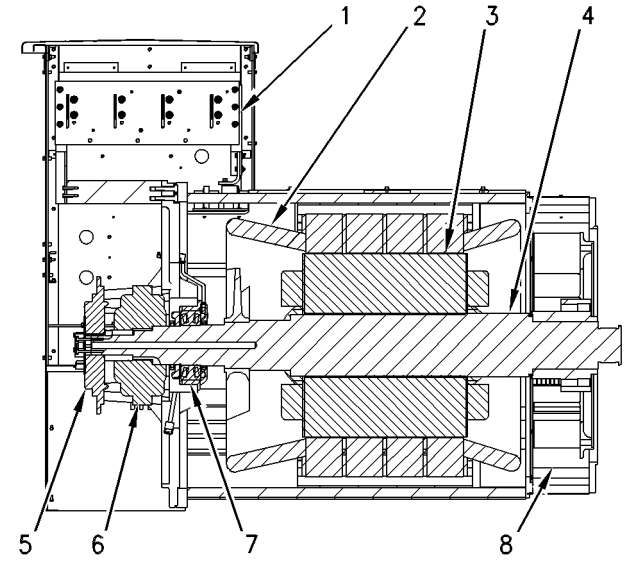

Illustration 3 g00609958
SR4B Generator

(1) Generator terminal strip
(2) Main armature (stator)
(3) Main field (rotor)
(4) Rotor shaft
(5) Permanent magnet pilot exciter (PMPE)
(6) Exciter
(7) Bearing
(8) Fan

The SR4B generator has the following characteristics:

- three-phase alternating current
- brushless type
- four pole or six pole design

Stationary main armature (2) bolts to the engine flywheel housing. A flexible plate type coupling connects rotor shaft (4) to the engine flywheel. Rotating main field (3) is keyed directly to the rotor shaft.

The SR4B generator is a self-ventilated generator. Air enters the generator through screened orifices that are located at the rear of the generator. Air exits the generator through screened orifices that are located at the drive coupling end of the generator. Fan (8) attaches to rotor shaft (4). Bearing (7) supports the exciter end of the rotor shaft.

Note: Some larger generators have two bearings. In this case, there will be a bearing at each end of the generator shaft.

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Component Descriptions

SMCS Code: 4450

All SR4B generators have the same basic design. The following list displays some differences that may occur between SR4B generators:

- Power for the exciter field is provided by either the permanent magnet pilot excited (PMPE) method or the self-excited (SE) method.
- The location of the bearing can be inboard or outboard. The following factors determine the location of the bearing: vibration characteristics of the engine, vibration characteristics of the generator, the size of the engine, and the size of the generator.
- On PMPE generators, the pilot exciter can be inboard or the pilot exciter can be outboard.

Note: Some larger generators have two bearings. When a generator has two bearings, there is a bearing at each end of the generator shaft.

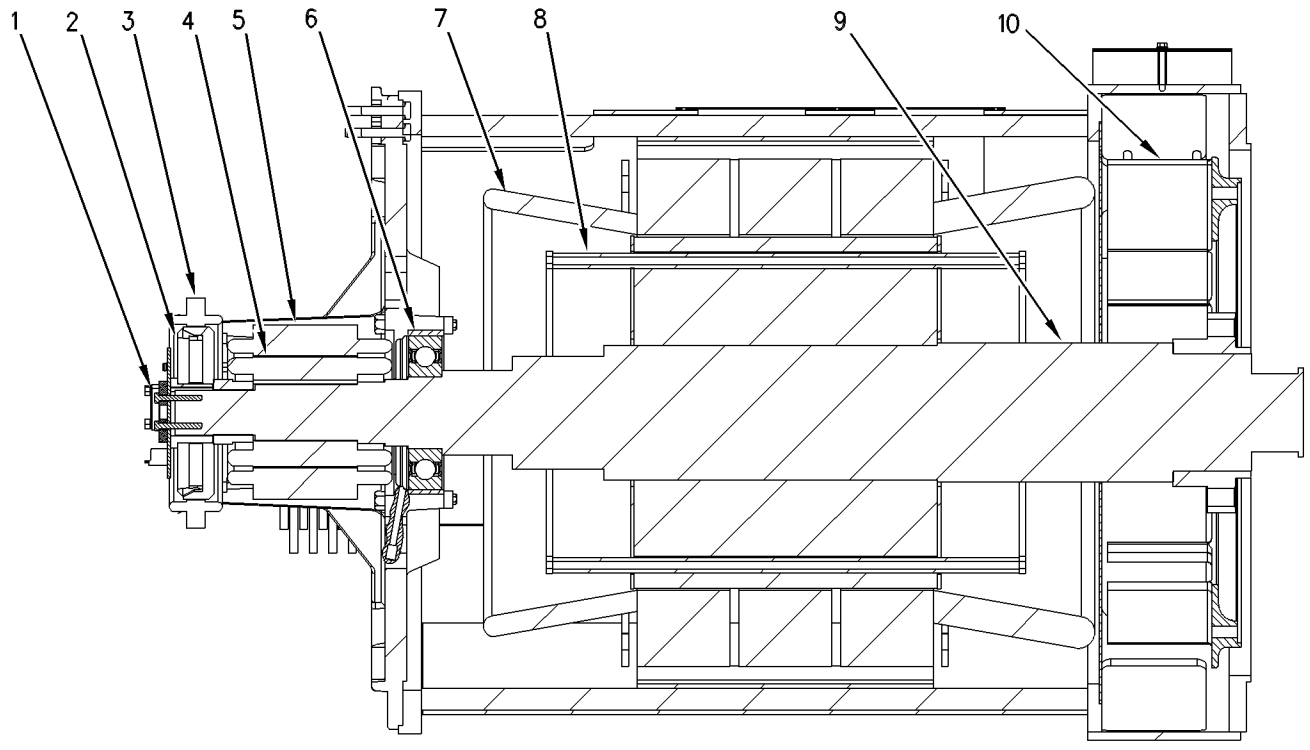

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Illustration 4

PMPE Type Components

(1) Rectifiers
(2) Pilot exciter field (permanent magnet)
(3) Pilot exciter armature (PM armature)
(4) Exciter armature (rotor)
(5) Exciter field (stator)
(6) Bearing with a sleeve for 3500 Engine Family only
(7) Main armature (stator)
(8) Main field (rotor)
(9) Rotor shaft
(10) Fan

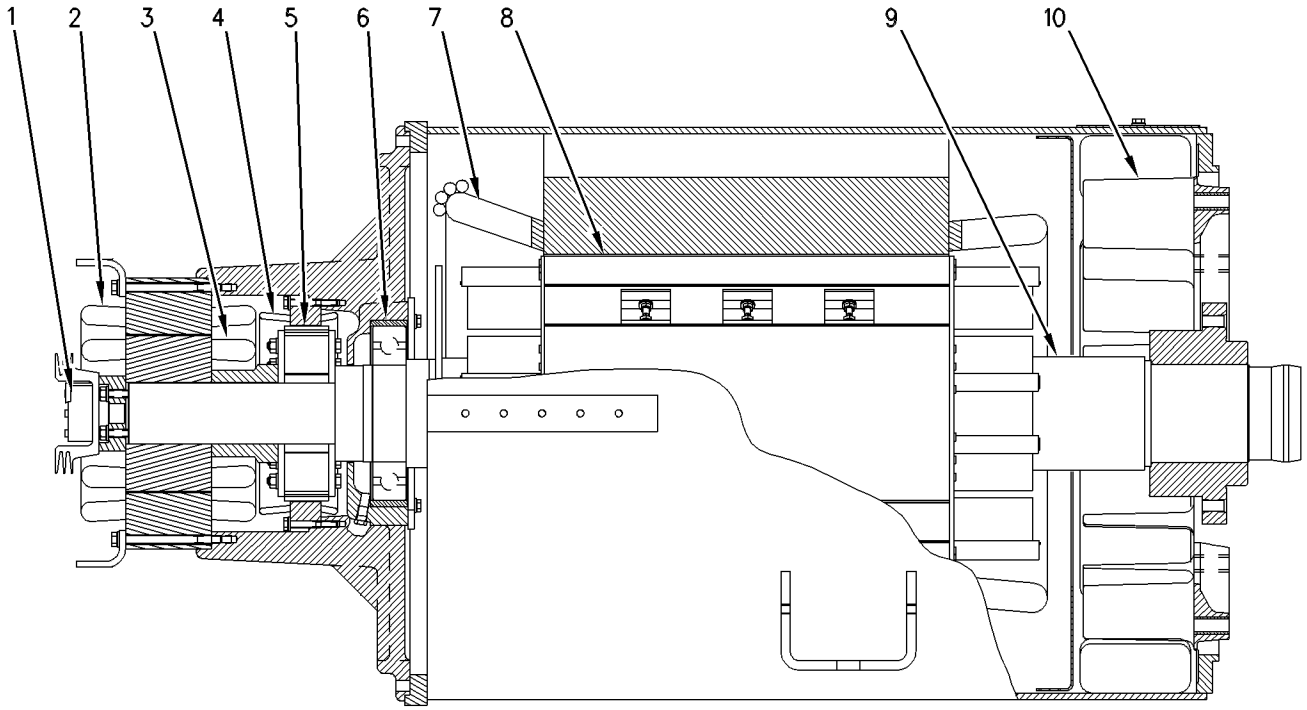

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Illustration 5

PMPE Type Components with a Pilot Exciter

(1) Rectifiers
(2) Exciter field (stator)
(3) Exciter armature (rotor)
(4) Pilot exciter armature (PM armature)
(5) Pilot exciter field (permanent magnet)
(6) Bearing
(7) Main armature (stator)
(8) Main field (rotor)
(9) Rotor shaft
(10) Fan

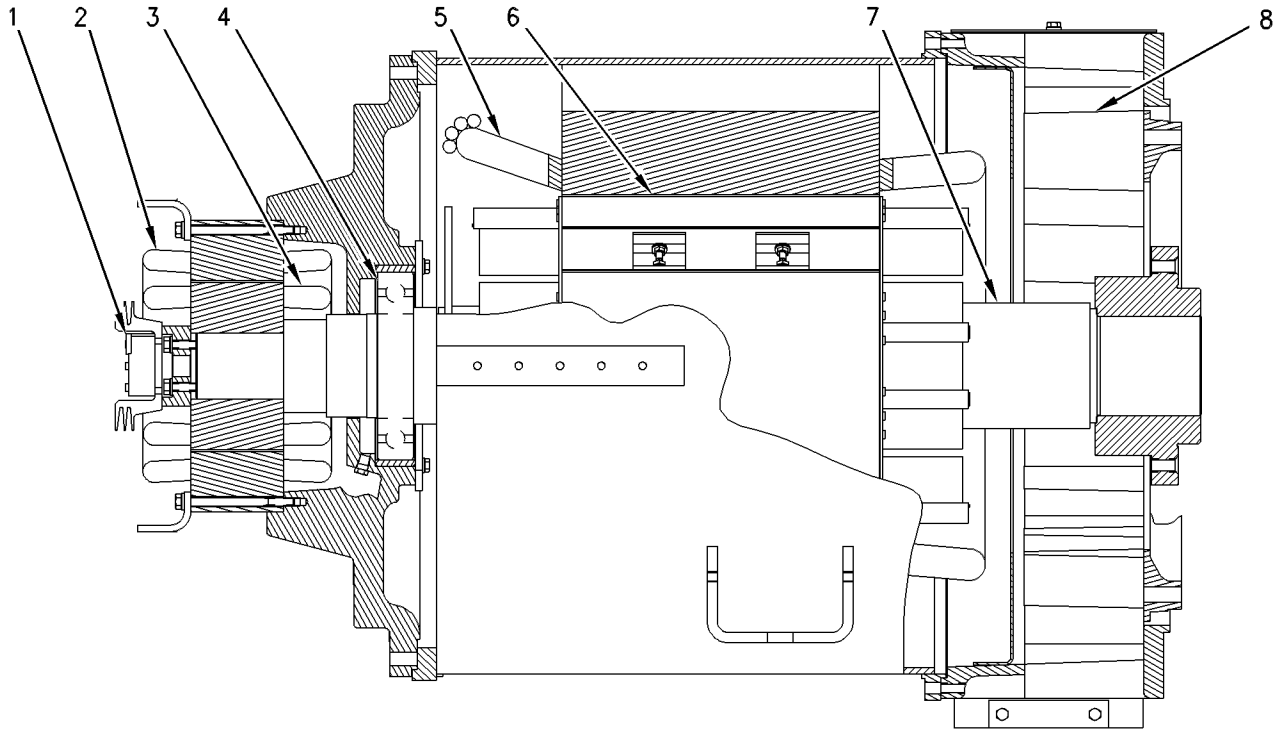

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Illustration 6

SE Type Components with Inboard Bearing

(1) Rectifiers
(2) Exciter field (stator)
(3) Exciter armature (rotor)
(4) Bearing
(5) Main armature (stator)
(6) Main field (rotor)
(7) Rotor shaft
(8) Fan

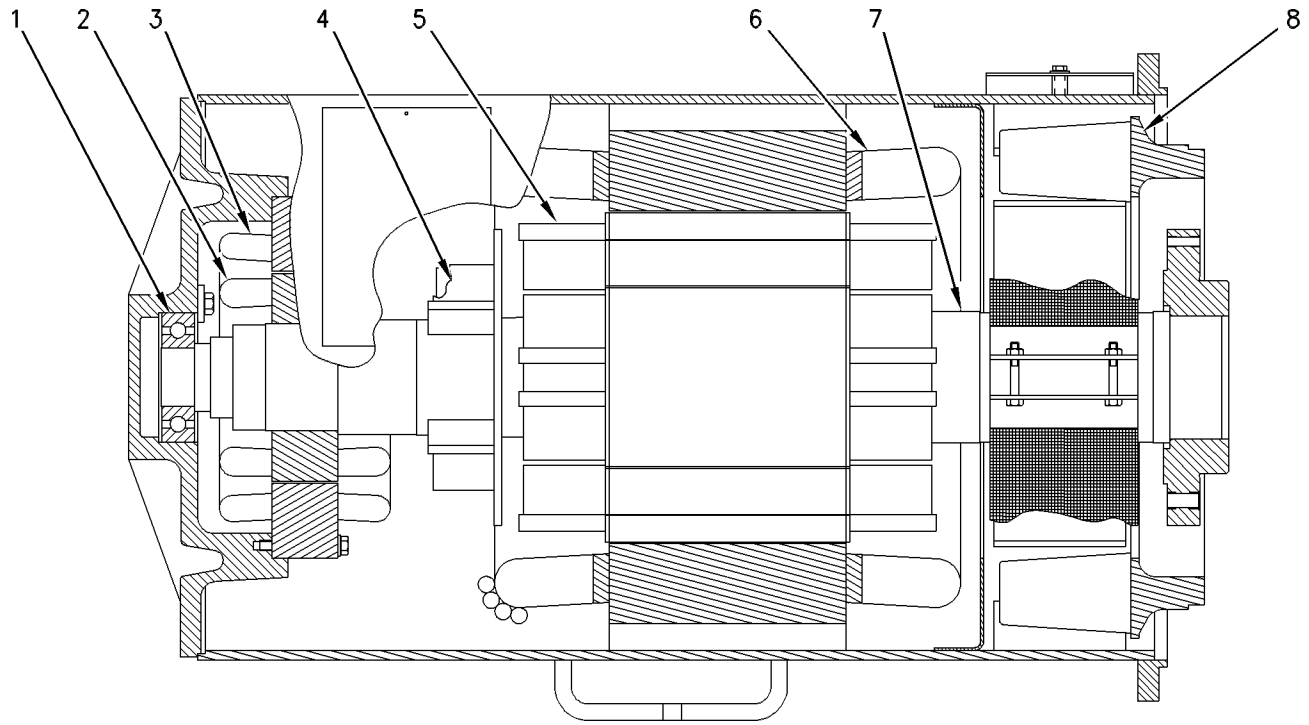

Illustration 7 g00611851

SE Type Components (Outboard Bearing)

(1) Bearing
(2) Exciter armature (rotor)
(3) Exciter field (stator)
(4) Rectifiers
(5) Main field (rotor)
(6) Main armature (stator)
(7) Rotor shaft
(8) Fan

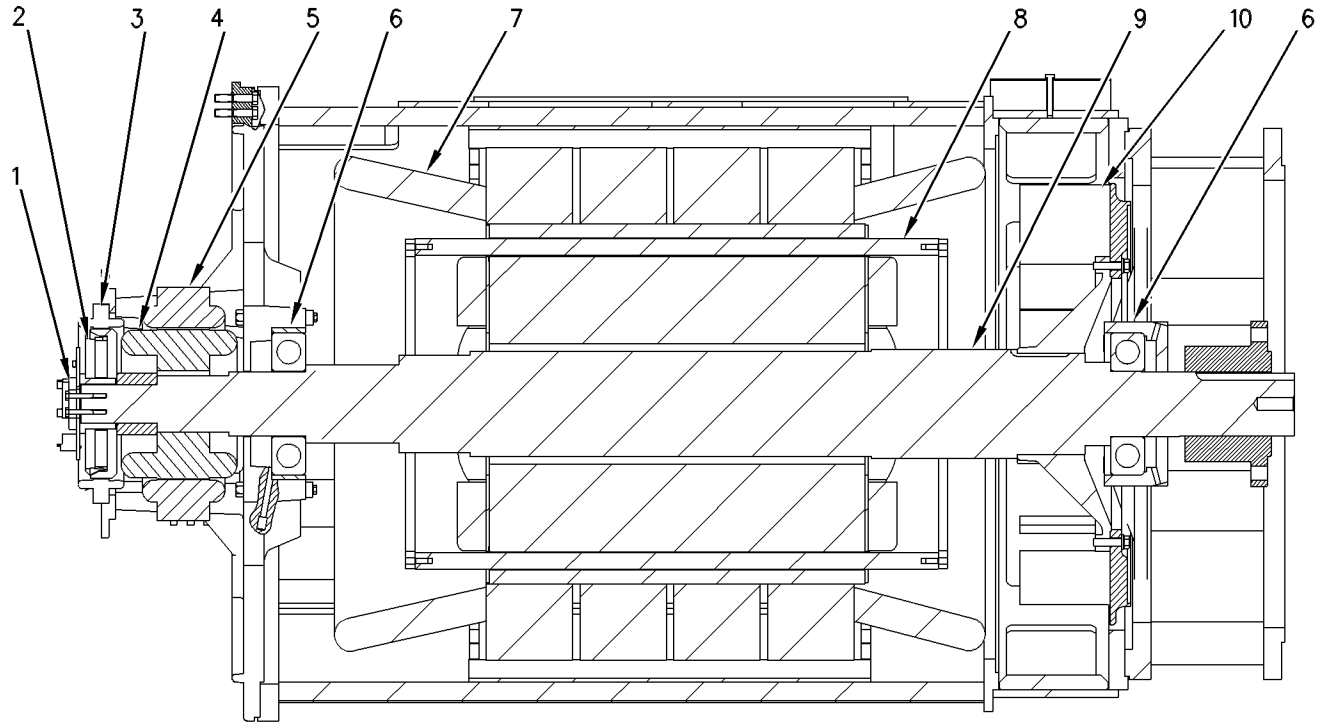

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Illustration 8

Two-Bearing Generator (PMPE Type Components)

(1) Rectifiers
(2) Pilot exciter field (permanent magnet)
(3) Pilot exciter armature (PM armature)
(4) Exciter armature (rotor)
(5) Exciter field (stator)
(6) Bearing with a sleeve for 3500 Engine Family only
(7) Main armature (stator)
(8) Main field (rotor)
(9) Rotor shaft
(10) Fan

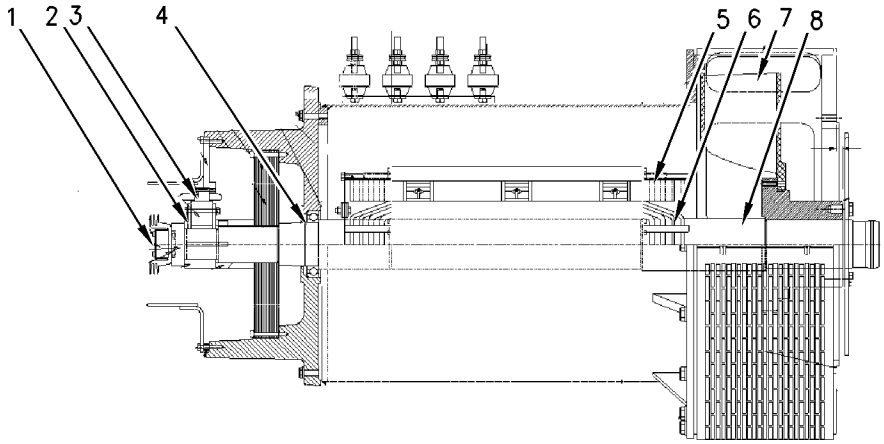

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Illustration 9

SR4B generator that is used with a 3406E engine

(1) Rectifiers
(2) Exciter armature (rotor)
(3) Exciter field (stator)
(4) Bearing
(5) Main armature (stator)
(6) Main field (rotor)
(7) Fan
(8) Rotor shaft

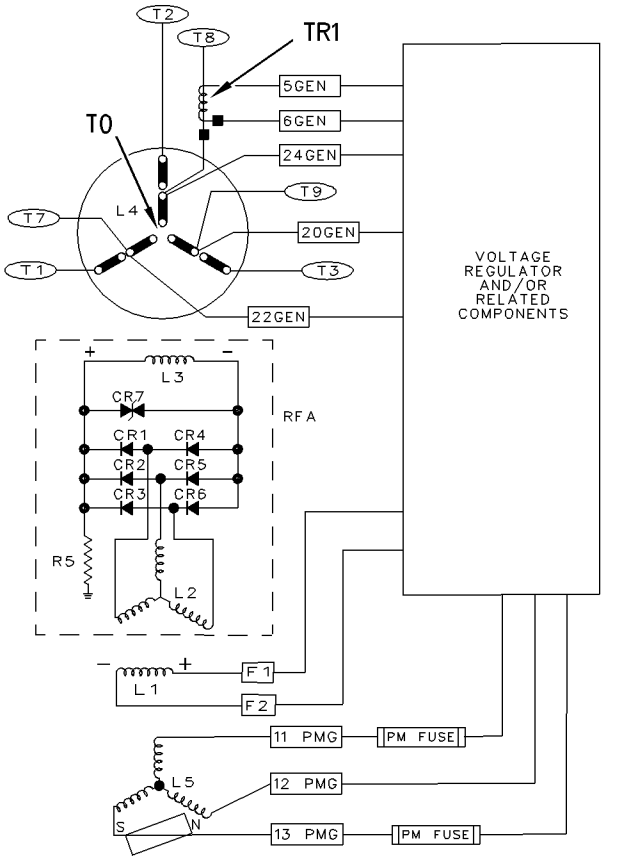

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Illustration 10

PMPE Generator Wiring Diagram

(CR1 - CR6) Diodes
(CR7) Varistor
(L1) Exciter field (stator)
(L2) Exciter armature (rotor)
(L3) Main field (rotor)
(L4) Main armature (stator)
(L5) Pilot exciter armature
(PM) Permanent magnet
(R5) Resistor
(RFA) Rotating field assembly
(TR1) Optional Voltage droop transformer
(T0, T1, T2, T3, T7, T8, T9) Generator Terminals and/or Generator leads

Rotating Field Assembly (RFA)

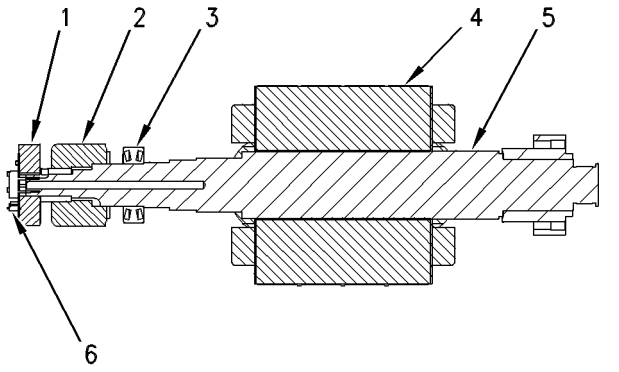

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Illustration 11

RFA Components (PMPE Type)

(1) Pilot exciter field (permanent magnet)
(2) Exciter armature (rotor)
(3) Bearing
(4) Main field (rotor)
(5) Rotor shaft
(6) Rectifiers

The RFA components attach to rotor shaft (5), which is supported by the engine flywheel and bearing (3).

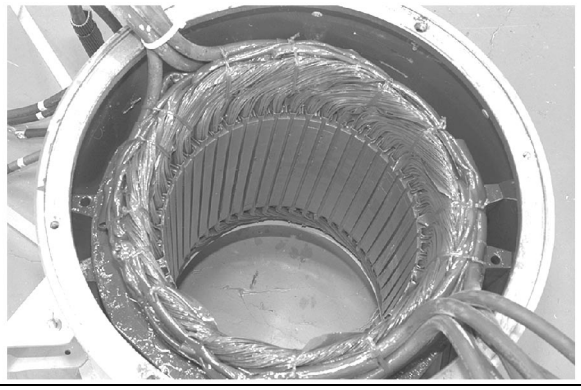

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Illustration 12

Main Armature (Stator (L4))

The generator main armature is stationary and the generator main armature contains the stator windings.

Main Field (Rotor)

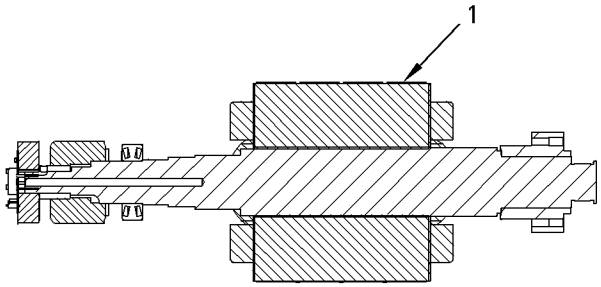

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Illustration 13

Rotating Field Assembly (RFA)

(1) Main Field (Rotor (L3))

Generator Main Field (1) is part of the rotating field assembly. The generator main field rotates with the rotating field assembly.

Exciter

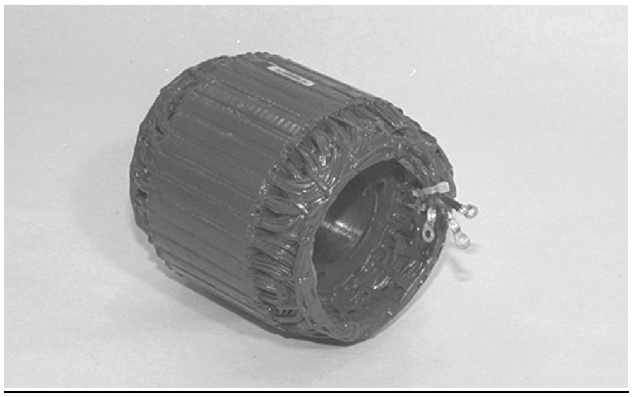

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Illustration 14

Exciter Armature (Rotor (L2))

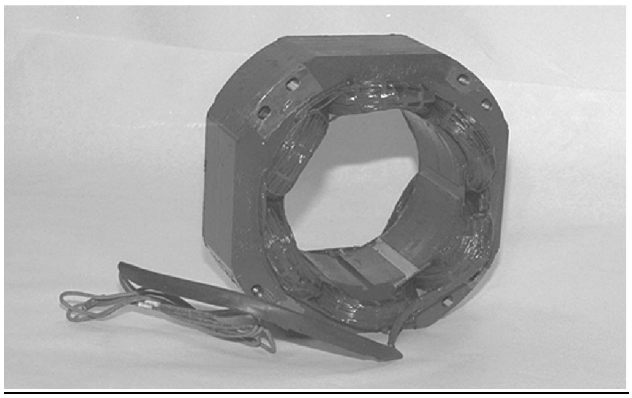

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Illustration 15

Exciter Field (Stator (L1))

Pilot Exciter

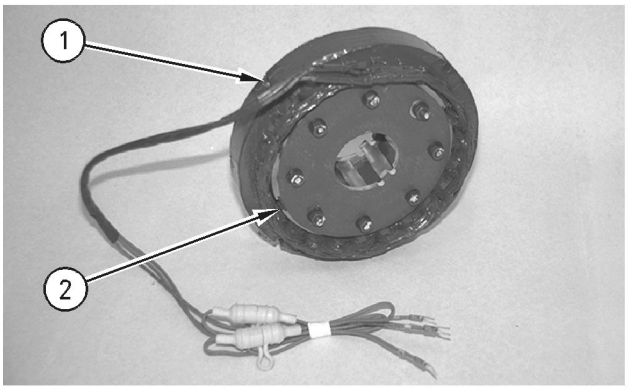

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Illustration 16

Pilot Exciter

The pilot exciter is used on PMPE generators. The pilot exciter consists of stationary pilot exciter armature (1) and the rotating pilot exciter field (2). The pilot exciter field is also referred to as the permanent magnet (PM).

Rotating Rectifier Blocks

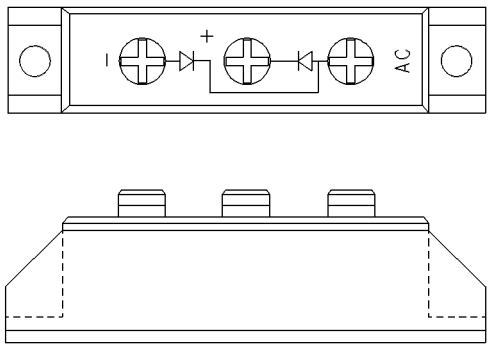

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Illustration 17

Two Diode Rectifier Block

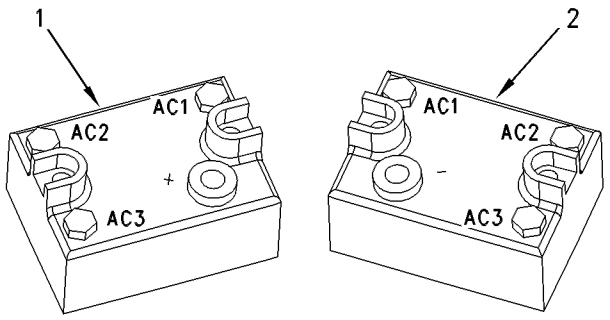

Illustration 18 g00610236

Three Diode Rectifier Block

(1) Positive rectifier block
(2) Negative rectifier block

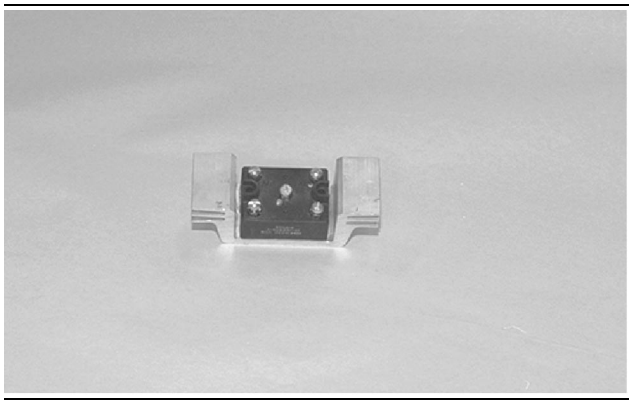

Illustration 19 g00611973

The rotating rectifier blocks are part of the rotating field assembly (RFA). There are three types of rotating rectifier blocks that are used. The size of the generator determines the size of the rotating rectifier block that is used.

- The two diode rectifier block contains two diodes. Three identical blocks are required.
- The three diode rectifier block contains three diodes. Two different blocks are required. One block is positive and the other block is negative.
- The six diode rectifier block contains six diodes. One block is required.

Note: For additional information, refer to Generator Operation, “Rectifier Circuits”.

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Generator Operation

SMCS Code: 4450

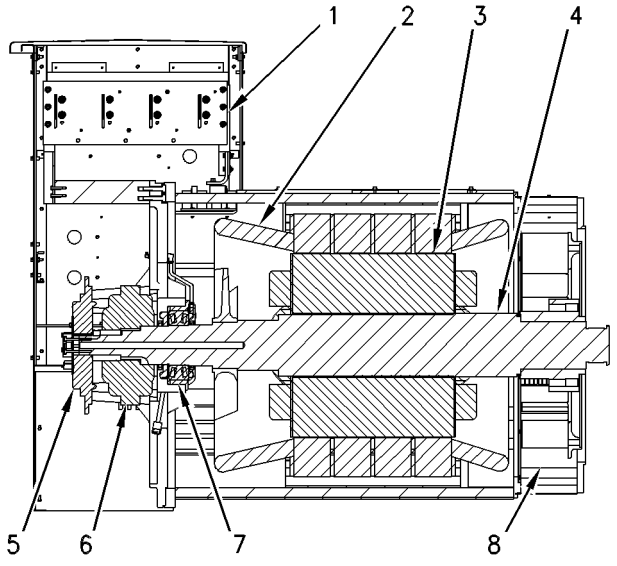

Illustration 20 g00609958

SR4B Generator

(1) Generator terminal strip
(2) Main armature (Stator)
(3) Main field (Rotor)
(4) Rotor shaft
(5) Permanent magnet pilot exciter
(6) Exciter
(7) Bearing
(8) Fan

An engine supplies the power in order to turn rotor shaft (4). The armature of exciter (6) and main field (3) attach to the rotor shaft. As the rotor shaft turns, the exciter generates AC current. The rectifier components convert the AC exciter current to DC current. This DC current is supplied to the main field. A magnetic field is created around the poles of the main field. As the main field turns with the rotor shaft, the magnetic field also rotates. The magnetic field induces an AC voltage into stationary main armature (2). The main armature is a coil with many turns of wire. The current that flows through the main armature flows to the load.

Two rectifiers supply DC current to main field (3). The load voltage is controlled by varying the current that goes to the exciter’s armature. There are two methods for excitation that are used on SR4B Generators:

- Permanent magnet pilot excited (PMPE)
- Self-excited (SE)

Permanent Magnet Pilot Excited (PMPE) Generator

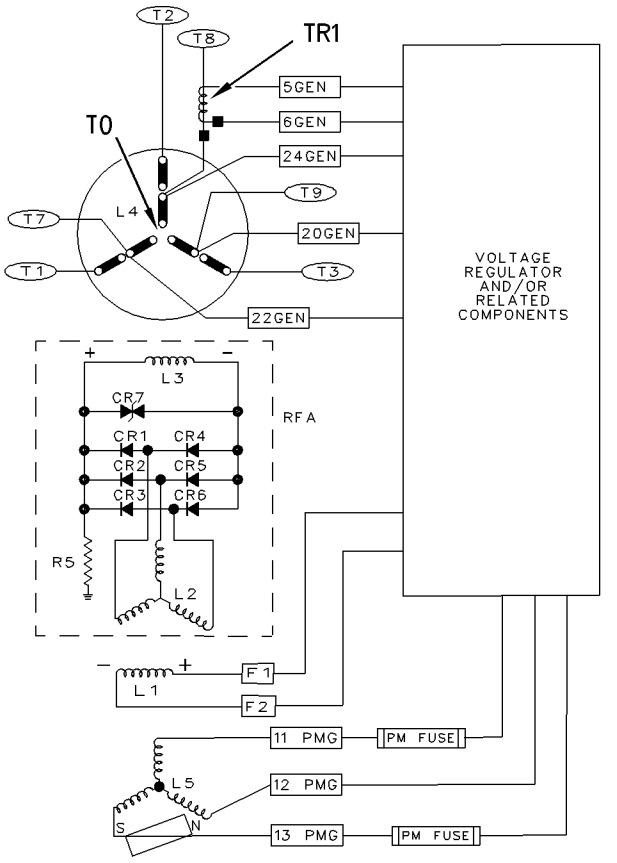

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Illustration 21

PMPE Generator Wiring Diagram

(CR1 - CR6) Diodes
(CR7) Varistor
(L1) Exciter field (stator)
(L2) Exciter armature (rotor)
(L3) Main field (rotor)
(L4) Main armature (stator)
(L5) Pilot exciter armature
(PM) Permanent magnet
(R5) Resistor
(RFA) Rotating field assembly
(TR1) Optional Voltage droop transformer
(T0, T1, T2, T3, T7, T8, T9) Generator terminals and/or Generator leads

Permanent magnet pilot excited generators receive power for the voltage regulator from a pilot exciter. Self-excited generators receive power for the voltage regulator from the main armature. The pilot exciter consists of permanent magnet (PM) and Pilot Exciter Armature (L5). The pilot exciter operates independently from the generator output voltage. Constant excitation during a large load application is possible. Constant excitation is possible because the irregularities that occur in the generator output voltage are not fed back into the exciter. The irregularities that occur in the generator output voltage are caused by load conditions. The independent operation also allows the generator to sustain excessive currents for short periods of time.

When the engine starts turning the Rotating Field Assembly (RFA), the permanent magnet (PM) induces an AC voltage in the pilot exciter armature (L5). The pilot exciter armature has three coils of wire. The pilot exciter armature generates three-phase alternating current (AC). The resulting AC flows through wires “11”, “12”, and “13” to the voltage regulator. Within the voltage regulator, the three-phase alternating current is rectified to direct current (DC). A controlled amount of DC is fed to exciter field (L1) through terminals “F1” and “F2”.

Direct current now flows to exciter field (L1) which creates a magnetic field. Exciter armature (L2) rotates in this magnetic field. The exciter field and the exciter armature generate three-phase alternating current. The AC is then rectified by a three-phase full-wave bridge rectifier circuit. This rectifier circuit is made of the following diodes: CR1, CR2, CR3, CR4, CR5, and CR6.

The DC output from the bridge rectifier is carried to main field (L3) by conductors which are routed through a passage in the generator shaft. Current through the main field creates the magnetic field of the generator. As the main field rotates, the main field induces a three-phase AC voltage in main armature (L4). This voltage is sent to the following terminals: T0, T1, T2, and T3. These terminals are connections for the load.

To keep the output voltage constant with changing loads, it is necessary to control the exciter current. This control is the function of the voltage regulator. The voltage regulator senses the generator output voltage at the following wires: “20”, “22”, and “24”. The regulator sends current to the exciter through wires “F1” and “F2”. The amount of current is dependent on the sensed voltage. The current is drawn from the pilot exciter and the armature (wires “11”, “12”, and “13”). Regardless of the generator’s type (PMPE generator or self-excited generator), changing the exciter current has the same effect on the generator’s operation. See the topic Self-Excited Generators for a description of generator operation when the exciter current changes.

Note: For more information on voltage regulation, see the appropriate voltage regulator service manual.

PMPE generators provide the magnetism for start-up of the generator. A Permanent Magnet (PM) supplies the initial magnetism that is required at start-up. Flashing the field is not required for start-up of the generator.

Self-Excited (SE) Generators

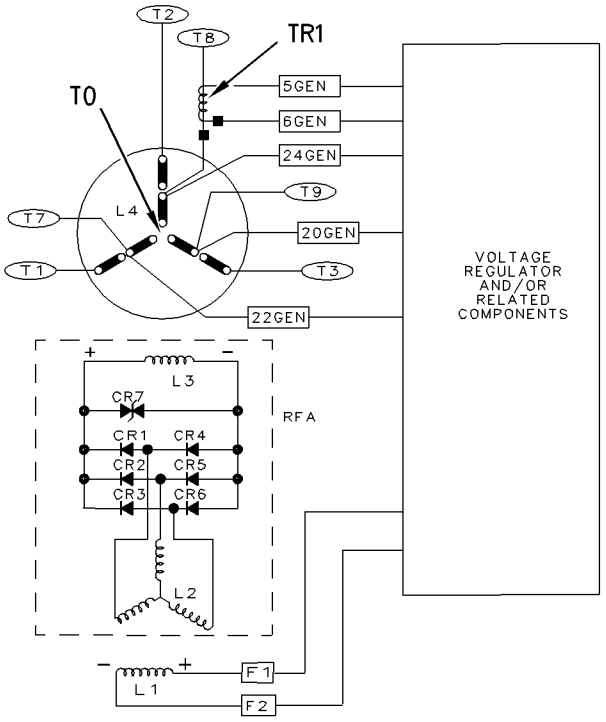

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Illustration 22

SE Generator Wiring Diagram

(CR1 - CR6) Diodes
(CR7) Varistor
(L1) Exciter field (stator)
(L2) Exciter armature (rotor)
(L3) Main field (rotor)
(L4) Main armature (stator)
(RFA) Rotating field assembly
(TR1) Optional Voltage droop transformer
(T0, T1, T2, T3, T7, T8, T9) Generator terminals and/or Generator leads

Self-excited generators are an option. The standard generator is a PMPE generator.

Self-excited generators receive the power for excitation from the generator armature (the generator output). When the engine starts turning the Rotating Field Assembly (RFA), the residual magnetism in exciter field (L1) causes a small amount of AC voltage to be generated in exciter armature (L2). Induced voltage causes current to flow. This current is present in the exciter armature. The AC is then rectified by a three-phase full-wave bridge rectifier circuit. This rectifier circuit is made of the following diodes: CR1, CR2, CR3, CR4, CR5, and CR6. Direct current then flows through main field (L3). The flow of DC through the main field creates a magnetic field. This magnetic field adds to the existing residual magnetism of the main field. As the main field rotates, an AC voltage is induced into main armature (L4) which appears as a three-phase AC voltage at the following output terminals: T0, T1, T2, and T3. The voltage regulator taps the AC output through wires: “20”, “22”, and “24”. During start-up, this tapped output is sensed by the voltage regulator. The voltage regulator senses the output as a low-voltage output condition. Therefore, the voltage regulator output to the exciter field is increased so that the generator output will continue to increase up to the rated voltage.

The amount of current which flows through the exciter directly affects the generator output voltage. The voltage regulator maintains a constant generator output voltage with changing loads. The voltage regulator controls the DC voltage and the DC current. The DC voltage and the DC current is supplied to the exciter which produces the generator output voltage. The voltage regulator senses the generator’s output voltage at wires: “20”, “22”, and “24”. The voltage regulator then supplies a controlled DC voltage and DC current to the exciter through wires “F1” and “F2”.

Note: For more information on voltage regulation, see Service Manual, “Voltage Regulator”.

When the voltage regulator senses a decrease in output voltage, the voltage regulator will increase the DC voltage and the DC current. This DC voltage and DC current is sent through the exciter through wires “F1” and “F2”. The exciter field’s magnetic field increases. As the magnetic field in the exciter field is increased, the AC voltage that is induced in the exciter armature is increased. This increased AC voltage from exciter armature (L2) causes more AC current to flow. The AC current is then rectified by a three-phase full-wave bridge rectifier circuit. This rectifier circuit is made of the following diodes: CR1, CR2, CR3, CR4, CR5, and CR6. The increased DC output from the bridge rectifier is carried to main field coils (L3) by conductors. These conductors are routed through a passage in the generator shaft. Increased current through main field coils increases the magnetic field of the generator. The increased magnetic field induces a larger AC voltage into main armature (L4). The three-phase AC voltage increases until the voltage regulator no longer senses a decreased output voltage.

When the voltage regulator senses an increase in output voltage, the voltage regulator will decrease the DC voltage to the exciter. This will result in a decrease in generator output voltage.

Residual magnetism is necessary for start-up of the self-excited generator. The main field coils are wound on magnetic steel which retains a small amount of magnetism after shutdown. After time and certain conditions, the residual magnetism may decrease. The residual magnetism will then be insufficient to start the generating process. If this occurs, refer to Testing And Adjusting Section, “Exciter Field - Flash”.

Rectifier Circuits

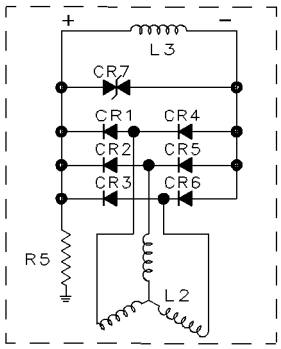

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Illustration 23

Rectifier Circuit

(CR1 - CR6) Diodes
(CR7) Varistor
(L2) Exciter armature (rotor)
(L3) Main field (rotor)
(R5) Resistor

The following diodes form a bridge rectifier circuit: CR1, CR2, CR3, CR4, CR5, and CR6. The bridge rectifier circuit receives three-phase alternating current from exciter armature (L2). The bridge rectifier circuit rectifies the alternating current into direct current. The DC power is then routed to main field (L3).

Diodes “CR1” through “CR6” are contained in rotating rectifier blocks. Three different rotating rectifier blocks are currently used on SR4B generators. The type of the generator and the size of the generator determine the rotating rectifier block that is used.

There are three types of rotating rectifier blocks:

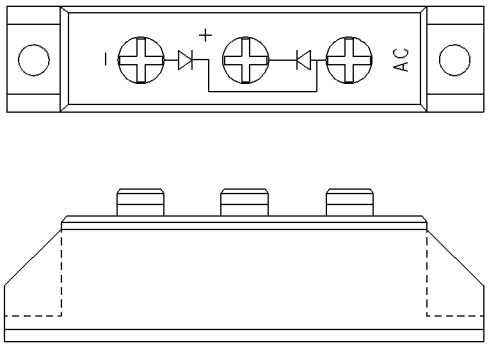
Two-diode rectifier block – The two-diode rectifier block contains two diodes. Three identical blocks are required.

Three-diode rectifier block – The three-diode rectifier block contains three diodes. Two different blocks are required. One block is positive and the other block is negative.

Six-diode rectifier block – The six-diode rectifier block contains six diodes. One block is required.

Rectifying the current creates heat. The rotating rectifier blocks are fastened to heat sinks. These heat sinks spread the heat. These heat sinks also allow the rotating rectifier blocks to operate at a cooler temperature.

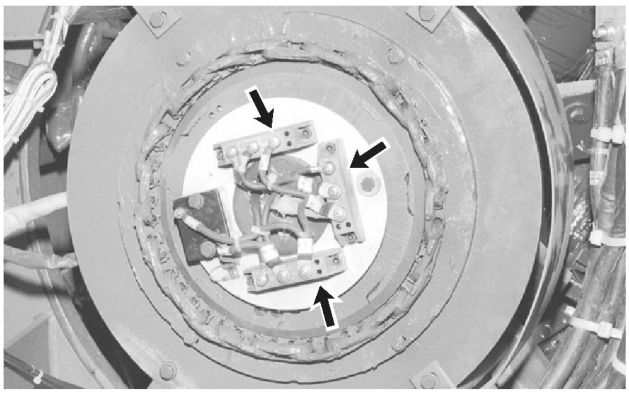
Two-Diode Rectifier Block



g00610186

Illustration 24

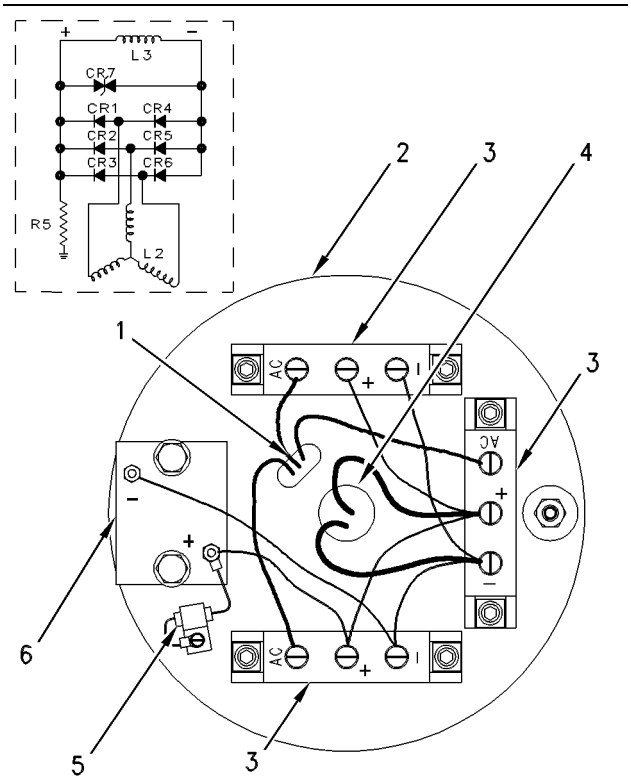
Two-diode rectifier block



g00610197

Illustration 25

The locations of the three two-diode rectifier blocks



g00610202

Illustration 26

The wiring of the three two-diode rectifier blocks

(1) “L2” (wire passage)
(2) Heat sink assembly
(3) Three two-diode rectifier blocks
(4) “L3” (wire passage)
(5) R5
(6) CR7

Three identical two-diode rectifier blocks (3) are interconnected in order to form a bridge rectifier circuit. Each of the two-diode rectifier blocks contains one of the following sets of two diodes:

- “CR1” and “CR4”
- “CR2” and “CR5”
- “CR3” and “CR6”

Two-diode rectifier blocks must be wired correctly. Refer to Illustration 26. Each “AC” terminal connects to an exciter armature wire (1). The “+” terminals connect together. The “+” terminals also connect to one “L3” wire (4) of the main field. The “-” terminals connect together. The “-” terminals also connect to the other “L3” wire (4) of the main field.

The two-diode rectifier blocks (3) are mounted to the heat sink assembly (2). The heat sink assembly is on the end of the generator shaft. Heat sink assembly (2) also contains a varistor (6) and a resistor (5). The varistor and the resistor are used to protect the generator circuit. Refer to Generator Operation, “Generator Circuit Protection”.

Three-Diode Rectifier Block

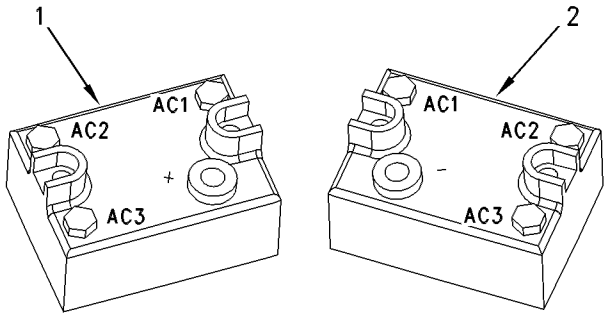


Illustration 27 g00610236

Three-diode rectifier blocks

(1) Positive rectifier block
(2) Negative rectifier block

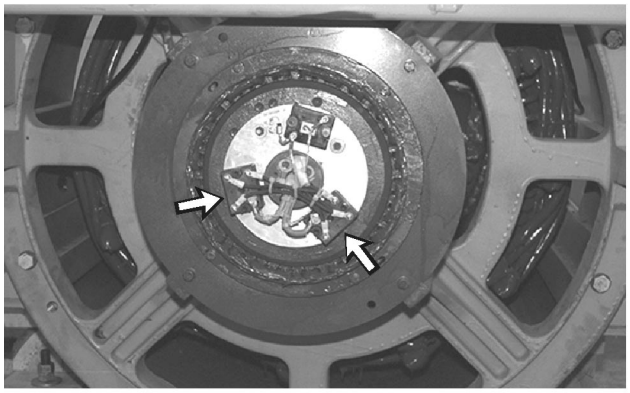


Illustration 28 g00610240

The location of the two three-diode rectifier blocks

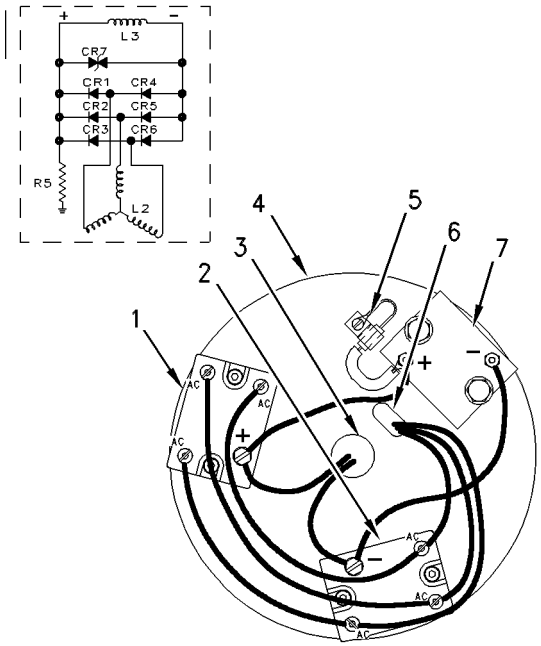


Illustration 29 g00610241

The wiring of the three-diode rectifier blocks

(1) Positive rectifier block
(2) Negative rectifier block
(3) “L3” (two-wire passage)
(4) Heat sink assembly
(5) R5
(6) “L2” (three-wire passage)
(7) CR7

In order to form a bridge rectifier circuit, two similar three-diode rectifier blocks are connected. Each of the three-diode rectifier blocks contain three diodes. Positive rectifier block (1) contains diodes “CR1”, “CR2”, and “CR3”. Negative rectifier block (2) contains diodes “CR4”, “CR5”, and “CR6”.

Three-diode rectifier blocks must be wired correctly. Refer to Illustration 29. Each “AC” terminal connects to an “L2” wire from the exciter armature (6). The “+” terminals connect together. The “+” terminals also connect to one “L3” wire (3) of the main field. The “-” terminals connect together. The “-” terminals also connect to the other “L3” wire (3) of the main field.

The positive rectifier block (1) and the negative rectifier block (2) are mounted to heat sink assembly (4). The heat sink assembly is on the end of the generator shaft. Heat sink assembly (4) also contains a varistor (7) and resistor (5). The varistor and the resistor are used to protect the generator circuit. Refer to Generator Operation, “Generator Circuit Protection”.

Six-Diode Rectifier Block

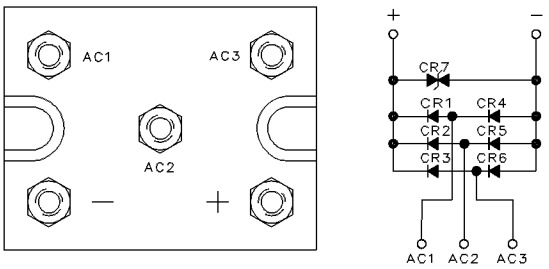


Illustration 30 g00610322

Six-Diode Rectifier Block

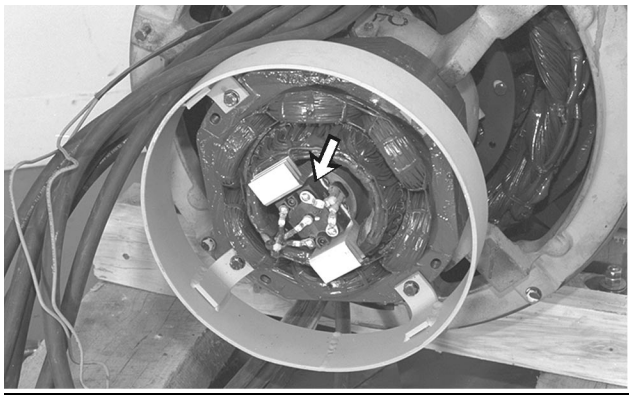


Illustration 31 g00610330

Six-Diode Rectifier Block Location (Inboard Bearing)

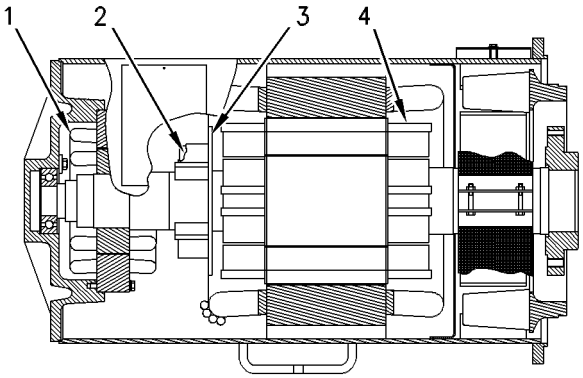


Illustration 32 g00610335

Six-Diode Rectifier Block Location (Outboard Bearing)

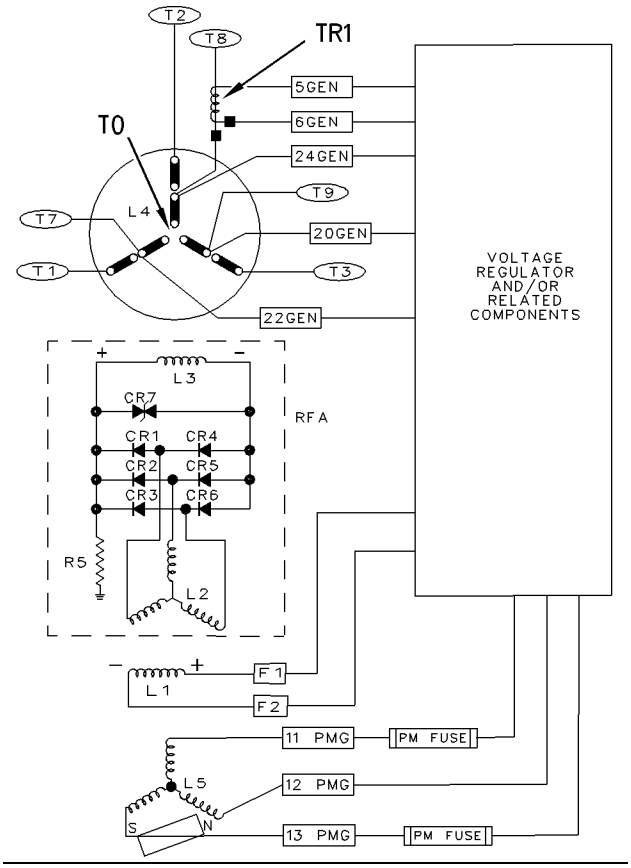
(1) Exciter
(2) Six-Diode Rectifier Block
(3) Disc
(4) Main Field

The six-diode rectifier block contains the six diodes of the bridge rectifier circuit. Each “AC” terminal connects to an exciter armature wire. The “+” terminal and the “-” terminal connect to main field (4).

On inboard bearing type generators, the six-diode rectifier block is on the end of the generator shaft. On outboard bearing type generators, six-diode rectifier block (2) is mounted on disc (3). Disc (3) is between exciter (1) and main field (4).

The six -diode rectifier block also contains varistor (CR7) which is used to protect the generator circuit. Refer to Generator Operation, “Generator Circuit Protection”.

Generator Circuit Protection

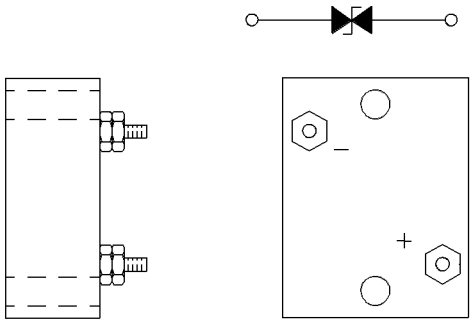


g00609975

Illustration 33

PMPE Generator Wiring Diagram

(CR1 - CR6) Diodes
(CR7) Varistor
(L1) Exciter field (stator)
(L2) Exciter armature (rotor)
(L3) Main field (rotor)
(L4) Main armature (stator)
(L5) Pilot exciter armature
(PM) Permanent magnet
(R5) Resistor
(RFA) Rotating field assembly
(TR1) Optional voltage droop transformer
(T0, T1, T2, T3, T7, T8, T9) Generator terminals and/or Generator leads



g00610379

Illustration 34

Varistor (CR7)

Varistor (CR7) protects the following diodes by suppressing any abnormal transient peak voltages: CR1, CR2, CR3, CR4, CR5, and CR6. On generators that use the two-diode rectifier blocks or the three-diode rectifier blocks, varistor (CR7) is a separate component and mounts on the heat sink assembly. On generators that use the six-diode rectifier block, varistor (CR7) is contained within the six-diode rectifier block.

Note: Some generators are provided with another varistor (CR8) for additional protection.

Resistor (R5) is a separate component and mounts on the heat sink assembly. This resistor is only used on some of the larger generators. Resistor (R5) provides a low resistance circuit from the insulated windings to the shaft and cores of revolving field assembly (RFA). Resistor (R5) is a 27000 ohm resistor. Air friction on the windings can cause an electrostatic charge. If this resistor is not installed, these charges can cause voltages to become high enough to destroy the winding insulation. Resistor (R5) allows charges to dissipate as the charges are generated. This resistor also prevents any buildup of voltage. Because of the resistance value and the power rating of resistor (R5), a ground failure at any point on revolving field assembly (RFA) will not prevent the generator from operating normally. A ground failure will not damage resistor (R5).

The voltage regulator and related components also protect the generator. All voltage regulators have fuses, which will stop the current flow to the exciter. When no voltage is applied to the exciter, the generator output voltage is reduced to a very low level. These fuses open very rapidly. This protects against secondary damage that is caused by another component failure. If any fuse is replaced, use only a fuse of the same type and amperage rating. A larger amperage rating or a fuse which does not open rapidly will not prevent damage to other components.

All voltage regulators have excessive current protection circuits that also open the excitation circuit.

Note: For more information on voltage regulation, see the appropriate voltage regulator service manual.

Space Heaters

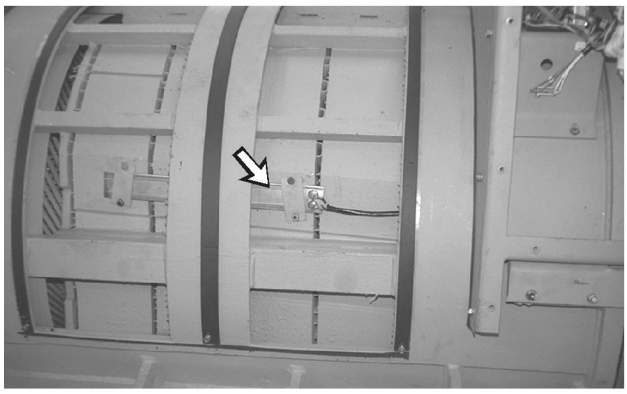


Illustration 35 g00610386

Location of the Space Heater (Large Frame Generator)

The space heater for small frame generators is located within the housing of the main stator. The space heater is located in the generator's exciter end.

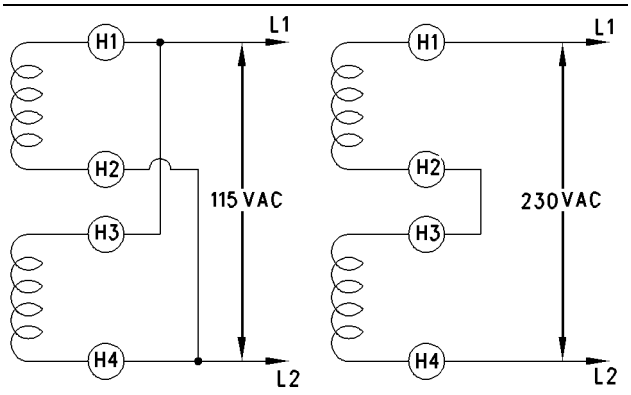


Illustration 36 g00610396

Space Heater Connection Diagram

The SR4B generator can operate in high humidity conditions without problems. However, problems can occur when the generator is idle and the surrounding air is warmer than the generator. Moisture can form on the windings. This moisture will result in poor performance or even damage to the windings. Whenever the generator is not active, the space heaters should be operated.

An external source is required to operate the space heaters. This source can be either 115 VAC or 230 VAC. Both of these sources must be single-phase. When the external source is 50 hertz, 200 VAC must be used. Refer to Illustration 36.

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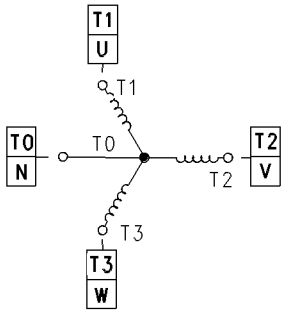
Lead Connections

SMCS Code: 4459

The Wye configurations and the Delta configurations are the most common generator lead connections. The following three-phase connection diagrams illustrate the proper connection and lead identification for Wye configurations.

Four Lead Wye Connection



g00611469

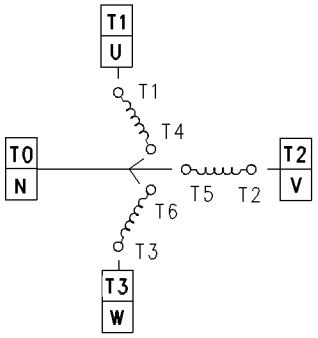
Illustration 37

Four Lead Wye Connection Diagram

Table 1

FOUR LEAD WYE CONNECTIONS		
Generator Lead	**Line Lead**	**Regulator Lead**
T1	T1	22
T2	T2	24
T3	T3	20
T0	Neutral	-

Six Lead Wye Connection



g00611486

Illustration 38

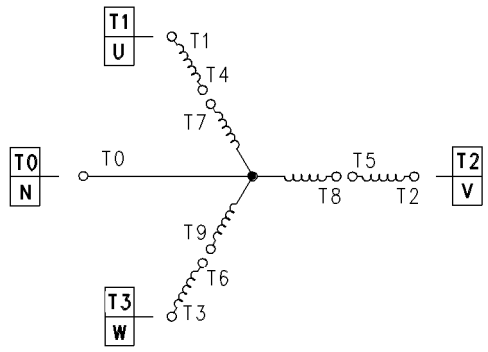
Six Lead Wye Connection Diagram

Table 2

SIX LEAD WYE CONNECTIONS		
Generator Lead	**Line Lead**	**Regulator Lead**(1)
T1	T1	22
T2	T2	24
T3	T3	20
Connect T4, T5, and T6	Neutral	-

(1) Regulator leads are used on Generator sets with a 3500B Engine. On PMPE generators, sensing isolation transformers are used. The line lead's voltage connects to one side of the sensing isolation transformer. The voltage regulator connects to the other side of the sensing isolation transformer. On SE generators, the stator windings are tapped in order to supply sensing voltage to the regulator.

Ten Lead Wye Connection (High Voltage)



g00611584

Illustration 39

Ten Lead Wye Connection Diagram (High Voltage)

Table 3

TEN LEAD WYE CONNECTIONS (HIGH VOLTAGE)		
Generator Lead	**Line Lead**	**Regulator Lead**
T1	T1	-
Connect T4 and T7	-	22
T2	T2	-
Connect T5 and T8	-	24
T3	T3	-
Connect T6, T9	-	20
T0	Neutral	-

Ten Lead Wye Connection (Low Voltage)

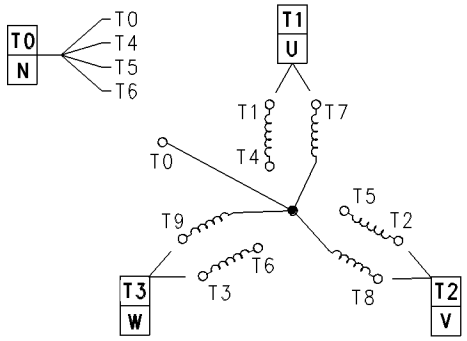


Illustration 40 g00611596

Ten Lead Wye Connection Diagram (Low Voltage)

Table 4

TEN LEAD WYE CONNECTIONS (LOW VOLTAGE)		
Generator Lead	**Line Lead**	**Regulator Lead**
Connect T1 and T7	T1	22
Connect T2 and T8	T2	24
Connect T3 and T9	T3	20
Connect T4, T5, T6, and T0	Neutral	-

Twelve Lead Wye Connection (High Voltage)

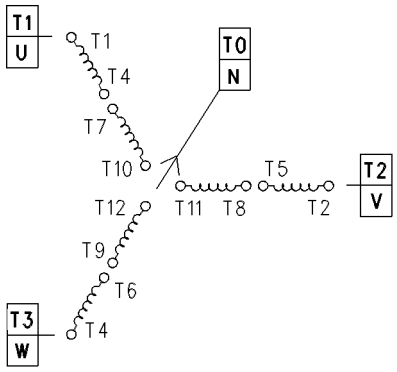


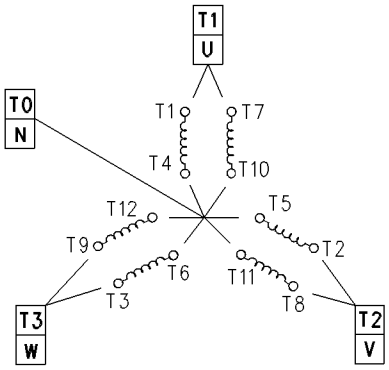
Illustration 41 g00611603

Twelve Lead Wye Connection Diagram (High Voltage)

Table 5

TWELVE LEAD WYE CONNECTIONS (HIGH VOLTAGE)		
Generator Lead	**Line Lead**	**Regulator Load**
T1	T1	-
Connect T4 and T7	-	22
T2	T2	-
Connect T5 and T8	-	24
T3	T3	-
Connect T6 and T9	-	20
Connect T10, T11, and T12	Neutral	-

Twelve Lead Wye Connection (Low Voltage)



g00611608

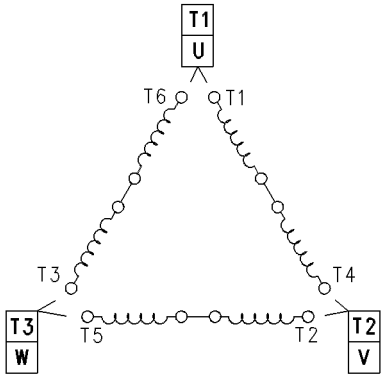
Illustration 42

Twelve Lead Wye Connection Diagram (Low Voltage)

Table 6

TWELVE LEAD WYE CONNECTIONS (LOW VOLTAGE)		
Generator Lead	**Line Lead**	**Regulator Lead**
Connect T1 and T7	T1	22
Connect T2 and T8	T2	24
Connect T3 and T9	T3	20
Connect T4, T5, T6, T10, T11, and T12	Neutral	-

Six Lead Delta Connection



g00611618

Illustration 43

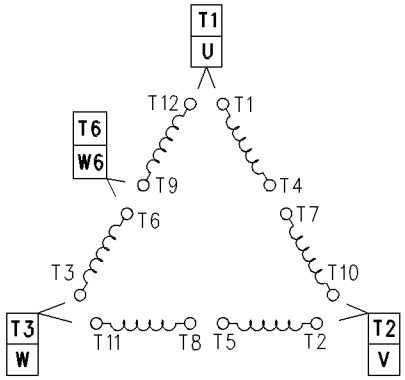
Six Lead Delta Connection Diagram

Table 7

SIX LEAD DELTA CONNECTIONS		
Generator Lead	**Line Lead**	**Regulator Lead**(1)
Connect T1 and T6	T1	22
Connect T2 and T4	T2	24
Connect T3 and T5	T3	20

(1) Regulator leads are used on Generator sets with a 3500B Engine. On PMPE generators, sensing isolation transformers are used. The line lead's voltage connects to one side of the sensing isolation transformer. The voltage regulator connects to the other side of the sensing isolation transformer. On SE generators, the stator windings are tapped in order to supply sensing voltage to the regulator.

Twelve Lead Delta Connection



g00611504

Illustration 44

Twelve Lead Delta Connection Diagram

Table 8

TWELVE LEAD DELTA CONNECTIONS		
Generator Lead	**Line Lead**	**Regulator Lead**
Connect T1 and T12	T1	22
Connect T4 and T7	-	-
Connect T2 and T10	T2	24
Connect T5 and T8	-	-
Connect T3 and T11	T3	20
Connect T6 and T9	Neutral	-

Generator line leads (“T1” through “T12”) can be multiple. For example, three generator line leads might be designated as “T4”. Multiple line leads allow the lead to be flexible. Flexible leads help maintain the current carrying capacity which is required. If generator line leads are similarly marked, these leads should be connected together. These leads should be treated as one conductor. Generator line leads can terminate in the following ways:

- end at the terminal strip
- directly fastened to the load leads
- fastened to another component

For more information, refer to Testing And Adjusting, “Leads - Connect”.

Depending on the connections that are made between the load and the generator line leads, single-phase voltages and/or three-phase voltages are possible. For more information, refer to Operation and Maintenance Manual, LEKQ7119, “Engine Data Sheet”. Refer to Connection Diagrams, SENR4794.

i01731631

Glossary

SMCS Code: 4450

Actuate – Actuation relates to putting something in motion.

Anode – An anode is the positive end of a diode or an anode is the positive end of a rectifier.

Blocking Rectifier – A blocking rectifier permits direct current flow in only one direction.

Bolted – A bolted device uses a bolt to hold two or more parts together.

Bridge – A bridge is a circuit that is used to measure small quantities of current, voltage, or resistance.

Bridge Rectifier – A bridge rectifier is a circuit that is used to change alternating current (AC) to direct current (DC).

Buildup – A buildup is a gradual increase in voltage.

Cathode – A cathode is the negative end of a diode or a cathode is the negative end of a rectifier.

Capacitance – Capacitance is the ability to store an electrical charge.

Capacitor – A capacitor is a device that will store an electrical charge.

Circuit Breaker – A circuit breaker is an automatic switch that is used to open a circuit.

Circulating Current – Circulating current is the flow of current between two or more generators that are working in parallel. Circulating current is also the flow of current between two or more generators that are parallel with a utility line.

Conduct – Conducting relates to allowing the flow of current.

Continuity – Continuity provides a path for current flow.

Control – A control is a device that controls another device. A control is also a circuit that controls a device.

Direct Current (DC) – Direct current is current flow that moves in only one direction in a given circuit.

Damping – Damping refers to decreasing the amplitude of a signal.

De-energized – A de-energized input refers to stopping the current that is going to a component.

Distribution Winding – Distribution windings go from one end of the core to the other end of the core. These windings are arranged in groups that are located in several slots.

Droop – Droop refers to a decrease.

Excitation – Excitation is controlled direct current (DC) that is used to make a magnetic field.

Energized – An energized input refers to activating a device.

Electrostatic Charge – Electrostatic charge is electricity that is caused by induced voltage and stored charge.

Exciter – An exciter supplies direct current (DC) to the field windings of the generator.

Field – A field is a magnetic line of force that surrounds a conductor. This force is caused by current flow in the conductor.

Field Windings – Field windings are many turns of wire that are wrapped around an iron core. When direct current (DC) flows through the field windings, a magnetic field is produced. This magnetic field is comparable to the magnetic field of a bar magnet.

Flashing – Flashing is a process of putting direct current from an external source into the field windings. This process causes the generator to produce an output voltage.

Flux – Flux is magnetic lines of force.

Full-Wave Rectifier – A full-wave rectifier changes the positive phase and the negative phase of alternating current to direct current.

Gain – Gain relates to the relationship between input magnitude and output magnitude.

Gate – A gate is an electronic part of a controlled rectifier (thyristor).

Generate – This refers to the process of making electricity.

Grounded – A device is grounded by making a connection to ground. A device could also be grounded by making a connection to a component that is connected to ground.

Humidity – Humidity is the water content that is present in the air.

Impedance – Impedance is the resistance to alternating current.

Impulse Modulation – Impulse modulation changes the following characteristics of a wave: amplitude, frequency, and phase. This is accomplished by impressing one wave on another wave that has constant properties.

Induce – This refers to the transfer of power from one device to another device. The transfer is done via a magnetic field or via an electric field.

Interference – Interference is an unwanted mixture of electrical signals. Interference is usually associated with electrical noise.

Instrumentation – Instrumentation is a group of instruments that are used for measuring a system function.

Insulated – An insulated device is a device that is covered with a nonconductive material.

Lead – A lead is a wire.

Line Voltage – Line voltage is the output voltage of the generator that is measured between the generator leads (phases).

Lock In – A lock in occurs when a contact closes in order to keep a device in an energized state.

Lock Out – Lockout occurs when a contact opens in order to keep a device in a de-energized state.

Magnetic – A magnetic device is a device that has the characteristics of a magnet.

Magnification – Magnification refers to the enlargement of an item.

Module – A module is an assembly of electronic components and electronic circuits.

Moisture – Moisture is the presence of water.

Oscillation – Oscillation is the flow of electricity that periodically changes direction and/or magnitude.

Permanent Magnet (PM) – A permanent magnet supplies the initial magnetism that is required to start a PMPE generator.

Permanent magnet pilot exciter (PMPE) – PMPE generators receive power for the voltage regulator from a pilot exciter. A PMPE generator consists of a permanent magnet and a pilot exciter.

Phase Winding – A phase winding is a group of generator stator coils. Electric power for one phase of the load is induced in the phase winding.

Polarity – Polarity is the positive characteristics or the negative characteristics of two poles.

Pulsating – Pulsating relates to the characteristics of current that are similar to mechanical vibration.

Radio Suppression – Radio suppression reduces the amplitude of radio frequency interference.

Reciprocating – Reciprocating motion is motion that first moves in a straight line in one direction. The direction of this motion then varies by 180 degrees.

Rectifier – A rectifier is a diode circuit that converts alternating current (AC) to direct current (DC).

Rotating Rectifier – A rotating rectifier is mounted to a plate on a generator shaft. This plate then rotates with the generator shaft.

Regenerative Power – Regenerative power is power that works against primary power.

Reset – A reset returns a switch to a ready condition. In addition, a reset returns a circuit to a ready condition.

Residual Magnetism – Residual magnetism is a small amount of magnetism that is remaining in a device after excitation is removed.

RFA – An RFA is a rotating field assembly.

Rotor – A rotor is the rotating windings of a generator.

Saturable Reactor – A saturable reactor has characteristics that are similar to a valve. As the load changes, a valve opens in order to give more current to the output or a valve closes in order to give less current to the output.

Saturated – A device has been saturated when the device has been magnetized in excess. When saturation occurs, a large increase in current results in a small increase in magnetic force.

SCR – An SCR is a silicon controlled rectifier. An SCR is a semiconductor.

SE – An SE generator is a self-excited generator. An SE generator uses a small part of the generator output to provide excitation current back to the generator. An SE generator uses residual magnetic field for start-up.

Semiconductor – A semiconductor is a component such as one of the following components:a transistor, a diode, and a thyristor. Semiconductors have electrical characteristics that are between a conductor and insulation.

Series Boost – A series boost is an attachment that allows generator output to continue for a short time during a line failure. This allows the circuit breaker to trip in sequence.

Short – A short is an undesired electrical connection that exists between two or more components.

Shutdown – A shutdown occurs when the engine is stopped. This shutdown can occur manually or this shutdown can occur automatically.

Simultaneous – A simultaneous occurrence refers to two actions that happen at the same time.

Solid-State – A solid-state component is an electrical component that has no moving parts.

Stator – A stator is the windings of a generator that do not rotate.

Surge – A surge is a sudden increase in voltage or current.

Tap – A tap is a connection at the midpoint of a circuit. From this tap, power is taken from the circuit.

Transfer – A transfer refers to moving something from one point to another point. A transfer also refers to converting something from one state to another state.

Transient Peak Voltage – A transient peak voltage is a high voltage condition of limited duration.

Turn-on – When a device is turned on, the device is activated or the device is started.

Varistor – A varistor is a device that loses resistance as voltage increases.

Voltage Droop Resistor – A voltage droop resistor is a variable resistor. This resistor is used to control the change of voltage. This can occur when a generator is paralleled with another generator. This can also occur when the generator is paralleled with a utility.

Voltage Gain Resistor – A voltage gain resistor is a variable resistor. This resistor is used to control the change of voltage from no load to full load.

Voltage Level Rheostat – A voltage level rheostat gives a range of control that is used when the voltage output level is adjusted.

Voltage Spike – A voltage spike is a brief high voltage.

Windings – Windings are layers of wire on a core.

Wiring – Wiring relates to the wires of a circuit.

Testing and Adjusting Section

Testing and Adjusting

i01154940

General Information

SMCS Code: 4450

⚠ WARNING

Personal injury or death can result from high voltage.

When power generation equipment must be in operation to make tests and/or adjustments, high voltage and current are present.

Improper test equipment can fail and present a high voltage shock hazard to its user.

Make sure the testing equipment is designed for and correctly operated for high voltage and current tests being made.

When servicing or repairing electric power generation equipment:

- **Make sure the unit is off-line (disconnected from utility and/or other generators power service) , and either locked out or tagged DO NOT OPERATE.**
- **Remove all fuses.**
- **Make sure the generator engine is stopped.**
- **Make sure all batteries are disconnected.**
- **Make sure all capacitors are discharged.**

Failure to do so could result in personal injury or death. Make sure residual voltage in the rotor, stator and the generator is discharged.

When work is being done on a generator, the following general rules should be used as a guide:

- Before you work on the generator, the operating principles must be understood.
- The generator is a constant speed unit. An RPM that varies can cause terminal voltages to vary. When the rpm exceeds the rated rpm (5% to 10%), the terminal voltage could exceed the rated output voltage (5% to 10%). When the rpm is lower than the rated rpm (5% to 10%), the terminal voltage could be lower than the rated output voltage (5% to 10%).
- Generator heat is caused by line current. As the line current increases, the generator temperature increases.
- Instrumentation will not accurately show a generator's kVA load (including ammeters, wattmeters, and voltmeters). This is because of the power factor of the load.

i01157451

Service Tools

SMCS Code: 0785

⚠ WARNING

Personal injury or death can result from high voltage.

When power generation equipment must be in operation to make tests and/or adjustments, high voltage and current are present.

Improper test equipment can fail and present a high voltage shock hazard to its user.

Make sure the testing equipment is designed for and correctly operated for high voltage and current tests being made.

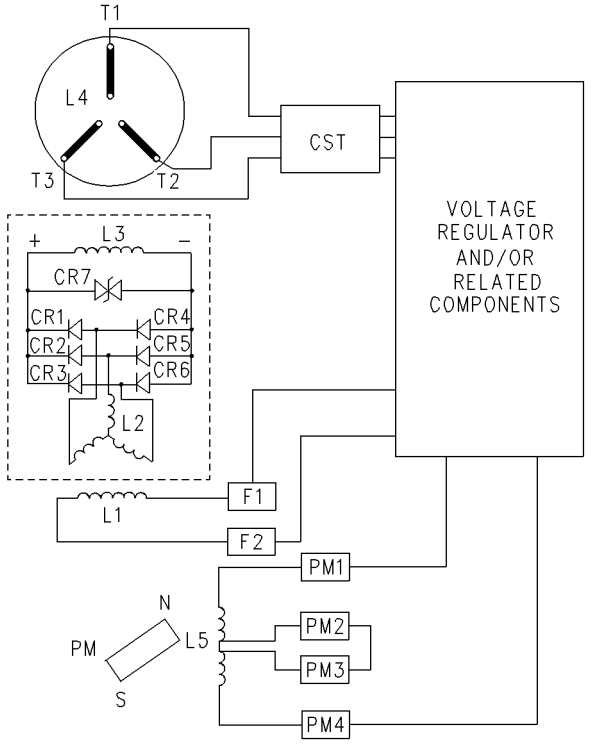
Table 9

TOOLS NEEDED		
Part Number	**Tool**	**Quantity**
6V-7070	Digital multimeter Used to measure voltage, resistance, or current up to 10 amperes. Rectifiers can be checked by using the diode function. Refer toSpecial Instruction, SEHS7734.	1
9U-7330	Digital multimer (optional) Used to measure voltage, current, frequency, duty cycle, and capacitance.	1
8T-0900	AC/DC clamp-on ammeter. Used to measure current up to 1200 amperes. When measuring line current on multiple lead units, measure the current in each conductor per phase and add the currents together. Refer to Special Instruction, SEHS8420.	1
9U-6003	Insulation Tester (megohmmeter) Used to measure the insulation resistance of the main armature, main field, exciter armature, and exciter field.	1
	A Milliohmmeter (Wheatstone Bridge) Used to measure the winding resistance of the main armature and the exciter field.	1

i01155184

Troubleshooting

SMCS Code: 4450-035



g00555151

Illustration 45

PMPE Generator Wiring Diagram

(CR1 through CR6) Rectifiers
(CR7) Varistor
(L1) Exciter field (stator)
(L2) Exciter armature (rotor)
(L3) Main field (rotor)
(L4) Main armature (stator)
(L5) Pilot exciter armature
(PM) Permanent magnet
(RFA) Rotating field assembly
(CST) Customer supplied transformer
(T1, T2, T3) Generator terminals and/or generator leads

This section provides probable causes to a known problem. There may be several probable causes to each problem. Specific inspections or tests are recommended in order to help isolate the damaged component.

The generator is a component of the generator set. The generator should be tested with the entire system. The voltage regulator's service manual provides tests in order to determine if the generator is the cause of a generator set malfunction.

A problem must be identified and defined before the problem can be corrected. After you identify the problem, refer to Table 10.

The following procedure should be used to identify the problem:

1. Perform Visual Checks in order to help identify the problem.
2. If previous tests were performed from the voltage regulator service manual, use the test results to help identify the problem.
3. Perform the Generator Functional Test. The Generator Functional Test will help identify the problem.

Visual Checks

A visual inspection of the generator set can detect possible causes of a malfunction. Inspect all wiring for worn insulation or missing insulation. Ensure that all wire terminal connections are tight. Also ensure that all wire terminal connections are not corroded. Discolored electrical components indicate that the item has been greatly stressed.

A large percentage of electrical problems are caused by mechanical defects. Carefully inspect the total installation. Keep the mechanical defects separate from the electrical defects.

Problem List

Table 10

PROBLEM	PROBABLE CAUSE	REFERENCE
All Phase Voltages Are Too Low.	Damaged diodes (CR1 through CR6)	“Rotating Rectifier - Test”
	Damaged exciter armature (Rotor - L2)	“Winding - Test”
	Damaged exciter field (Stator - L1)	“Winding - Test”
	Damaged PM armature (L5)	“Winding - Test”
	Damaged varistor (CR7)	“Varister - Test”
The Phase Voltages Are Not Equally Balanced.	Damaged main armature (Stator - L4)	“Winding - Test”
The Phase Voltages Do Not Change With Engine Speed.	Damaged diodes (CR1 through CR6)	“Rotating Rectifier - Test”
	Damaged Exciter armature (Rotor - L2)	“Winding - Test”
	Damaged exciter field (Stator - L1)	“Winding - Test”
	Damaged PM armature (L5)	“Winding - Test”

i01699662

Generator Set - Test

SMCS Code: 4450-081

Table 11

TOOLS NEEDED		
Part Number	**Tool**	**Quantity**
6V-7070	Digital Multimeter	1
	12 VDC Battery	1

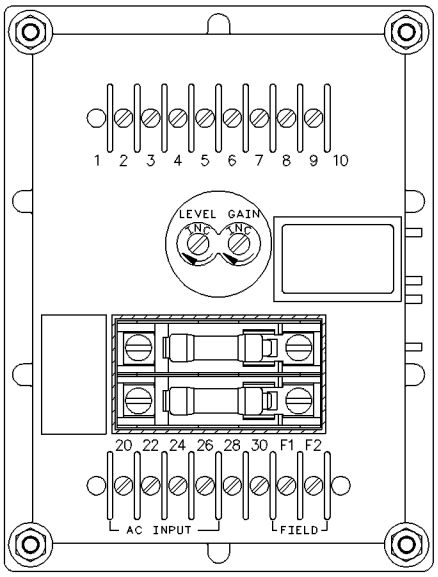


Illustration 46 g00613756

Voltage Regulator

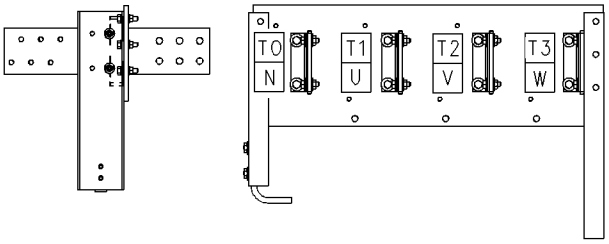


Illustration 47 g00613767

Terminals

The generator set functional test is a simplified test that can be performed in order to determine if the generator is functional. The final test should be on the complete generator set while the generator is under load. The generator set functional test will determine if a phase voltage is being generated. The generator set functional test will also determine if the phase voltages are balanced. In addition, this test will determine if the phase voltages change with engine speed.

The generator set functional test consists of the following steps:

1. Disconnect wires F1 and F2 from the voltage regulator. Disconnect the generator load.

2. Connect a 12 VDC automotive type battery to wires F1+ and F2-.

NOTICE

Do not operate the generator set at a speed that is higher than one-half of the rated speed.

Higher speeds under these test conditions can cause damage to the system.

Note: Do not allow the generator output voltage to exceed the nameplate rating.

3. Operate the generator set at half the rated speed.

4. Measure the AC voltage across the following terminals. Record the results.

Table 12

AC VOLTAGE ACROSS TERMINALS		
Generator Set Speed	**Terminals**	**AC Voltage**
Half of the Rated Speed	“T1” and “T2”	
	“T1” and “T3”	
	“T2” and “T3”	
Decrease Generator Set Speed by 10%.	“T1” and “T2”	
	“T1” and “T3”	
	“T2” and “T3”	
Increase Generator Set Speed by 10%. **Do Not Exceed Half of the Rated Speed.**	“T1” and “T2”	
	“T1” and “T3”	
	“T2” and “T3”	

5. Monitor the same voltages as Step 4, while decreasing and then increasing the generator set speed 10%. Do not exceed half of the rated speed.

6. The measured voltages of Step 4 should be at least 85 VAC. With a 10% increase in generator set speed, the voltages of Step 5 should show an increase of 10%. With a 10% decrease in generator set speed, the voltages of Step 5 should show a decrease of 10%.

Note: If the engine speed cannot be adjusted to half of the rated speed, a 6 VDC battery can be used. The 6 VDC battery would be connected to wires F1+ and F2- in Step 2.

i01699677

Varistor - Test

SMCS Code: 4466-081

Table 13

TOOLS NEEDED		
Part Number	**Tool**	**Quantity**
6V-7070	Digital Multimeter	1

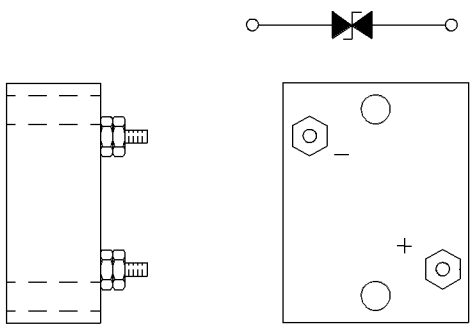


Illustration 48 g00610379

Varistor (CR7)

Varistor (CR7) can be checked by measuring the resistance between the positive “+” terminal and the negative “-” terminal. The resistance should equal 15000 ohms or the resistance should exceed 15000 ohms.

Note: For testing rectifier blocks with integral varistor (CR7), refer to Testing And Adjusting, “Rotating Rectifier - Test”.

i01155464

Rotating Rectifier - Test

SMCS Code: 4465-081

Table 14

TOOLS NEEDED		
Part Number	**Tool**	**Quantity**
6V-7070	Multimeter	1

Six-Diode Rectifier Block

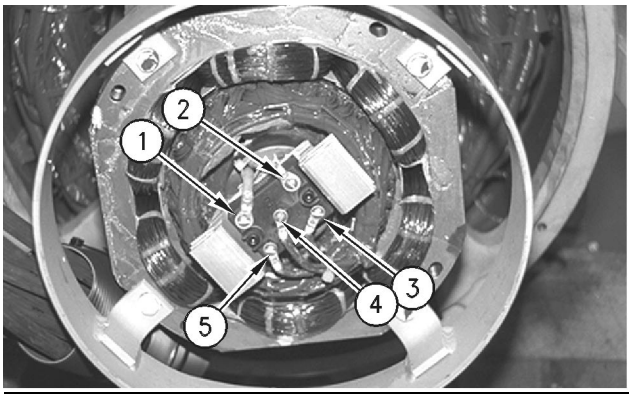


Illustration 49 g00613957

Six-Diode Rectifier Block (one piece)

(1) Positive Rectifier Block
(2) Negative Rectifier Block
(3) Rectifier Terminal “AC1”
(4) Rectifier Terminal “AC2”
(5) Rectifier Terminal “AC3”

The following procedure tests all six diodes within the block. If any meter reading does not fall within the given ranges, replace the rectifier block .

1. Set the digital multimeter on the diode range. Remove all leads from the rectifier block.

2. Place the black test lead on the positive “+” rectifier terminal. Place the red test lead on the following rectifier terminals: “AC1”(3), “AC2”(4), and “AC3”(5). All readings on the meter should be between 0.4 and 1.0.

3. Place the red test lead on the negative “-” rectifier terminal. Place the black test lead on the following rectifier terminals: “AC1”(3), “AC2”(4), and “AC3”(5). All readings on the meter should be between 0.4 and 1.0.

4. Place the red test lead on the positive “+” rectifier terminal. Place the black test lead on the following rectifier terminals: “AC1”(3), “AC2”(4), and “AC3”(5). In all cases, the meter should read “OL” (overload).

5. Place the black test lead on the negative “-” rectifier terminal. Place the red test lead on the following rectifier terminals: “AC1”(3), “AC2”(4), and “AC3”(5). In all cases, the meter should read “OL” (overload).

Note: A shorted diode can cause damage to the exciter rotor. If a diode is shorted, check the exciter rotor. Refer to the Testing and Adjusting, “Winding - Test” and Testing and Adjusting, “Insulation - Test”. Perform these tests.

Note: This rectifier block also contains varistor “CR7”. “CR7” can be checked by measuring the resistance between the positive “+” rectifier terminal and the negative “-” rectifier terminal. The resistance should be a minimum of 15000.

Three-Diode Rectifier Block

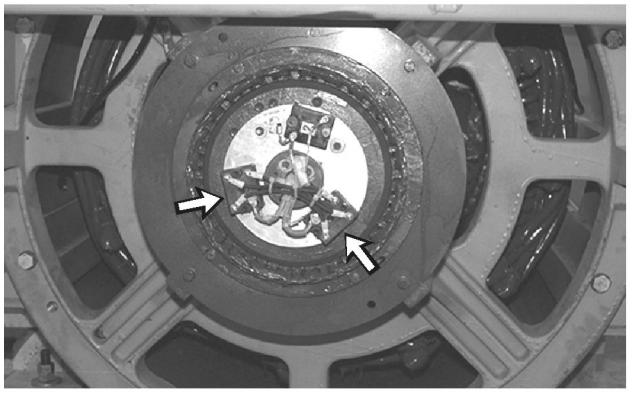


Illustration 50 g00610240

Three-Diode Rectifier Block (two pieces)

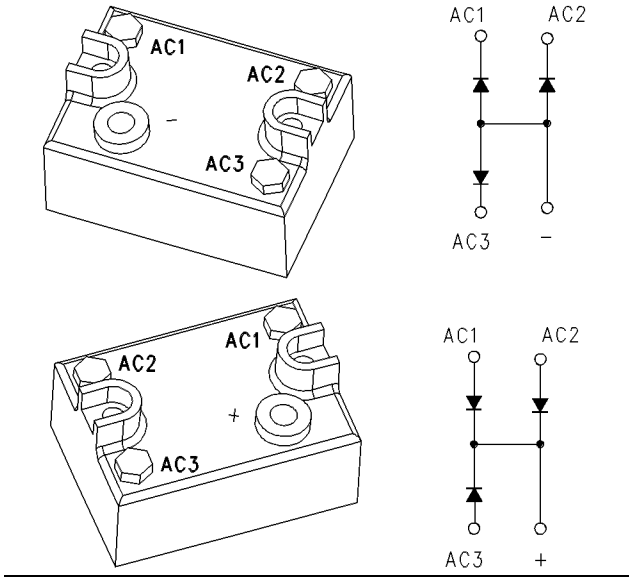


Illustration 51 g00613971

Three-Diode Rectifier Block (two pieces)

The following procedure tests all three diodes within a block. Check the positive rectifier block and the negative rectifier block. If any meter reading does not fall within the given ranges, replace the rectifier block.

1. Set the digital multimeter on the diode range. Remove all leads from the rectifier block.

2. To test the negative rectifier block, follow these steps:

   a. Place the red test lead on the negative “-” terminal. Place the black test lead on the following rectifier terminals: “AC1”(3), “AC2”(4), and “AC3”(5). All readings on the meter should be between 0.4 and 1.0.

   b. Place the black test lead on the negative “-” terminal. Place the red test lead on the following rectifier terminals: “AC1”(3), “AC2”(4), and “AC3”(5). In all cases, the meter should read “OL” (overload).

3. To test the positive rectifier block, follow these steps:

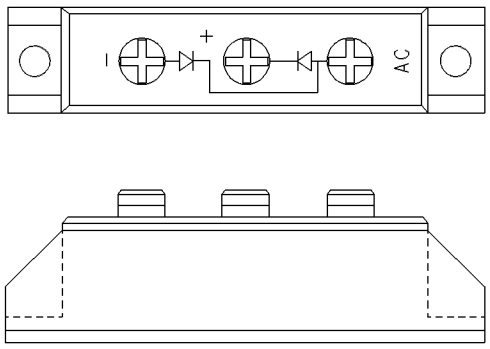
   a. Place the red test lead on the positive “+” rectifier terminal. Place the black test lead on the following rectifier terminals: “AC1”(3), “AC2”(4), and “AC3”(5). In all cases, the meter should read “OL” (overload).

   b. Place the black test lead on the positive “+” rectifier terminal. Place the red test lead on the following rectifier terminals: “AC1”(3), “AC2”(4), and “AC3”(5). All readings on the meter should be between 0.4 and 1.0.

Note: A shorted diode can cause damage to the exciter rotor. If a diode is shorted, check the exciter rotor. Refer to the Testing and Adjusting, “Winding - Test” and Testing and Adjusting, “Insulation - Test”. Perform these tests.

Note: This rectifier block also contains varistor “CR7”. “CR7” can be checked by measuring the resistance between the positive “+” rectifier terminal and the negative “-” rectifier terminal. The resistance should be a minimum of 15000.

Two-Diode Rectifier Block



g00610186

Illustration 52

Two-Diode Rectifier Block (three pieces)

The following procedure tests both diodes within the block. Perform this procedure on all three of the two diode rectifier blocks. If any meter reading does not fall within the given ranges, replace the rectifier block.

1. Set the digital multimeter on the diode range. Remove all leads from the rectifier block.

2. Place the black test lead on the AC rectifier terminal.

a. Place the red test lead on the negative “-” rectifier terminal. The reading on the meter should be between 0.4 and 1.0.

b. Place the red test lead on the positive “+” rectifier terminal. The reading on the meter should be “OL” (overload).

3. Place the red test lead on the AC rectifier terminal.

a. Place the black test lead on the negative “-” rectifier terminal. The reading on the meter should be “OL” (overload).

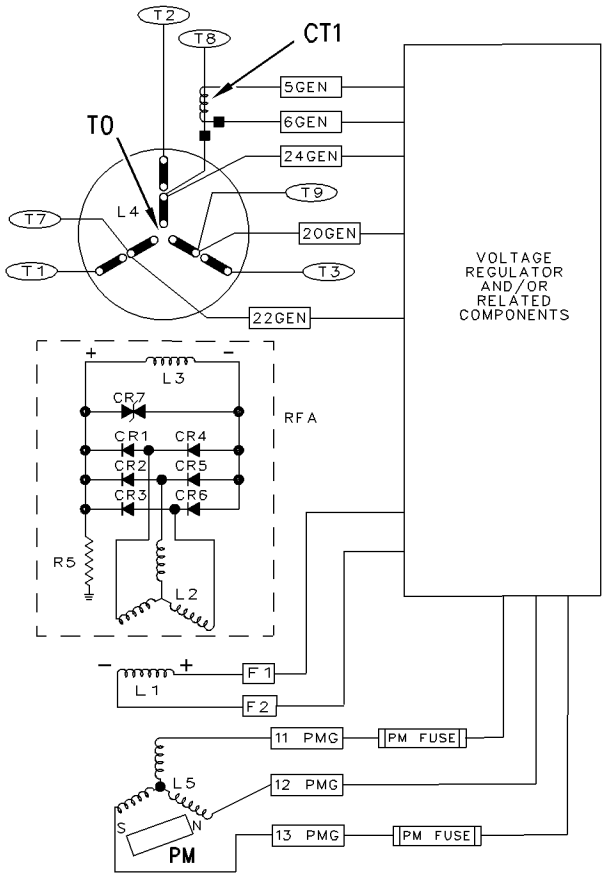
b. Place the black test lead on the positive “+” rectifier terminal. The reading on the meter should be between 0.4 and 1.0.

Note: A shorted diode can cause damage to the exciter rotor. If a diode is shorted, check the exciter rotor. Refer to the Testing and Adjusting, “Winding - Test” and Testing and Adjusting, “Insulation - Test”. Perform these tests.

i01699685

Winding - Test

SMCS Code: 4453-081; 4454-081; 4457-081; 4470-081



g00874841

Illustration 53

PMPE Generator Wiring Diagram

(CR1-C6) Diodes

(CR7) Varistor

(L1) Exciter Field (Stator)

(L2) Exciter Armature (Rotor)

(L3) Main Field (Rotor)

(L4) Main Armature (Stator)

(L5) Pilot Exciter Armature

(PM) Permanent Magnet

(RFA) Rotating Field Assembly

(CT1)Optional Voltage Droop Transformer

(T0, T1, T2, T3, T7, T8, T9) Generator Terminals

Table 15

TOOLS NEEDED		
Part Number	**Tool**	**Quantity**
6V-7070	Digital Multimeter	1

Measure the resistance of the following windings: (L1), (L2), (L3), (L4), and (L5). The winding that is being tested must be disconnected from the other components before the resistance can be measured.

Note: The winding temperature affects the resistance. When the winding temperature increases, the winding resistance increases. When the winding temperature decreases, the winding resistance decreases. Therefore, a correct measurement can be performed only when the winding is at room temperature.

The following resistance measurements are approximations. If the measured value is not near the listed approximation, the winding is probably damaged. For a more precise resistance value, consult the Technical Marketing Information (TMI). Refer to the generator arrangement that is in question.

The following armature windings have very little resistance: (L2), (L4), and (L5). The resistance of these windings will measure near 0 ohms. Use a milliohmmeter to measure the resistance of the armature windings.

Exciter Armature (Rotor) (L2) – less than 0.1 ohm

Main armature (Stator) (L4) – less than 0.1 ohm

Pilot Exciter Armature (L5) – less than 0.1 ohm

Use a multimeter in order to measure the resistance of field windings (L1) and (L3).

Exciter Field (Stator) (L1) – approximately 3.0 ohms to 6.0 ohms

Main Field (Rotor) (L3) – approximately 0.75 ohms to 2.0 ohms

Note: There should be no continuity between any winding and ground. There should be no continuity between any winding and another winding.

i01699697

Insulation - Test

SMCS Code: 4453-081; 4454-081; 4457-081; 4470-081

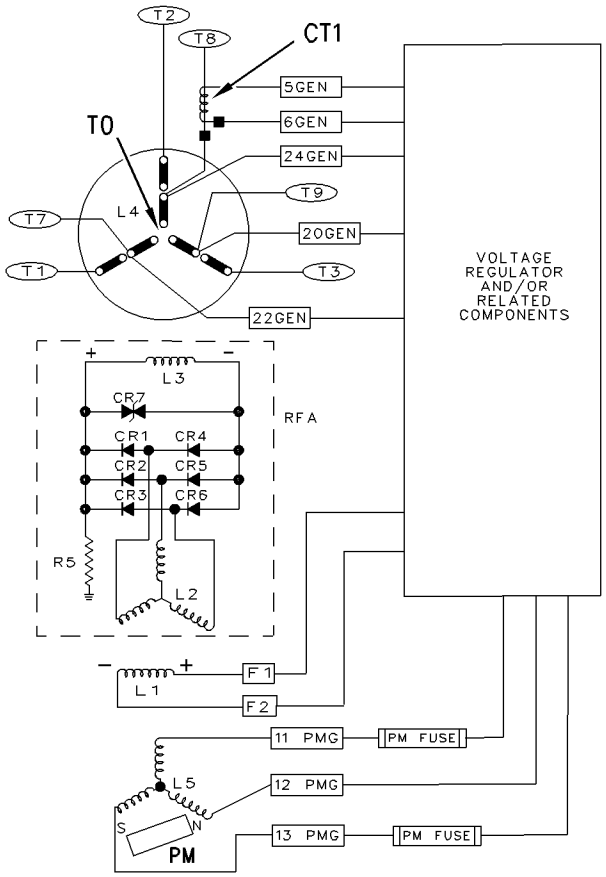


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Illustration 54

PMPE Generator Wiring Diagram

(CR1-C6)Diodes

(CR7) Varistor

(L1) Exciter Field (Stator)

(L2) Exciter Armature (Rotor)

(L3) Main Field (Rotor)

(L4) Main Armature (Stator)

(L5) Pilot Exciter Armature

(PM) Permanent Magnet

(RFA) Rotating Field Assembly

(CT1) Optional Voltage Droop Transformer

(T0, T1, T2, T3, T7, T8, T9) Generator terminals

Table 16

TOOLS NEEDED		
Part Number	**Tool**	**Quantity**
142-5055	Insulation Tester Megohmmeter	1

⚠ WARNING

Personal injury or death can result from electrocution.

The megohmmeter is applying a high voltage to the circuit.

To avoid electrocution, do not touch the instrument leads without first discharging them. When finished testing also discharge the generator windings.

The following materials will cause the winding insulation to deteriorate:

- moisture (water)
- dust
- grease
- other foreign matter within the generator

This deterioration reduces the resistance of the insulation. This test will measure the resistance of the winding insulation.

The insulation tester (megohmmeter) produces a high potential voltage between the test leads. During the test, a small current flows. The tester converts this current to a resistance reading.

The insulation test is performed as part of periodic maintenance in order to detect the deterioration of the winding insulation. When there is a rapid decrease in the insulation resistance in a short amount of time, the generator needs to be cleaned.

Note: For information on generator cleaning, refer to Special Instruction, SEHS9124.

When generators have not been used for a period of time, moisture can accumulate. Therefore, the insulation test should be performed on generators that have been idle. If moisture is known to exist, the windings must be dried prior to testing. Refer to Testing And Adjusting, “Generator - Dry”.

The winding needs to be reconditioned or the winding needs to be replaced in the following cases:

- The measured insulation resistance falls below the specified amount. The cleanup procedure does not correct the discrepancy.

- The measured insulation resistance falls below the specified amount. The drying procedure does not correct the discrepancy.

The specified insulation resistance is an approximate value. It can be possible to operate the generator with less than the specified value. However, a generator that has a low winding insulation resistance will be more likely to have a failure.

⚠ WARNING

Personal injury or death can result from improper troubleshooting and repair procedures.

The following troubleshooting and repair procedures should only be performed by qualified personnel familiar with this equipment.

The insulation test gives accurate results only when the generator windings are free of moisture and the generator windings are at room temperature.

Each winding must have a minimum insulation resistance of one megohm.

Main Armature (Stator L4)

1. Remove the load from the generator by either opening the line circuit breaker or the load connections to (T1), (T2), (T3), and (T0). Prevent these wires from coming into contact with each other and prevent these wires from contacting ground.

2. Isolate main armature (L4) from the voltage regulator by disconnecting wires 20, 22, and 24. If generator lead (T0) is connected to the generator frame or ground, open the connection.

3. Connect one test lead of the insulation tester (megohmmeter) to the generator enclosure (ground).

4. Connect the other test lead of the insulation tester (megohmmeter) to generator lead (T0).

5. The insulation resistance must be one megohm or more.

Exciter Field (Stator L1)

1. Isolate exciter field (L1) from the voltage regulator by disconnecting wires F1 and F2. Prevent these wires from coming into contact with each other and prevent these wires from contacting ground.

2. Connect one test lead of the insulation tester (megohmmeter) to the generator enclosure (ground).

3. Connect one test lead of the insulation tester (megohmmeter) to exciter field lead (F1 or F2).

4. Measure the resistance of the exciter field winding insulation to ground. The insulation resistance must be a minimum of 0.25 megohm (250000 ohms).

Exciter Armature (Rotor L2)

1. Isolate exciter armature (L2) from the rectifier circuit. Disconnect the three wires of the exciter armature from the rectifier blocks.

2. Connect one test lead of the insulation tester (megohmmeter) to the rotor shaft.

3. Connect one test lead of the insulation tester (megohmmeter) to any one exciter field lead.

4. The insulation resistance must be a minimum of 0.25 megohm (250000 ohms).

Pilot Exciter Armature L5

1. Isolate pilot exciter armature (L5) from the voltage regulator. Disconnect wires 26, 28, and 30 of the pilot exciter from the termination points. These wires are usually fused. These wires connect to a terminal strip or these wires connect to the voltage regulator.

2. Connect one test lead of the insulation tester (megohmmeter) to the generator enclosure (ground).

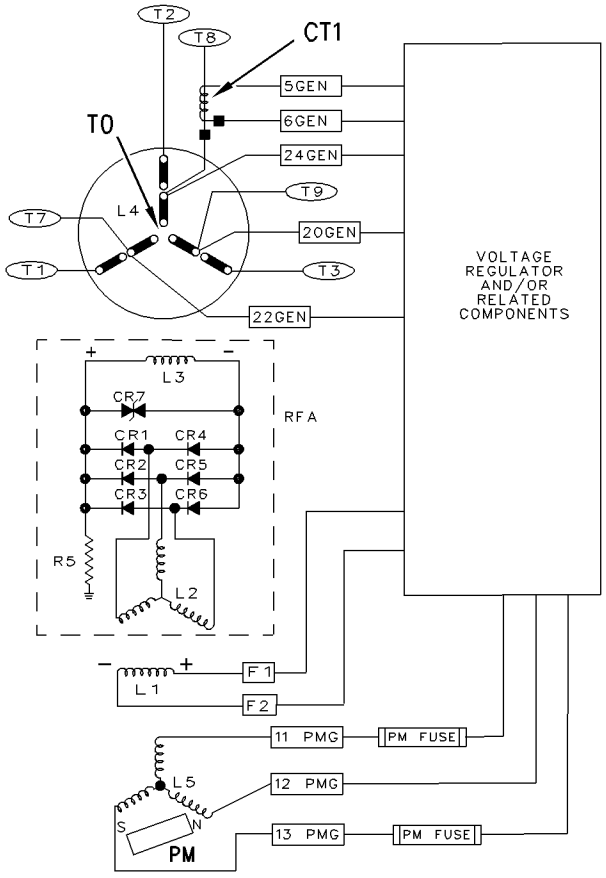
3. Connect the other test lead of the insulation tester (megohmmeter) to any one lead of the pilot exciter armature.

4. The insulation resistance must be a minimum of 0.25 megohm (250000 ohms).

i01699707

Resistor - Test

SMCS Code: 1437-081



g00874841

Illustration 55

PMPE Generator Wiring Diagram

(CR1-C6)Diodes

(CR7) Varistor

(L1) Exciter Field (Stator)

(L2) Exciter Armature (Rotor)

(L3) Main Field (Rotor)

(L4) Main Armature (Stator)

(L5) Pilot Exciter Armature

(PM) Permanent Magnet

(R5)Resistor

(RFA) Rotating Field Assembly

(CT1) Optional Voltage Droop Transformer

(T0, T1, T2, T3, T7, T8, T9) Generator terminals

Table 17

TOOLS NEEDED		
Part Number	**Tool**	**Quantity**
6V-7070	Digital Multimeter	1

Resistor (R5) is used on generators that have three diode rectifier blocks.

The Resistor Test consists of the following steps:

1. Disconnect one lead of resistor (R5) from the positive terminal of varistor (CR7).
2. Connect one test lead of the multimeter to each lead of the resistor.
3. Resistor (R5) should measure 27000 ohms (± 2700 ohms).

i01699710

Generator - Dry

SMCS Code: 4450-569

NOTICE

Do not operate the generator if the windings are wet. If the generator is operated when the windings are wet, damage can occur due to insulation breakdown.

When moisture is present or when moisture is suspected in a generator, the generator must be dried before being energized. For information on drying the generator, refer to Testing And Adjusting, “Insulation - Dry”.

If the drying procedure does not restore the insulation resistance to an acceptable value, the winding should be reconditioned.

Note: For additional information, refer to Special Instruction, SEHS9124 .

Drying Methods

The following methods can be used for drying a generator:

- Self-circulating air method
- Oven method
- Controlled current method

NOTICE
Do not allow the winding temperature to exceed 85 °C (185.0 °F). Temperatures that are greater than 85 °C (185.0 °F) will damage the winding insulation.

Self-Circulating Air Method

Run the engine and disconnect the generator load. This will help circulate air. Operate the generator space heaters.

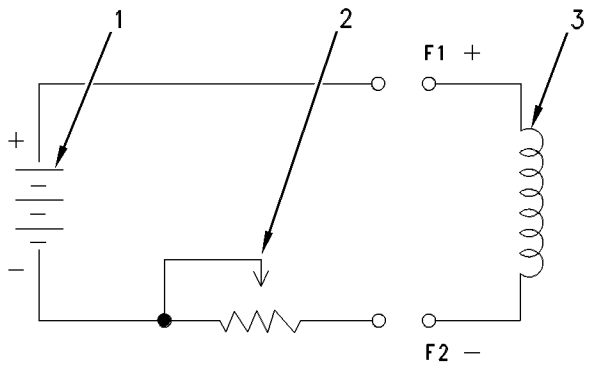
Oven Method

Place the entire generator inside a forced air drying oven for four hours at 65 °C (149 °F).

NOTICE
Use a forced air type oven rather than a radiant type oven.

Radiant type ovens can cause localized overheating.

Controlled Current Method



g00614674

Illustration 56

External Power Source Circuit

(1) Battery (12 VDC)
(2) Rheostat (15 Ohm 25 watt)
(3) Exciter field (stator “L1”)

Table 18

TOOLS NEEDED		
Part Number	**Tool**	**Quantity**
8T-0900	Clamp-on Ammeter (1200 amperes)	1
	External Power Source Circuit	1

Heat can be used in order to dry the generator windings. This heat can be created by allowing a controlled current to flow through the generator. No high voltages are generated during the following procedure. Therefore, insulation breakdown will not occur.

1. Make an external power source. Refer to Illustration 56.

2. Disconnect F1+ from the voltage regulator. Disconnect F2- from the voltage regulator. Disconnect the generator load. Connect the generator output leads T0, T1, T2, and T3 together. Install the clamp-on ammeter to generator output lead T1.

Note: When the line current is measured on multiple lead units, measure the current in each conductor per phase. The currents can then be added.

3. Refer to Illustration 56. Adjust the rheostat to the maximum resistance value. Connect the external power source to wires F1+ and F2-.

4. Start the generator set. Run the generator set at idle speed.

NOTICE
Do not exceed the rated phase current that is listed on the generator nameplate. Exceeding the rated phase current will easily damage the generator windings.

5. Monitor the phase current. Gradually increase the engine RPM. Increase the engine RPM until one of the following conditions are met:

   - The rated phase current is obtained.
   - The full generator set speed is obtained.

6. If more phase current is necessary, slowly turn the rheostat. Turn the rheostat until the rated phase current is reached.

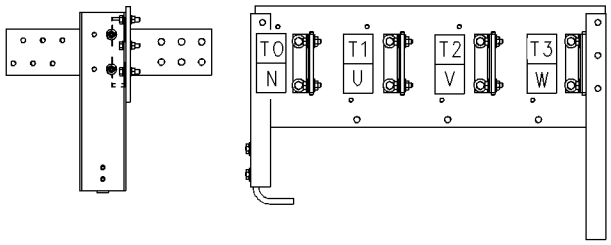
7. On an hourly basis, stop the drying procedure. Check the insulation resistance. Repeat the above steps until the insulation resistance is acceptable.

i01699714

Leads - Connect

SMCS Code: 4459-077

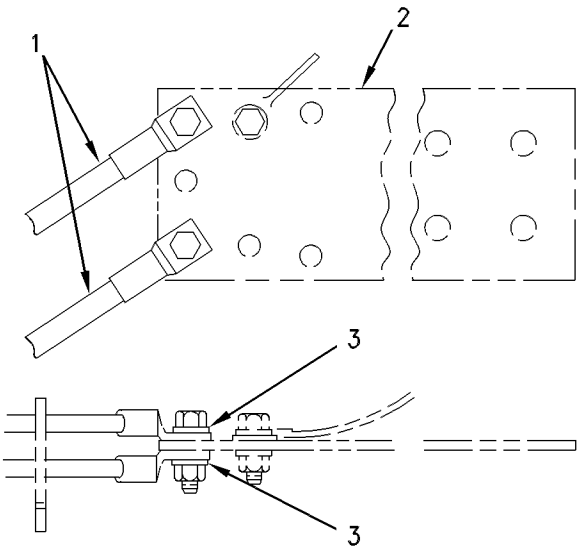
Generator Leads To Terminal Strips



g00613767

Illustration 57

Terminal Strips



g00614345

Illustration 58

Terminal Strip Lead Connections

(1) Generator leads
(2) Terminal strip (Bus Bar)
(3) Plated washer

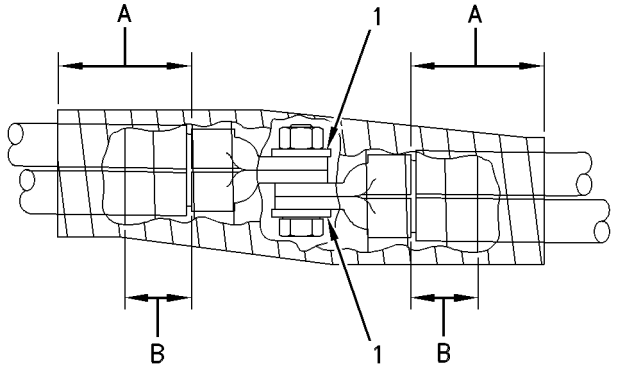
Attach the generator leads (1) to terminal strip (2) in the following manner:

1. When more than one lead attaches to the bus bar, place the leads on each side of the bus bar. Use flat plated washer (3) under the bolt head and under the nut.

2. After connecting the leads to the bus bar, group all generator phase leads together. Tie these leads together.

Ensure that there is a minimum clearance of 25 mm (1.0 inch) between uninsulated connections (phase to phase and phase to ground).

Generator Lead To Other Lead



g00614361

Illustration 59

Lead To Lead Connection (Generators with medium voltage or less)

(1) Plated washer

Table 19

TOOLS NEEDED		
Part Number	**Tool**	**Quantity**
5N-4685	Varnished cambric electric tape 15000 volt rating 105 °C (221.0 °F) rating	1
5N-4686	Black vinyl plastic electrical tape –40 °C (–40.0 °F) to 80 °C (176.0 °F) rating	1

When connecting the generator leads together or when connecting generator leads to a load lead, use the following procedure:

1. Fasten the generator leads together by using flat plated washer (1) under the bolt head and under the nut.

2. Apply two layers of varnished cambric high voltage tape. When the tape is being wrapped, the tape must be overlapped. The tape must be overlapped 50% of the width of the tape. Taping must extend length “B” onto the lead wire insulation. Length “B” is equal to 25 mm (1.0 inch).

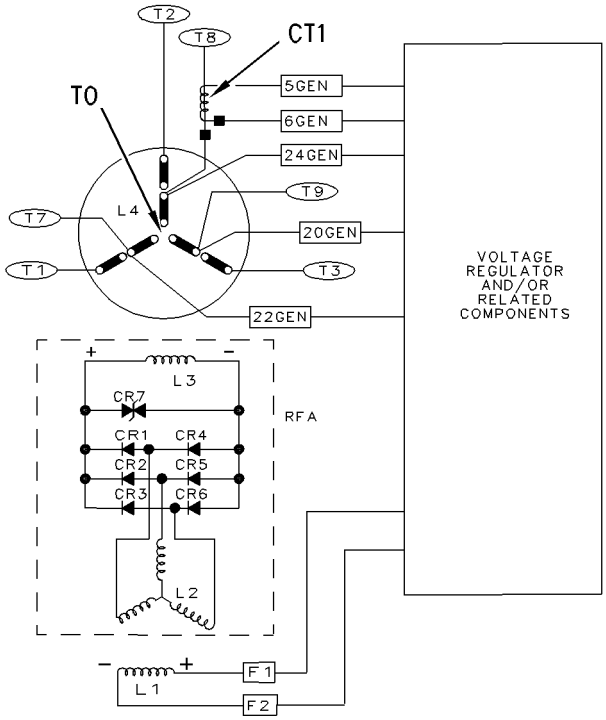
3. Apply two layers of vinyl plastic electrical tape over the varnished cambric high voltage tape. Taping must extend length “A” onto the lead wire insulation. Length “A” is equal to 51 mm (2.0 inches).

4. The generator leads must not contact the sheet metal of the terminal box or any rotating parts. For each generator phase, group the leads together. Secure the leads together with cable straps.

i01699728

Exciter Field - Flash

SMCS Code: 4470



g00874825

Illustration 60

Wiring Diagram of the Self-Excited Generator

(CR1-C6) Diodes

(CR7) Varistor

(L1) Exciter field (stator)

(L2) Exciter armature (rotor)

(L3) Main field (rotor)

(L4) Main armature (stator)

(RFA) Rotating field assembly

(CT1) Optional Voltage Droop Transformer

(T0, T1, T2, T3, T7, T8, T9) Generator terminals

Self-excited generators may lose the residual magnetism that normally exists in the exciter field (L1) and the main field (L3). Residual magnetism is necessary to start the generation process. The magnetism can be restored by flashing exciter field (L1) with direct current. A 6 VDC battery can be used to supply the direct current.

NOTICE
Do not flash permanent magnet pilot excited (PMPE) generators. Damage to the generator set can occur.

There are two methods of flashing the field:

- Static Flashing (stopped engine)
- Dynamic Flashing (running engine)

Static Flashing (Stopped Engine)

Table 20

TOOLS NEEDED	
Tool	**Quantity**
6 VDC Battery	1

1. Stop the engine.

2. At the voltage regulator, disconnect wire F1 GEN from terminal F1 and disconnect wire F2 GEN from terminal F2.

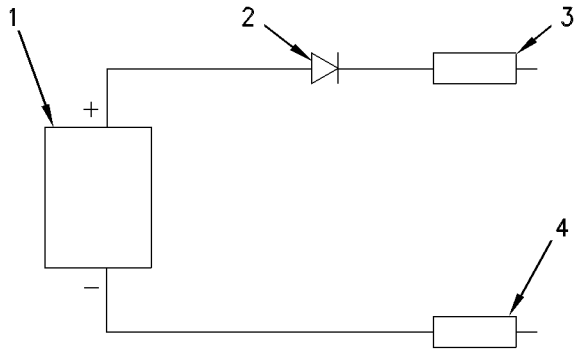
3. Connect the positive cable of the 6 volt source to wire F1 GEN.

4. Momentarily put the negative cable of the 6 volt source on wire F2 GEN (two or three times).

Note: Do not hold the negative cable to wire F2 GEN for more than one or two seconds.

5. Connect all wires that were previously disconnected.

Dynamic Flashing (Running Engine)



g00614470

Illustration 61

Dynamic Flashing Circuit

(1) Battery (≤ 6 VDC)
(2) Diode
(3) Red test lead "+"
(4) Black test lead "-"

Table 21

TOOLS NEEDED		
Part Number	**Tool**	**Quantity**
6V-7070	Digital Multimeter	1
9P-5153	Diode (MR-504)	1
	Dynamic Flashing Circuit	1

1. Construct the dynamic flashing circuit that is shown in Illustration 61.

2. Stop the engine.

3. Connect a multimeter (set on ACV) to terminals 20 and 22 at the voltage regulator.

4. Start the engine and run the engine at low idle.

NOTICE
Do not hold the flashing circuit's test leads on the terminals longer than necessary. This can cause the voltage to become too high. Excessive voltage can cause damage to the generator and can cause damage to the flashing circuit.

5. Hold the red lead of the dynamic flashing circuit to terminal F1.

6. Monitor the voltmeter. Touch the black lead to terminal F2 of the dynamic flashing circuit.

7. When the voltmeter shows an increase in voltage, remove the test leads from terminal F1 and terminal F2. If the generator voltage does not increase within 5 to 10 seconds, remove the test leads from terminals F1 and F2.

Disassembly and Assembly Section

i01162628

Exciter - Remove and Install

SMCS Code: 4454-010

Removal Procedure

Remove The Exciter Field and Remove The Exciter Armature

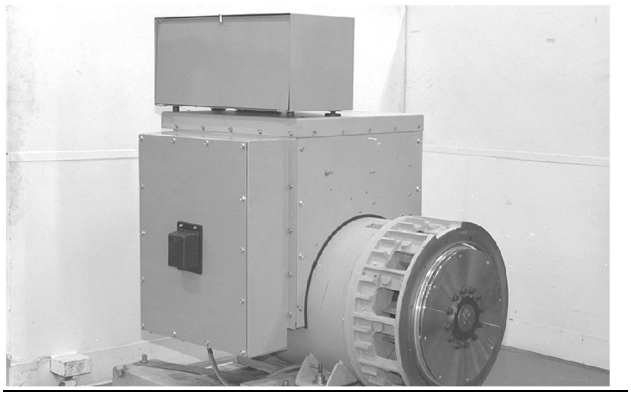


Illustration 62 g00619102

400 Frame

1. Remove the side and rear access panels from the generator.

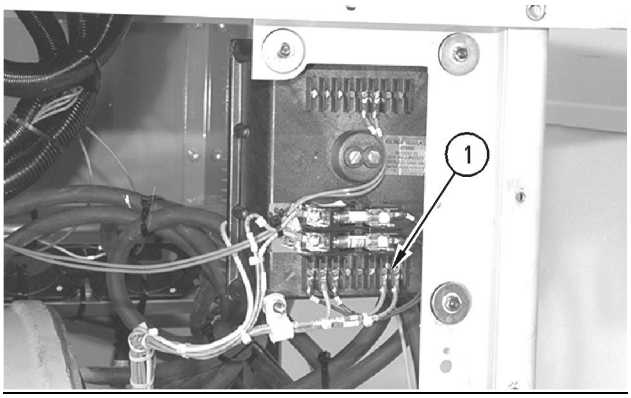


Illustration 63 g00619559

Voltage Regulator

"F1" and "F2" first terminate at a voltage regulator.

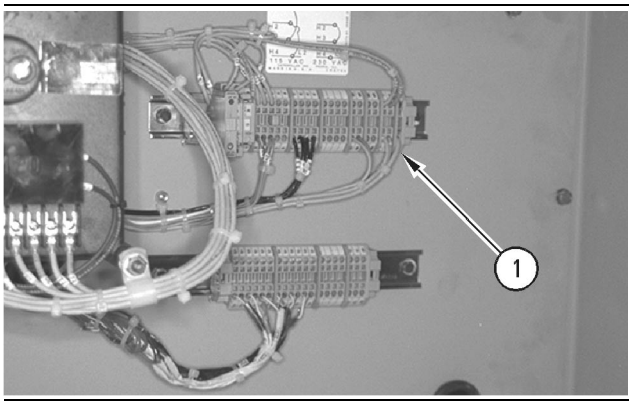


Illustration 64 g00619563

Terminal Strip

"F1" and "F2" first terminate at a terminal strip.

(1) Wires "F1" and "F2"

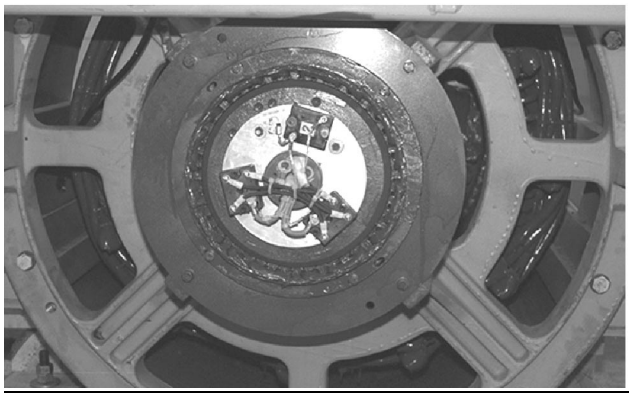
2. Disconnect exciter wires ("F1" and "F2") from the first termination point. These wires terminate at the voltage regulator or at a terminal strip.

For permanent magnet pilot excited generators, disconnect wires "26", "28", and "30" from the first termination point. These wires first terminate at fuses. These fuses are located on a terminal strip or these fuses are located in the harness.

Pull the disconnected wires from the harness bundles and place the disconnected wires near the exciter field.

Illustration 65 g00619571

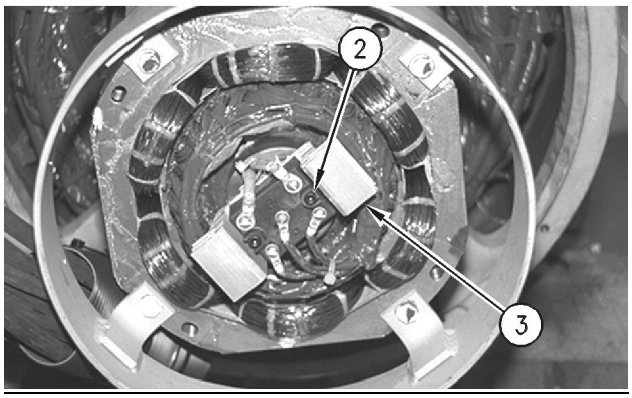
Two-Diode Rectifier Blocks (Three Pieces)



g00619585

Illustration 66

Three-Diode Rectifier Block (One Piece)



g00619588

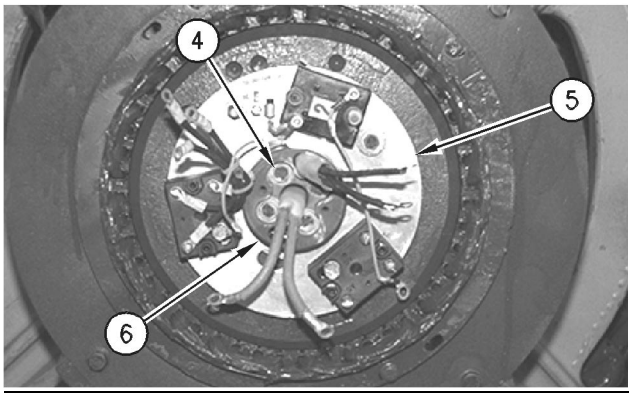
Illustration 67

Six-Diode Rectifier Block (One Piece)

(2) Screws
(3) Mounting Assembly

3. Various rectifier blocks and mounting hardware are used. The rectifier blocks and the mounting plate must be removed in order to remove the exciter. Disconnect the two generator leads from the rectifier blocks. Also, disconnect the three exciter leads from the rectifier blocks.

For generators with the six-diode rectifier block, remove two allen head screws (2) which fasten the six-diode rectifier block and mounting assembly (3) to the rotor shaft. Remove the six-diode rectifier block and mounting assembly (3).



g00619592

Illustration 68

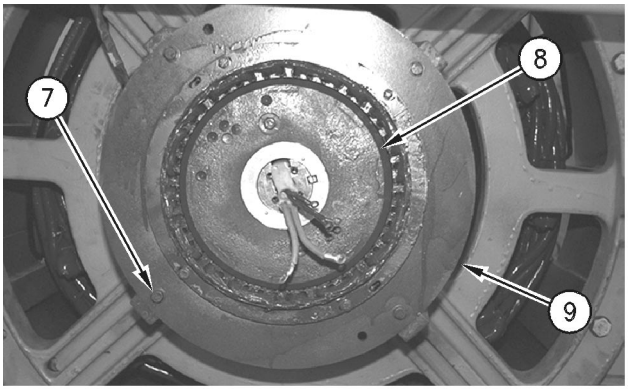
Generator with Outboard PM Pilot Exciter

(4) Bolts
(5) Mounting Assembly
(6) Retainer

4. On generators with an outboard PM pilot exciter, perform the following procedure:

a. Remove four bolts (4) which fasten retainer (6) and mounting assembly (5) to the rotor shaft.

b. Remove retainer (6) and mounting assembly (5). Ensure that the diode rectifier blocks remain attached.



g00619603

Illustration 69

Generator with Outboard PM Pilot Exciter

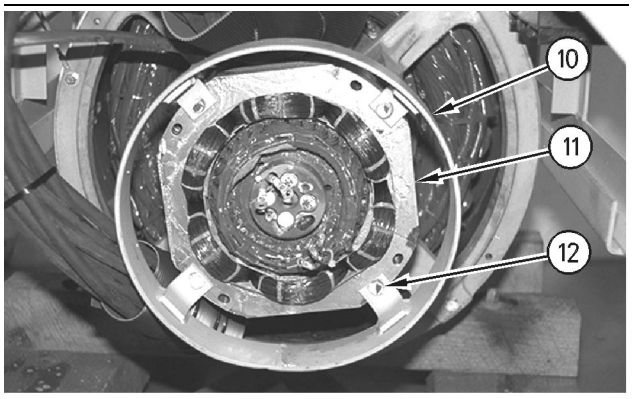
(7) Bolts
(8) Rotating Pilot Exciter Field
(9) Stationary Pilot Exciter Armature

5. On generators with an outboard PM pilot exciter, perform the following procedure:

Note: The magnetism between pilot exciter armature (9) and pilot exciter field (8) is very strong. The components may come off at the same time.

a. Remove four bolts (7) which fasten stationary pilot exciter armature (9) to the generator.

b. Remove stationary pilot exciter armature (9) and rotating pilot exciter field (8).



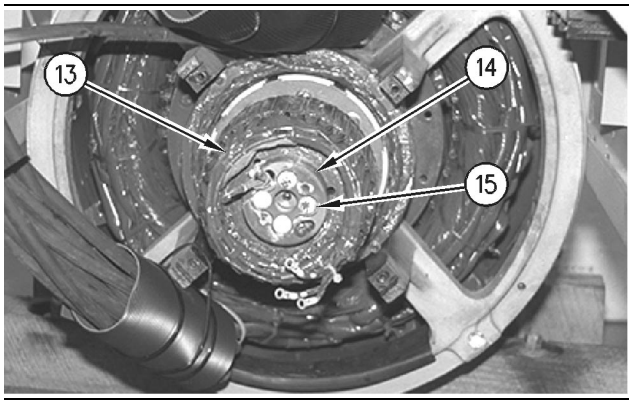
g00619613

Illustration 70

Shroud and Exciter Field

(10) Shroud
(11) Exciter Field
(12) Bolts

6. If equipped, remove four bolts (12) which fasten shroud (10) and exciter field (11) to the generator. Remove shroud (10) (if equipped) and exciter field (11) from the generator.



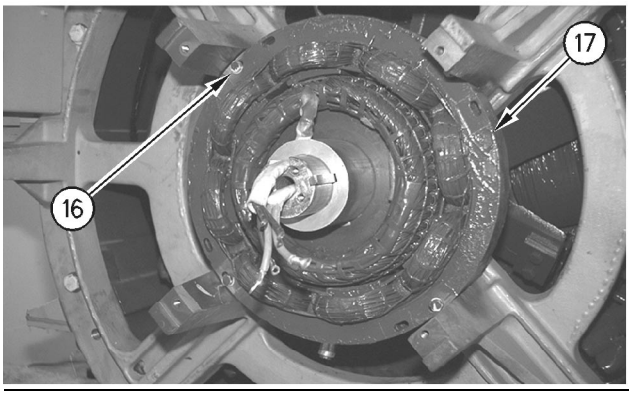
g00620388

Illustration 71

Retainer and Exciter Armature

(13) Exciter Armature
(14) Retainer
(15) Bolts

7. Four bolts (15) and a retainer (14) are used to fasten the exciter armature (13) to the rotor shaft. Remove the four bolts and remove the retainer. While the retainer is being removed, carefully pass the generator leads through the retainer's opening. Remove exciter armature (13) from the rotor shaft.



g00619644

Illustration 72

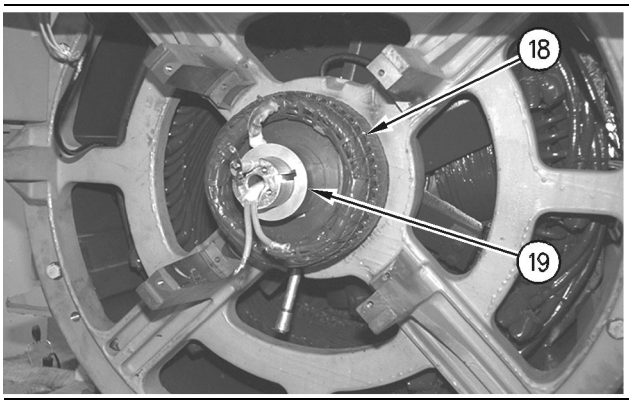
Generator with Outboard PM Pilot Exciter

(16) Bolt
(17) Exciter Field

8. On generators with an outboard PM pilot exciter, perform the following procedure:

a. Remove four bolts (16) which fasten exciter field (17) to the generator.

b. Remove exciter field (17).



g00619666

Illustration 73

Generator with Outboard PM Pilot Exciter

(18) Exciter Armature
(19) Spacer

9. On generators with an outboard PM pilot exciter, perform the following procedure:

a. Carefully slide spacer (19) off the rotor shaft.

b. As the spacer is slid off the rotor shaft, ensure that the spacer clears the exciter leads.

c. Remove exciter armature (18) from the rotor shaft.

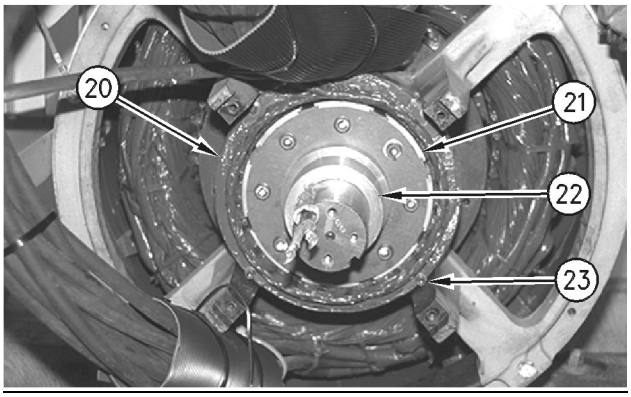


Illustration 74 g00619669

Generator with Inboard PM Pilot Exciter

(20) Pilot Exciter Armature
(21) Pilot Exciter Field
(22) Spacer
(23) Bolts

Note: The magnetism between pilot exciter armature (20) and pilot exciter field (21) is very strong. The components may come off at the same time.

10. Slide spacer (22) off the rotor shaft.

11. Remove four bolts (23) which fasten stationary pilot exciter armature (20) to the generator.

12. Remove stationary pilot exciter armature (20) and rotating pilot exciter field (21).

Installation Procedure

Install The Exciter Field and Install The Exciter Armature

1. On generators with an inboard PM pilot exciter, perform the following procedure:

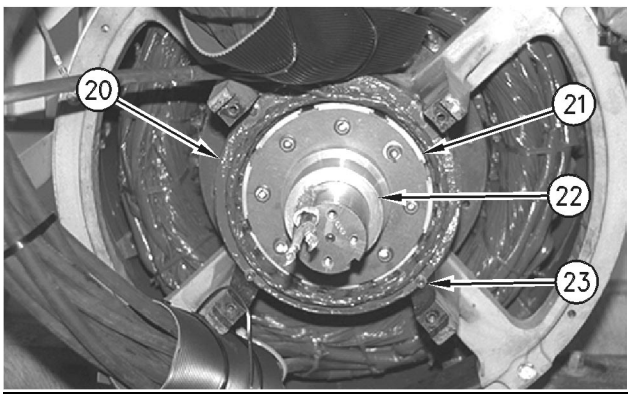


Illustration 75 g00619669

Generator with Inboard PM Pilot Exciter

(20) Pilot Exciter Armature
(21) Pilot Exciter Field
(22) Spacer
(23) Bolts

a. Slide stationary pilot exciter armature (20) and rotating pilot exciter field (21) over the rotor shaft.

b. Use four bolts (23) in order to fasten the stationary pilot exciter armature (20) to the generator.

c. Slide spacer (22) on the rotor shaft.

2. On generators with an outboard PM pilot exciter, perform the following procedure:

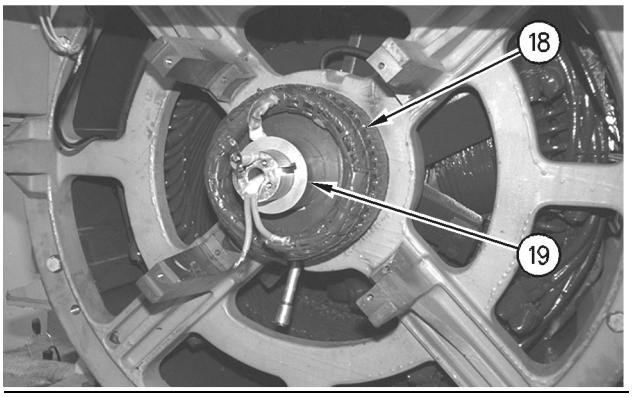


Illustration 76 g00619666

Generator with Outboard PM Pilot Exciter

(18) Exciter Armature
(19) Spacer

a. Slide exciter armature (18) on the rotor shaft.

b. As the spacer is slid on the rotor shaft, ensure that the spacer clears the exciter leads.

c. Carefully slide spacer (19) on the rotor shaft.

3. On generators with an outboard PM pilot exciter, perform the following procedure:

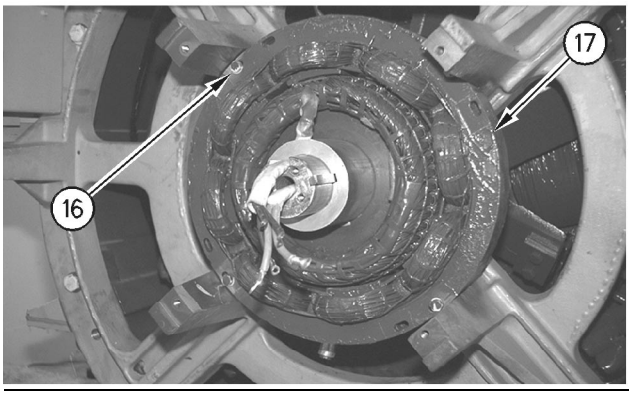


Illustration 77 g00619644

a. Place exciter field (17) on the generator.

b. Use four bolts (16) to fasten the exciter field to the generator.

4. Slide exciter armature (13) on the rotor shaft.

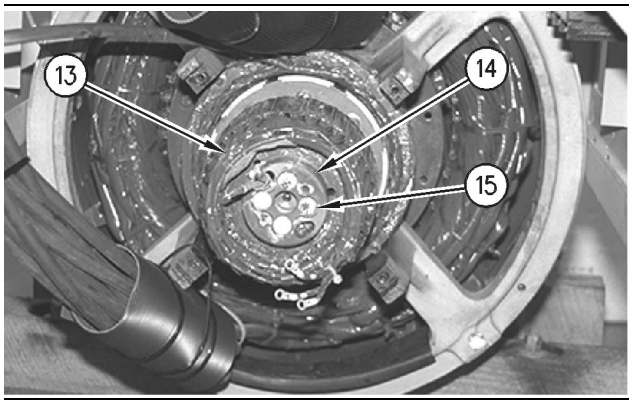


Illustration 78 g00620388

Retainer and Exciter Armature

(13) Exciter Armature
(14) Retainer
(15) Bolts

5. A retainer (14) is used to fasten the exciter armature (13) to the generator. Carefully pass the generator leads through the retainer's opening.

6. Use four bolts (15) to fasten the retainer to the generator.

Note: When the exciter armature (13) is installed, the bolts (15) must be properly tightened.

Apply **9S-3263** Thread Lock to the bolts (15) before the bolts are installed. Refer to Table 22 for information regarding bolt torque.

Table 22

BOLT TORQUE	
Bolt Size	**Torque**
5/16 inch	35.4 N·m (26.11 lb ft)
3/8 inch	55.8 N·m (41.16 lb ft)

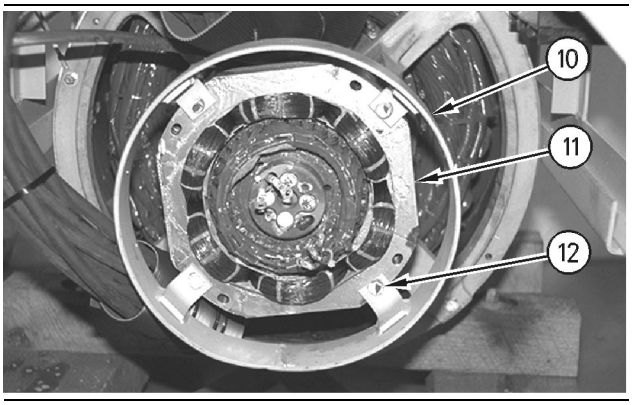


Illustration 79 g00619613

Shroud and Exciter Field

(10) Shroud
(11) Exciter Field
(12) Bolts

7. Use four bolts (12) to attach shroud (10) (if equipped) and exciter field (11) to the generator.

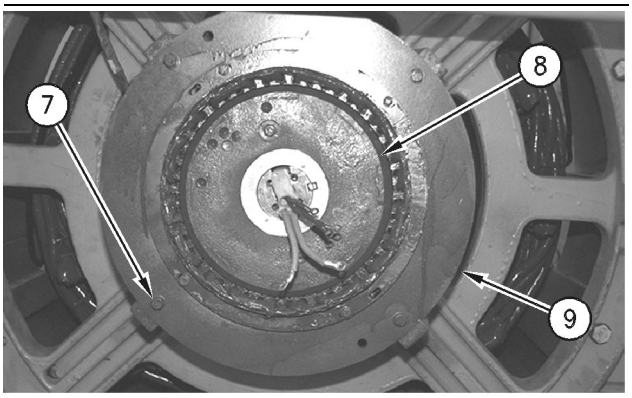


Illustration 80 g00619603

Generator with Outboard PM Pilot Exciter

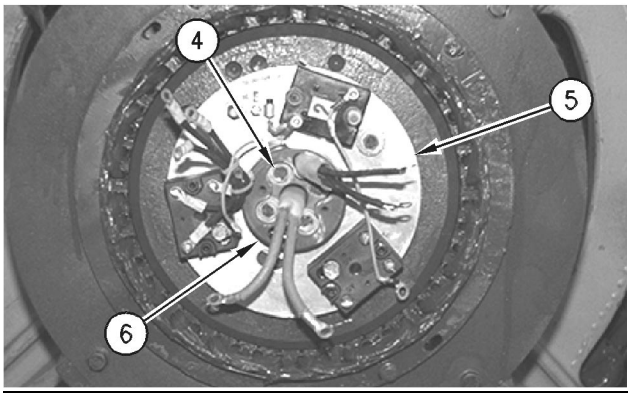
(7) Bolts
(8) Rotating Pilot Exciter Field
(9) Stationary Pilot Exciter Armature

8. On generators with an outboard PM pilot exciter, perform the following procedure:

a. Place stationary pilot exciter armature (9) and rotating pilot exciter field (8) on the generator.

b. Use four bolts to attach the stationary pilot exciter armature (9) and rotating pilot exciter field (8) to the generator.

9. On generators with an outboard PM pilot exciter, perform the following procedure:



g00619592

Illustration 81

Generator with Outboard PM Pilot Exciter

(4) Bolts
(5) Mounting Assembly
(6) Retainer

a. Slide mounting assembly (5) and retainer (6) over the rotor shaft.

b. Use four bolts to attach the mounting assembly (5) and retainer (6) to the rotor shaft.

10. Various rectifier blocks and mounting hardware are used. The rectifier blocks and mounting plates must be installed after the exciter is attached.

End By:

a. Connect the two generator leads to the rectifier blocks.

b. Connect the three exciter leads to the rectifier blocks.

c. For permanent magnet pilot excited generators, connect wires “26”, “28”, and “30” to the first termination point.

d. Connect exciter wires (“F1” and “F2”) to the first termination point.

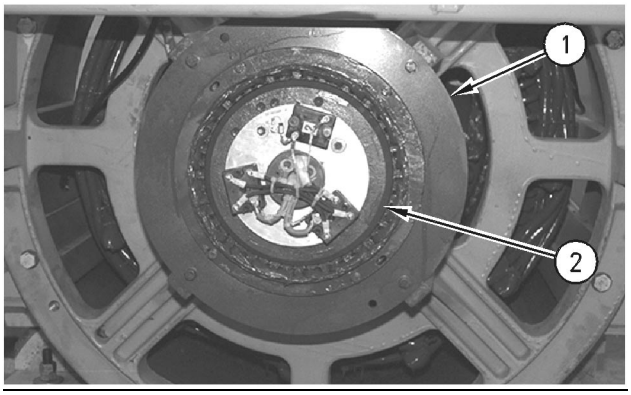
e. Install the side and rear access panels to the generator.

i01161961

Generator - Remove

SMCS Code: 4450-011

Removal Procedure

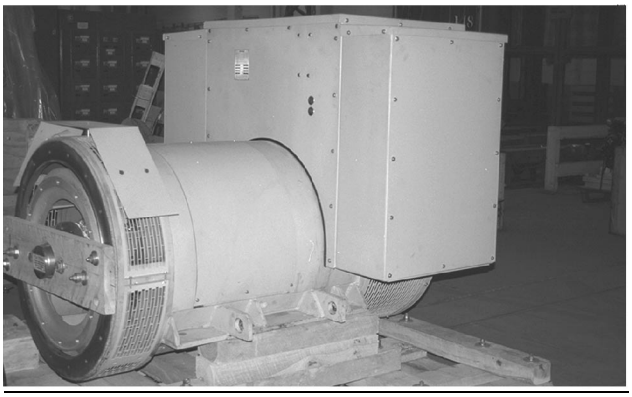


g00619076

Illustration 82

(1) Stationary pilot exciter armature
(2) Rotating pilot exciter field

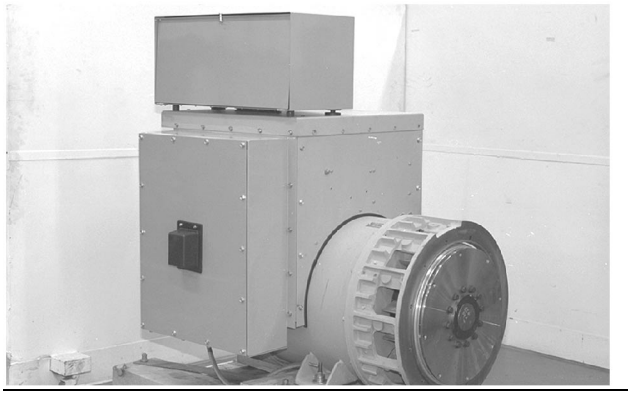
Note: This procedure describes removing the generator terminal box from the generator. Some service operations do not require the removal of the generator terminal box. The removal of the generator terminal box may not be necessary.



g00619082

Illustration 83

Generator Terminal Box with a Typical 600 Frame

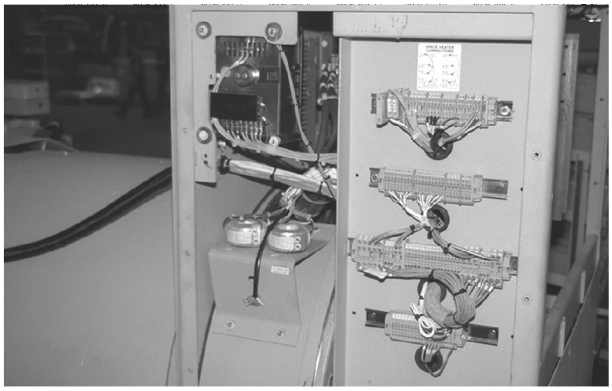


g00619102

Illustration 84

Generator Terminal Box with a Typical 400 Frame

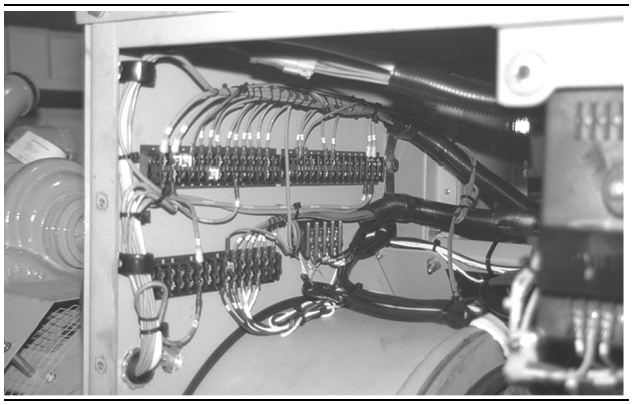
1. Remove the side and rear panels of the generator terminal box in order to access the wiring.



g00619117

Illustration 85

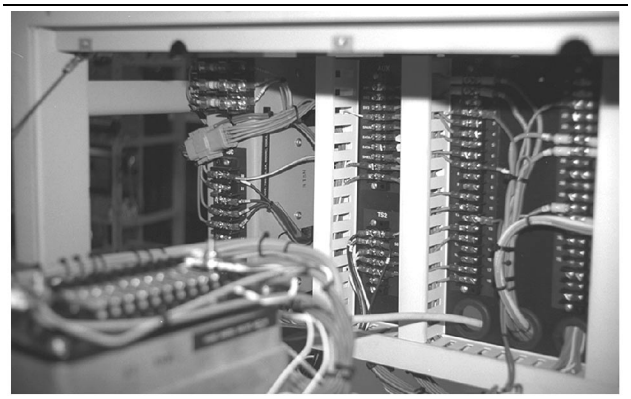
Terminal Strips (DIN)



g00619124

Illustration 86

Terminal Strips



g00619154

Illustration 87

Terminal Strips (Control Panel interior)

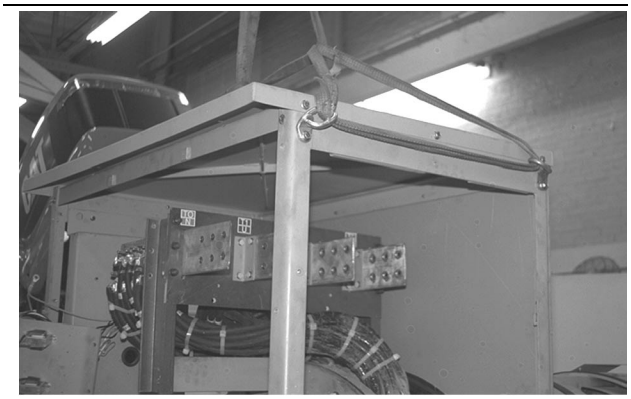
2. To remove the generator terminal box, disconnect all the wiring that extends from the generator terminal box to the generator or to the engine. Disconnect the following wires:

- engine harness wires
- generator leads
- current transformer wires
- temperature sensing wires
- space heater wires
- ground wires

Remove the engine harness from the generator terminal box.

Most of the wiring can be disconnected at the terminal strips. The exact location of the terminal strips and the type of terminal strips varies with the different generator set packages. The preceding illustrations show some of the various terminal strips.

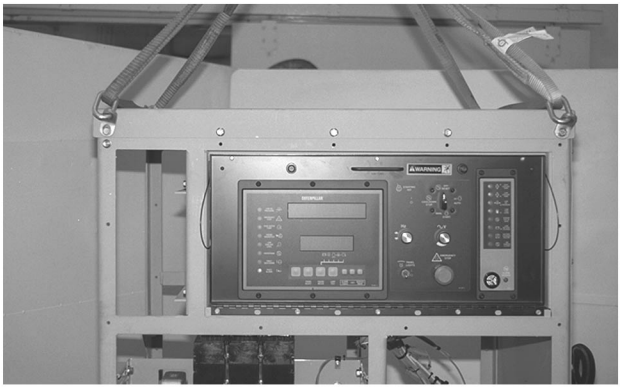
3. To remove the generator terminal box, remove the lower rear panel and the screen beneath the rear of the generator.



g00619180

Illustration 88

Generator Terminal Box (Typical 600 Frame)

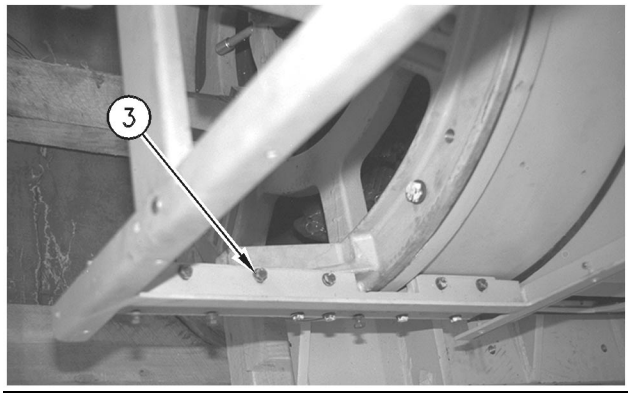


g00619185

Illustration 89

Generator Terminal Box (Typical 400 Frame)

4. Attach a hoist to the four corners of the generator terminal box.



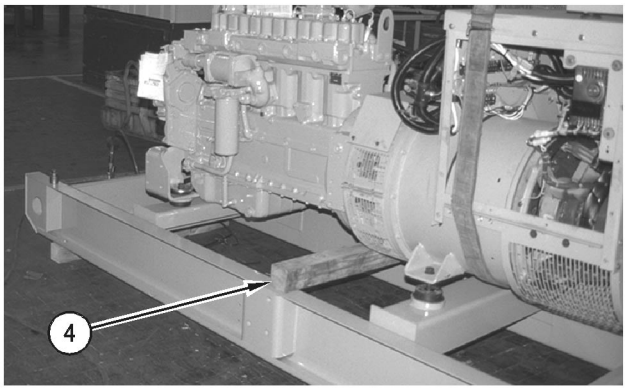
g00619192

Illustration 90

Top View

(3) Bolt

5. Remove bolts (3) which fasten the generator terminal box to the mounting brackets. Use the hoist to lift the generator terminal box and remove the generator terminal box.



g00619203

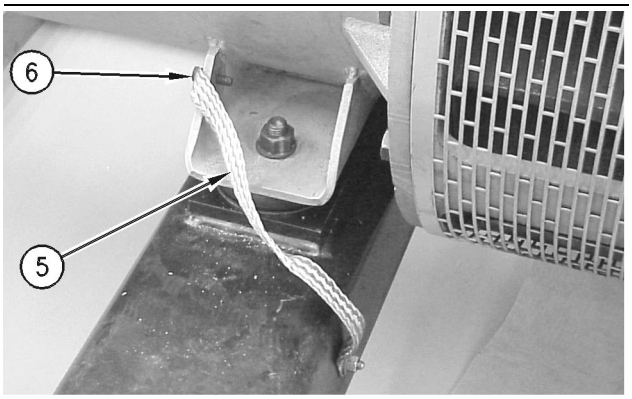
Illustration 91

Generator support

(4) Support Beam

6. If there are no supports between the base of the generator set and the flywheel end of the engine, perform this Step. For supporting the engine during removal of the generator, use one of the following devices:

- hoist
- jack
- support beam (4)



g00621148

Illustration 92

Generator ground strap

(5) Ground strap
(6) Bolt

7. Remove bolt (6) that attaches ground strap (5) to the generator.

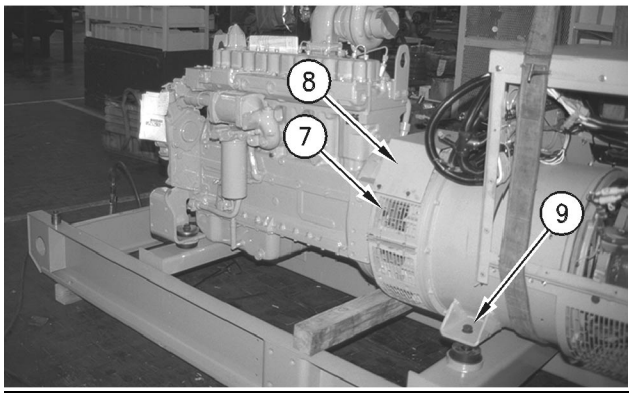


Illustration 93 g00619206

(7) Screen
(8) Shield
(9) Bolts

8. Attach a hoist to the generator. The point of attachment varies with the size of the generator. A strap must be used on smaller generators when no shackle is provided.

9. Remove bolts (9) which fasten the generator to the base.

10. Remove shield (8) and screen (7).

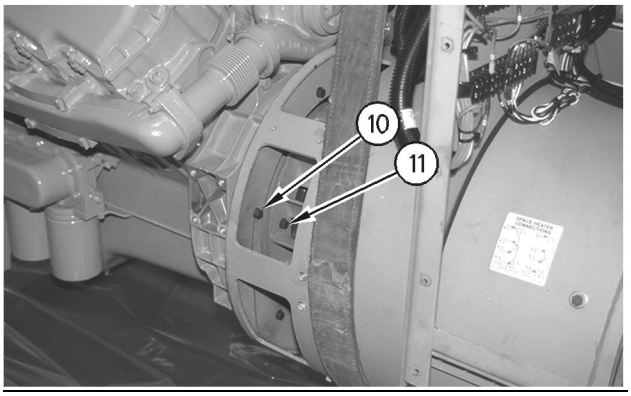


Illustration 94 g00619261

(10) Bolts
(11) Bolts

11. Remove bolts (11) which fasten the fan and the coupling plate to the engine flywheel.

12. Remove bolts (10) which fasten the generator housing to the flywheel housing.

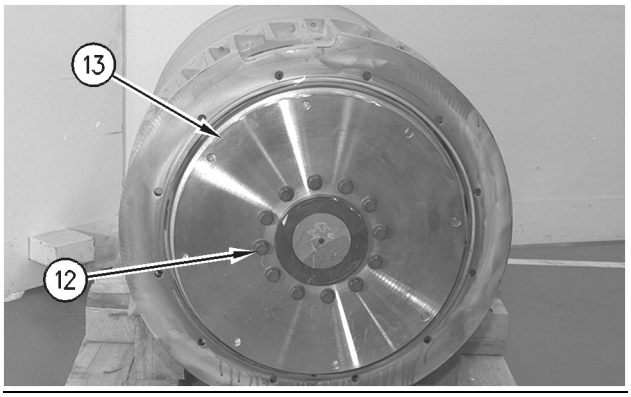


Illustration 95 g00619267

(12) Bolts
(13) Coupling Plate

13. Separate the generator from the engine. Remove the generator. Place the generator on solid blocking material which will not allow the generator to roll.

14. Remove bolts (12) which fasten coupling plate (13) to the rotor. Remove coupling plate (13).

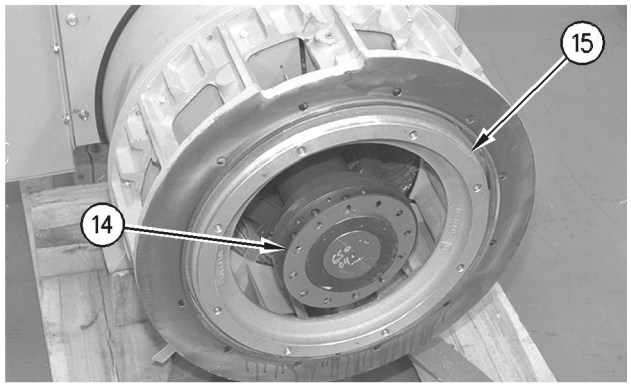


Illustration 96 g00619275

(14) Shims
(15) Fan

15. Remove shims (14) from the rotor shaft. If the fan (15) is not attached to the rotor, remove the fan from the generator housing.

i01159488

Generator - Install

SMCS Code: 4450-012

Installation Procedure

All Generator Sets Except 3500 Engine Family

Table 23

TOOLS NEEDED		
Part Number	**Tool**	**Quantity**
8S-2328	Dial Indicator Group	1

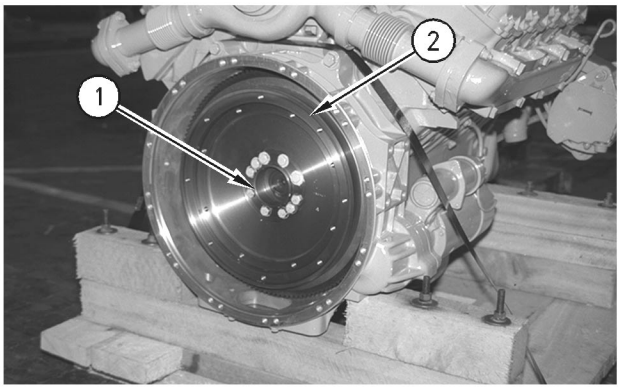


Illustration 97 g00616707

(1) Flywheel Pilot Bore
(2) Surface

1. Remove all dirt, burrs, and paint from the contact surfaces of the generator supports and the base. Remove the protection material (compound) from flywheel pilot bore (1) and from surface (2). There should be no protection material that makes contact with the coupling. All contact surfaces of the engine, the coupling, and the generator must be completely clean.

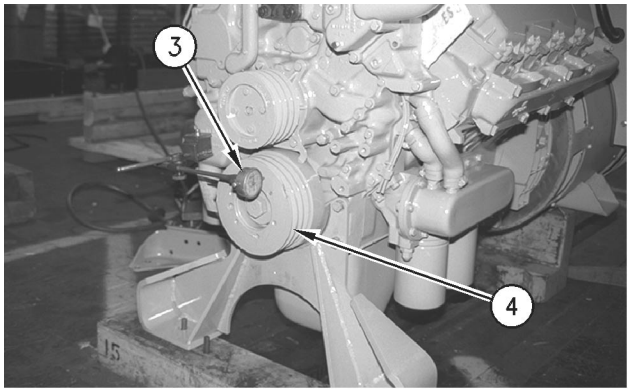


Illustration 98 g00295967

(3) Dial Indicator Group
(4) Crankshaft Pulley

2. In order to manually rotate the engine, remove the timing pointer's cover from the engine's flywheel housing. Install dial indicator group (3). Refer to Illustration 98. The tip of the indicator must touch the face of crankshaft pulley (4). Use a bar between the flywheel and the flywheel housing in order to push the crankshaft toward the flywheel. This will remove all the end play. Put the dial indicator in the ZERO position. Move the crankshaft to the most forward position. Make a record of the total indicator reading (TIR). The TIR is the end play of the crankshaft.

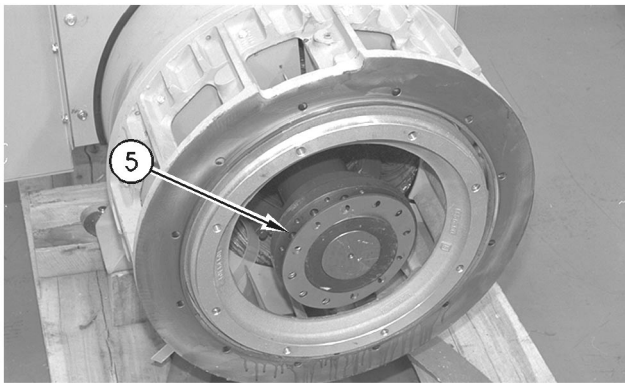


Illustration 99 g00616727

(5) Shim Pack

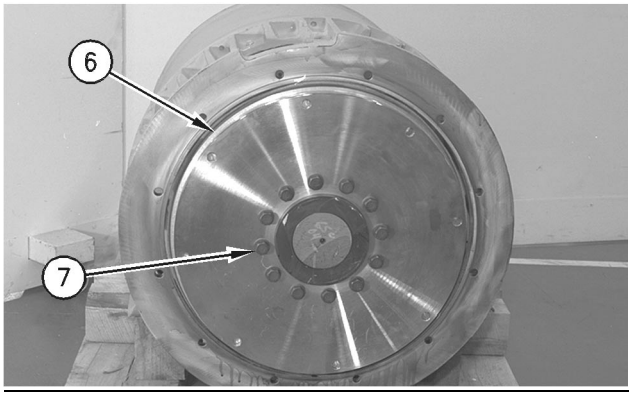


Illustration 100 g00616734

(6) Plate Assembly
(7) Bolts

NOTICE

Do not run the generator set unless the plate assembly has the correct clearance. If the plate assembly does not have the correct clearance, damage can occur to the engine and/or generator.

3. Before installation, temporarily position plate assembly (6) in the bore of the flywheel to check for clearance. There must be clearance between the plate assembly's outside diameter and the flywheel bore's inside diameter. The plate assembly (6) can be a single solid plate or the plate assembly can be numerous flexible plates.

4. Install a full shim pack (5) and plate assembly (6) on the generator with bolts (7). Tighten the bolts to the torques that are shown in Table 24.

Table 24

REQUIRED TORQUE	
Engine	**Torque**
D379, G379, D398, G398, D399, G399	505 ± 45 N·m (372.0 ± 33.0 lb ft)
All other engines	Standard torque

Note: Incorrect torque of bolts (7) can distort the shims which may reduce rotor bearing end play. When the shims are assembled to the drive coupling, the bolts (7) must be tightened to the correct torque.

Note: The total thickness of shims (5) must not cause a reduction of crankshaft end play. When the generator is installed, the total thickness of shims (5) must not cause bending of plate assembly (6).

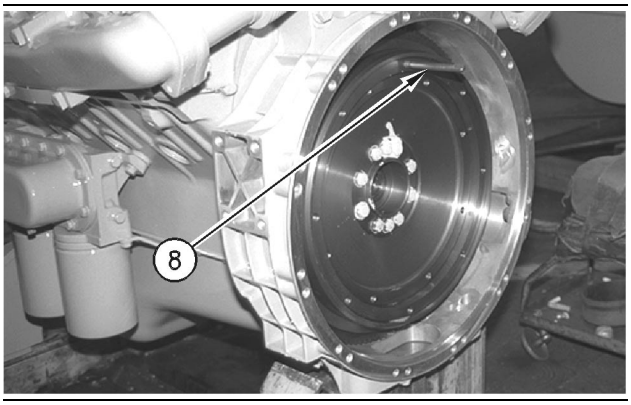


Illustration 101 g00295970

(8) Guide Bolt

5. Install guide bolt (8) in the flywheel.

6. Put the generator in position on the engine.

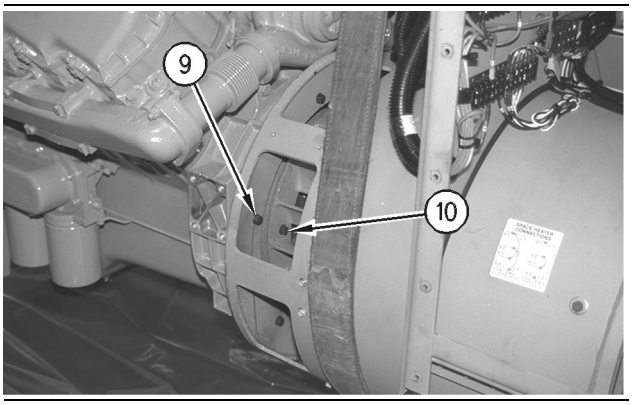


Illustration 102 g00295971

(9) Bolts
(10) Bolts

7. Install bolts (9) and (10). Tighten bolts (9) and (10).

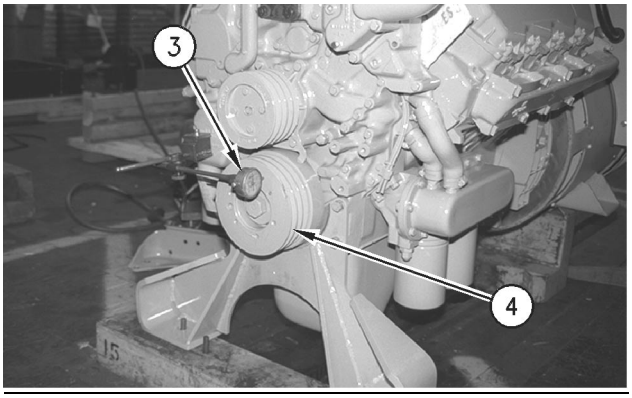


Illustration 103 g00295967

8. Install dial indicator group (3) in order to measure crankshaft end play at crankshaft pulley (4). In order to remove all end play, place a bar between the flywheel and the flywheel housing. Push the crankshaft toward the flywheel. Put the dial indicator in the ZERO position. Move the crankshaft to the most forward position and make a record of the total indicator reading (TIR). Do not use force to hold the crankshaft in position. The TIR is the end play of the crankshaft.

If the amount of end play is equal to the end play that was measured in Step **2**, proceed to Step **11**.

If the crankshaft end play is NOT equal to the original amount that was measured in Step **2**, go to Step **9**.

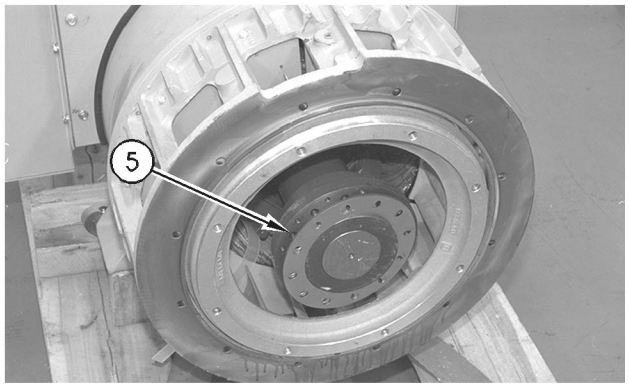


Illustration 104 g00616727

9. Remove the generator. Remove shims (5) until the original amount of end play is reached. Refer to Step **2**.

10. Install the generator and again check the crankshaft end play. Repeat Step **8**.

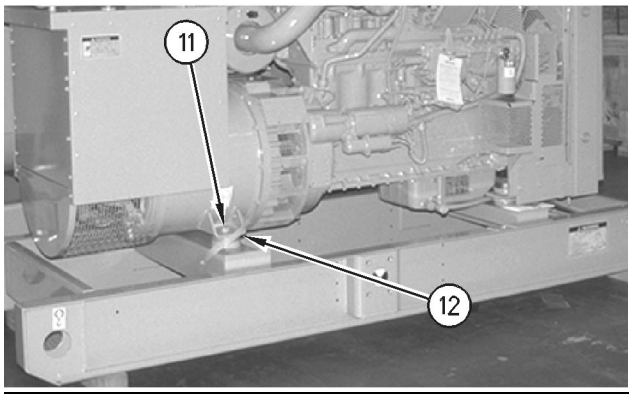


Illustration 105 g00616719

(11) Bolts
(12) Generator supports

11. Install all bolts (11) which fasten generator supports (12) to the base. Do not tighten. Align the generator to the engine. Go to the following alignment procedure which corresponds to the particular generator set.

Generator Sets With 3500 Engine Family

Table 25

TABLE FOR RECORDING MEASUREMENTS AND CALCULATIONS THAT ARE NECESSARY FOR THE INSTALLATION AND THE ALIGNMENT OF GENERATOR SETS WITH SINGLE BEARING GENERATORS			
Line	**Step**	**Description**	**Value**
A	Step 2	Crankshaft End Play	
B	Step 2	A / 2 =	
C	Step 3	Flywheel Housing Surface	
D	Step 3	Flywheel Pilot Surface	
E	Step 3	C - D =	
F	Step 5	Rotor End Play	
G	Step 5	F / 2 =	
H	Step 6	End Ring	
I	Step 6	Drive Coupling	
J	Step 6	I - H =	
K	Step 7	Average Thickness of Plates	
L	Step 8	Shim Gap J – B – E – G – K =	
M	Step 8	Total Number of Shims L ÷ 0.8 mm (0.032 inch) = (1)	
N	Step 14	Crankshaft End Play After Assembly	
P	Step 14	Heat sink End Play After Assembly	
Q	Step 14	Compare “N” to “A”. If “N” is greater than “A” or equal to “A”, the installation is finished. If “N” is less than “A”, repeat the installation. Check for calculation errors and check for measurement errors.	

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

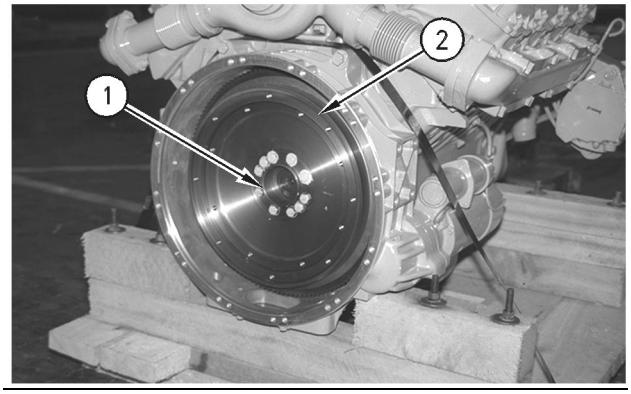
Table 26

PARTS NEEDED		
Part Number	**Part**	**Quantity**
5N-4479	Shim	6
5N-4478	Plate Assembly	1

Table 27

TOOLS NEEDED		
Part Number	**Tool**	**Quantity**
8S-2328	Dial Indicator Group	1

Disengage the generator from the engine. Perform the following procedure.



g00616707

Illustration 106

(1) Flywheel Pilot Bore
(2) Surface

1. Remove all dirt, burrs and paint from the contact surfaces of the generator supports and the base. Remove the protection material (compound) from flywheel pilot bore (1) and from surface (2). There should be no protection material that makes contact with the coupling. All contact surfaces of the engine, the coupling and the generator must be completely clean.

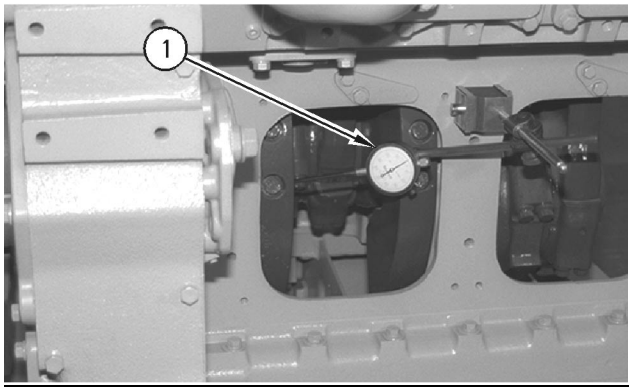


Illustration 107 g00617579

(1) Dial indicator

2. Remove two of the engine side covers. Use a bar to rotate the crankshaft. Rotate the crankshaft until one of the crankshaft's throw cheeks is perpendicular to the side cover's opening. Place a dial indicator on the perpendicular surface of the throw. Place a bar between the engine block and the crankshaft throw. Use the bar to push the crankshaft toward the flywheel in order to remove all end play. Zero the dial indicator. Turn the crankshaft to the most forward position. The amount of crankshaft end play that is shown on the dial indicator should be 0.178 mm (0.0070 inch) to 0.635 mm (0.0250 inch).

a. Record the measured value of crankshaft end play on "Line A" of Table 25.

b. Divide the value of "Line A" by two. Record this value on "Line B" of Table 25 (A / 2 = B).

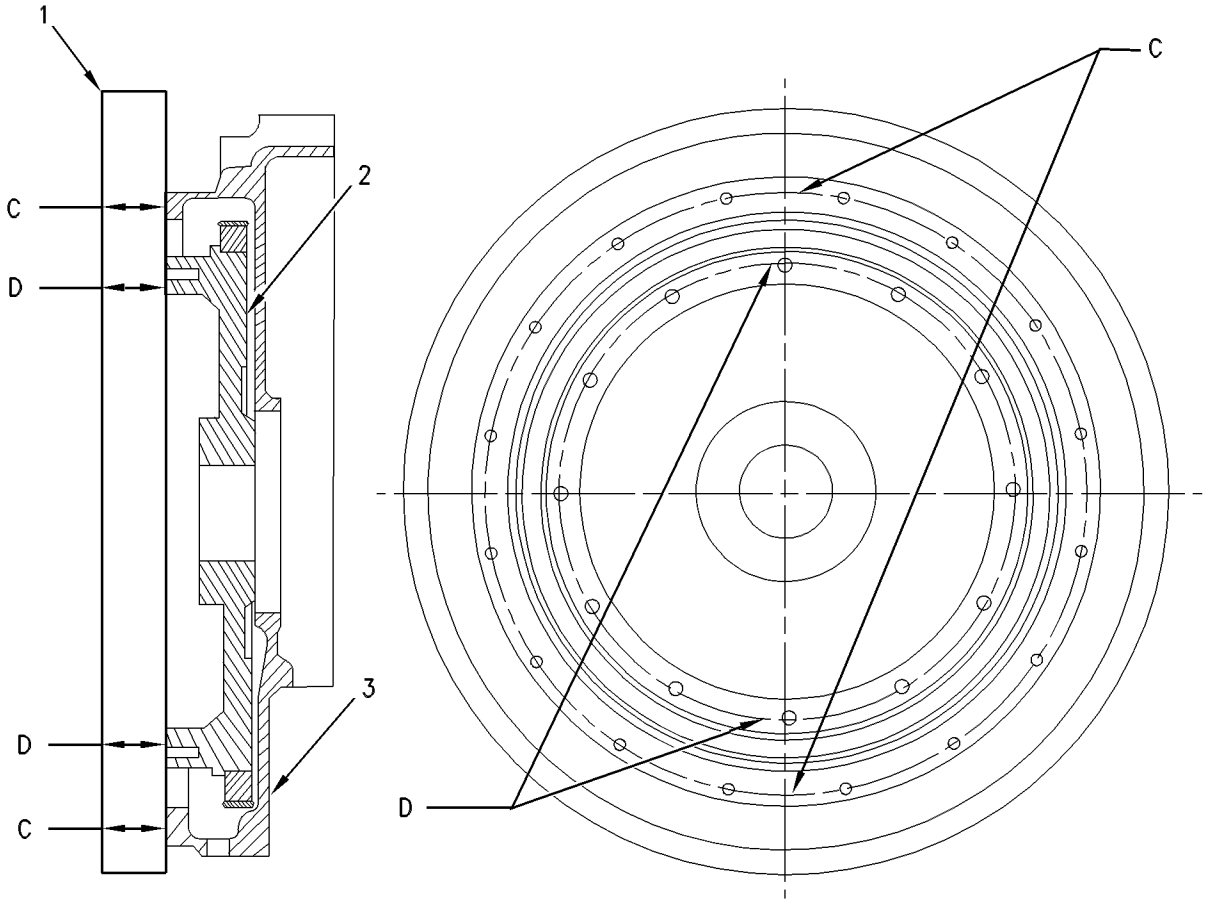


Illustration 108 g00617602

(1) Straight edge (2) Flywheel (3) Flywheel housing

3. Place the engine crankshaft at the extreme forward position. Position straight edge (1) across the face of flywheel (2). See Illustration 108.

a. Measure the distance between the top of straight edge (1) and flywheel housing (3) (mounting surface “C”). Record the value on “Line C” of Table 25.

b. Measure the distance between the top of straight edge (1) and Flywheel (2) (pilot surface (D)). Record the value on “Line D” of Table 25.

c. Subtract “Line D” from “Line C”. Record the value on “Line E” of Table 25 (C - D = E).

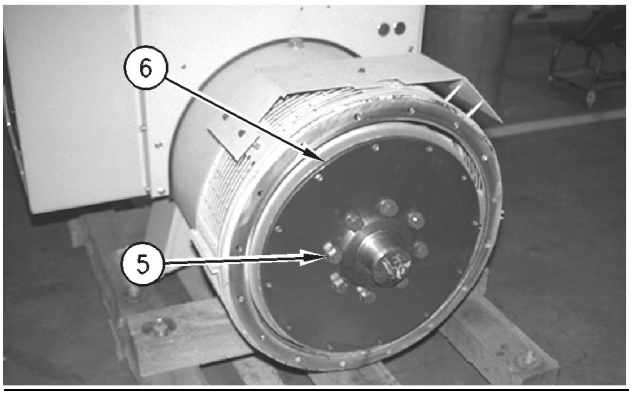


Illustration 109 g00617609

(5) Coupling bolts
(6) Flex plates

4. Remove coupling bolts (5) and washers. Remove flex plates (6), shims, and the exhaust fan. See Illustration 109. Attach a hoist to the rotor shaft and 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 rearmost position.

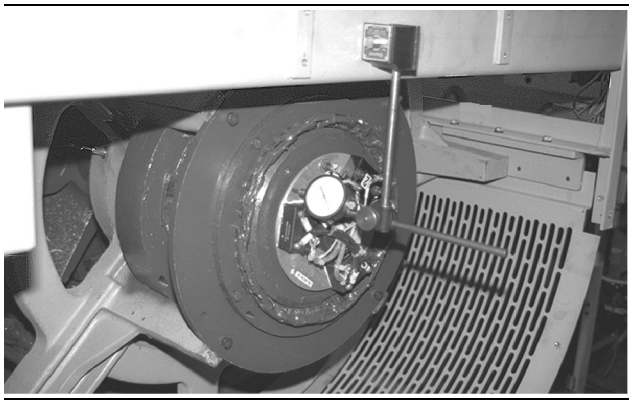


Illustration 110 g00617618

5. Place a dial indicator on the vertical surface of the heat sink assembly. The heat sink assembly is located at the rear of the generator's rotor shaft. See Illustration 110. The dial indicator's plunger should be preloaded so that the forward movement of the rotor can be measured. Use the generator drive coupler to move the rotor forward. The amount of rotor end play that is shown on the dial indicator should be approximately 3.81 mm (0.150 inch) to 7.62 mm (0.300 inch).

a. Record the measured value of rotor end play on "Line F" of Table 25.

b. Divide the value of "Line F" by two. Record this value on "Line G" of Table 25 (F / 2 = G).

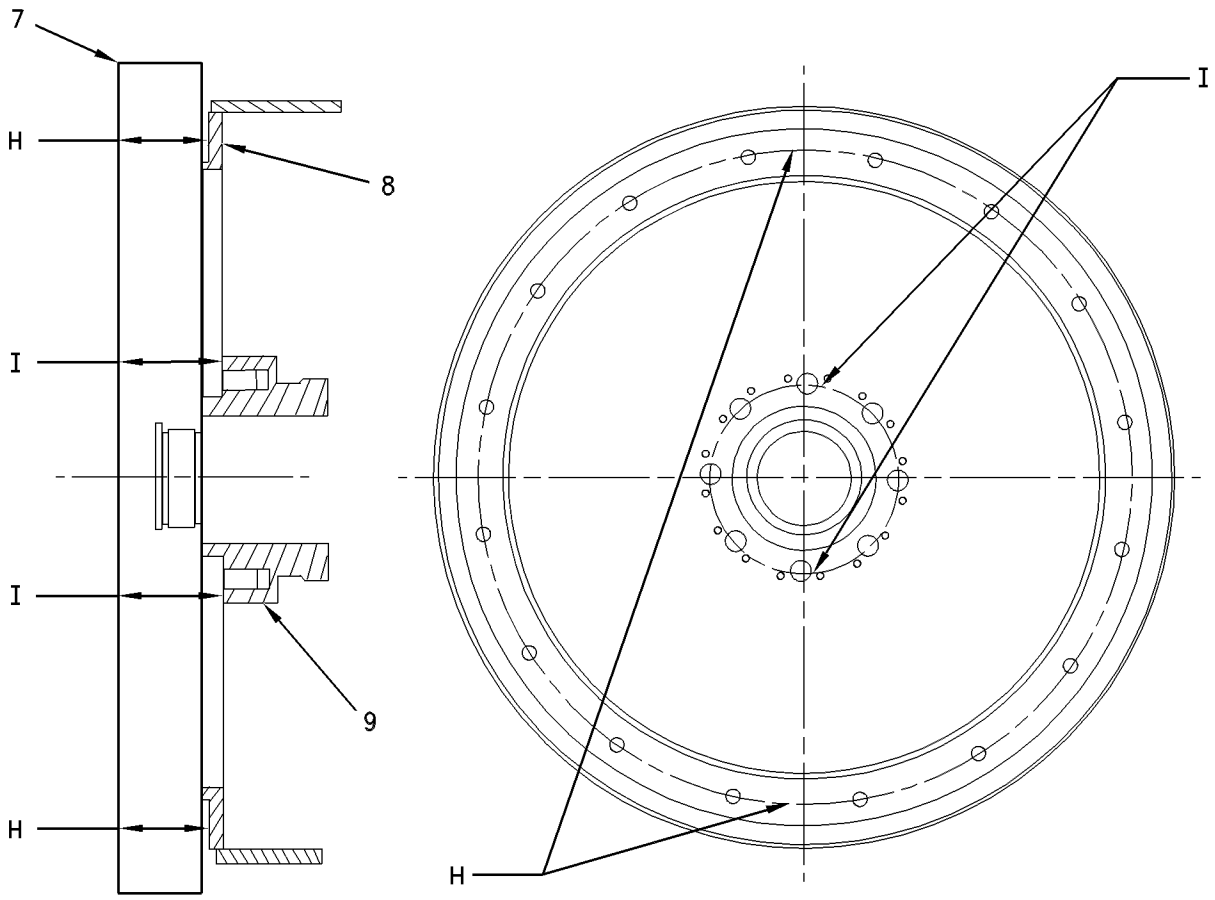


Illustration 111 g00617620

(7) Straight edge (8) End ring (9) Drive coupling

6. Move the rotor assembly to the rearmost position. Before proceeding, ensure that the air gap is equal between the rotor assembly and the stator. Position straight edge (7) across the diameter of end ring (8). See Illustration 111.

a. Measure the distance from the top of straight edge (7) to the mounting surface (H) of end ring (8). Record this value on “Line H” of Table 25.

b. Measure the distance from the top of straight edge (7) to the mounting surface (I) of drive coupling (9). Record the value on “Line I” of Table 25.

c. Subtract “Line H” from “Line I”. Record this value on “Line J” of Table 25 (I - H = J).

Note: Attachment of the straight edge (ferrous material) can be accomplished by using two magnetic bases from the dial indicator.

7. Take a standard set of seventeen 5N-4478 flex plates. Bolt the plates together by using the flywheel mounting holes. The bolts should be tight, but not tightened to the final torque. Measure the thickness of the plates in two locations along the border.

a. Calculate the average of the two measurements. Record this value on “Line K” of Table 25.

8. In order to determine the number of shims that are required to provide proper axial alignment, perform the calculation that is shown on “Line L” of Table 25 (J - B - E - G - K = L). Record this value on “Line L” of Table 25.

a. Divide the value of “Line L” by 0.8 mm (0.032 inch). Record this new value on “Line M” of Table 25. The value that is shown on “Line M” is the total number of shims. This value should be rounded up to the nearest whole number.

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

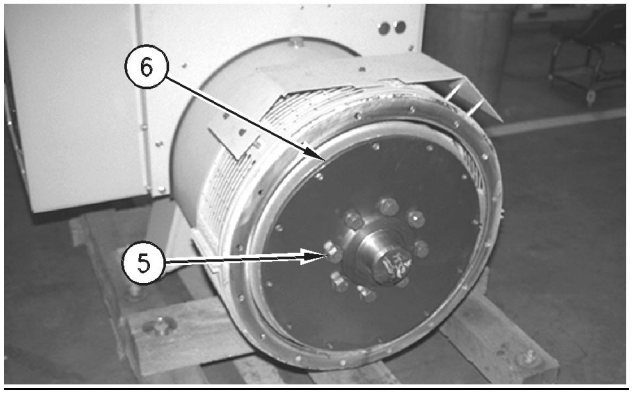


Illustration 112 g00617609

(5) Coupling bolts
(6) Coupling plate assembly

NOTICE

Do not run the generator set unless the plate assembly has the correct clearance. If the plate assembly does not have the correct clearance, damage can occur to the engine and/or generator.

10. Place the total number of shims onto the drive coupling. The total number of shims was calculated on "Line M" of Table 25. Install coupling plate assembly (6) and bolts (5). Tighten the bolts to the proper torque.

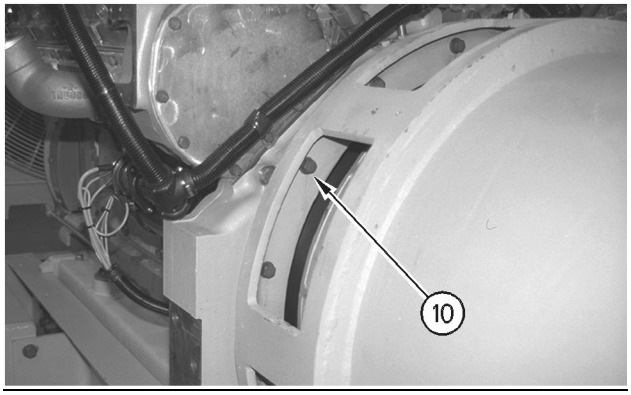


Illustration 113 g00617679

(10) Bolts

11. Install guide bolts in the flywheel. Guide bolts will assist in attaching the generator to the engine. Put the generator in position on the engine. Install bolts (10) which fasten the generator housing to the flywheel housing. Tighten bolts (10) to the standard torque.

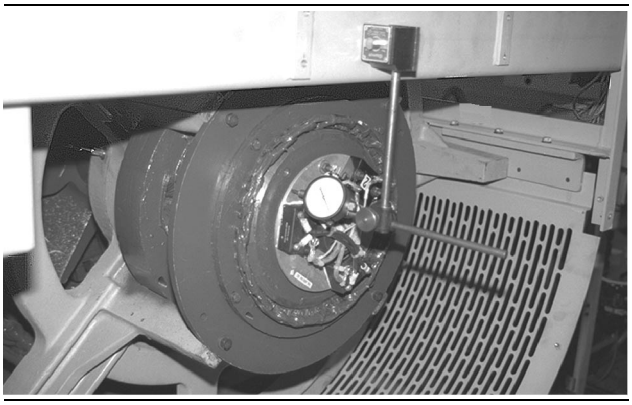


Illustration 114 g00617618

12. Place the crankshaft and the generator rotor in the respective rearmost positions. Place a dial indicator on the vertical surface of the heat sink assembly. The heat sink assembly is located at the rear of the generator rotor shaft. The dial indicator's plunger should be preloaded so that the forward movement of the rotor can be measured. Push the generator forward to the midpoint of end play (0.5 mm (0.02 inch)).

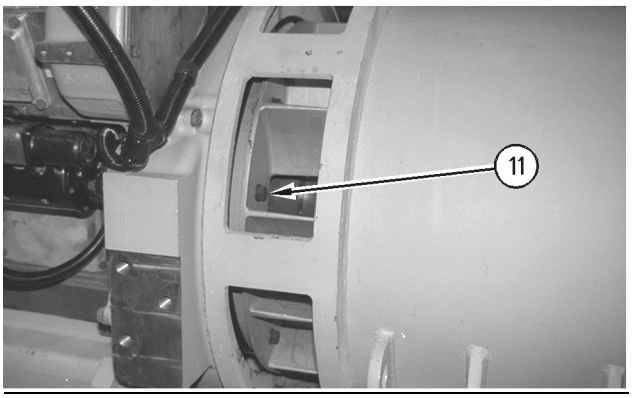


Illustration 115 g00617698

(11) Fan bolts

13. Install fan bolts (11) into the flywheel. Tighten the fan bolts to standard torque.

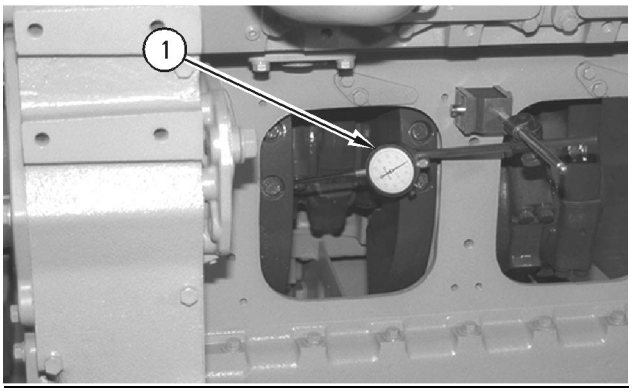


Illustration 116 g00617579

14. Place a dial indicator on the vertical surface of the crankshaft throw cheek. Place another dial indicator on the vertical surface of the heat sink assembly. Refer to Step **12**. 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 mm (0.0070 inch) to 0.635 mm (0.0250 inch). The amount of heat sink end play that is shown on the dial indicator should be 0.076 mm (0.0030 inch) to 0.635 mm (0.0250 inch).

a. After assembly is complete, measure the crankshaft end play. Record this value on "Line N" of Table 25.

b. After assembly is complete, measure the heat sink end play. Record this value on "Line P" of Table 25.

Note: If the value of "Line N" or the value of "Line P" is less than the value of "Line A", disassemble the generator. Check the coupling plate assembly for bowing. If bowing is present, replace the coupling plate assembly. Check the calculations and measurements of these procedures for errors.

15. Install the generator and again repeat Step **12** through Step **14**. After the correct amount of shims have been installed and all measurements are within limits, proceed with installation. Align the generator to the engine. Go to the following alignment procedure which corresponds to the particular generator set.

i01158999

Generator - Align

SMCS Code: 4450-024

Generator Alignment

Note: For the alignment procedure for two-bearing close coupled generators, see Special Instruction, SEHS7073, "Alignment Of Two Bearing Generators".

Note: A specific alignment procedure is not required for generators that are soft mounted.

Align Generator Sets With No Supports At The Flywheel Housing

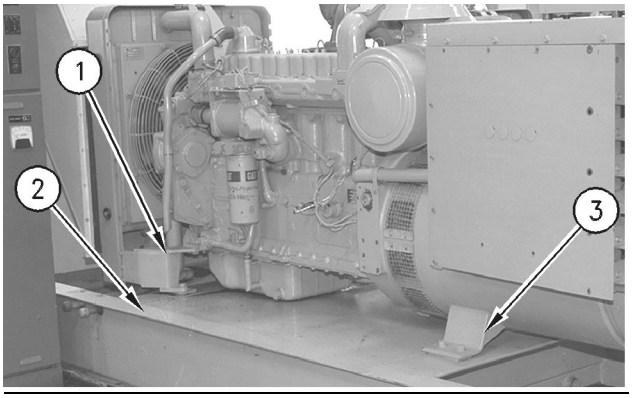


Illustration 117 g00616479

A Generator set with no supports at the flywheel housing

(1) Engine support
(2) Base
(3) Generator support

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 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 of the base, tighten all bolts that connect the base to the foundation to the final torque.

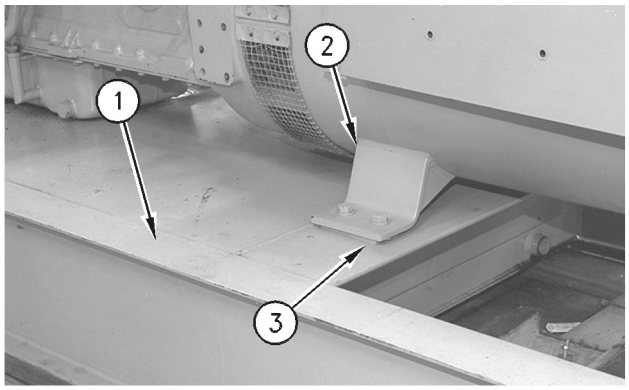
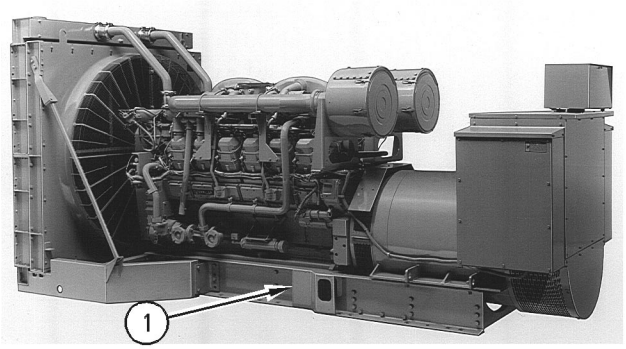


Illustration 118 g00616477

(1) Base
(2) Generator support
(3) Shims

4. Check the clearance between the base (1) and the engine. Check the clearance between the base (1) and the engine supports. Check the clearance between the base and the generator supports (2). Check the clearance over the entire length of the supports. This is especially important on generators with long supports (2), 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.

Align Generator Sets With Supports At The Flywheel Housing



g00616490

Illustration 119

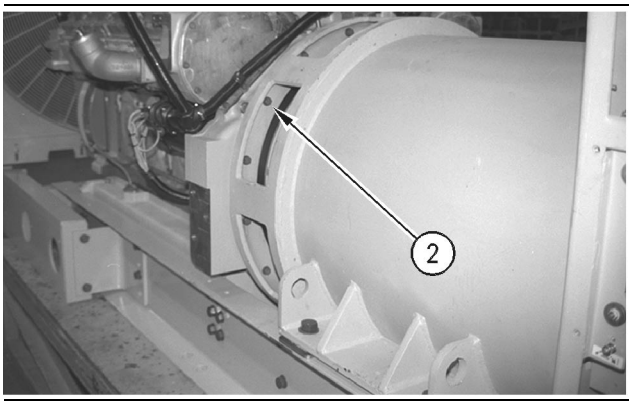
Generator Set With Supports At The Flywheel Housing

(1) Base

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.

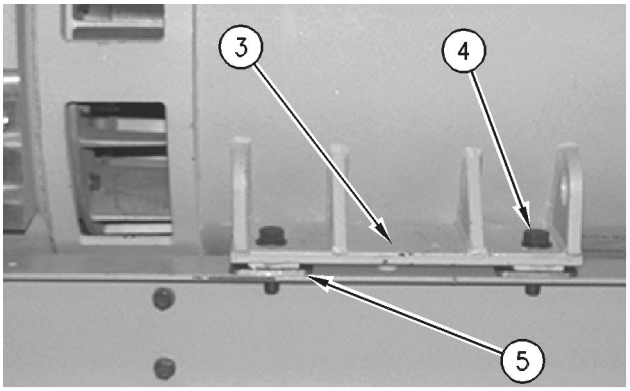
3. Check the clearance between the base and the foundation at all mounting locations. Shims should be used in order to prevent the deflection of the base as the bolts that connect the base to the foundation are tightened. When there is no deflection in the base, tighten all bolts that connect the base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



g00295995

Illustration 120

(2) Bolts



g00295996

Illustration 121

(3) Support
(4) Bolt
(5) Shims

4. While the generator is supported by a crane, loosen all bolts (2) that fasten the generator to the flywheel housing. Tighten alternate bolts to the final torque.

5. 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 (5) should be installed until all of the mounting surfaces are flat and parallel.

6. 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) that fasten the generator to the flywheel housing. Measure the gap between the generator and the flywheel housing. Visually ensure that the bolts (2) are centered in the clearance holes.

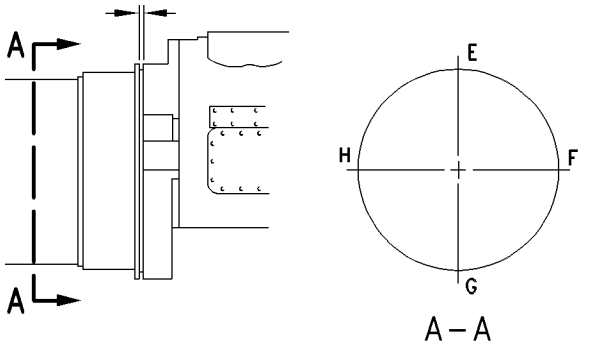


Illustration 122 g00295997

7. The gaps at locations (E), (G), (F), and (H) should be more than 0.03 mm (0.0012 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. Move the rear of the generator to the right or left accordingly.

8. 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 (332.0 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 **6**.

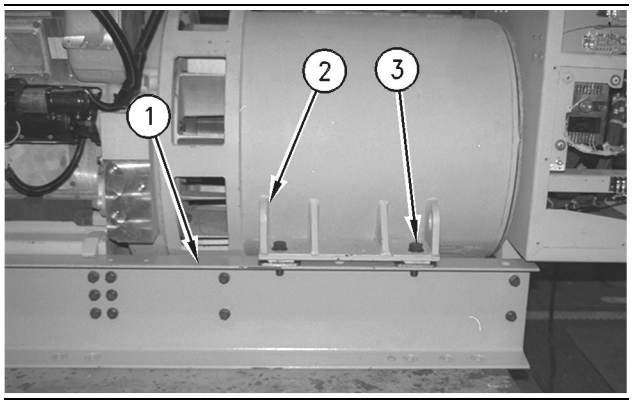


Illustration 123 g00616519

(1) Base
(2) Support
(3) Bolt

9. Install a dial indicator on the base (1) with the indicator tip next to a support mounting bolt (3). Put the indicator tip on the support (2). 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.

i01158402

Rotor - Remove and Install

SMCS Code: 4457-010

Removal Procedure

Start By:

a. Remove the generator. Refer to Disassembly and Assembly, "Generator - Remove".

b. Remove the exciter field and remove the exciter armature. Refer to Disassembly and Assembly, "Exciter - Remove and Install".

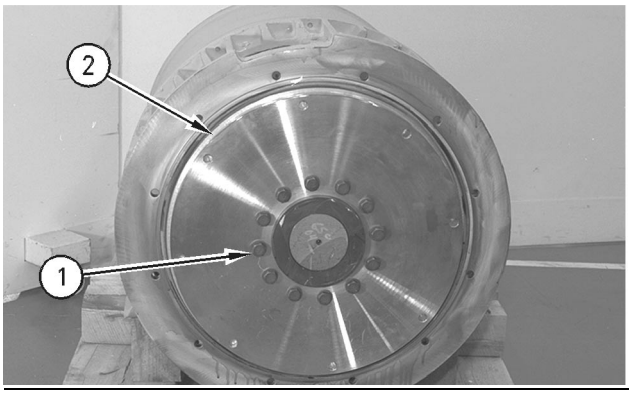


Illustration 124 g00615990

(1) Bolts
(2) Coupling plate

1. Remove bolts (1) which fasten coupling plate (2) to the rotor. Remove the coupling plate. The coupling plate assembly can be a single solid plate or the coupling plate assembly can be numerous flexible plates.

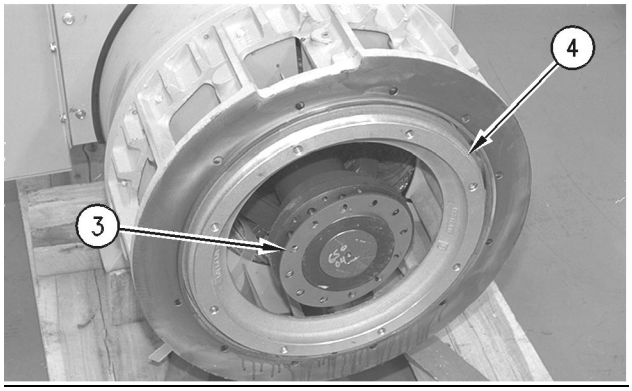


Illustration 125 g00615994

(3) Shims
(4) Fan

2. Remove shims (3) from the rotor shaft. Remove fan (4) from the generator housing.

Note: On 3406E Generator Sets, do not remove the fan at this point.

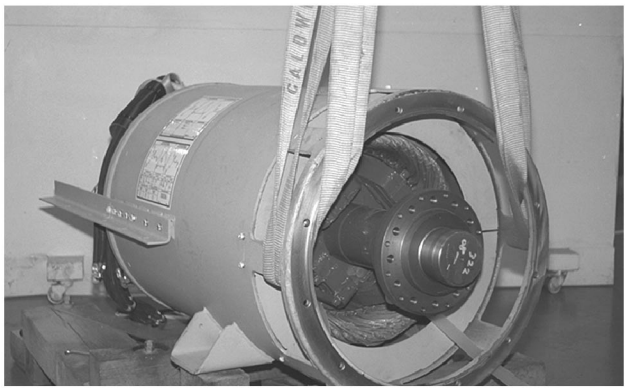


Illustration 126 g00616040

400 Frame Generator

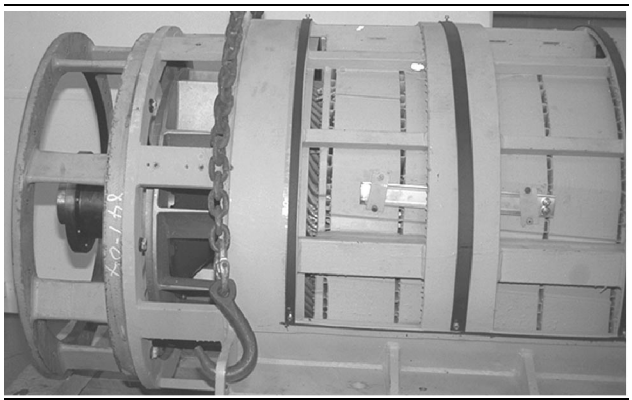


Illustration 127 g00616013

800 Frame Generator

3. Attach straps or chains to the drive end of the generator housing. With a hoist, raise the generator until the generator is in a vertical position. Ensure that the drive end is oriented upward.

Illustration 128 g00616056

400 frame generator

The strap is used to secure generator leads.

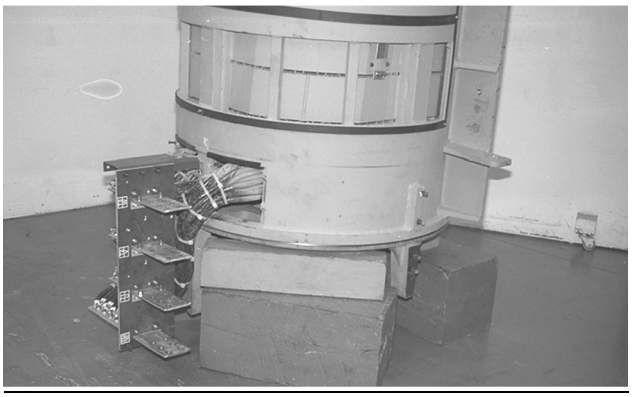


Illustration 129 g00616057

800 frame generator

4. Align the blocks with the generator housing's outside diameter. Lower the generator onto the blocks.

5. There is a generator bearing on the exciter end of the rotor shaft. This bearing is retained in the generator end housing. The bearing is retained in the generator end housing by a bearing cap or the bearing is retained in the generator end housing by retainer bars.

When the generator end housing is equipped with retaining bars, remove the four bolts that fasten the retaining bars to the generator end housing. Remove the retaining bars.

When the generator end housing is equipped with a bearing cap, remove the necessary bolts that fasten the bearing cap to the generator end housing. Pry the bearing cap out of the generator end housing. The bearing cap remains with the rotor shaft. If a bearing lube line is attached to the bearing cap, remove the lube line.

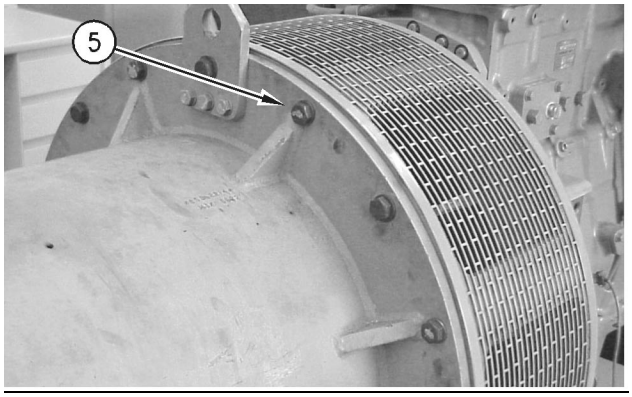


Illustration 130 g00624626

(5) Bolts

6. On 3406E generator sets, the drive end housing must be removed. Attach a hoist to the drive end housing. Remove the bolts (5) that attach the drive end housing to the generator. Remove the drive end housing.

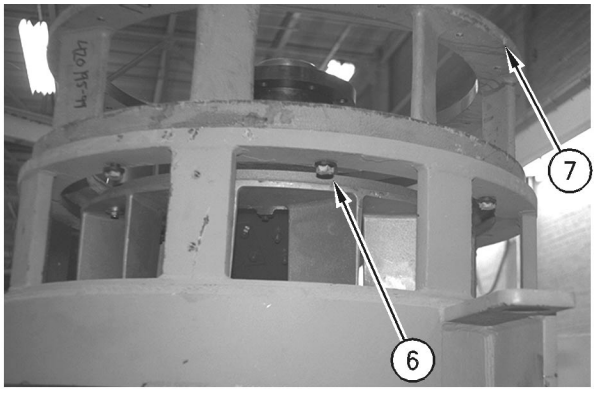


Illustration 131 g00616086

800 Frame Two-Bearing Generator

(6) Bolts
(7) Drive end housing

7. For two-bearing generators, bolts (6) which fasten drive end housing (7) to the generator must be removed. The drive end housing remains with the rotor shaft. Remove the bolts.

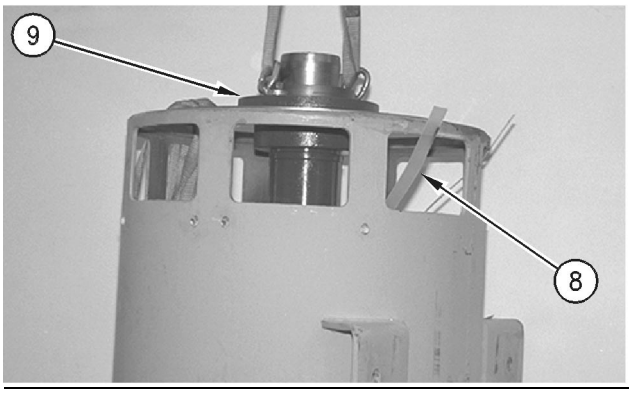


Illustration 132 g00616101

400 Frame Single Bearing Generator

(8) Protective strip
(9) Drive coupling

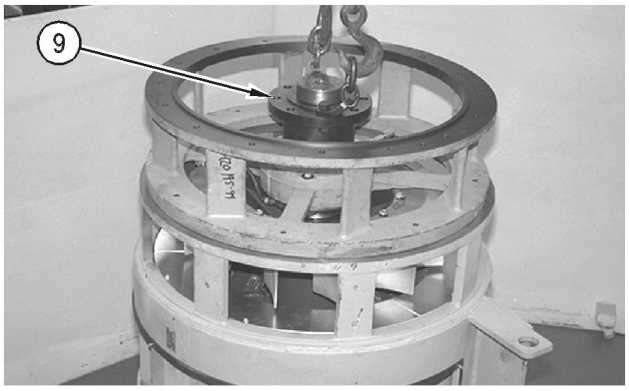


Illustration 133 g00616108

800 Frame Two-Bearing Generator

(9) Drive coupling

NOTICE

During removal of the generator, the rotor assembly must not contact the stator assembly. If the rotor assembly contacts the stator assembly, the windings can be damaged.

8. Put protective strips (8) of cardboard, plastic or curved sheet metal between the rotor assembly and the stator assembly. The pieces should be as long as the rotor assembly. These pieces protect the rotor and these pieces protect the stator from damage during rotor removal.

For two-bearing generators, put a mark on drive end housing (7) and the generator housing. This will ensure proper alignment during installation.

9. Attach a hoist to drive coupling (8). Remove the rotor assembly from the stator assembly.

Installation Procedure

Start By:

a. Place the generator in a vertical position. Ensure that the drive end is oriented upward.

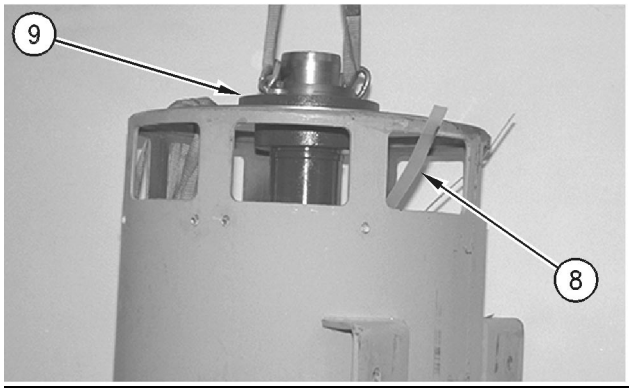


Illustration 134 g00616101

400 Frame Single Bearing Generator

(8) Protective strip
(9) Drive coupling

1. Put protective strips (8) of cardboard, plastic or curved sheet metal between the rotor assembly and the stator assembly. The pieces should be as long as the rotor assembly. During installation of the rotor, these pieces protect the rotor from damage. These pieces also protect the stator from damage.

2. Attach a hoist to drive coupling (9). Lower the rotor assembly into the stator assembly.

3. For two-bearing generators, the drive end housing is attached to the rotor shaft. When the rotor was removed from the generator, an alignment mark was made on the drive end housing and the generator housing. Align these marks. Start the bolts that attach the drive end housing to the generator. Do not tighten the bolts.

4. There is a generator bearing on the exciter end of the rotor shaft. This bearing is retained in the generator end housing. The bearing is retained in the generator end housing by a bearing cap or the bearing is retained in the generator end housing by retaining bars.

When the generator end housing is equipped with retaining bars, install the four bolts that fasten the retaining bars to the generator end housing.

When the generator end housing is equipped with a bearing cap, install the necessary bolts that fasten the bearing cap to the generator end housing. If a bearing lube line is attached to the bearing cap, install the lube line.

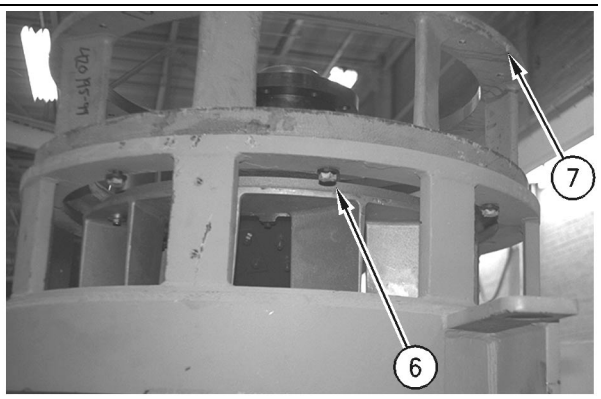


Illustration 135 g00616086

(6) Bolts
(7) Drive end housing

5. On a two-bearing generator, tighten the bolts (6) that attach the drive end housing (7) to the generator.

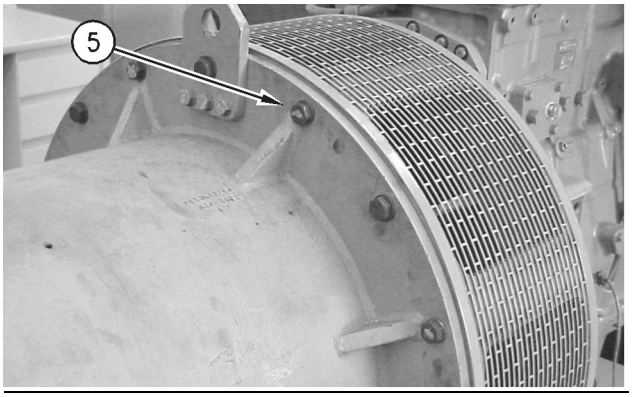


Illustration 136 g00624626

(5) Bolts

6. On a 3406E generator set, install the drive end housing. Tighten bolts (5).

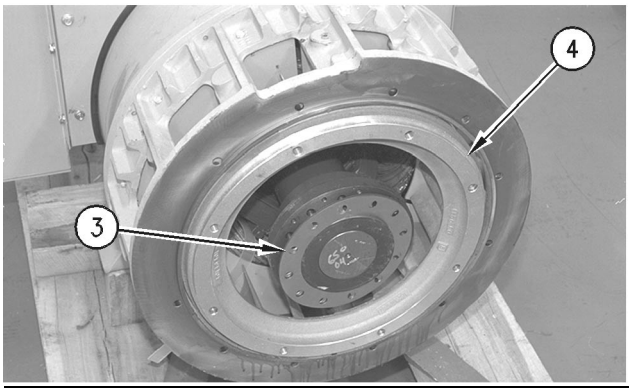


Illustration 137 g00615994

7. Place fan (4) in the drive end housing.

8. Install shims (3) on the rotor shaft.

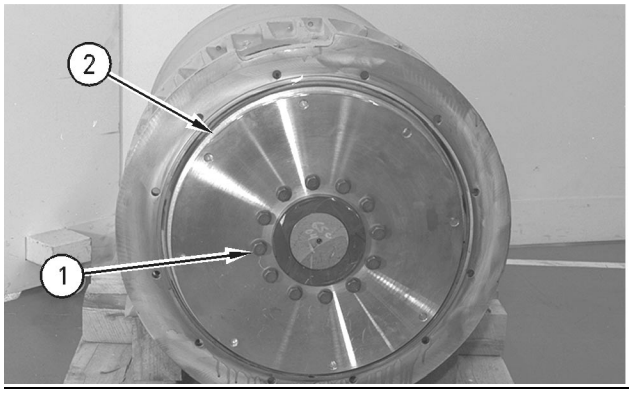


Illustration 138 g00615990

9. Install coupling plate (2) on the rotor. Tighten bolts (1).

i01731574

Bearing - Remove and Install

SMCS Code: 4471-010

Removal Procedure

Start By:

a. Remove the exciter field and remove the exciter armature. Refer to Disassembly and Assembly, “Exciter - Remove and Install” and Disassembly and Assembly, “Rotor - Remove and Install”.

Table 28

TOOLS NEEDED		
Part Number	**Tool**	**Quantity**
1H-3107	Push-Puller	1
1H-3108	Push-Puller Leg	2
1H-3110	Bearing Pulling Attachment	1

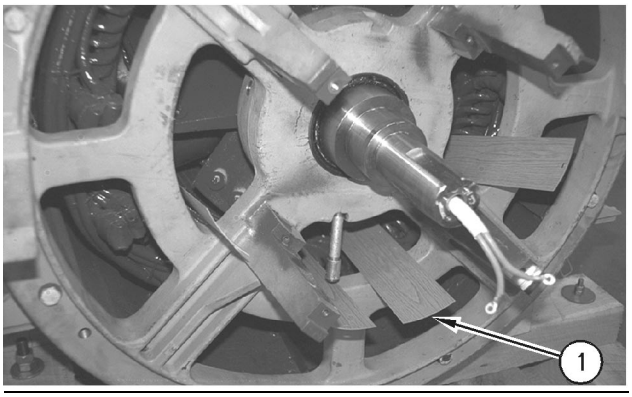


Illustration 139 g00615777

(1) Protective strip

1. Put protective strips (1) of cardboard, plastic or curved sheet metal between the rotor assembly and the stator assembly. The pieces should be as long as the rotor assembly. During removal of the end housing, these pieces protect the rotor and these pieces protect the stator from damage.

2. The generator bearing is retained in the generator end housing. On the inside of the generator end housing, a bearing cap or retaining bars are used to retain the bearing.

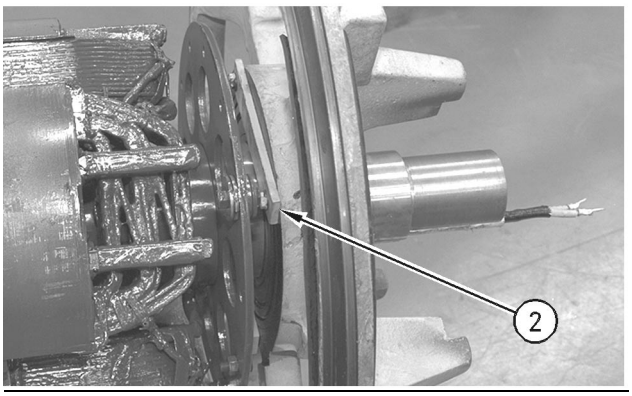


Illustration 140 g00615790

Retaining Bar

(2) Retaining bar

3. If the generator end housing is equipped with retaining bars (2), remove the four bolts that fasten the retaining bars to the generator end housing. Remove the retaining bars.

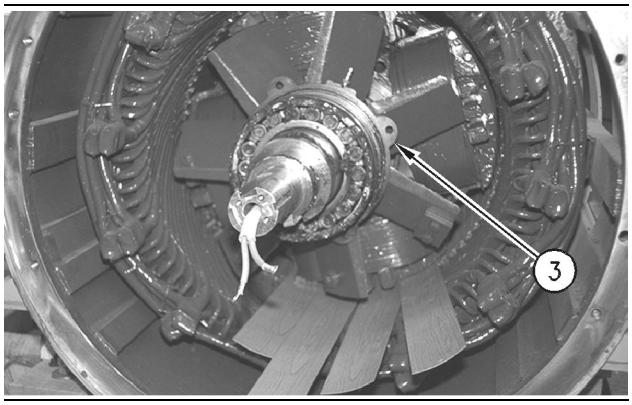


Illustration 141 g00615797

Bearing Cap

(3) Bearing Cap

4. If the generator end housing is equipped with bearing cap (3), remove the necessary bolts which fasten the bearing cap to the generator end housing. Pry the bearing cap out of the generator end housing. The bearing cap remains with the rotor shaft. If a bearing lube line is attached to the bearing cap, remove the lube line.

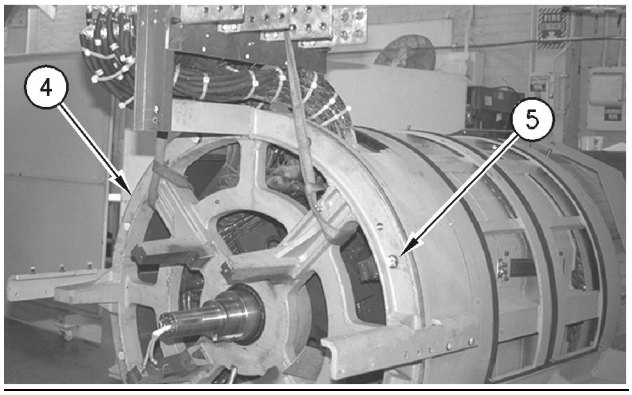


Illustration 142 g00615803

(4) End housing
(5) Bolts

Note: The weight of end housing (4) varies with the size of the generator. Larger end housings require the use of a hoist.

5. Attach a hoist to end housing (4). Remove bolts (5) that fasten end housing (4) to the generator. Use a pry bar to separate the end housing from the generator. Some end housings have provisions which allow the use of forcing screws. Lift the end housing from the generator and remove the end housing from the generator.

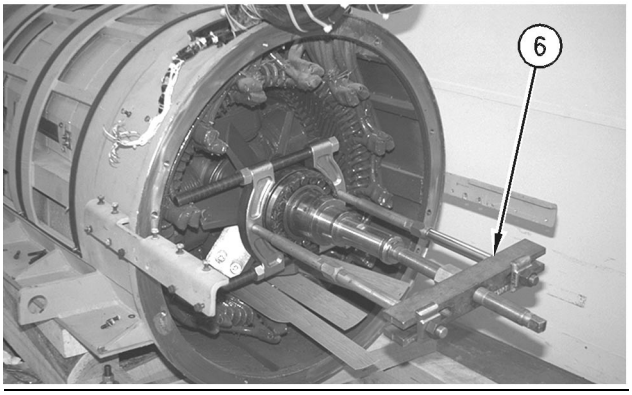


Illustration 143 g00615809

(6) Tooling

6. Attach tooling (6). Remove the bearing.

Two-Bearing Generator

Table 29

TOOLS NEEDED		
Part Number	**Tool**	**Quantity**
1U-6415	Puller Group (40 ton)	1

Note: On two-bearing generators, there is a bearing on each end of the generator. To remove the bearing that is located at the drive end of the generator, use the following procedure.

For removal of the bearing at the drive end of the generator, begin by removing the drive coupling. Refer to Disassembly and Assembly, “Coupling - Remove”.

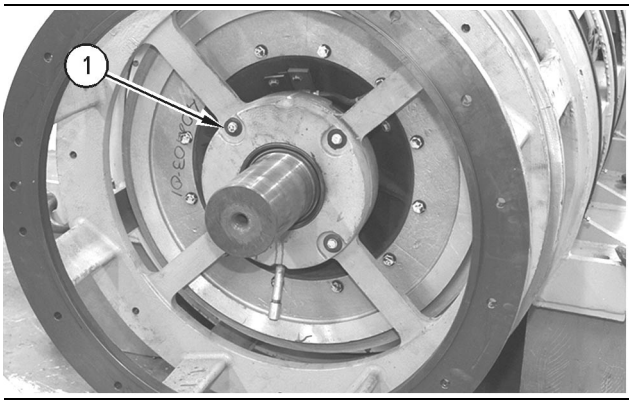


Illustration 144 g00615814

(1) Bolts

1. The generator bearing is retained in the generator end housing. On the inside of the generator end housing, a bearing cap retains the bearing.

Remove bolts (1) which fasten the bearing cap to the generator end housing. Pry the bearing cap out of the generator end housing. The bearing cap remains with the rotor shaft. If a bearing lube line is attached to the bearing cap, remove the lube line.

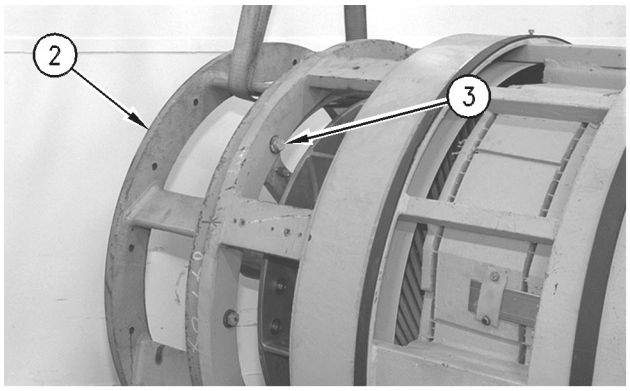


Illustration 145 g00615816

(2) End Housing
(3) Bolts

2. Attach a hoist to end housing (2). Remove bolts (3) which fasten end housing (2) to the generator. Use a pry bar to separate the end housing from the generator. Some end housings have provisions which allow the use of forcing screws. Lift the end housing from the generator and remove the end housing from the generator.

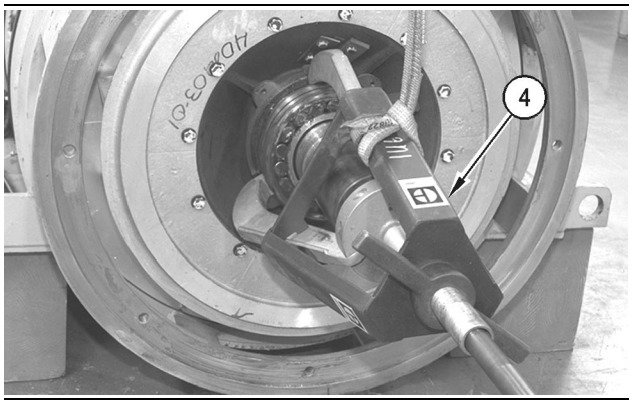


Illustration 146 g00615820

(4) Removal Tool 1U-6415

3. Attach tooling (4). Remove the bearing.

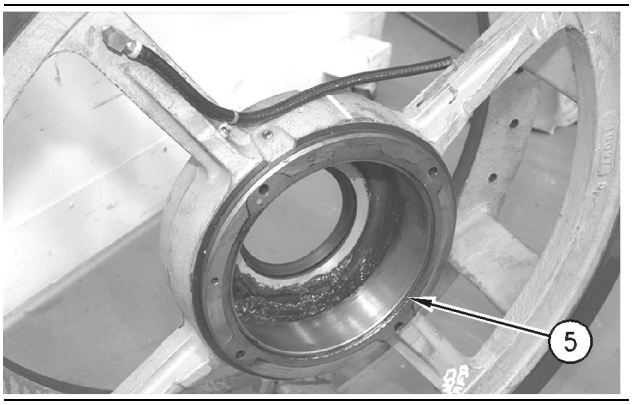


Illustration 147 g00615824

Replaceable bearing wear sleeve (inside view of end housing)

(5) Bearing wear sleeve

Some end housings have a bearing wear sleeve (5) which is replaceable.

Installation Procedure

To install the bearing that is located at the exciter end of the generator, use the following procedure.

1. Heat the bearing to 149 °C (300.2 °F).

2. While the bearing is heated to 149 °C (300.2 °F), place the bearing inside the end housing.

3. If the generator end housing is equipped with a bearing cap, attach bearing cap to the end housing. Install bolts.

4. If equipped, attach bearing lube line to the bearing cap.

5. If the generator end housing is equipped with retaining bars, attach the retaining bars to the end housing. Install bolts.

Two-Bearing Generator

Note: On two-bearing generators, there is a bearing on each end of the generator. To install the bearing on the drive end of the generator, use the following procedure.

1. Heat the bearing to 149 °C (300.2 °F).

2. While the bearing is heated to 149 °C (300.2 °F), place the bearing inside the generator end housing.

3. Attach a hoist to the generator end housing. Attach the generator end housing to the generator. Install bolts.

4. Attach bearing cap to the end housing. Install bolts.

5. If equipped, attach bearing lube line to bearing cap.

i01157853

Coupling - Remove

SMCS Code: 4456-011

Removal Procedure

Start By:

a. Remove the generator. See the topic Disassembly and Assembly, “Generator - Remove”.

Table 30

TOOLS NEEDED	
Tool	**Quantity**
Acetylene Torch with a Rosebud Tip	2
Heat Resistant Gloves	1

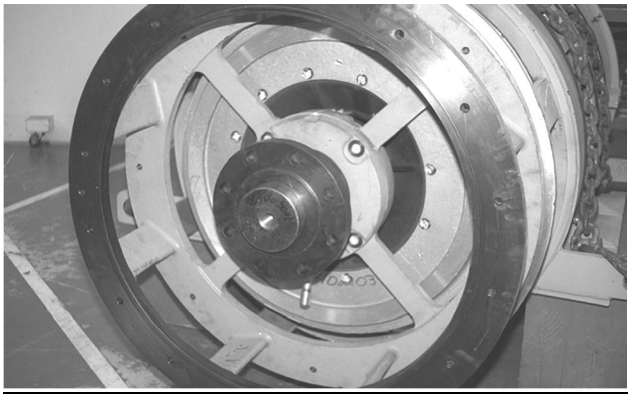


Illustration 148 g00615745

1. Simultaneously, heat the two opposite ends of the drive coupling. Use two acetylene torches that are equipped with rosebud tips. This method will quickly heat the coupling. Heat the coupling for three to five minutes. Do not overheat the coupling.

⚠ WARNING

Always wear protective gloves when handling parts that have been heated.

Illustration 149 g00615513

2. Slide the coupling on the rotor until the stop fixture contacts the end of the rotor shaft.

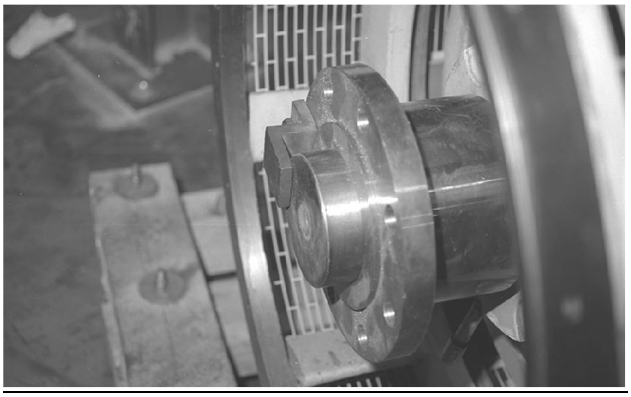


Illustration 150 g00615518

3. Remove the stop fixture from the coupling.

i01602306

Coupling - Install

SMCS Code: 4456-012

Installation Procedure

Table 31

TOOLS NEEDED	
Tool	**Quantity**
Stop Fixture. Refer to Illustration 151.	1
Heat Resistant Gloves	1

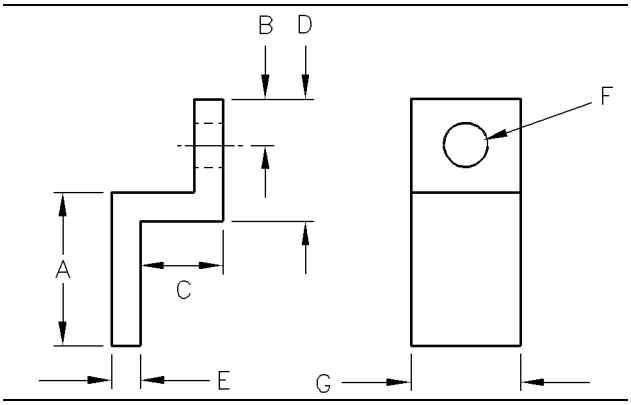


Illustration 151 g00615434

Stop Fixture Fabrication

(A) 114.3 mm (4.50 inch)
(B) 19.7 mm (0.78 inch)
(C) 45.5 mm (1.79 inch) (for SR4B only)
(C) 39.4 mm (1.55 inch) (for SR4 only)
(D) 50.8 mm (2.00 inch)
(E) 12.7 mm (0.50 inch)
(F) 19.1 mm (0.75 inch)
(G) 50.8 mm (2.00 inch)

1. Evenly heat the coupling to 315 °C (599.0 °F). An oven is the preferred method for heating the coupling.

⚠ WARNING

Always wear protective gloves when handling parts that have been heated.

2. Place the coupling on a work bench.

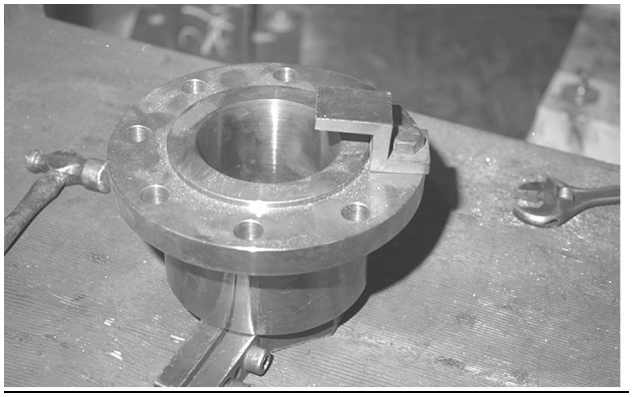


Illustration 152 g00615500

A Coupling with a stop fixture attached.

3. Attach the stop fixture to the coupling.

Illustration 153 g00615513

4. Slide the coupling on the rotor shaft. Continue to slide the coupling until the stop fixture contacts the rotor shaft.

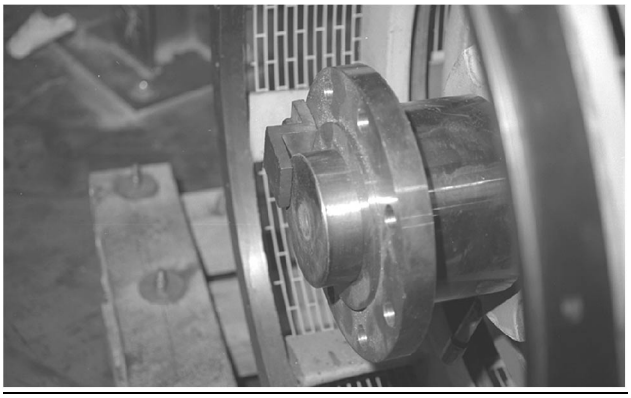


Illustration 154 g00615518

5. Remove the stop fixture from the coupling.

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