ENGINE ELECTRICAL

CHARGING SYSTEM

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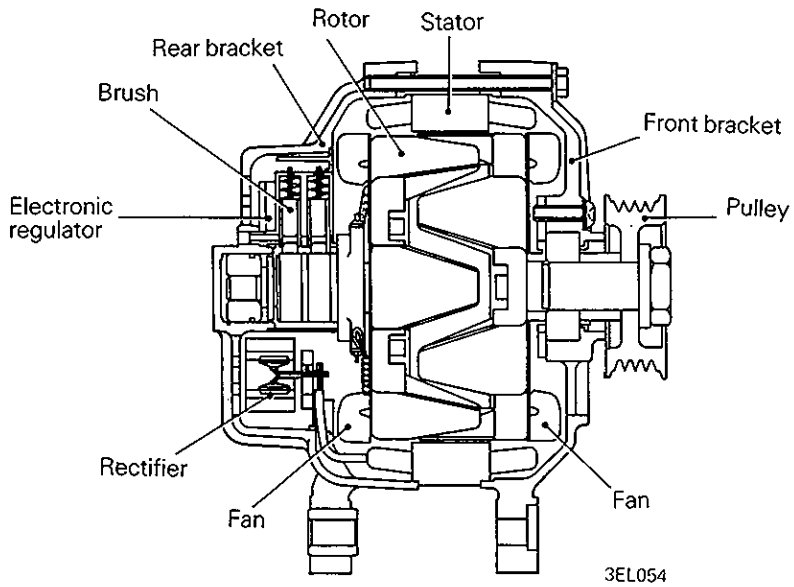
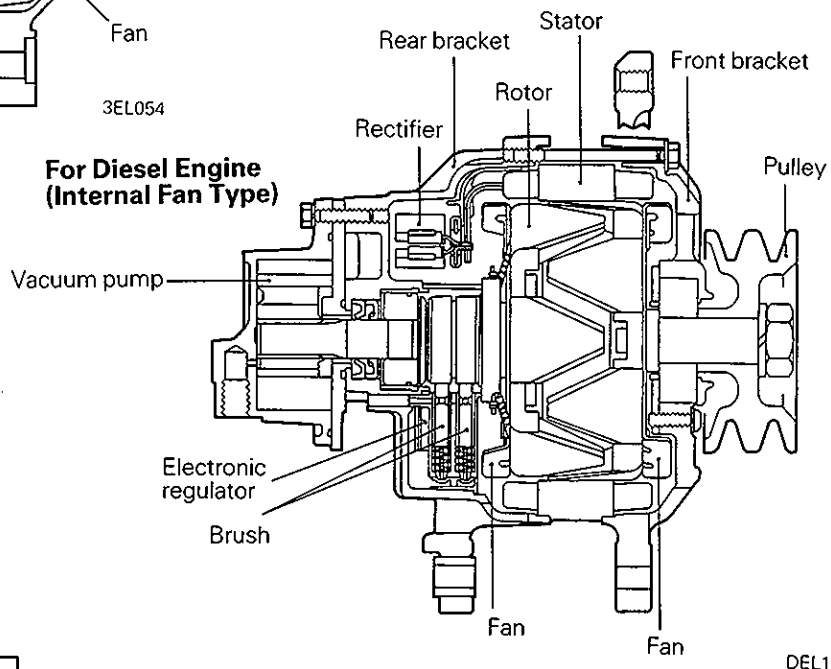
GENERAL INFORMATION

For Petrol Engine



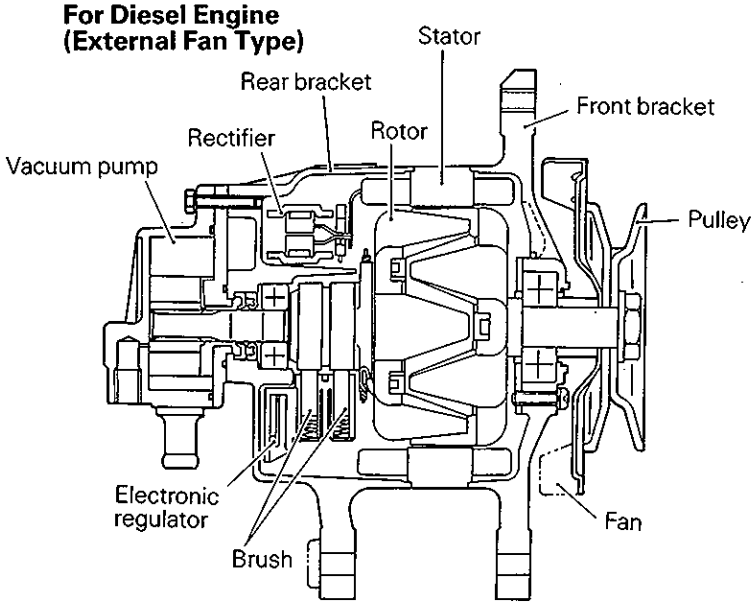
3EL054

For Diesel Engine (Internal Fan Type)



DEL100

For Diesel Engine (External Fan Type)



DEL072

NOTES

1. SPECIFICATIONS

SERVICE SPECIFICATIONS

mm (in.)

	Standard	Limit
Alternator		
<Except 4M40 engine>		
Brush replacement		When beyond wear limit line
Rotor coil resistance	3 – 5 Ω	
<4M40 engine>		
Rotor assembly		
Filed coil resistance		
65A	2.4 – 2.9 Ω	
75A, 90A	2.3 – 2.7 Ω	
Slip ring O.D.	22.7 (0.894)	22.1 (0.870)
Brush length	18.5 (0.728)	5 (0.20)

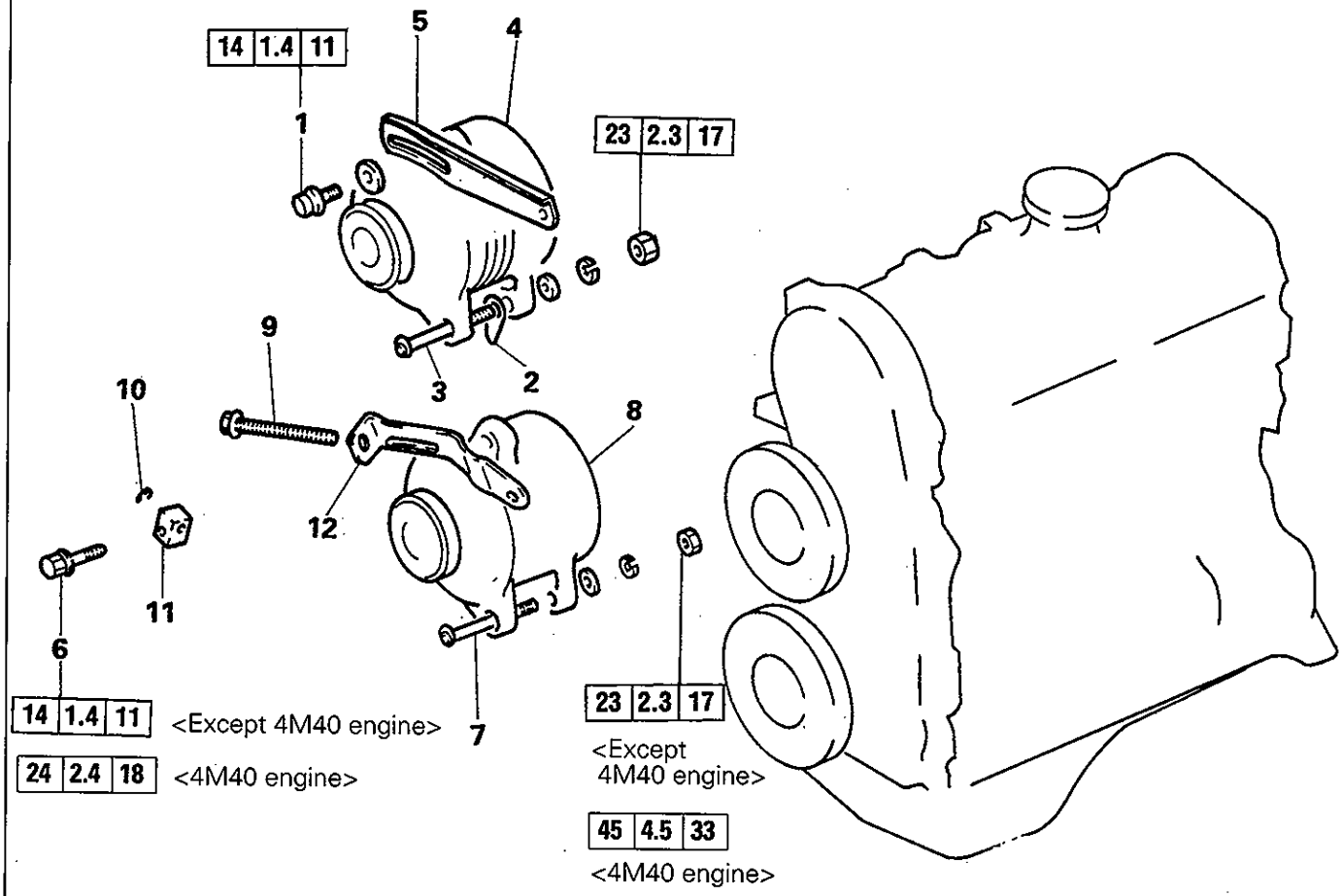
TORQUE SPECIFICATIONS

		Torque		
		Nm	kgm	ft.lbs.
Brace bolt		14	1.4	11
Lock bolt		14	1.4	11
Lock bolt (4G9 engine)		23	2.3	17
Lock bolt (6G72 DOHC and 4M40 engines)		24	2.4	18
Alternator pivot bolt nut		23	2.3	17
Alternator pivot bolt nut (4G9, 6A1 and 4M40 engines)		45	4.5	33
Alternator bolt (6G72 SOHC 12-valve engine)		14	1.4	11
Alternator bolt (6G72 SOHC 24-valve and 6G74 DOHC engines)	(M8)	22	2.2	16
	(M10)	52	5.2	38
Alternator cover bolt	(M6)	10	1.0	8
	(M8)	13	1.3	10
Alternator bracket (6A12 engine)		23	2.3	17
Alternator bracket (6G72 DOHC engine)	(M8)	23	2.3	17
	(M10)	45	4.5	33

NOTES

2. ALTERNATOR

REMOVAL AND INSTALLATION – Except 4G9, 6G72, 6G74 AND 6A12 ENGINES



Pre-removal operation
- Remove the alternator drive belt (See Group 11).

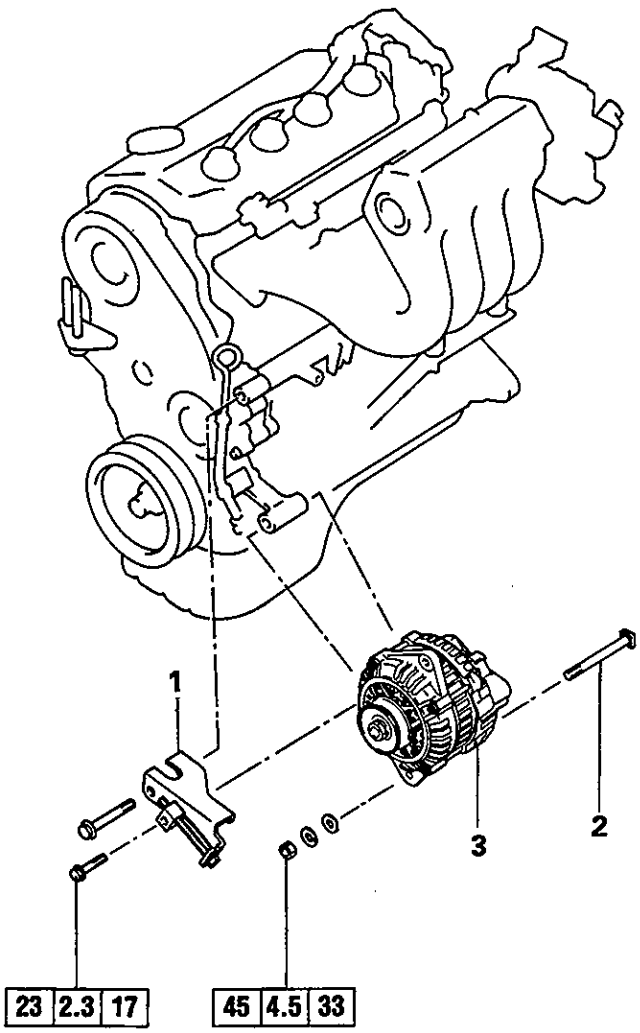
Post-installation operation
- Install the alternator drive belt (See Group 11).
- Adjust drive belt tension. (See Group 11).

Removal steps

1. Brace bolt
2. ◆A◆ Spacer (4G54 Engine only)
3. Pivot bolt
4. Alternator assembly
5. Alternator brace
6. Lock bolt
7. Pivot bolt
8. Alternator assembly
9. Adjusting bolt
10. Snap ring
11. Lock nut
12. Alternator brace

6EL0110

REMOVAL AND INSTALLATION – 4G9 ENGINE



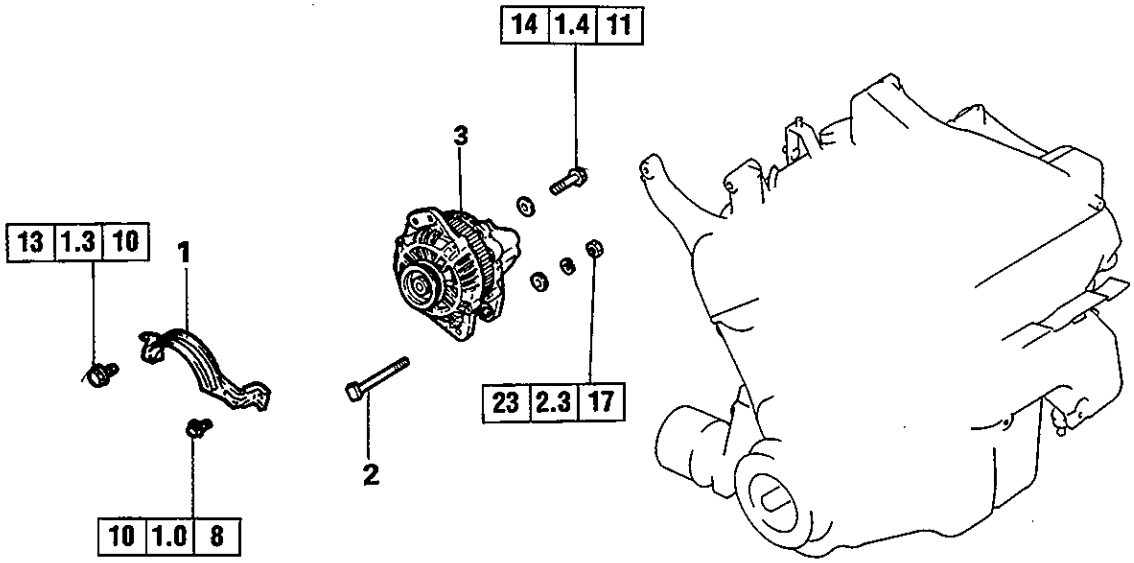
Pre-removal operation
- Remove the alternator drive belt (See Group 11).

Removal steps
1. Alternator brace assembly
2. Pivot bolt
3. Alternator

Post-installation operation
- Install the alternator drive belt (See Group 11).
- Adjust drive belt tension. (See Group 11).

9EN0253

REMOVAL AND INSTALLATION – 6G72 SOHC 12-VALVE ENGINE (Rear Wheel Drive Vehicle)



Pre-removal operation
- Remove the alternator drive belt (See Group 11).

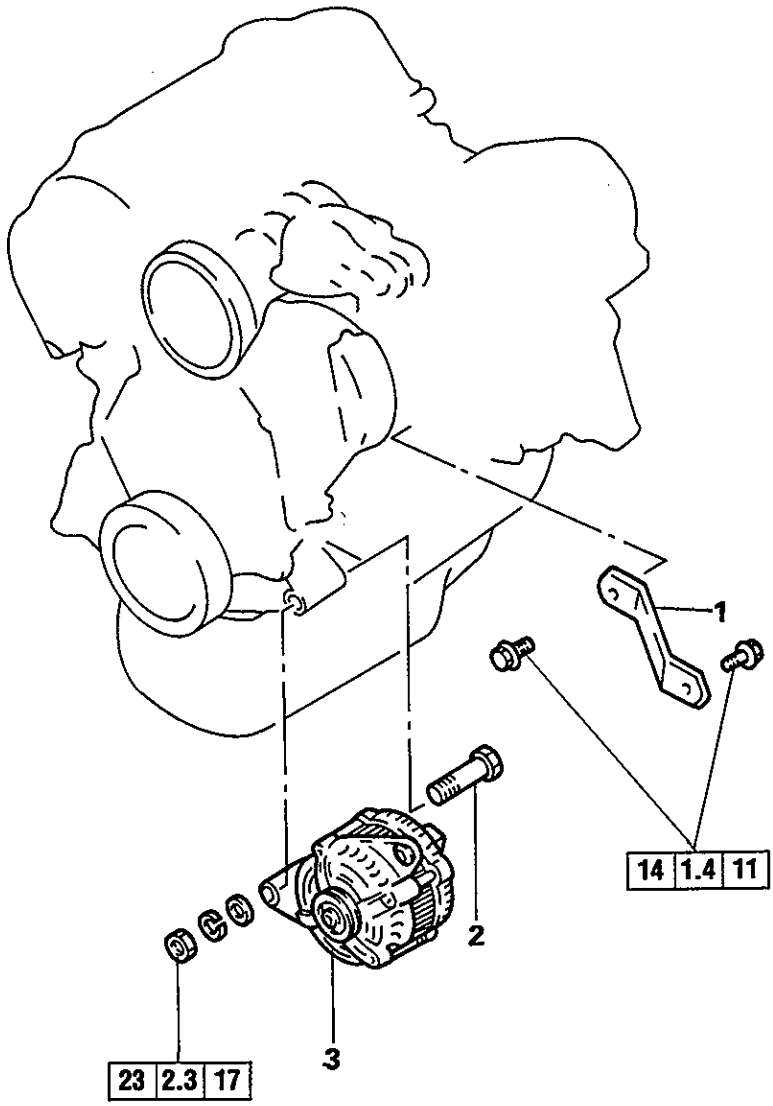
Removal steps

1. Alternator cover
2. Pivot bolt
3. Alternator

Post-installation operation
- Install the alternator drive belt (See Group 11).
- Adjust drive belt tension. (See Group 11).

7EL0080

REMOVAL AND INSTALLATION – 6G72 SOHC ENGINE (Front Wheel Drive Vehicle)



Removal steps

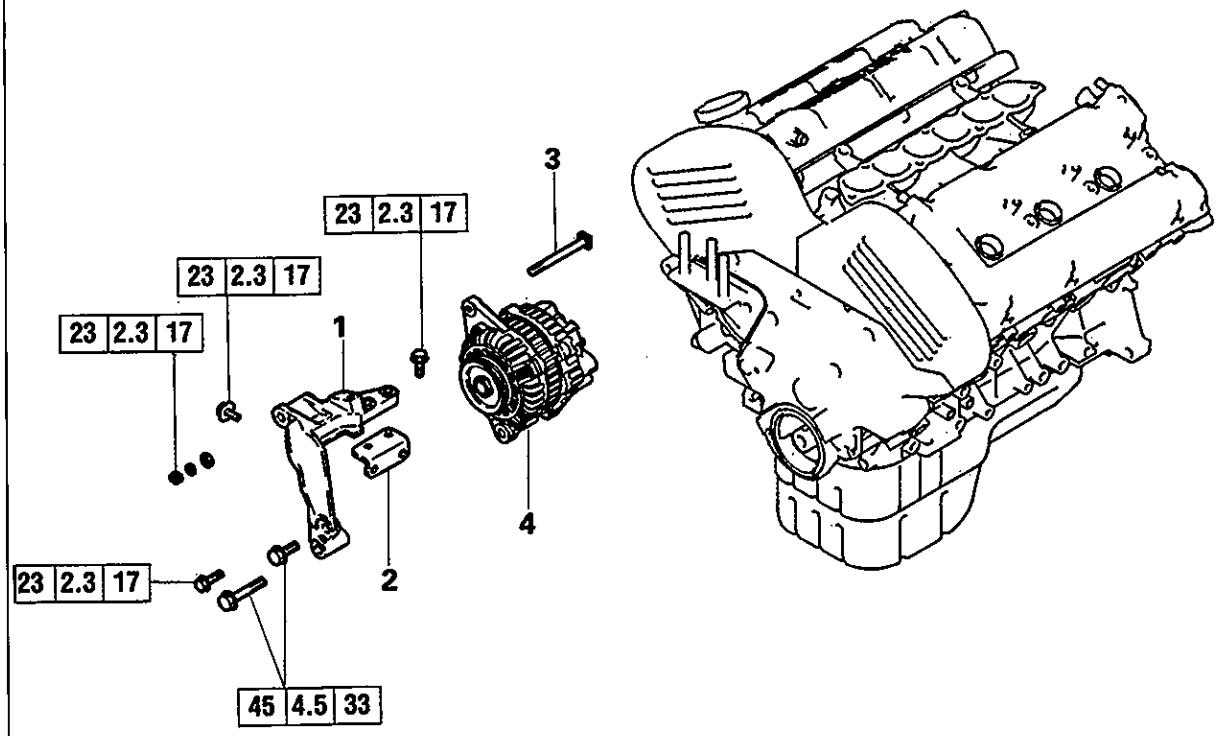
1. Alternator brace
2. Pivot bolt
3. Alternator

Pre-removal operation
- Remove the alternator drive belt (See Group 11).

Post-installation operation
- Install the alternator drive belt (See Group 11).
- Adjust drive belt tension. (See Group 11).

7EN0473

REMOVAL AND INSTALLATION – 6G72 DOHC ENGINE (Front Wheel Drive Vehicle)



Pre-removal operation
- Remove the alternator drive belt (See Group 11).

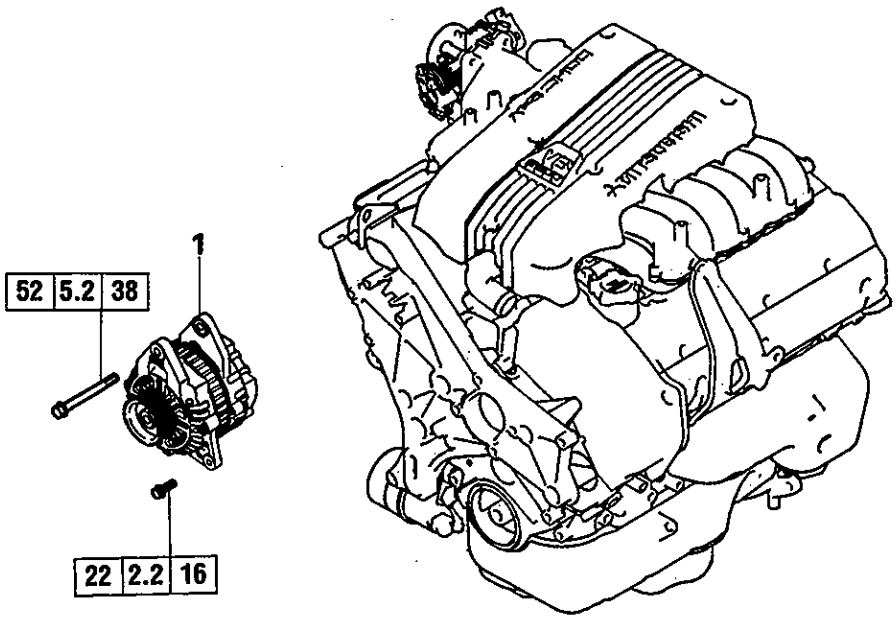
Removal steps

1. Alternator bracket
2. Bracket
3. Pivot bolt
4. Alternator

Post-installation operation
- Install the alternator drive belt (See Group 11).
- Adjust drive belt tension. (See Group 11).

7EN0686

REMOVAL AND INSTALLATION – 6G72 SOHC 24-VALVE AND 6G74 DOHC ENGINES (Rear Wheel Drive Vehicle)



Removal steps

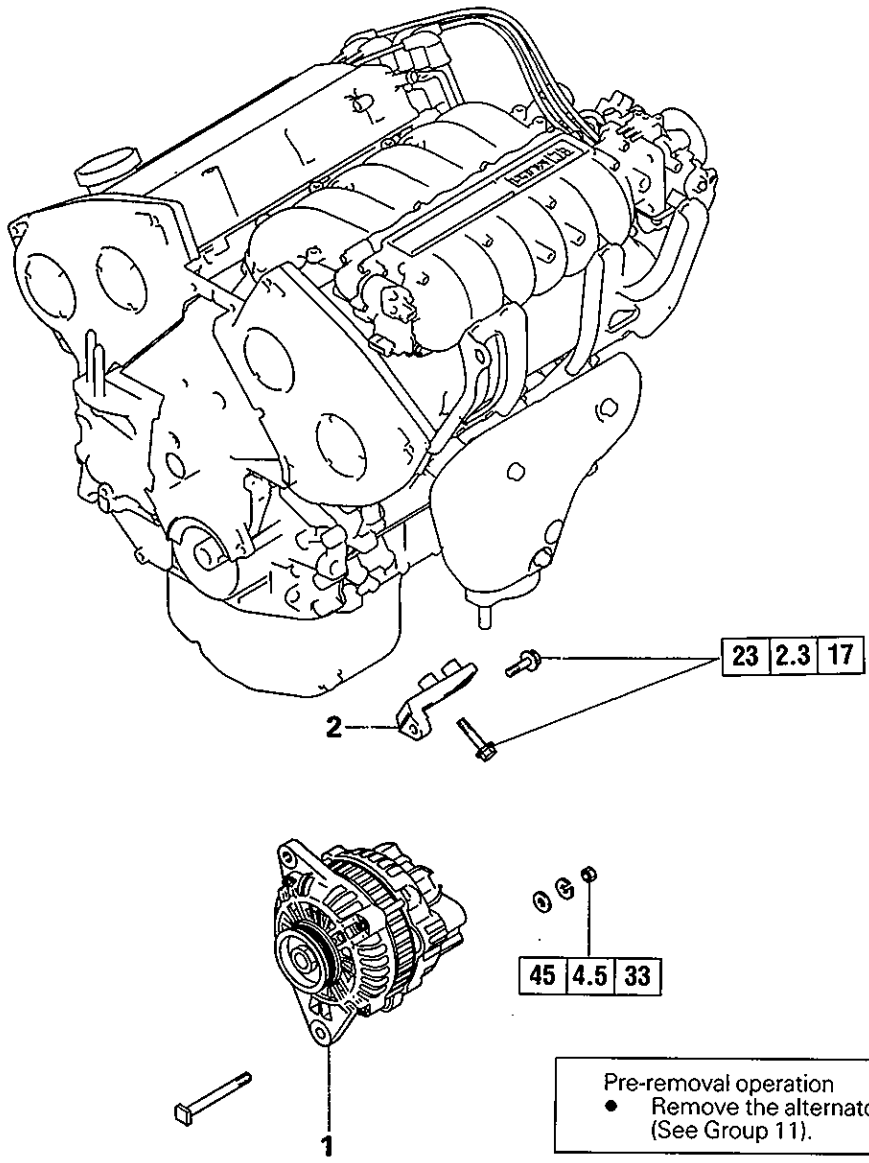
1. Alternator

Pre-removal operation
- Remove the alternator drive belt (See Group 11).

Post-installation operation
- Install the alternator drive belt (See Group 11).
- Adjust drive belt tension. (See Group 11).

7EN0687

REMOVAL AND INSTALLATION – 6A12 ENGINE

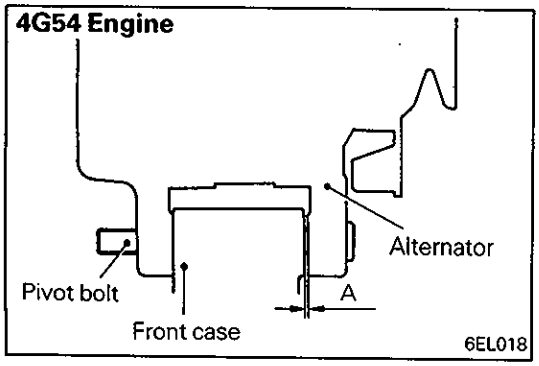


Pre-removal operation
- Remove the alternator drive belt (See Group 11).

Post-installation operation
- Install the alternator drive belt (See Group 11).
- Adjust drive belt tension. (See Group 11).

Removal steps
1. Alternator assembly
2. Alternator bracket

6AE0195



SERVICE POINTS OF INSTALLATION

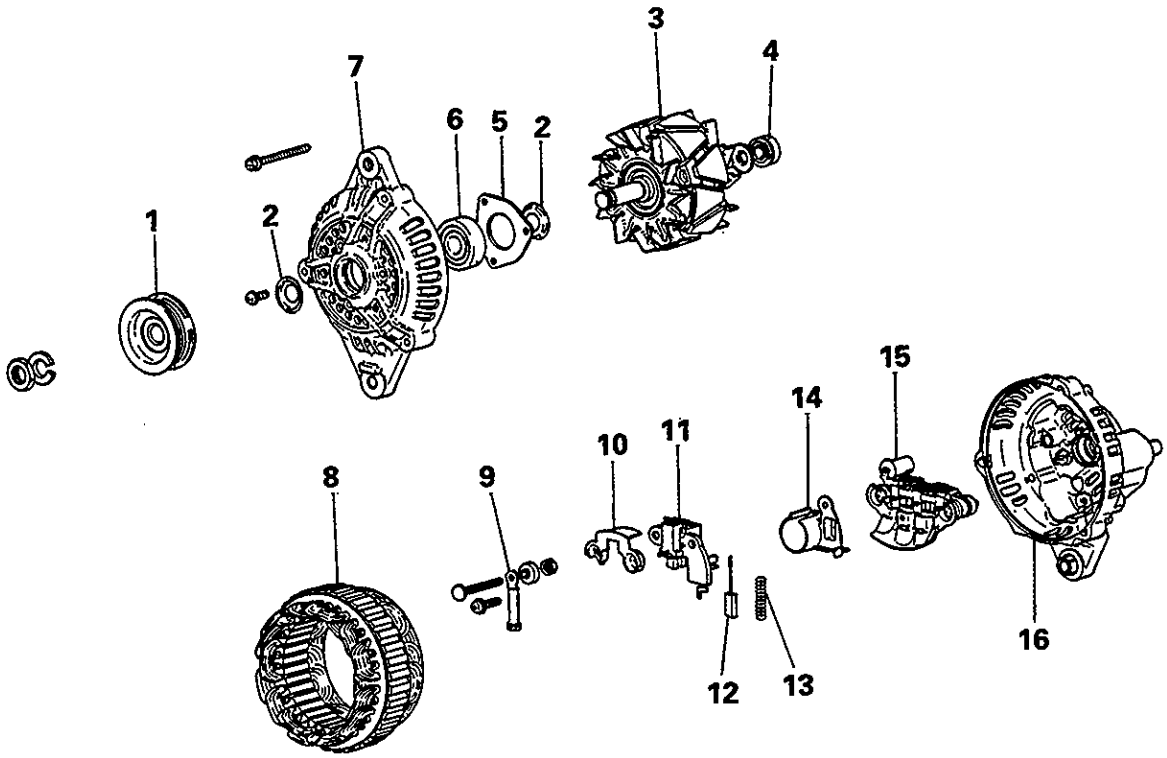
◆A◆ INSTALLATION OF SPACER (4G54 ENGINE ONLY)

(1) While forcing the alternator toward the pulley side, insert spacers (0.198 mm thick) in space A between the alternator front leg and front case to determine the number of spacers required.
(Find the number of spacers that will not drop when released.)
(2) With the required number of spacers inserted at A, install the bolt and tighten the nut.

NOTES

3. ALTERNATOR <EXCEPT 4M40 ENGINE>

DISASSEMBLY AND REASSEMBLY – FOR PETROL ENGINE (TYPE "A")

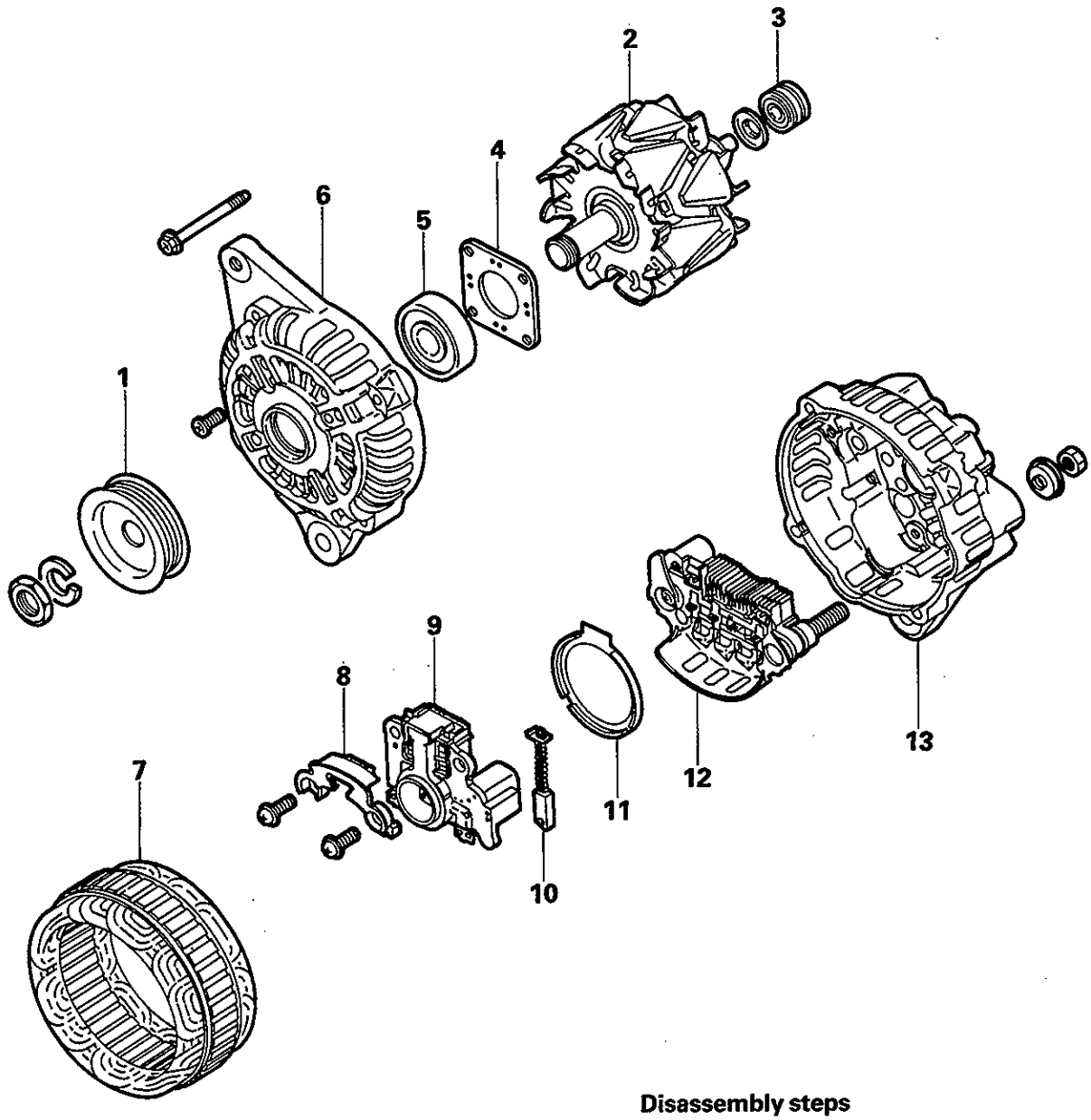


Disassembly steps

◇A◇ 1. Alternator pulley
2. Seal
◆A◆ 3. Rotor assembly
4. Rear bearing
5. Bearing retainer
6. Front bearing
7. Front bracket
◇B◇ 8. Stator assembly
9. Terminal
10. Plate
◇B◇ 11. Regulator and brush holder
12. Brush
13. Brush spring
14. Slinger
15. Rectifier assembly
16. Rear bracket

1EL096

DISASSEMBLY AND REASSEMBLY – FOR PETROL ENGINE (TYPE "B")

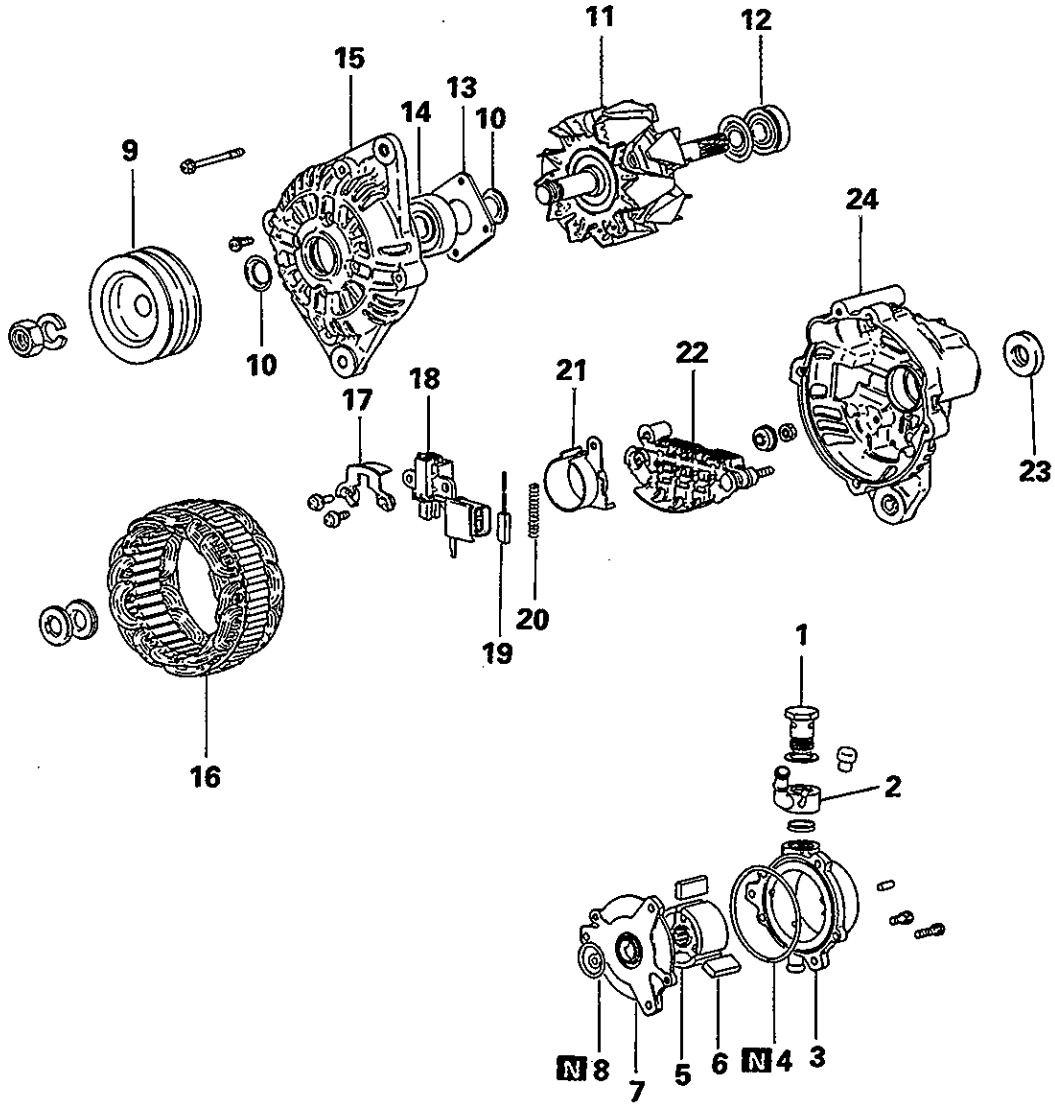


Disassembly steps

◇A◇ 1. Generator pulley
◆A◆ 2. Rotor assembly
3. Rear bearing
4. Bearing retainer
5. Front bearing
6. Front bracket
◇B◇ 7. Stator assembly
8. Plate
9. Regulator and brush holder
10. Brush
11. Slinger
12. Rectifier assembly
13. Rear bracket

9EN0187

DISASSEMBLY AND REASSEMBLY – INTERNAL FAN "A" TYPE FOR DIESEL ENGINE

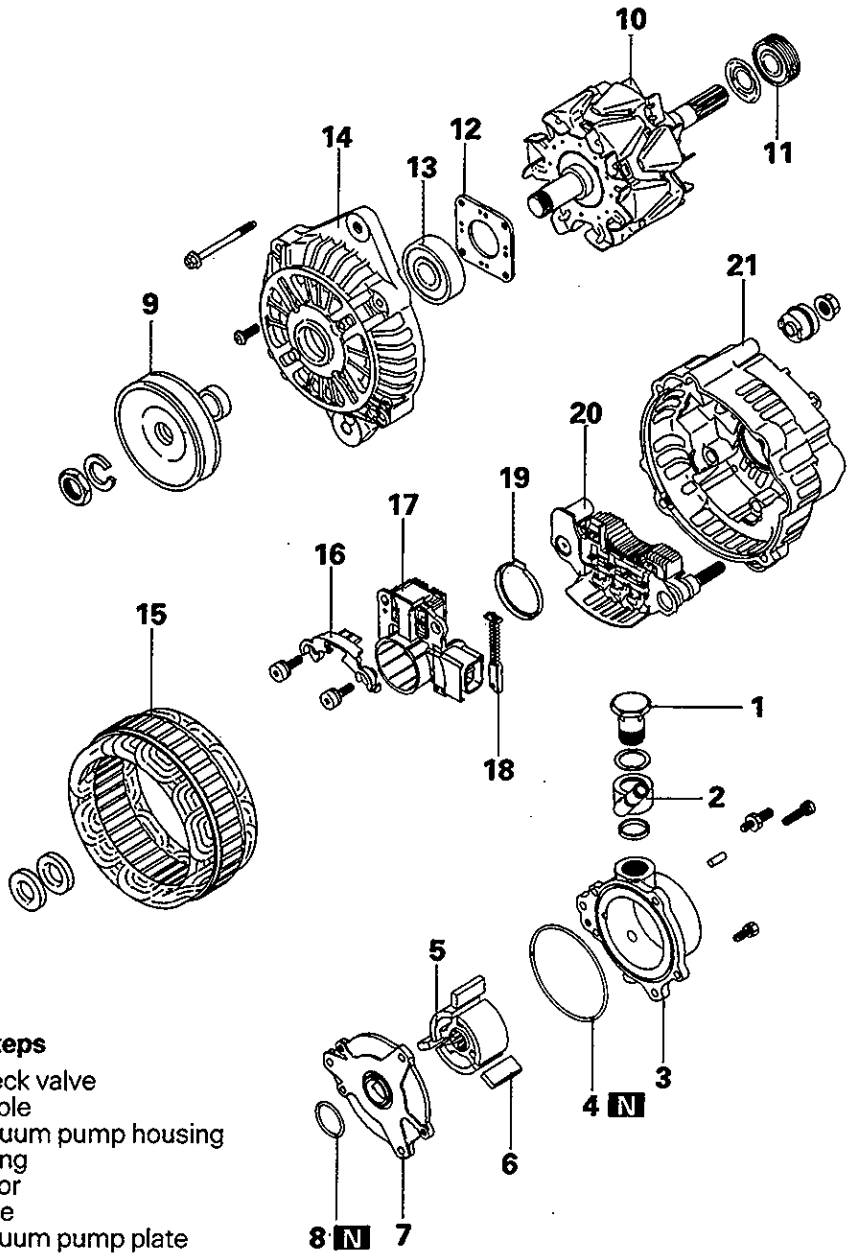


Disassembly steps

1. Check valve
2. Nipple
3. Vacuum pump housing
4. O-ring
5. ◆B◆ Rotor
6. ◆B◆ Vane
7. Vacuum pump plate
8. O-ring
9. ◇A◇ Pulley
10. Seal
11. ◆A◆ Rotor assembly
12. Rear bearing
13. Bearing retainer
14. Front bearing
15. Front bracket
16. ◇B◇ Stator assembly
17. Plate
18. ◇B◇ Regulator & brush holder
19. Brush
20. Brush spring
21. Slinger
22. Rectifier assembly
23. ◇C◇ Oil seal
24. Rear bracket

DEL096

DISASSEMBLY AND REASSEMBLY – INTERNAL FAN "B" TYPE FOR DIESEL ENGINE

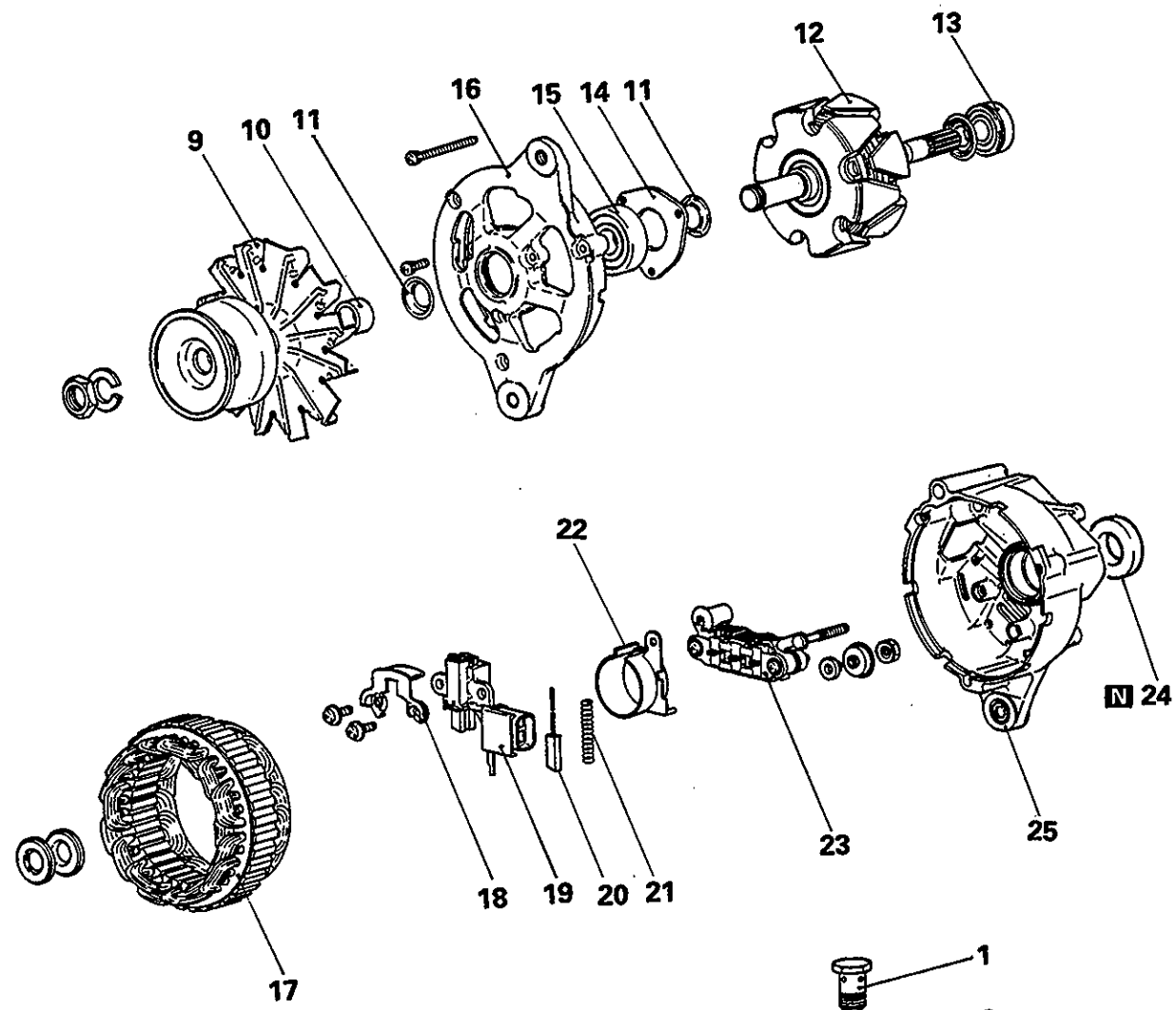


Disassembly steps

1. Check valve
2. Nipple
3. Vacuum pump housing
4. O-ring
◆B◆ 5. Rotor
◆B◆ 6. Vane
7. Vacuum pump plate
8. O-ring
◇A◇ 9. Pulley
◆A◆ 10. Rotor assembly
11. Rear bearing
12. Bearing retainer
13. Front bearing
14. Front bracket
◇B◇ 15. Stator assembly
16. Plate
◇B◇ 17. Regulator and brush holder
18. Brush
19. Slinger
20. Rectifier assembly
21. Rear bracket

DEN0795

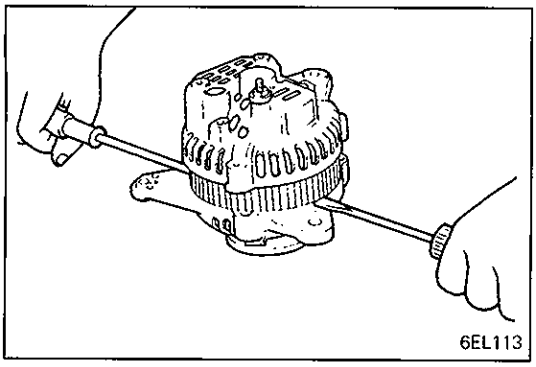
DISASSEMBLY AND REASSEMBLY – EXTERNAL FAN TYPE



Disassembly steps

1. Check valve
2. Nipple
3. Vacuum pump housing
4. O-ring
- ◆B◆ 5. Rotor
- ◆B◆ 6. Vane
7. Vacuum pump plate
8. O-ring
- ◇A◇ 9. Pulley fan
10. Spacer
11. Seal
- ◆A◆ 12. Rotor assembly
13. Rear bearing
14. Bearing retainer
15. Front bearing
16. Front bracket
- ◇B◇ 17. Stator assembly
18. Plate
- ◇B◇ 19. Regulator & brush holder
20. Brush
21. Brush spring
22. Slinger
23. Rectifier assembly
- ◇C◇ 24. Oil seal
25. Rear bracket

DEL080

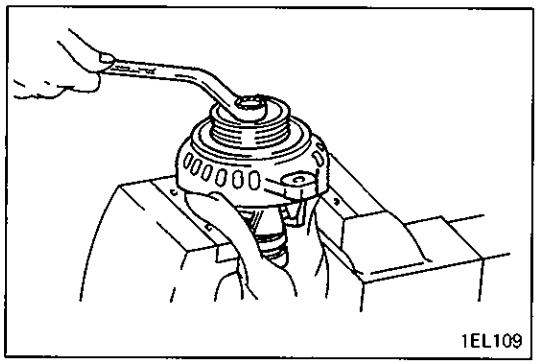


SERVICE POINTS OF DISASSEMBLY

SEPARATION OF THE STATOR AND FRONT BRACKET

(1) With a screwdriver blade inserted between the front bracket and stator core, pry to separate the stator from the front bracket.
(2) If they are hard to separate, lightly strike the bracket with a plastic hammer while prying with the screwdriver.

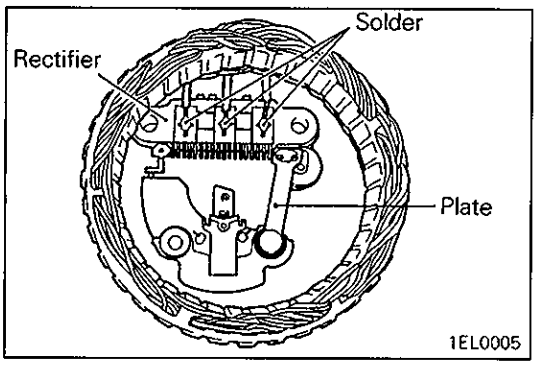
Caution
- **Do not insert the screwdriver too deep as the stator core could be damaged.**



◇A◇ REMOVAL OF ALTERNATOR PULLEY / PULLEY FAN

(1) With the pulley side facing up, hold the rotor in a vice and remove the pulley.

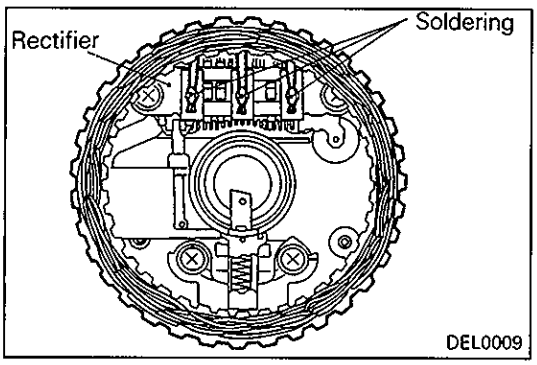
Caution
- **Use care not to damage the rotor.**

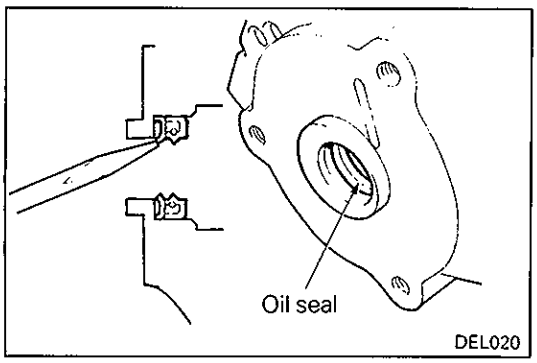


◇B◇ REMOVAL OF STATOR ASSEMBLY / REGULATOR AND BRUSH HOLDER

(1) Remove the solder connecting the stator lead wire to the main diode of the rectifier when removing the stator.
(2) Remove the solder from soldered connections with the rectifier when removing the rectifier from the brush holder.

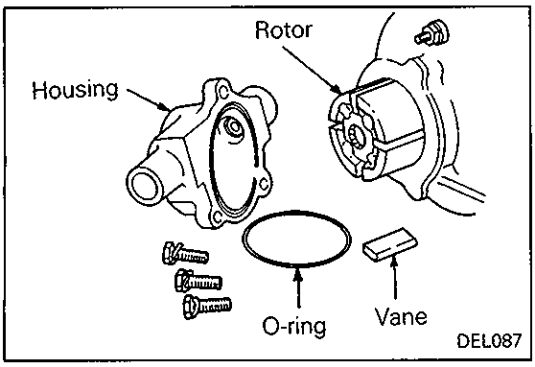
Caution
- **When soldering connections or when removing solder, be careful not to let heat transfer to the diode for long periods of time.**
  Finish soldering and removing solder in as short a time as possible.
- **Be careful not to exert excessive force on the diode leads.**





◇C◇ REMOVAL OF OIL SEAL (For Diesel engine only)

(1) Push out and remove the oil seal using a screwdriver or the like.

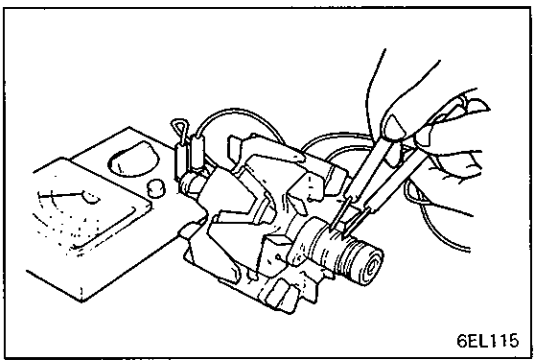


INSPECTION

VACUUM PUMP (For diesel engine only)

Check the following and replace if defective.

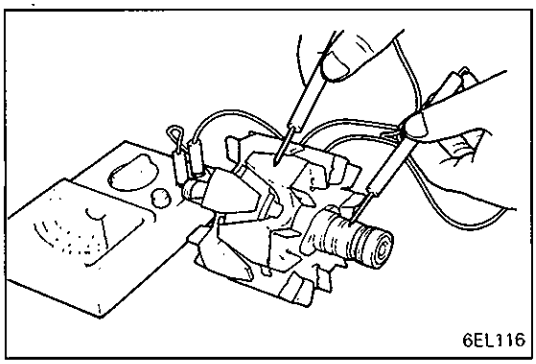
(1) Check the rotor ends for streaks or damage.
(2) Check the housing surface in contact with the rotor for streaks or damage.
(3) Check the vanes for damage or breaks.



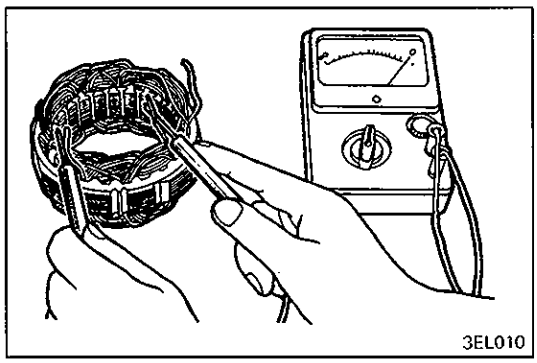
ROTOR

(1) Check the rotor coil continuity. Make sure that there is continuity between the slip rings.
Measure the rotor resistance. If it is excessively small, it indicates a shorted rotor. If there is no continuity or if it is shorted, replace the rotor assembly.

Standard value: 3 – 5 Ω

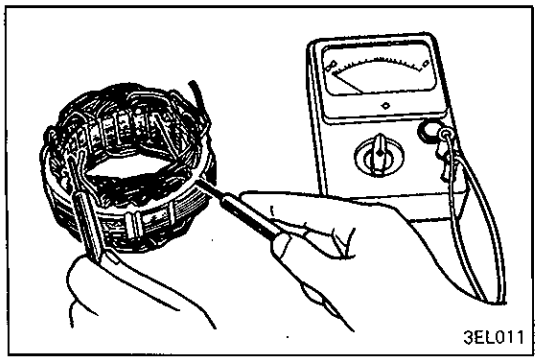


(2) Check for rotor coil grounding. Make sure that there is no continuity between the slip ring and the core. Replace the rotor assembly if there is continuity.

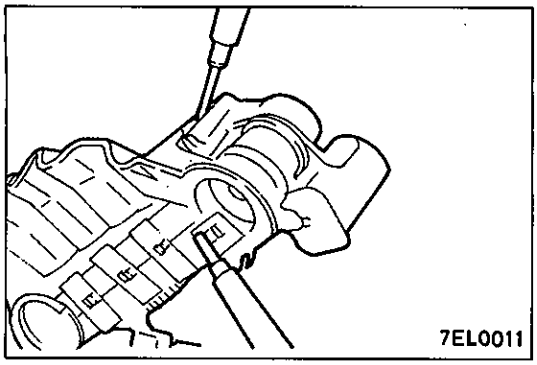


STATOR

(1) Check the stator continuity. Make sure that there is continuity between the coil leads. Replace the stator assembly if there is no continuity.

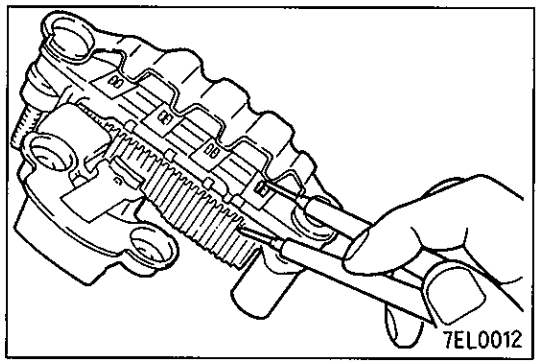


(2) Check for coil grounding. Make sure that there is no continuity between the coil and the core. Replace the stator assembly if there is continuity.

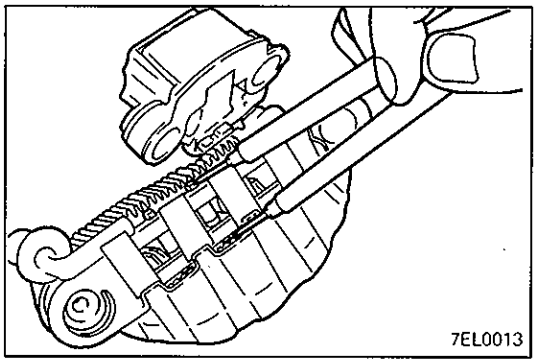


RECTIFIERS

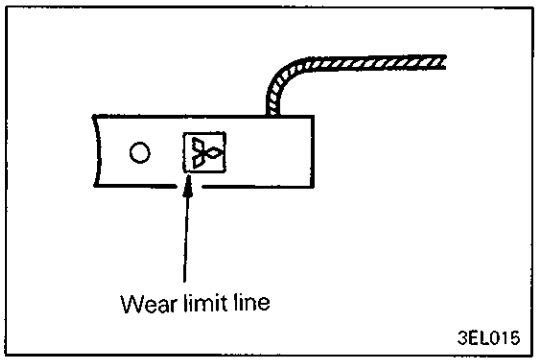
(1) **Positive Rectifier Test**
Check for continuity between positive rectifier and stator coil lead connection terminal with a circuit tester. If there is continuity in both directions, diode is shorted.
Replace rectifier assembly.



(2) **Negative Rectifier Test**
Check for continuity between negative rectifier and stator coil lead connection terminal. If there is continuity in both direction, diode is shorted, and rectifier assembly must be replaced.

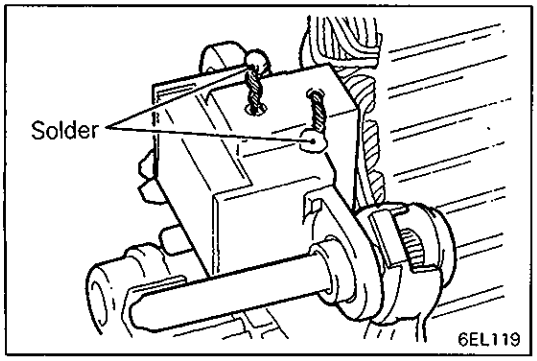


(3) **Diode Trio Test**
Check three diodes for continuity by connecting an ammeter to both ends of each diode. If there is no continuity in both directions, diode is faulty and heatsink assembly must be replaced.

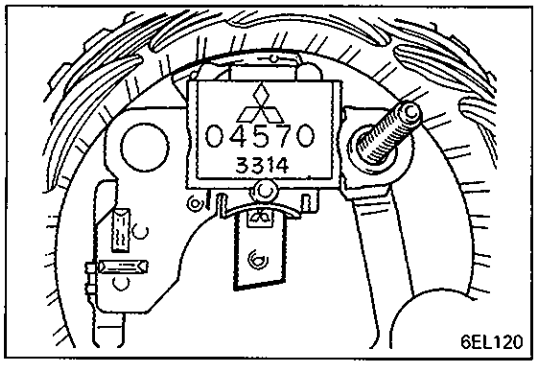


BRUSH (TYPE A)

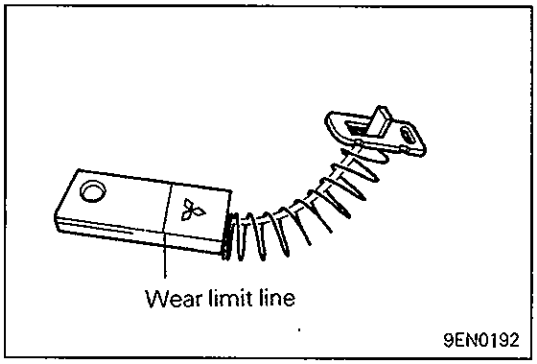
(1) The brush must be replaced if worn to the wear limit line.



(2) Unsolder the brush lead wires and the brush and spring will come out.

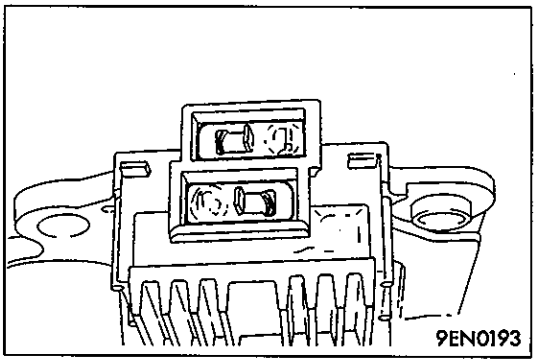


(3) When installing a new brush, push the brush into the holder as illustrated and solder the leads.

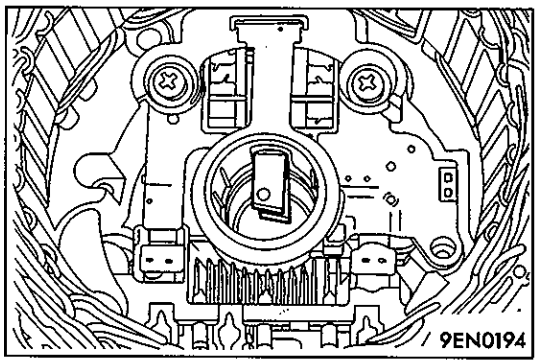


(TYPE B)

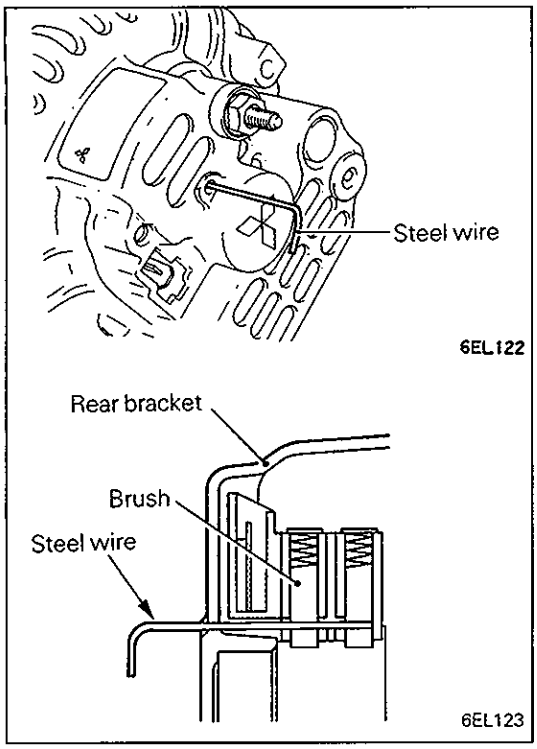
(1) Replace brush by the following procedures if it has been worn to limit line.



(2) Unsolder the lead wire of the brush, and the brush will appear.



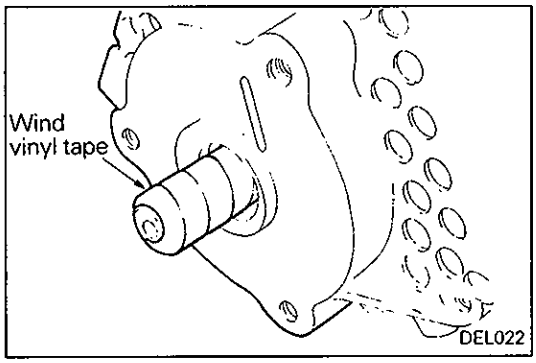
(3) To install a new brush, insert the brush in the holder until it is positioned as illustrated, and solder and lead wire.



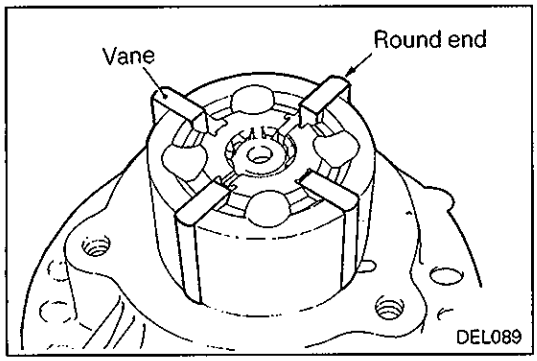
SERVICE POINTS OF REASSEMBLY

◆A◆ INSTALLATION OF ROTOR ASSEMBLY

(1) Before installing the rotor on the rear bracket, thread a steel wire through the small hole provided in the rear bracket to hold back the brush. After rotor installation, remove the steel wire.

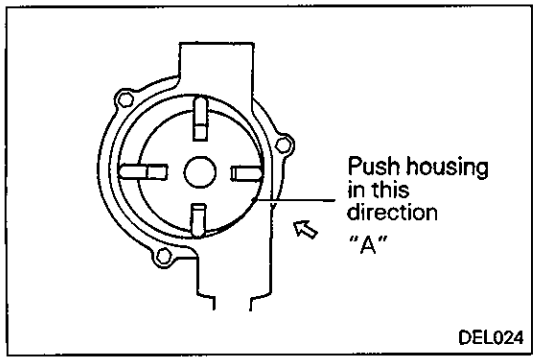


(2) When installing the rotor on the alternator rear bracket, wrap vinyl tape around the splined shaft to prevent damage to the oil seal. (For diesel engine only)



◆B◆ INSTALLATION OF ROTOR / VANES (For diesel engine only)

(1) Carefully check the housing, rotor, etc. for chips and foreign matter. Then, apply engine oil and install.
(2) Install the vanes with the round end facing outward.
(3) Apply grease to the O-ring and fit in the housing groove so that it will not come out from the groove when the bolts are tightened.



(4) When tightening the housing, lightly push it in the direction of arrow so as to minimize the clearance at "A" and tighten the bolts uniformly.

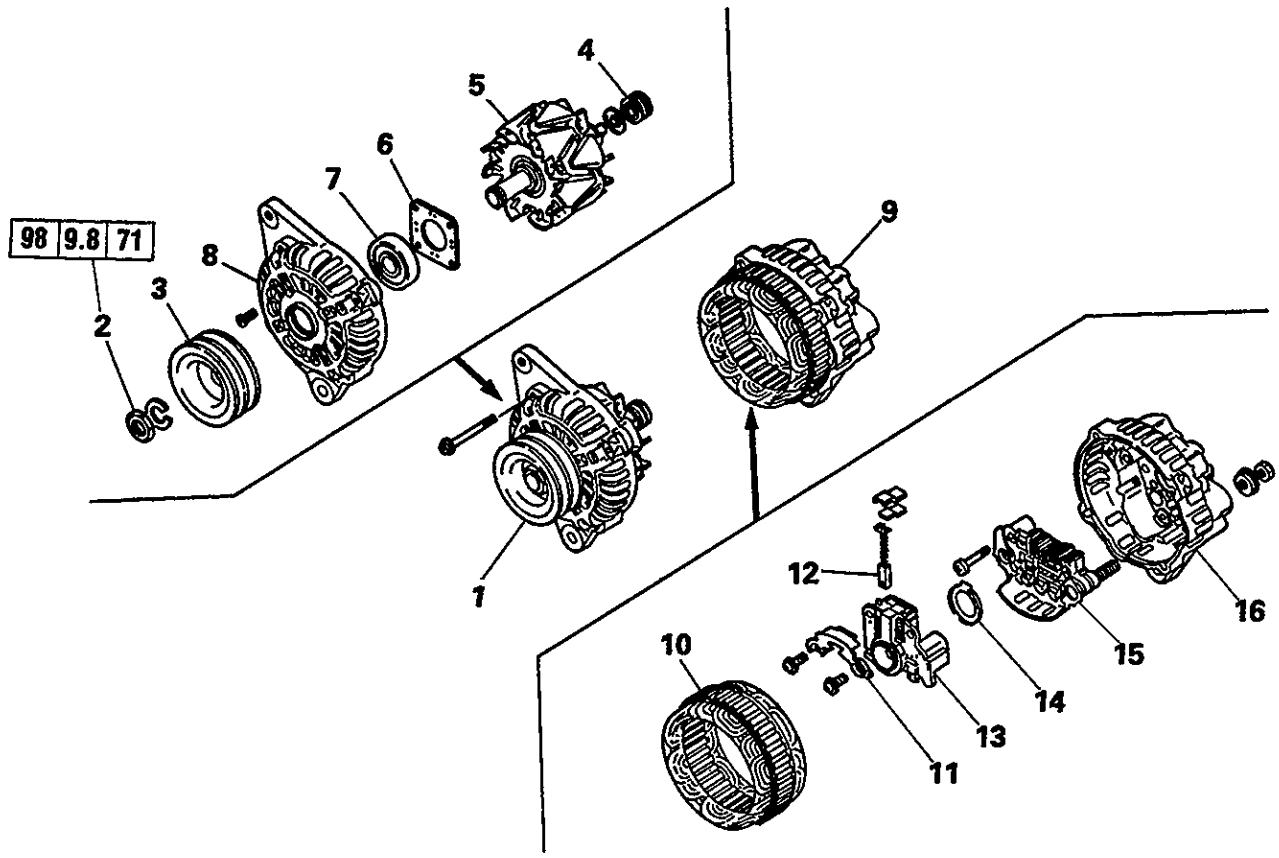
NOTE
After assembly, be sure to conduct a performance test to check to see that the maximum vacuum is as specified below.

Standard value of maximum vacuum
80.00 kPa (600 mmHg, 23.63 in.Hg) or greater at 3,000 rpm

Added

4. ALTERNATOR <4M40 ENGINE>

DISASSEMBLY AND REASSEMBLY



Disassembly steps

- ◊A◊ 1. Rotor and front bracket assembly
- 2. Nut
- 3. Pulley
- ◊B◊ 4. Rear bearing
- ◊C◊ 5. Rotor assembly
- 6. Bearing retainer
- 7. Front bearing
- 8. Front bracket
- ◊A◊ 9. Stator and rear bracket assembly
- ◊D◊ 10. Stator assembly
- 11. Plate
- ◊E◊ 12. Brush
- ◊F◊ 13. Regulator and brush holder
- 14. Slinger
- 15. Rectifier
- 16. Rear bracket

Reassembly steps

- 14. Slinger
- ◆B◆ 13. Regulator and brush holder
- ◆A◆ 12. Brush
- 11. Plate
- 15. Rectifier
- 16. Rear bracket
- ◆C◆ 10. Stator assembly
- ◆E◆ 9. Stator and rear bracket assembly
- 8. Front bracket
- 7. Front bearing
- 6. Bearing retainer
- ◆D◆ 5. Rotor assembly
- 4. Rear bearing
- 3. Pulley
- 2. Nut
- ◆E◆ 1. Rotor and front bracket assembly

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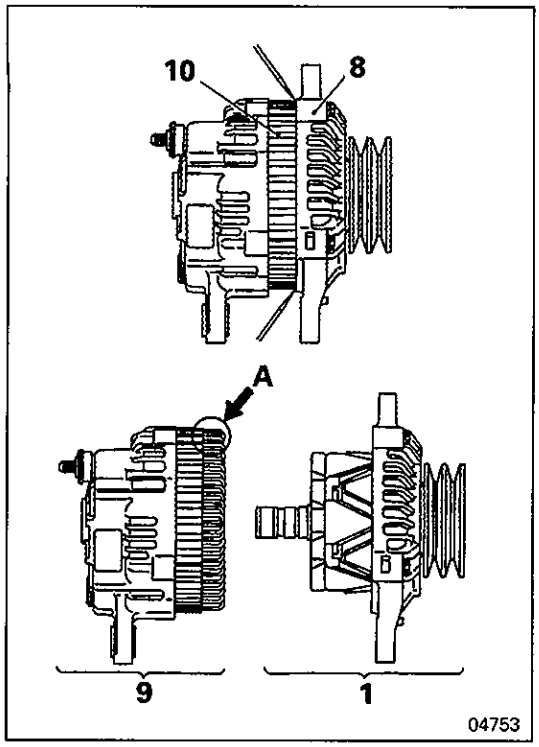


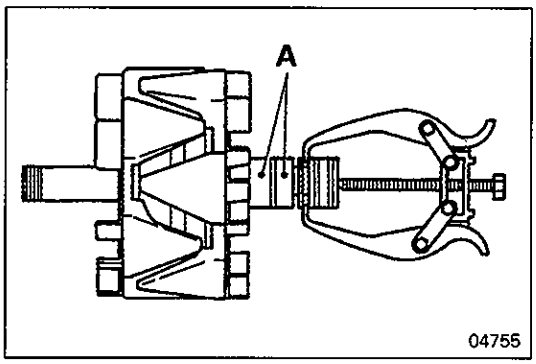
DISASSEMBLY SERVICE POINTS

◇A◇ ROTOR AND FRONT BRACKET ASSEMBLY AND STATOR AND REAR BRACKET ASSEMBLY

(1) Insert a standard screwdriver or the like between the front bracket **8** and stator assembly **10**, and pry apart the rotor and front bracket assembly **1** and the stator and rear bracket assembly **9**.

Caution

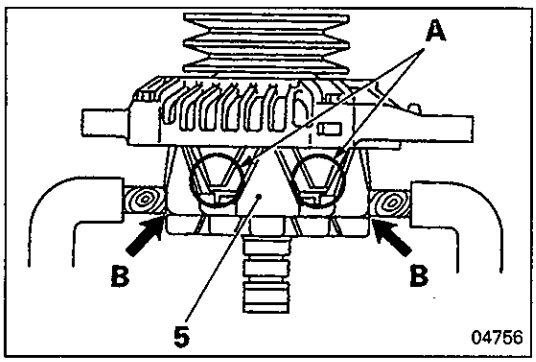
- **Do not insert the screwdriver too deep. Otherwise, the coil A in the stator assembly 10 may be damaged, causing short-circuit.**



◇B◇ REAR BEARING REMOVAL

Caution

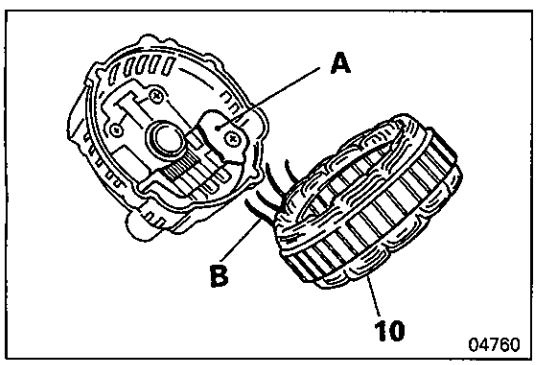
- **Use care not to damage the slip ring A with the bearing puller.**



◇C◇ ROTOR ASSEMBLY REMOVAL

Caution

- **When holding the rotor assembly 5 in a vise, be sure that it is clamped at points B, not at A, as shown, or the core tabs A may be broken.**

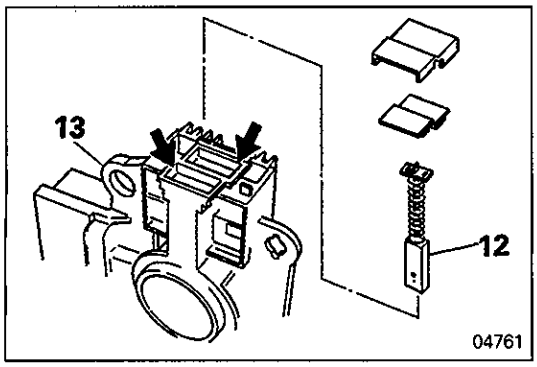


◇D◇ STATOR ASSEMBLY REMOVAL

(1) To remove the stator assembly **10**, unsolder the lead wires at diodes **A** of the rectifier **15**.

Caution

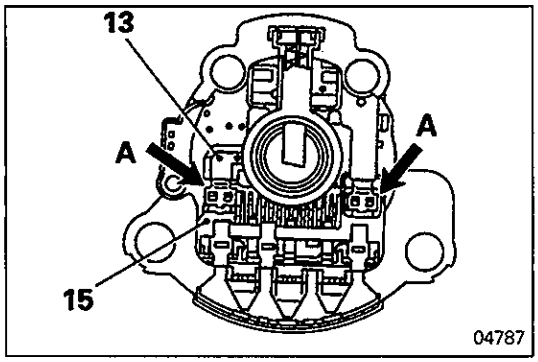
- **Unsolder quickly (within 5 seconds) to prevent heat damage of the diodes.**



◇E◇ BRUSH REMOVAL

(1) Remove the brush **12** from the regulator and brush holder **13** by unsoldering the lead wires at the specified points.

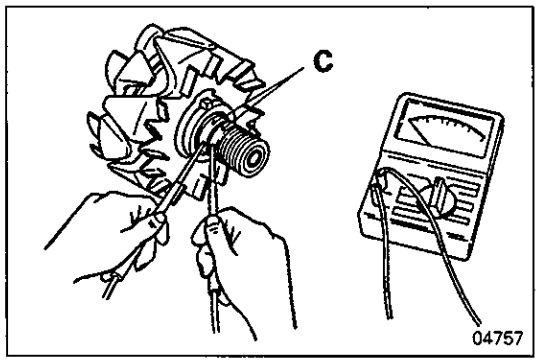
Caution
- **Unsolder quickly (within 5 seconds) to prevent heat damage of the regulator.**



◇F◇ REGULATOR AND BRUSH HOLDER REMOVAL

(1) Separate the regulator and brush holder **13** from the rectifier **15** by unsoldering at the arrow-indicated points **A** (2 places).

Caution
- **Unsolder quickly (within 5 seconds) to prevent heat damage of the regulator.**



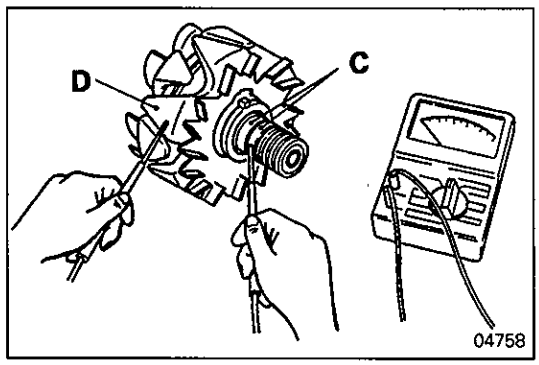
INSPECTION

ROTOR ASSEMBLY

Field Coil Resistance

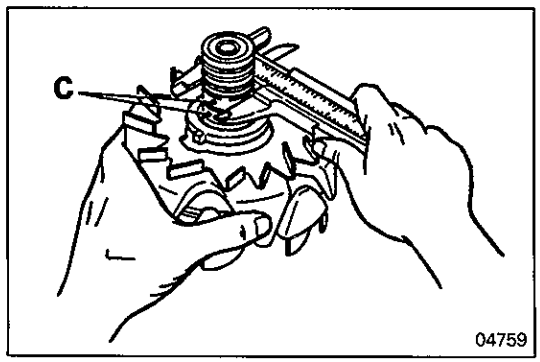
(1) Measure the resistance between the slip rings **C**.
(2) If the reading deviates the specified standard value, replace the rotor assembly **5**.

Standard value: 2.4 – 2.9 Ω ..... 65 A
2.3 – 2.7 Ω ..... 75 A, 90 A



Continuity between Slip Ring and Core

(1) Check that there is no continuity between the slip ring **C** and the core **D**.
(2) If continuity is detected, replace the rotor assembly **5**.



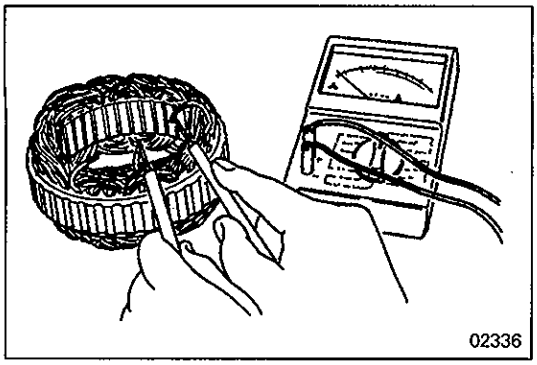
Slip Ring Outside Diameter

(1) Measure the O.D. of the slip ring **C** and if the measurement is less than the specified service limit, replace the rotor assembly **5**.

Standard value: 22.7 mm (0.894 in.)
Limit: 22.1 mm (0.870 in.)

(2) If the outer surface of the slip ring is too rough or unevenly worn, redress it with appropriate sandpaper or a grinder.

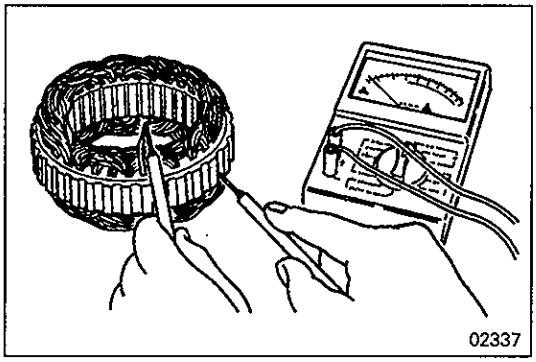
Caution
- **When grinding, use care that the O.D. of the slip ring C is not reduced below the specified service limit.**



STATOR

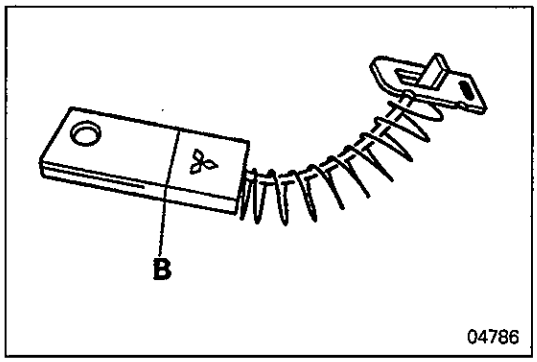
Continuity between Lead Wires

(1) Check that there is continuity between lead wires. If no continuity is detected, replace the stator assembly **10** because it is open.



Continuity between Lead Wire and Core

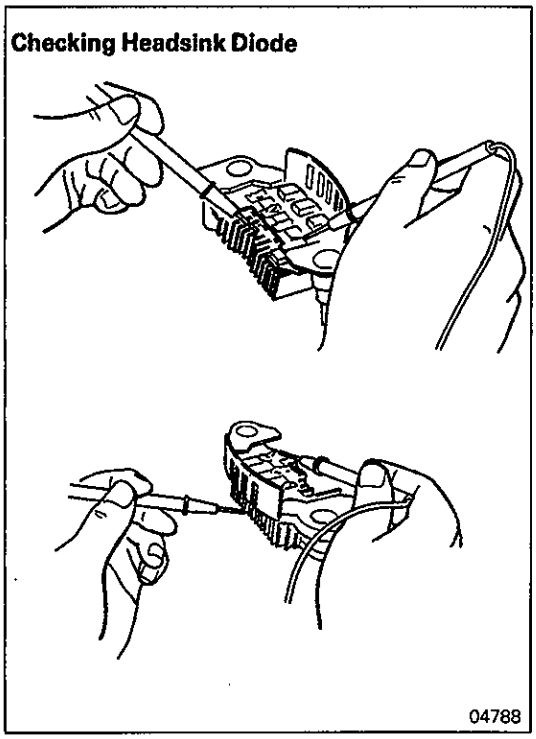
(1) Check that there is no continuity between each lead wire and the core. If continuity is detected, replace the stator assembly **10** because it is grounded.



BRUSH

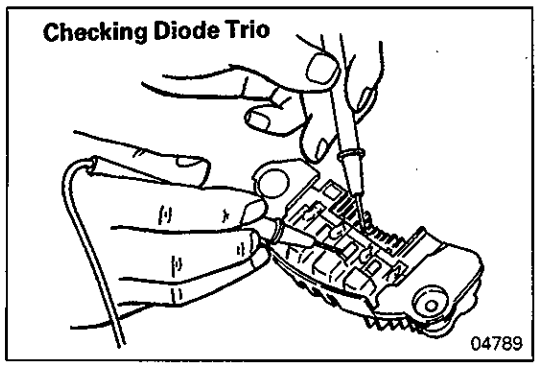
(1) Replace the brush **12** if its length reaches the wear limit line **B**.

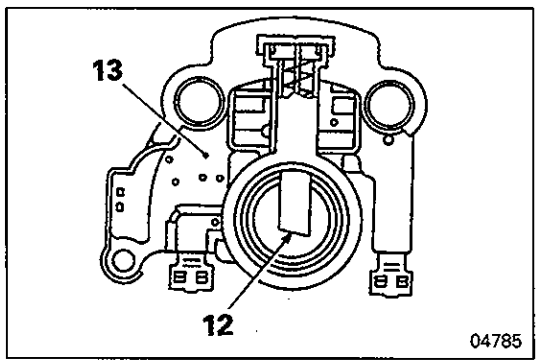
Standard value: 18.5 mm (0.728 in.)
Limit: 5 mm (0.28 in.)



RECTIFIER

(1) Check the rectifier **15** for proper function by measuring diode resistance. Measure the resistance both when the positive probe of the tester is connected to the diode and when the negative probe is connected to the diode.
If the resistance is infinitely great in both instances:
Open circuit
If the resistance is near 0 ohm in both instances:
Short circuit

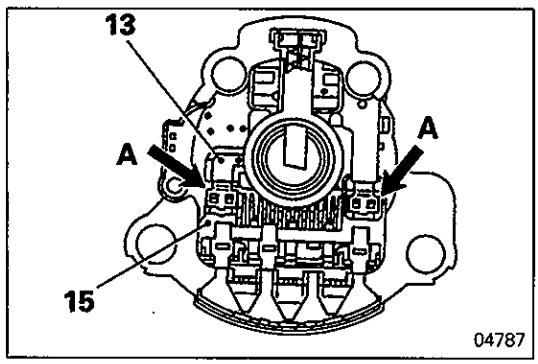




REASSEMBLY SERVICE POINTS

◗A◖ BRUSH INSTALLATION

(1) Fit the brush **12** in the regulator and brush holder **13** in the direction indicated in the illustration and solder the leads.

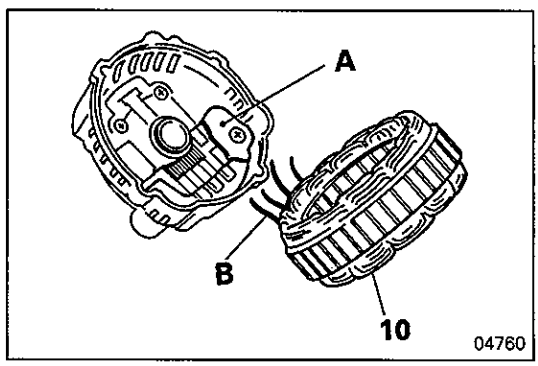


◗B◖ REGULATOR AND BRUSH HOLDER INSTALLATION

(1) Connect the regulator and brush holder **13** to the rectifier **15** by soldering the leads at the arrow-indicated points **A** (2 places).

Caution

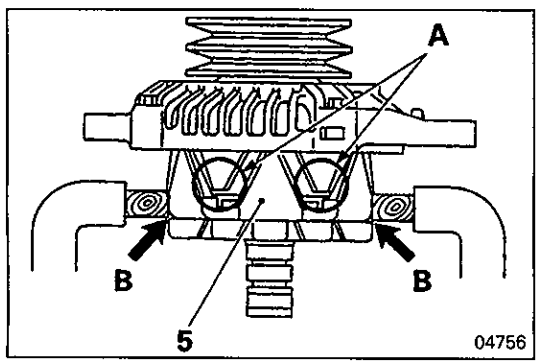
- **Solder the leads quickly (within 5 seconds) to prevent heat damage of the regulator.**



◗C◖ STATOR ASSEMBLY INSTALLATION

Caution

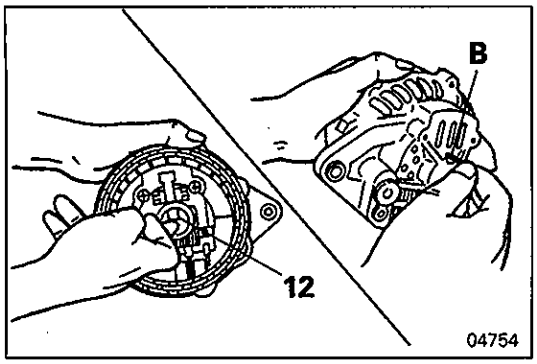
- **Solder the leads quickly (within 5 seconds) to prevent heat damage of the diodes.**



◗D◖ ROTOR ASSEMBLY INSTALLATION

Caution

- **Be sure to vise the rotor assembly 5 at the points B. If it is clamped at the core tabs A, they may be broken.**



◆E◆ ROTOR AND FRONT BRACKET ASSEMBLY/STATOR AND REAR BRACKET ASSEMBLY INSTALLATION

(1) When the brush **12** protrudes, the rotor assembly **5** cannot be fitted into position. Press the brush into the regulator and brush holder **13** and lock it with the pin **B** inserted from behind the rear bracket **16**.
(2) Remove the pin **B** carefully after the installation.