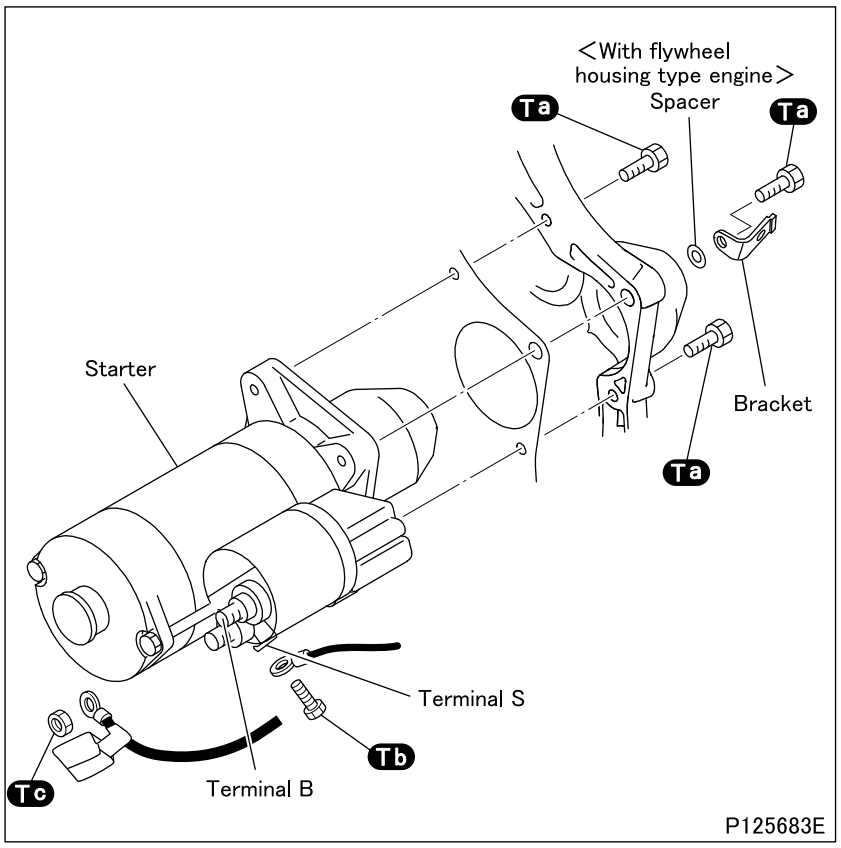
GROUP 54-12
STARTER AND ALTERNATOR



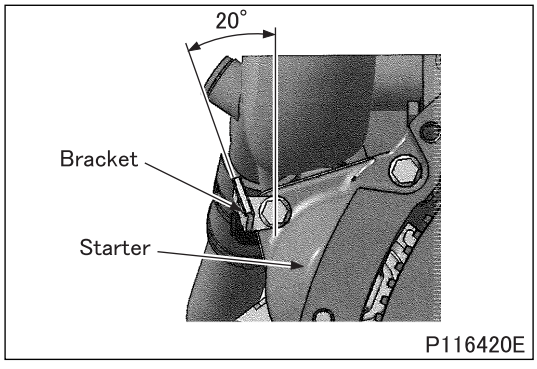
WARNING ⚠

- **Before removing the starter, disconnect the (–) battery cable and insulate the cable and the (–) battery terminal with tape.**
- **It is dangerous to leave the (–) battery cable connected since the battery cable voltage is always present at terminal B.**

Tightening torque (Unit: N·m {kgf·m})

Mark	Parts to be tightened	Tightening torque	Remarks
Ta	Bolt (starter mounting)	22 to 30 {2.2 to 3.1}	–
Tb	Bolt (harness mounting)	2.25 to 4.08 {0.2 to 0.4}	–
Tc	Nut (battery cable mounting)	9.8 to 11.8 {1.0 to 1.2}	–

◆Assembly procedure◆



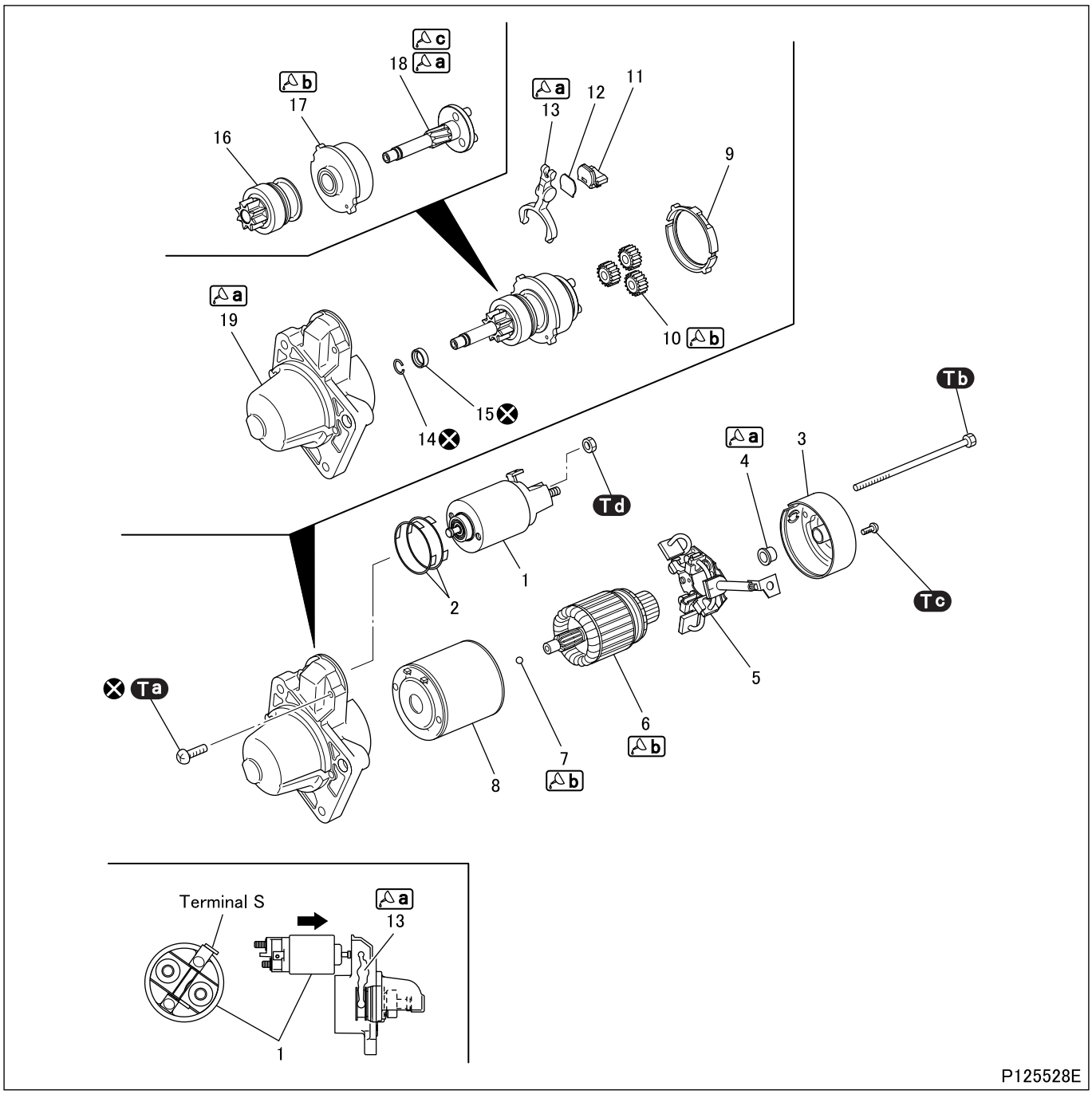
■Assembly: Bracket

- Install the bracket at the angle shown in the illustration.

◆Work after installation◆

- In vehicles with an idling stop and start system, clear the idling stop and start system cycle number stored in the idling stop and start system electronic control unit with the FUSO Diagnostics after replacing the starter. (See Gr54-13.)

M E M O



● Disassembly sequence

1 Magnetic switch
2 Shim
3 Rear bracket
4 Rear bearing
5 Brush holder
6 Armature
7 Ball
8 Yoke
9 Packing A
10 Planetary gear
11 Packing B
12 Plate
13 Lever
14 Snap ring
15 Stop ring
16 Overrunning clutch
17 Internal gear
18 Planetary gear holder
19 Front bracket

⊗: Non-reusable parts

CAUTION ⚠

- **When the armature is removed, the ball may come out with it. Take care not to lose the ball.**

- Do not remove the rear bearing unless defects are evident.

● Assembly sequence

Follow the disassembly sequence in reverse.

CAUTION ⚠

- **Do not immerse parts in any kind of solvent for cleaning.**
- **Immersing the armature in a solvent will damage the insulation. Wipe parts clean with a cloth.**
- **Immersion cleaning of the drive unit is prohibited.**
- **The overrunning clutch is filled with grease at the factory. Immersion cleaning will wash away the grease from the clutch. To clean the drive unit, use a cleaning solvent-moistened brush and then wipe it dry with a cloth.**

- Whenever the magnetic switch is replaced, the pinion gap must be adjusted.
- The packing A is serviceable if any defect is not found.

Service standards (Unit: mm)

Location	Maintenance item			Standard value	Limit	Remedy
–	Pinion gap			0.5 to 2.0	–	Replace
–	No-load characteristics	With 11 V applied	Current	120 A or less	–	Correct or replace
			Rotation speed	2870 rpm or higher	–	
4, 6	Difference between inside diameter of rear bearing and outside diameter of armature shaft			0.1 or less	–	Replace
5	Brush spring pressure			23.4 to 31.6 N {2.4 to 3.2 kgf}	10 N {1.0 kgf}	Replace
	Brush length			17.6	12.1	Replace
6	Commutator outside diameter			29.4	28.8	Replace
	Runout of commutator periphery			–	0.1 or higher	
	Mold depth between segments			0.5	0.2 or less	Correct or replace
13	Overrunning clutch contact surface of lever			8 or higher	–	Replace

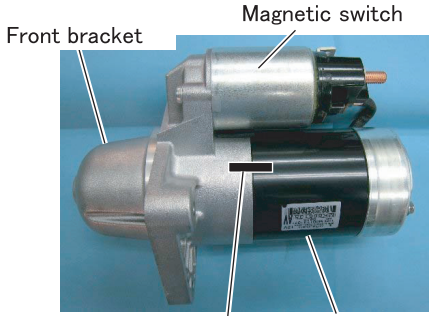
Tightening torque (Unit: N·m {kgf·m})

Mark	Parts to be tightened	Tightening torque	Remarks
Ta	Screw (magnetic switch mounting)	4.1 to 7.6 {0.4 to 0.8}	–
Tb	Through bolt (rear bracket mounting)	5.0 to 7.1 {0.5 to 0.7}	–
Tc	Screw (rear bracket mounting)	2.4 to 4.4 {0.2 to 0.4}	–
Td	Nut (tightening cable to terminal M)	9.8 to 11.8 {1.0 to 1.2}	–

Lubricant and/or sealant

Mark	Points of application	Specified lubricant and/or sealant	Quantity
a	Armature contact surface of rear bearing	Multipurpose grease [NLGI No. 2 (Li soap)]	As required
	Sliding surfaces of lever and overrunning clutch and lever supporting point		
	Internal gear contact surface and spline of planetary gear holder		
	Gear shaft contact surface of front bracket		
b	Sliding surfaces of armature and gear shaft	Molykote AG650	As required
	Ball		
	Teeth of planetary gear		
	Internal gear and gear shaft contact surfaces		
c	Splines of planetary gear holder	Multemp OA-171 (Kyodo Yushi Co., Ltd.)	As required

◆Work before disassembly◆



P116359E

■ **Mating mark: Front bracket and yoke**

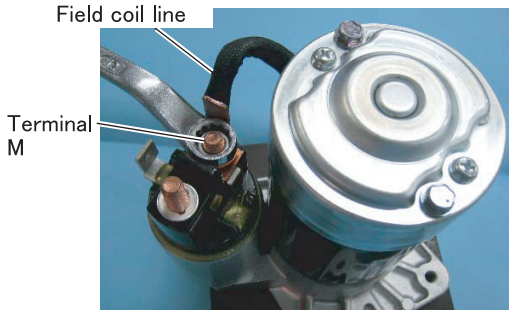
CAUTION ⚠

- **Make sure that the motor body is free of damage and that the magnet switch terminals S, B and M are normal.**

CAUTION ⚠

- **A permanent magnet is used in the field section. Do not strike at the yoke hard with a hammer or equivalent, drop it nor squeeze it with a vise.**

◆Disassembly procedure◆



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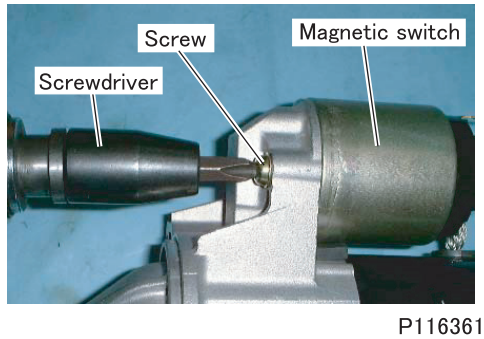
■ **Disassembly: Magnet switch**

- Remove the terminal M nut from the magnet switch and disconnect the field coil line.



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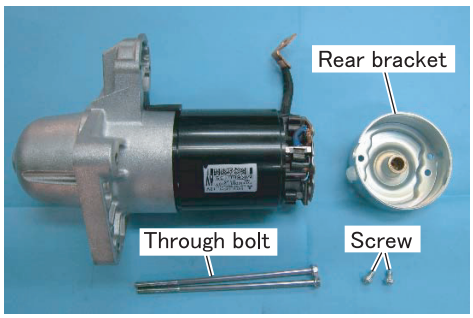
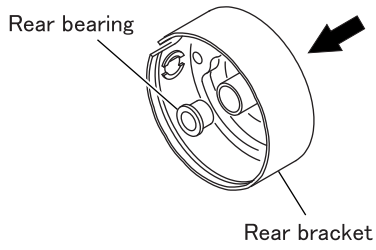
- Remove screws and remove the magnet switch.



P116362E

■ Disassembly: Rear bracket

- Remove through bolts and screws, and then remove the rear bracket.



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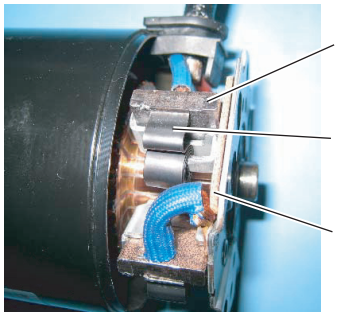
■ Disassembly: Rear bearing

- To remove the rear bearing, press it out of the rear bracket using a round bar slightly thinner than the bearing and a hand press to apply force from outside of the rear bracket.



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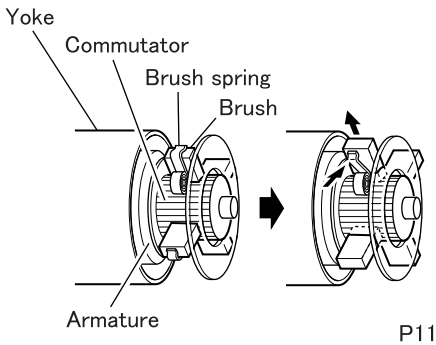
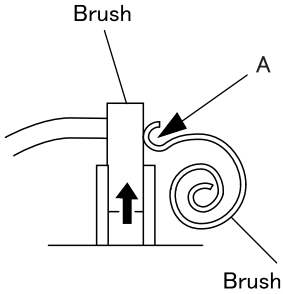


P116417E

■ Disassembly: Brush holder, armature and yoke

- Separate the brushes from the commutator. Then, hold each brush with the brush spring applied against the flank of brush.



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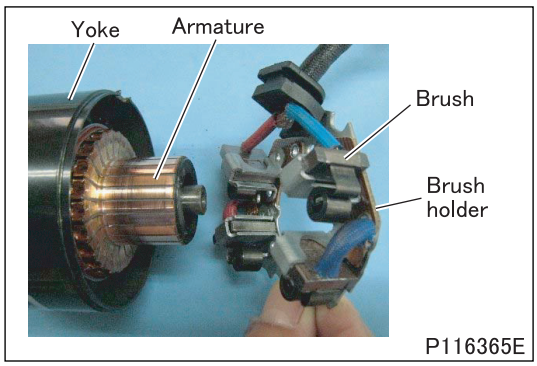
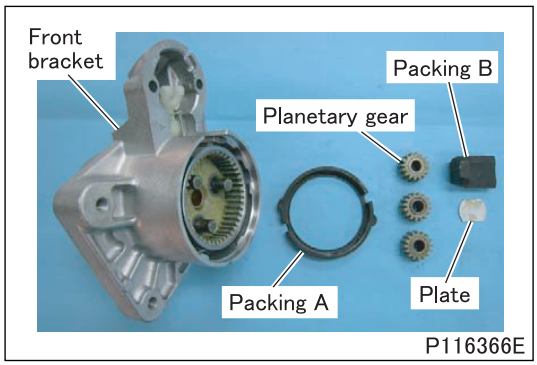
- Pull the brush spring at A to draw up the brush.
- Hold the drawn-up brush with the brush spring as shown.

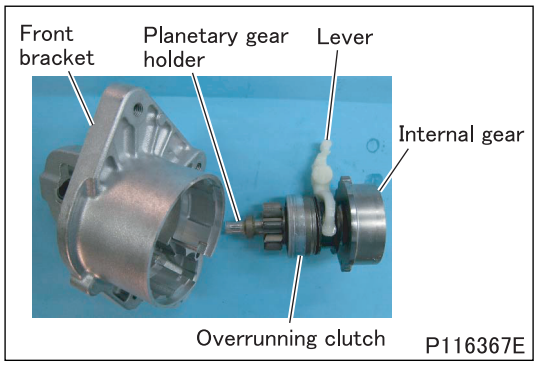


- With the brushes held, remove in this order: the brush holder, armature and yoke.



■ Disassembly: Packing A, B, plate and planetary gear

- Remove packing A, three planetary gears, packing B and plate from the front bracket.

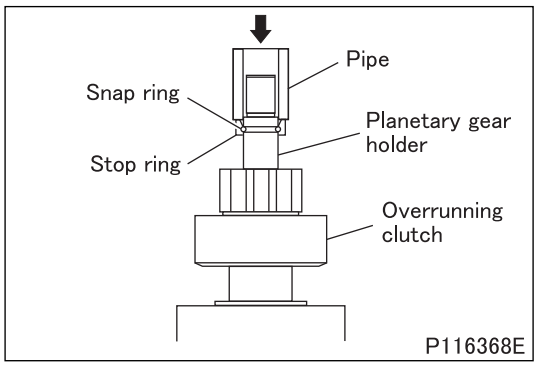


■ Disassembly: Planetary gear holder, internal gear, overrunning clutch and lever

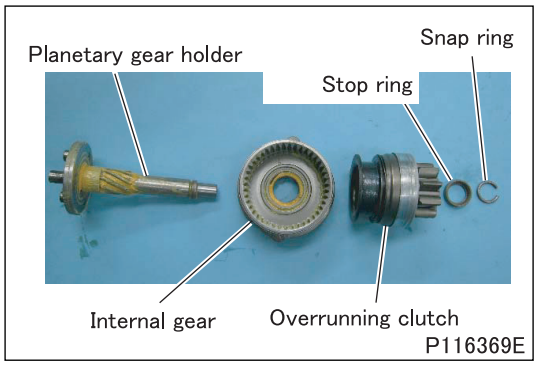
- Remove the planetary gear holder, internal gear, overrunning clutch and lever from the front bracket.

CAUTION ⚠

- **Confirm the lever direction before removal.**

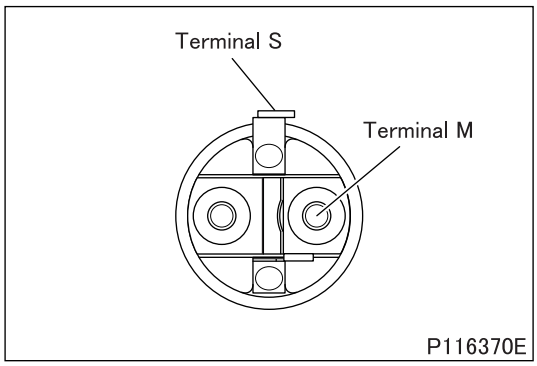


- Apply a pipe of the same size to the stop ring, and then hammer the pipe moderately to release the stop ring from the snap ring.



- Remove the snap ring, stop ring, overrunning clutch and internal gear from the planetary gear holder.

◆Inspection procedure◆

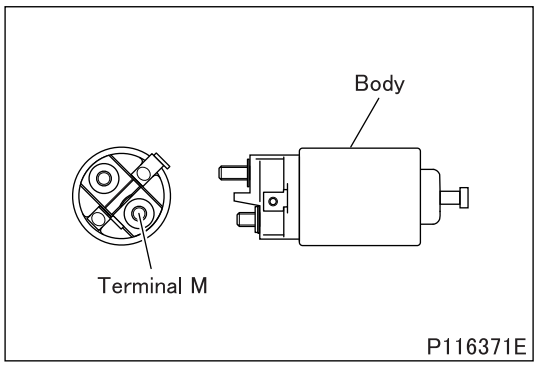


■**Inspection: Magnetic switch**

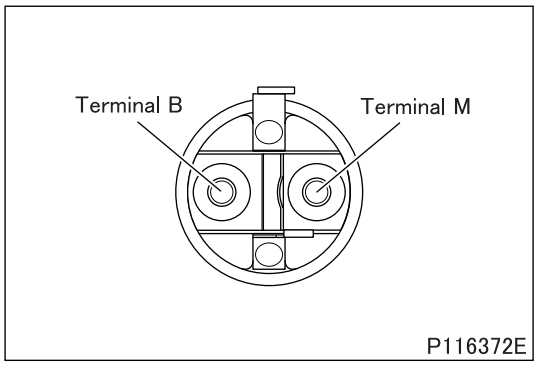
- Perform the following checks, and if any fault is found, replace the switch.

(1) Test for coil open circuit

- Confirm that continuity exists between terminals S and M.

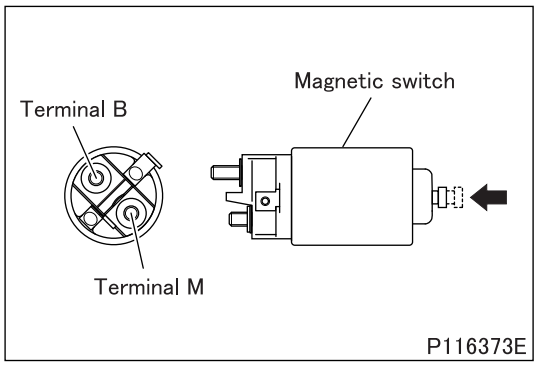


- Confirm that continuity exists between terminal M and the body.



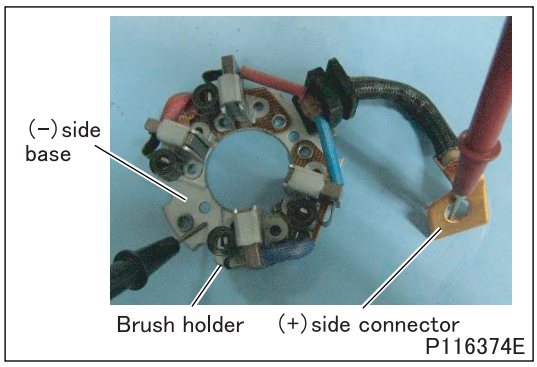
(2) Test for fused-together contacts

- Confirm that continuity does not exist between terminals B and M.



(3) Test for contact-to-contact continuity

- Push in the end of the magnetic switch to close the internal contacts. Then, confirm that continuity exists between terminals B and M.



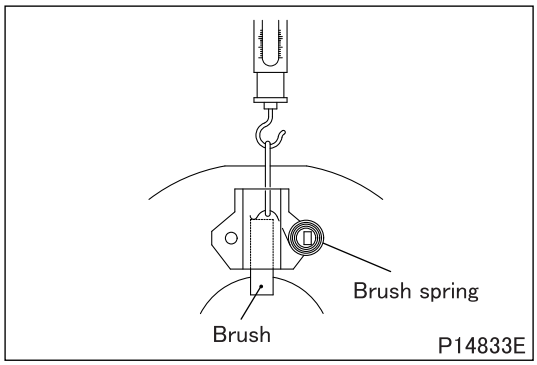
■**Inspection: Brush holder**

(1) Test for insulation

- Thoroughly clean the (+) side connector and (–) side base and check for continuity between them.
- If continuity exists, there is a short circuit and the brush holder must be replaced.

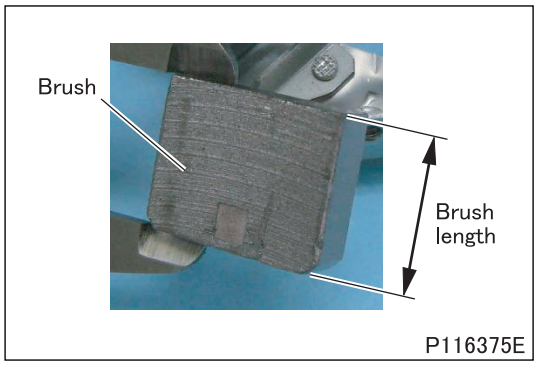
(2) Manual and visual inspections

- Perform the following inspections. If any fault is found, replace the brush holder.
  - The brush holder should be free of deformation, cracks, loosening of swaged joints and rusted base.
  - The brushes should be able to move smoothly in the brush holder.
  - The brush springs should be free of rust.



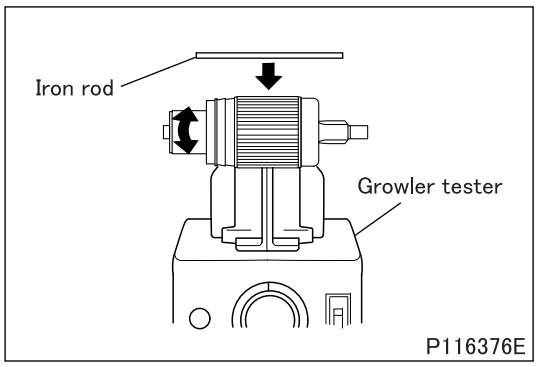
■ **Inspection: Brush spring**

- Using new brushes, measure the load required to separate each brush spring from its brush.
- If either measurement is lower than the specified limit, replace the brush springs.



■**Inspection: Brush (+) (–)**

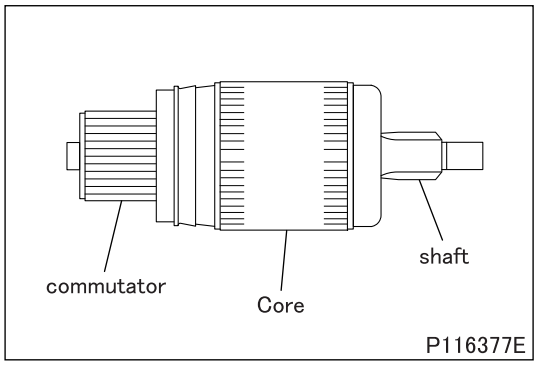
- If either brush is shorter than the limit, it must be replaced.



■ **Inspection: Armature**

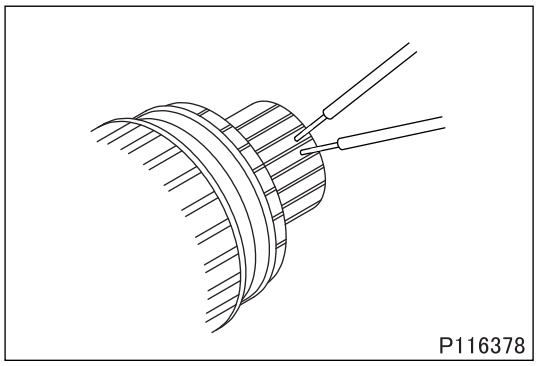
(1) Test for coil short circuit

- Hold an iron rod parallel with the armature.
- Slowly rotate the armature by hand.
- If the iron rod vibrates or is pulled toward the armature, the coil is short-circuited and the armature must be replaced.



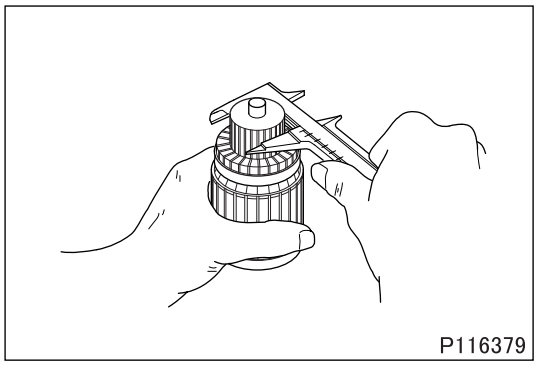
(2) Test for coil grounding

- Confirm that continuity does not exist between the commutator and the core (or shaft).
- If continuity exists, the coil is grounded and the armature must be replaced.



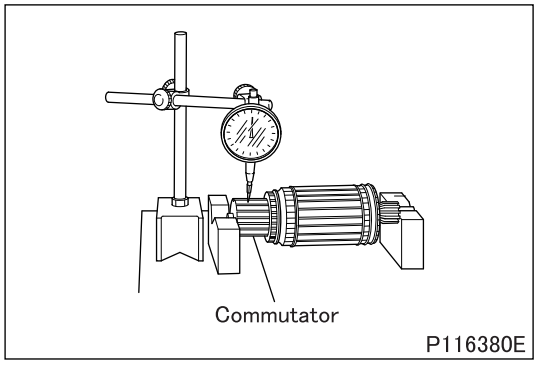
(3) Test for coil open circuit

- Check for continuity between commutator segments.
- If continuity does not exist, replace the armature.



(4) Commutator outside diameter

- If the measurement is out of specification, replace the armature.

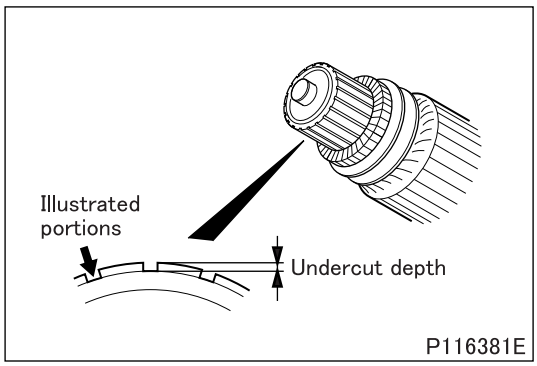


(5) Runout of commutator periphery

- If the reading exceeds the specified limit, replace the armature.

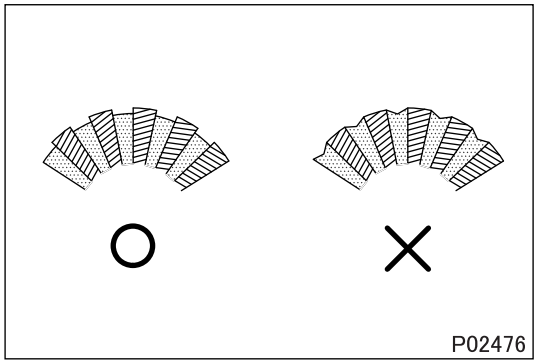
(6) Condition of commutator surface

- If the surface is rough or has stepped wear, rectify it with emery paper (#300 to 500).
- After rectifying the surface, check the extent of commutator runout.



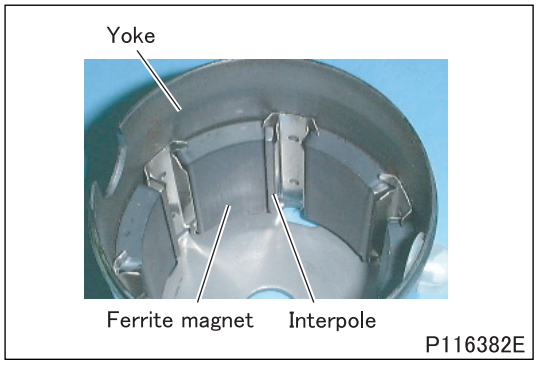
(7) Undercut depth between segments

- If the measurement is lower than the specified limit, rectify or replace the armature.
- To rectify the armature, grind the illustrated portions.



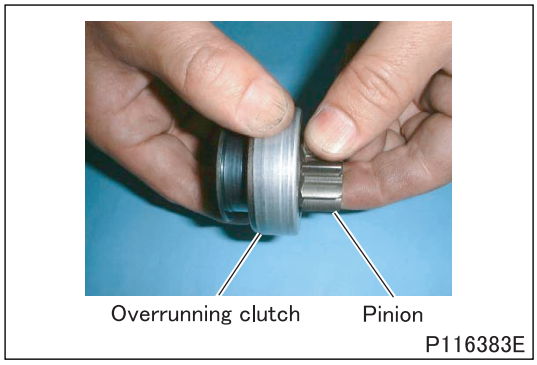
- If the undercut is worn as illustrated, rectify or replace the armature.

○: Acceptable
×: Unacceptable



■ Inspection: Yoke

- Inspect the ferrite magnet in the yoke for damages and cracks. If any fault is found, replace the yoke.



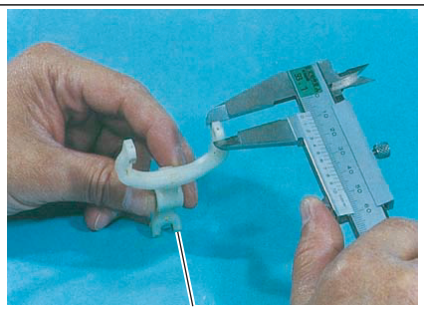
■ Inspection: Overrunning clutch

If the following inspections reveal any abnormality, replace the overrunning clutch.

- While holding the housing, give a turn to the pinion. The pinion should not turn at all in one direction but should turn smoothly in the other direction with some resistance felt.
- Confirm that the pinion teeth are free of chips and not abnormally worn.
- Confirm that the pinion metal is not abnormally worn.

CAUTION ⚠

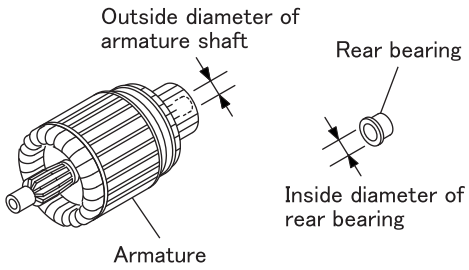
- **The overrunning clutch is filled with grease inside. Do not use immersion cleaning.**



P116384E

■ **Inspection: Lever**

- Measure the overrunning clutch contact surface of the lever to see if it meets the standard value.
- If the measurement is out of the standard value, replace the lever.

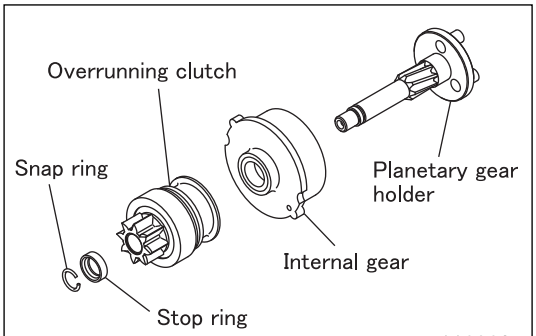


P116385E

■ **Inspection: Rear bearing**

- Confirm that the difference between the inside diameter of the rear bearing and outside diameter of the armature shaft meets the standard value.
- If the measurement is out of the standard value, replace the rear bearing.

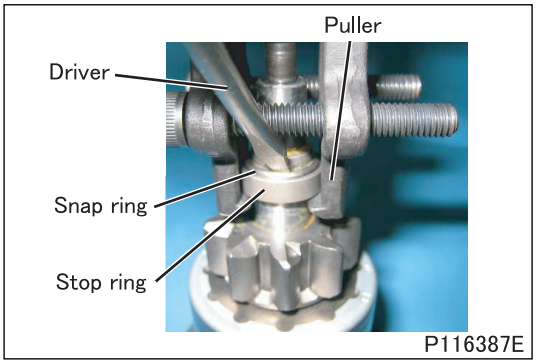
◆Assembly procedure◆



P116860E

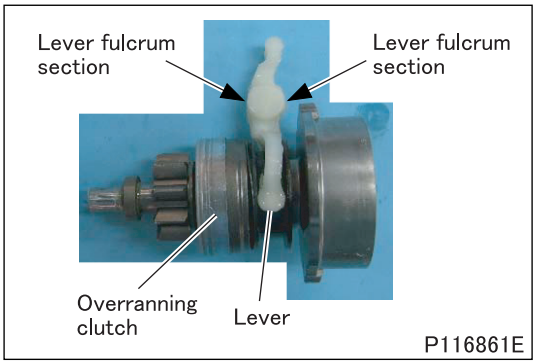
■ **Assembly: Planetary gear holder, internal gear and overrunning clutch**

- Install the internal gear, overrunning clutch and stop ring onto the planetary gear holder.



P116387E

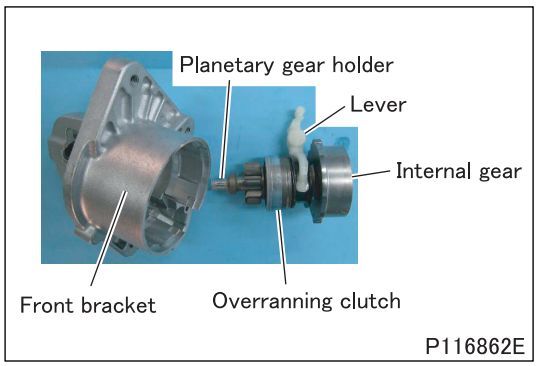
- Set a new snap ring in the groove of the planetary gear holder.
- Using a puller, draw the stop ring toward the snap ring and then fit the snap ring into the stop ring by pressing with a screwdriver.



P116861E

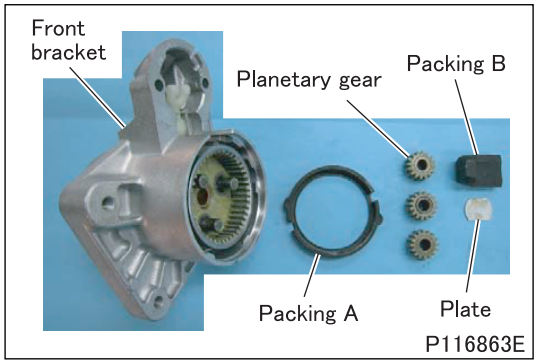
■ **Assembly: Lever**

- Paying attention to its direction, install the lever onto the overrunning clutch.



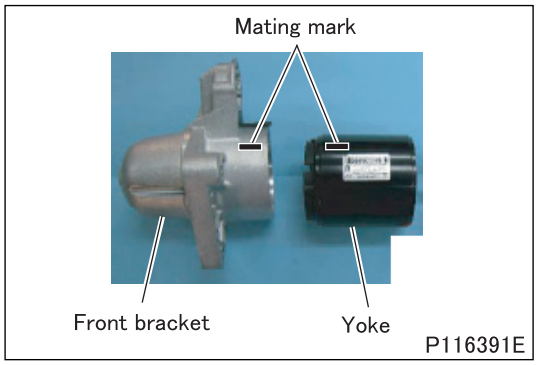
■ **Assembly: Front bracket**

- Install the planetary gear holder, internal gear, overrunning clutch and lever on the front bracket.



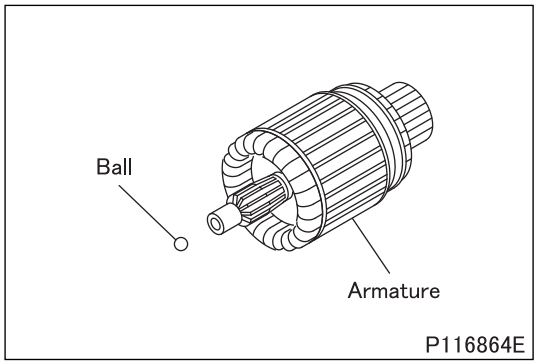
■ **Assembly: Packing A, B, plate and planetary gear**

- Install in this order: plate, packing B, three planetary gears and packing A.



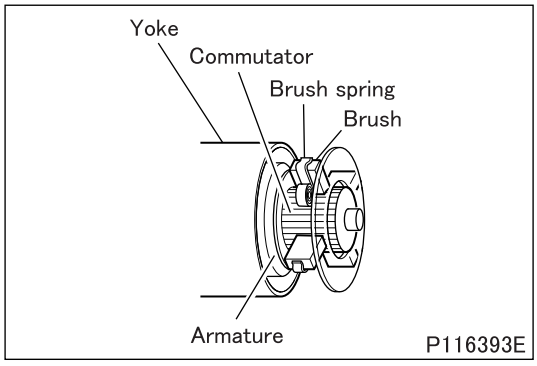
■ **Assembly: Front bracket and yoke**

- Using the mating marks provided before disassembly for alignment, install the yoke to the front bracket.



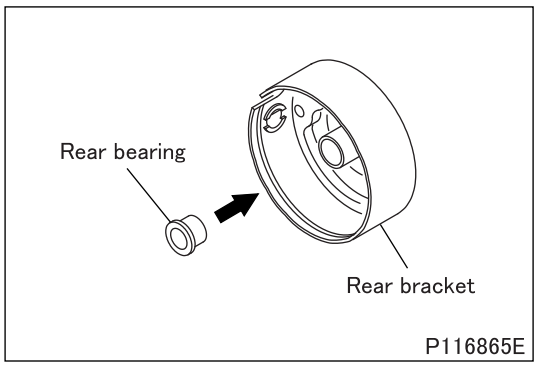
■ **Assembly: Ball and armature**

- Insert the ball, and then install the armature on the planetary gear holder side.



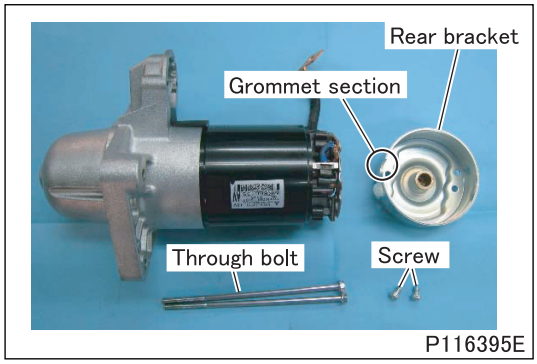
■ **Assembly: Brush holder**

- Install the brush holder on the armature.
- Set the brush springs in the regular state.

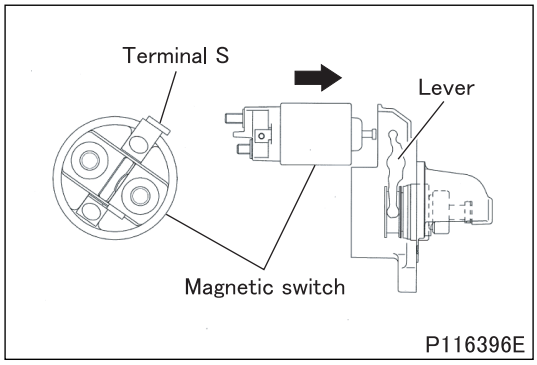


■ **Assembly: Rear bearing and rear bracket**

- Install the rear bearing to the rear bracket.

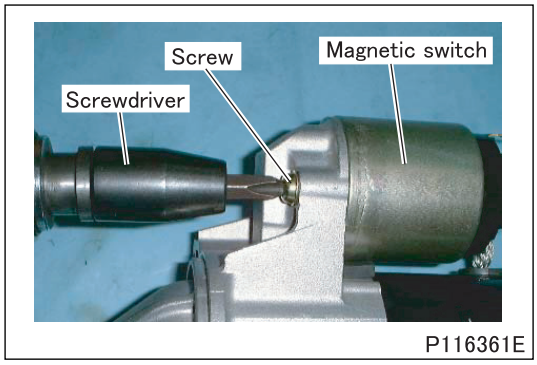


- Install the rear bracket on the yoke. Make sure that the parts are fitted at the grommet section of the rear bracket.
- Tighten the through bolts and screws.

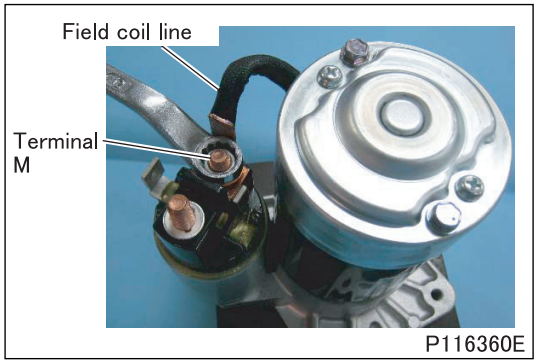


■ **Assembly: Magnetic switch**

- Install the magnet switch onto the lever with its terminal S in the illustrated direction.

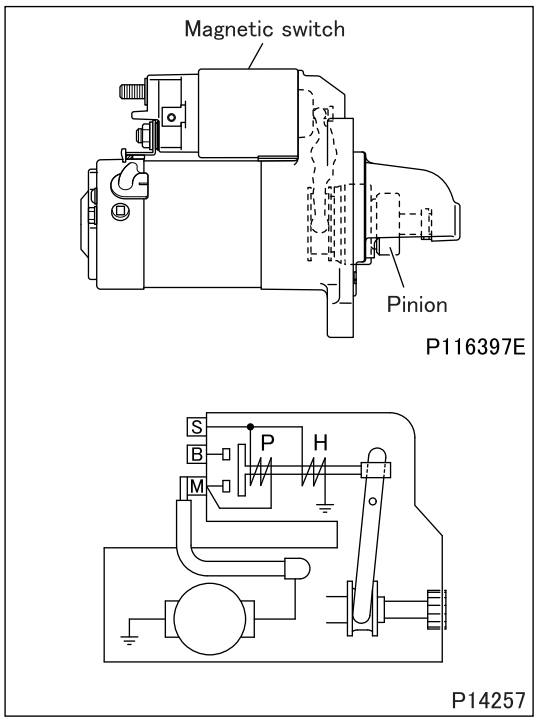


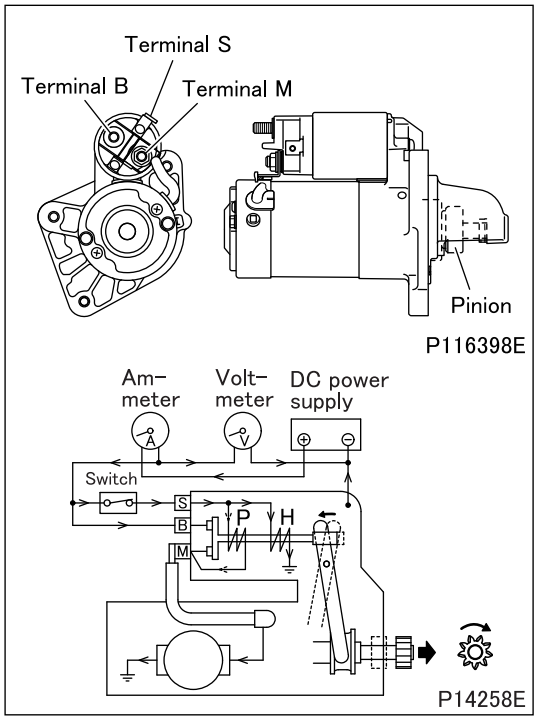
- Tighten the screws.



- Connect the field coil line to terminal M of the magnet switch, and then tighten the nut.

◆Inspection after assembly◆





■ Inspection: Performance and pinion gap

- After assembling the starter, perform inspections with current supplied to it.

WARNING ⚠

- **When the starter is energized, the pinion will spring out and rotate. Be careful not to touch it with your hands.**
- **The magnetic switch may become very hot during inspections. Be careful when touching it.**

CAUTION ⚠

- **Do not energize the pull-in coil P for longer than 10 seconds, and do not energize the holding coil H for longer than 30 seconds. If these periods are exceeded, the coils may overheat and burn out.**
- **When current is supplied to the starter, a large current (100 A or higher) will flow. For inspection purposes, booster cables or similarly thick cables must therefore be used. It is also important to ensure that all connections are secure.**

(1) Performance test

- Connect the starter as illustrated.
- Set the voltage to 11 volts DC.

CAUTION ⚠

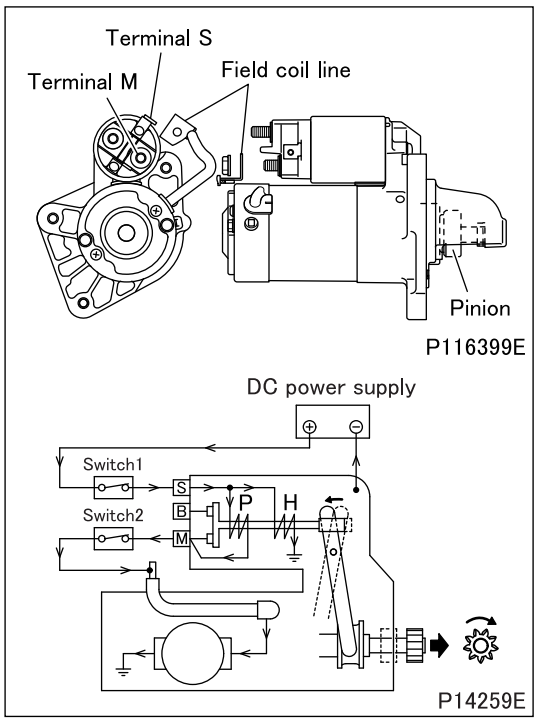
- **The voltage applied must not exceed 12 V.**

- The following operations are performed with current supplied to the starter. Thus, the entire test (consisting of measurement of the current flowing through the starter and measurement of the starter's rotational speed) must be completed within 30 seconds.
  - Turn ON the switch to supply current to the starter. The pinion will spring out and rotate.

CAUTION ⚠

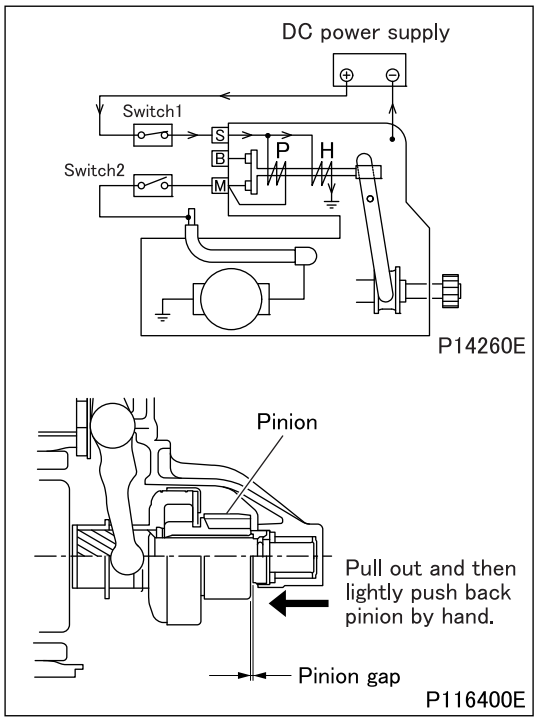
- **When the switch is turned ON, the pull-in coil P and holding coil H are both energized. When the large current from the DC power supply flows from terminal B to terminal M, the supply of current to the pull-in coil P is cut; only the holding coil H remains energized. To prevent the holding coil from burning out, it is essential to complete all operations within 30 seconds.**

  - Measure the current, then measure the starter's rotational speed with a digital tachometer.
  - Turn OFF the switch to de-energize the starter.
- If either measurement is out of specification, disassemble and inspect the starter again.



(2) Pinion gap

- Connect the starter as illustrated.
- The following operations are performed with current supplied to the starter. Thus, the entire procedure for measurement of the pinion gap must be completed within 30 seconds.
  - Turn ON switches 1 and 2 to supply current to the starter. The pinion will spring out and rotate.



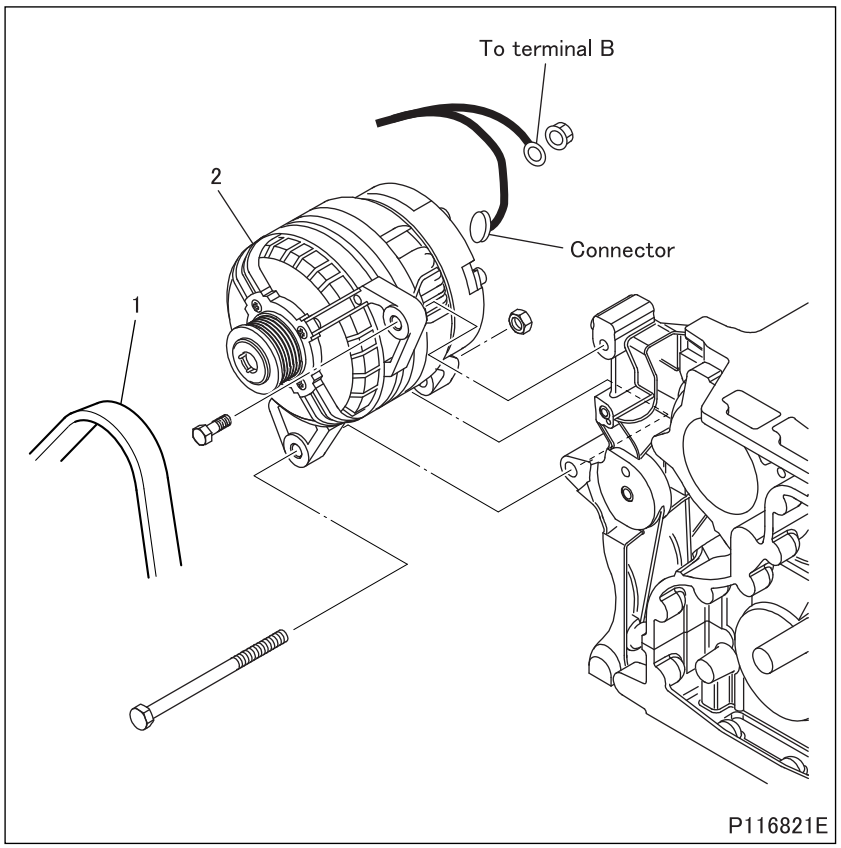
  - After the pinion starts to rotate, quickly (within five seconds) turn OFF switch 2 to stop the pinion's rotation.

CAUTION ⚠

- **When switches 1 and 2 are turned ON, the pull-in coil P and holding coil H are both energized. The circuit is connected such that no voltage is applied to starter terminal B, so current flows to the pull-in coil while the pinion rotates. To prevent the pull-in coil from burning out, it is essential to turn OFF switch 2 quickly (within five seconds) after the pinion starts to rotate.**

  - Pull out the end of the pinion by hand, and then lightly push it back by hand. Measure the amount of axial movement (pinion gap).
  - Turn OFF switch 1 to de-energize the starter.
- If the measurement is out of specification, replace the lever.

#940 ALTERNATOR



● **Removal sequence**

1 Belt
2 Alternator

WARNING ⚠

- **Before removing the alternator, disconnect the (–) battery cable and insulate the cable and the (–) battery terminal with tape.**
- **It is dangerous to leave the (–) battery cable connected since the battery cable voltage is always present at terminal B.**

● **Installation sequence**

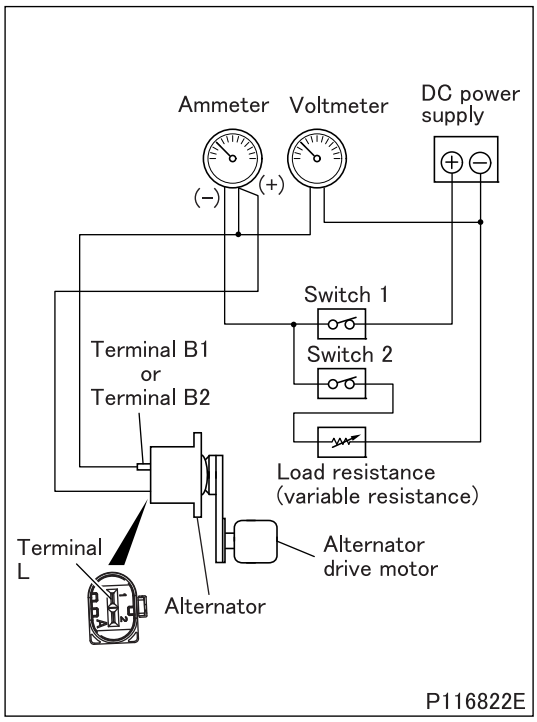
Follow the removal sequence in reverse.

Service standards

Location	Maintenance item		Standard value	Limit	Remedy
2	Alternator output current (*when alternator is hot and producing 13.5 V)	At 1800 rpm	55 A or more	–	Correct or replace
		At 6000 rpm	110 A or more	–	
	Adjustment voltage of regulator (at 6000 rpm, 5 A is loaded)		14.5 ± 0.25 V	–	Replace

* The hot condition occurs after the alternator has been running at normal ambient temperature at 6000 rpm and maximum output for 30 minutes.

◆Inspection procedure◆



■Inspection: Alternator

(1) Alternator output current (bench test)

- Connect the alternator as illustrated.

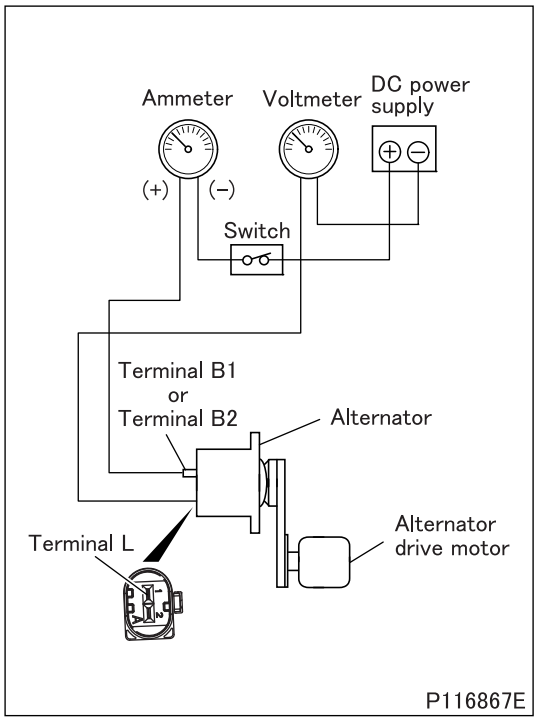
CAUTION ⚠

- **Wires with sufficient thickness should be used for wiring and each connection should be securely fastened.**

- Increase load resistance to the maximum (condition under which the load current hardly flows).
- Turn switch 1 and 2 ON.
- Run alternator at 6000 rpm for 30 minutes by adjusting load resistance so that electric current can conform to the following standard.
  Alternator nominal current

Alternator	Current
110A	Approx. 110A

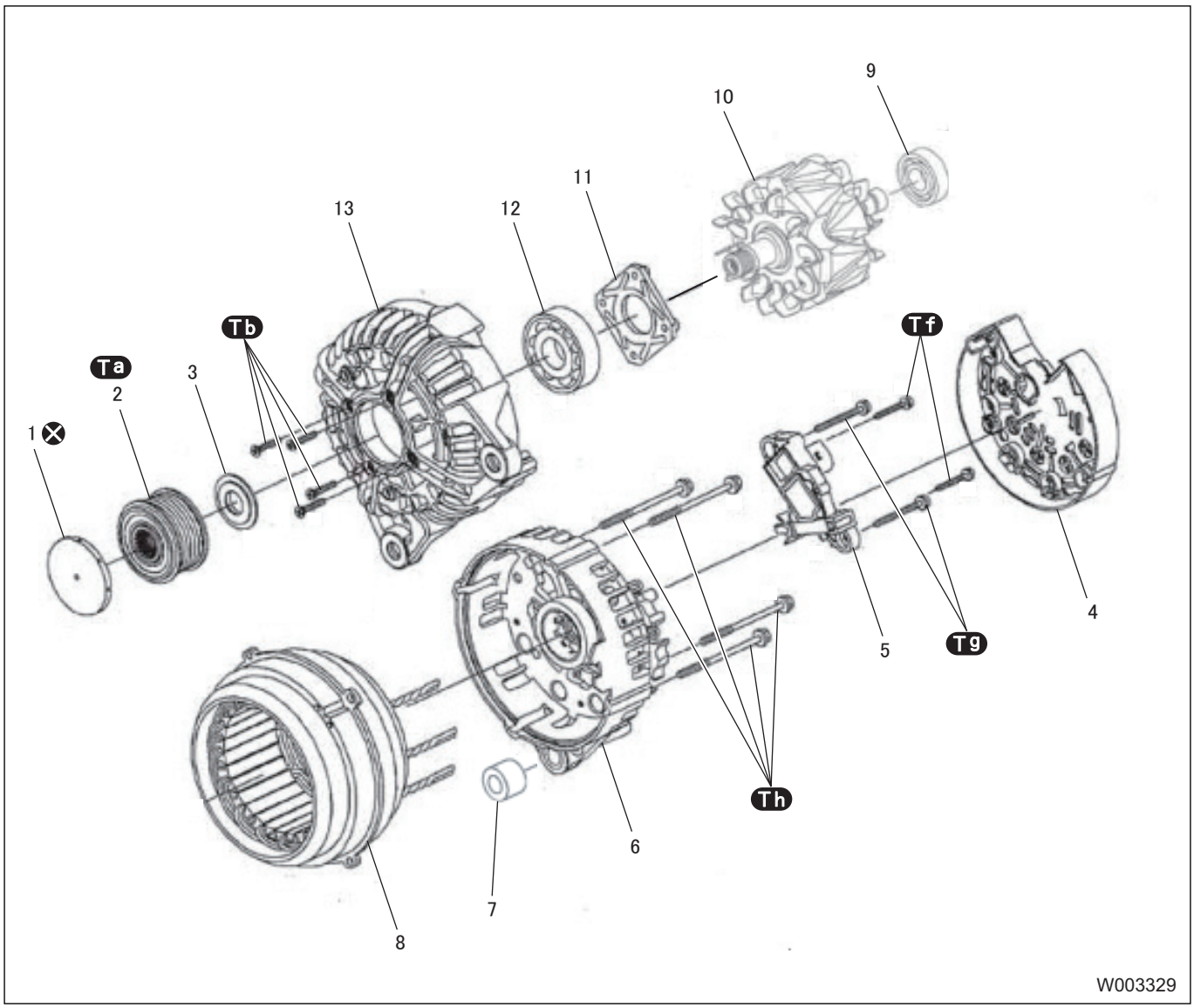
- Measure the current at each specified revolution of alternator.
- If the measured value is lower than the standard value, disassemble and check alternator.



(2) Adjustment voltage of regulator (bench test)

- Connect the alternator as illustrated.
- Turn switch ON.
- Run alternator at low speeds.
- Increase the speed of alternator to 6000 rpm and measure the voltage (adjustment voltage) at this speed. At the same time, make sure that the current is 5 amperes or less at 6000 rpm.
- If the measured value deviates from the standard value, do as follows:
  - If higher than the standard value: Replace the regulator.
  - If lower than the standard value: Inspect the alternator related parts before replacing the regulator.

#940 ALTERNATOR



● Disassembly sequence

1 Pulley cover
2 Pulley
3 Spacer
4 Rear cover
5 Regulator
6 Rear bracket
7 Bushing
8 Stator
9 Rear bearing
10 Rotor
11 Cover plate
12 Front bearing
13 Front bracket

⊗: Non-reusable parts

CAUTION ⚠

- **Do not remove the rear, front bearing, and stator unless faulty.**

● Assembly sequence

Follow the disassembly sequence in reverse.

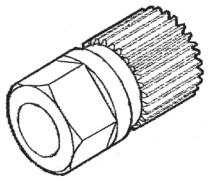
Service standards (Unit: mm {in.})

Location	Maintenance item	Standard value	Limit	Remedy
5	Terminal measurement of regulator	2.0 to 2.4 uF	–	Replace
	Length of brush	13.2 {0.52}	6.0 {0.24}	Replace
8	Resistance between lead wire	–	0.1 Ω or more	Replace
10	Coil resistance between slip rings	1.8 to 2.4 Ω	–	Replace
	Outside diameter of slip ring	13.4 {0.53}	12.0 {0.47}	Replace
	Runout of slip ring periphery	–	0.03 {0.0012} or more	Replace
	Runout of rotor periphery	–	0.05 {0.0020} or more	Replace

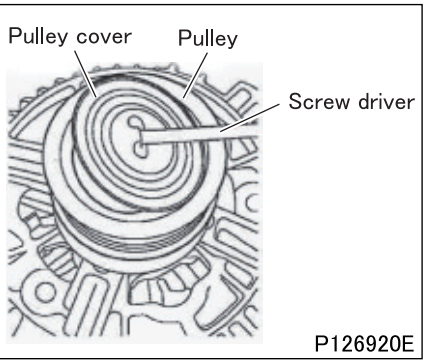
Tightening torque (Unit: N·m {ft.lbs, kgf·m})

Mark	Parts to be tightened	Tightening torque	Remarks
Ta	Pulley	80 {59, 8.0}	–
Tb	Screw (cover plate mounting)	28 {2.1, 0.28}	–
Tf	Screw (regulator mounting)	1.2 {0.9, 0.12}	–
Tg	Screw (regulator mounting)	2.5 {1.8, 0.25}	–
Th	Screw (rear bracket mounting)	4.3 {3.2, 0.43}	–

Special tools

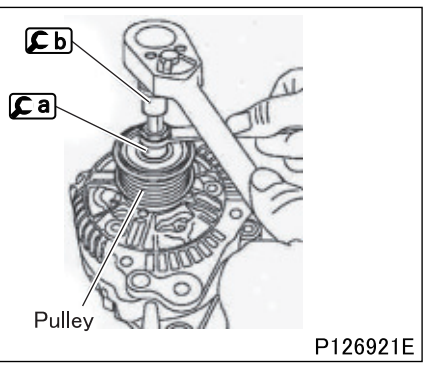
Mark	Tool name and shape	Part No.	Application
Ca	Alternator pulley wrench  P116715	MH063986	Removal and installation of alternator pulley
Cb	Alternator pulley socket  P126962	MH064641	

◆Disassembly procedure◆



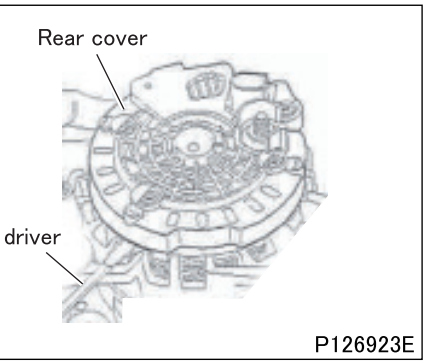
■ Disassembly: Pulley cover

- Insert a screwdriver in center of the pulley cover and remove it.



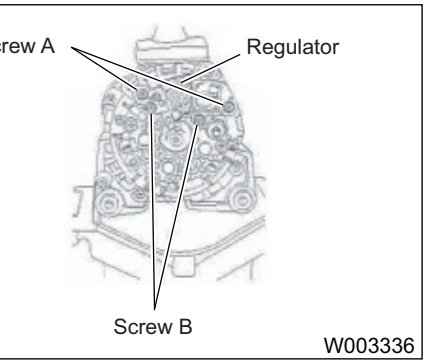
■ Disassembly: Pulley

- Install a on the pulley, and insert b.
- Hang a wrench on a, and remove the pulley by setting a box wrench at b.



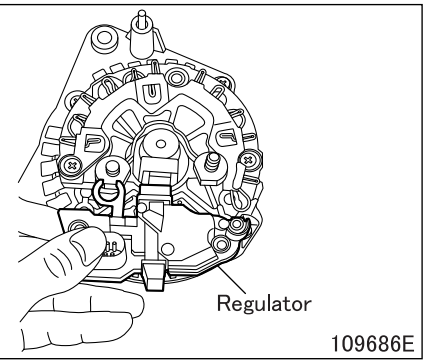
■ Disassembly: Rear cover

- Remove the rear cover with a screwdriver.



■ Disassembly: Regulator

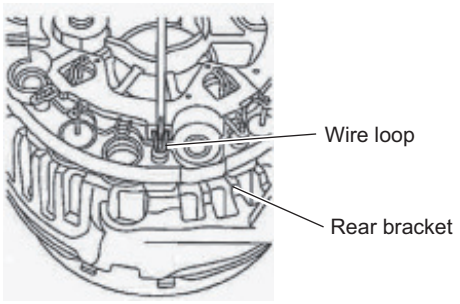
- Remove screw A and B



- Remove the Regulator.

CAUTION ⚠

- **Be careful not to damage the brush when removing.**



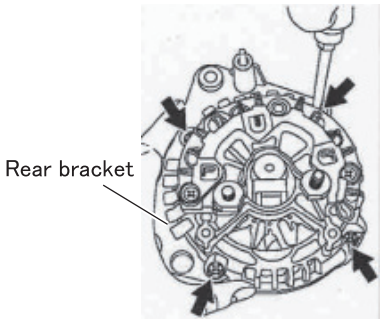
W003335

■ **Disassembly: Removal soldering**

- If the stator lead wire is soldered on the rear bracket, remove soldering.

CAUTION ⚠

- **Unsolder within as shot a time period as possible. Otherwise diode can be easily damaged by heat.**



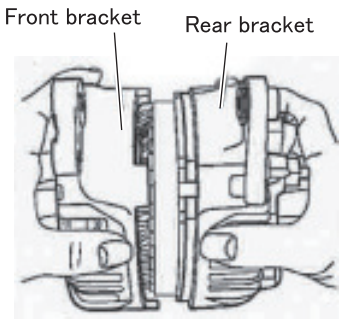
P126928E

■ **Disassembly: Rear bracket**

- Remove mounting bolts.

CAUTION ⚠

- **Put a mating mark on the rear and front bracket.**

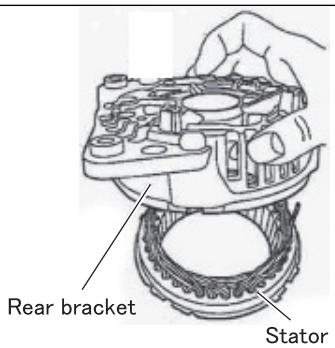


P126929E

- Separate the rear and front bracket by hitting with a rubber hummer.

CAUTION ⚠

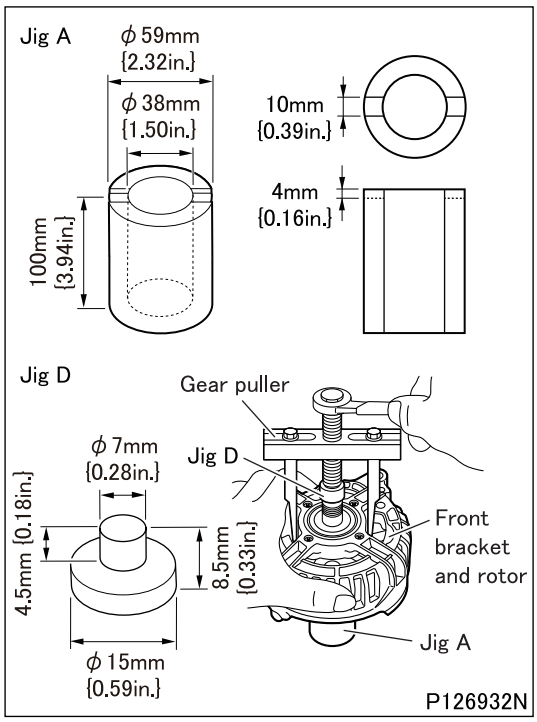
- **Be careful not to drop down the parts.**



P126931E

■ **Disassembly: Stator**

- Remove the stator from the rear bracket.

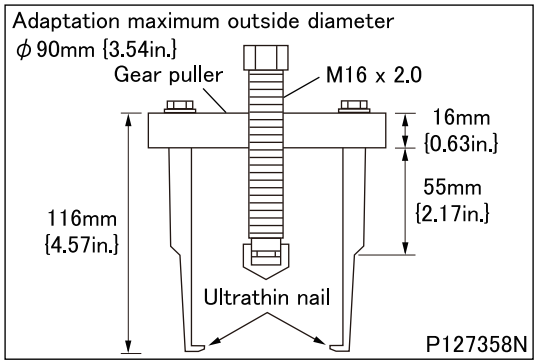


■ **Disassembly: Rotor**

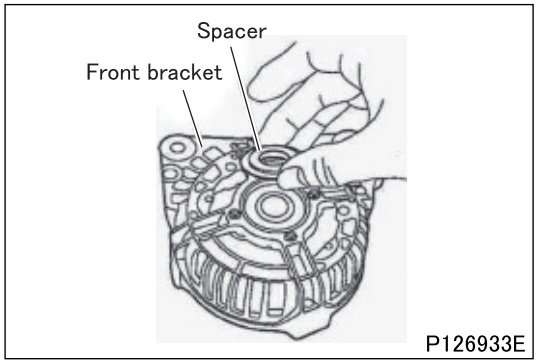
- Make fixture jig A and jig D shown in the illustration.
- Put the front bracket and rotor on the jig A, apply the jig D on the rotor shaft, and then remove the rotor with a gear puller.

CAUTION ⚠

- **Be careful not to drop down the rotor when removing.**
- **Be careful not to damage the slip ring of the rotor shaft.**
- **Use the jig suitable for the operation.**

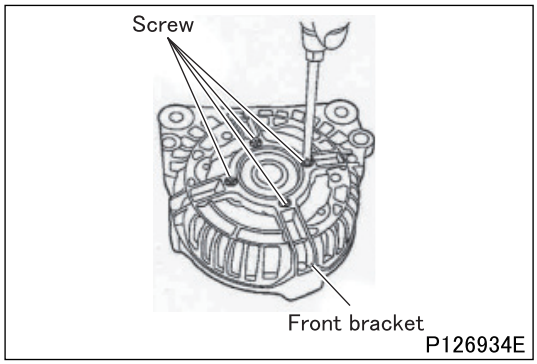


- For the gear puller, CP-98A ultra thin nail type made by HASCO is used.



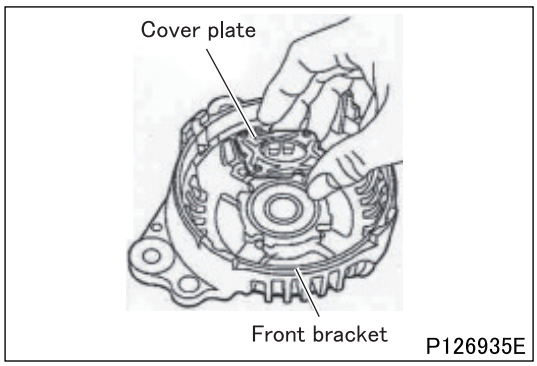
■ **Disassembly: Spacer**

- Remove the spacer from the front bracket.

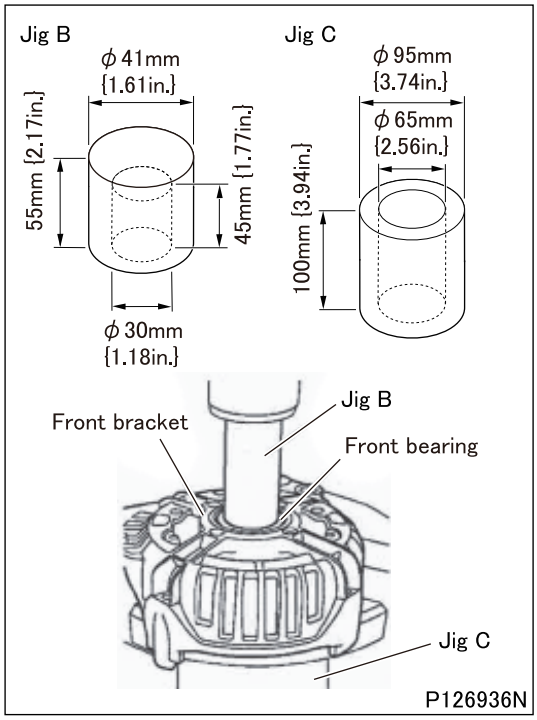


■ **Disassembly: Cover plate**

- Remove screws.



- Remove the cover plate from the back side of front bracket.

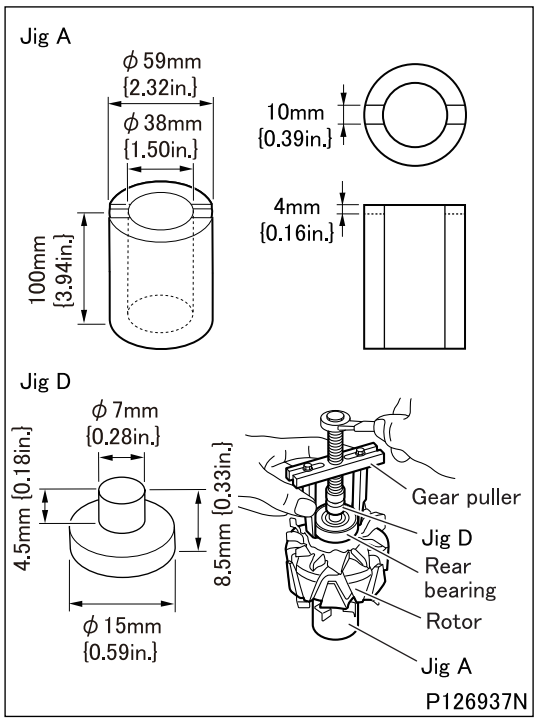


■ Disassembly: Front bearing

- Make fixture jig B and jig C shown in the illustration.
- Put the front bracket on the jig C, and remove the front bearing with the jig B.

CAUTION ⚠

- **Use the jig suitable for the operation.**

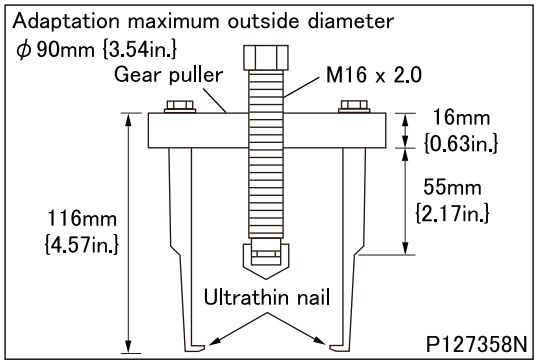


■ **Disassembly: Rear bearing**

- Make fixture jig A and jig D shown in the illustration.
- Put the rotor on the jig A, apply the jig D on the rotor shaft, and then remove the rear bearing with a gear puller.

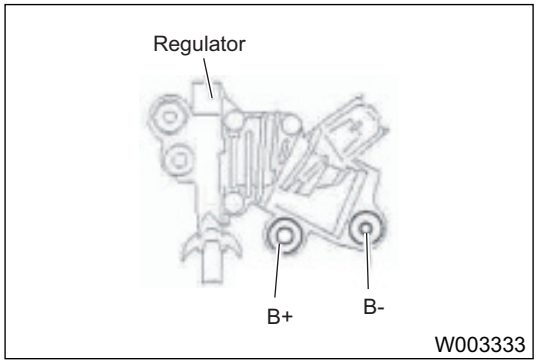
CAUTION ⚠

- **Be careful not to damage the rotor.**
- **Because the slip ring of the rotor shaft is a resin product, it may damage if the gear puller is applied it on directly.**
- **Use the jig suitable for the operation.**



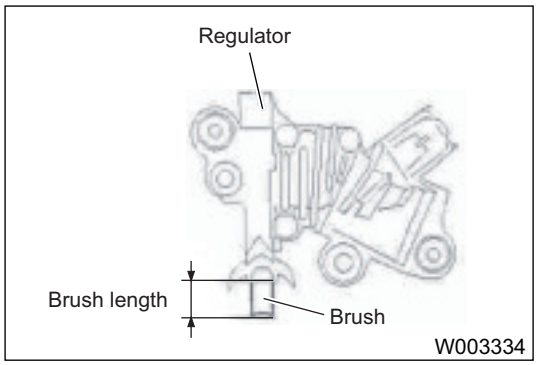
- For the gear puller, CP-98A ultra thin nail type made by HASCO is used.

◆Inspection procedure◆



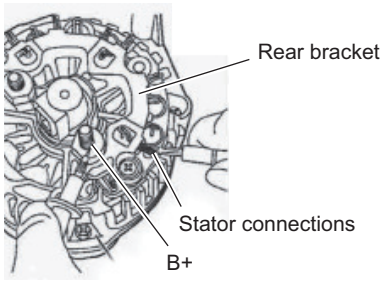
■Inspection: Terminal measurement

- Measure the capacitance between B+ and B- of rear cover and regulator.
- If the measured value deviates from the standard value, replace the rear cover or the regulator.



■Inspection: Regulator

- Perform the following checks, and if any fault is found, replace the regulator.
  - Check if there is any damage on the regulator or the brush.
  - Check that the brush moves smoothly.
  - Measure the length of brush, and if the measured value is less than the limit value, replace the regulator.



W003331

■ **Inspection: Rear bracket**

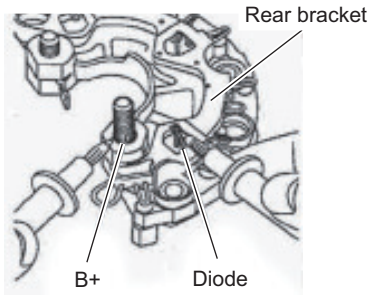
- Perform the following checks, and if any fault is found, replace the rear bracket.

(1) Continuity of B+ and stator connection, B+ and the rear bracket

- Check that there is continuity.

(2) Continuity of the rear bracket and stator connection

- Check that there is no continuity.



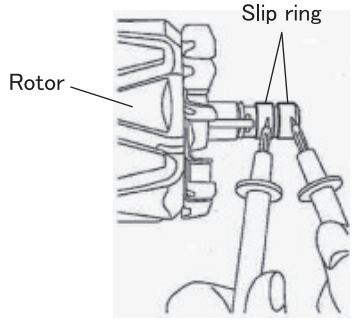
W003332

(3) Diode

- Measure the resistance between B+ and the diode, the rear bracket and the diode.
- Inspection should be conducted twice, changing over the positive probe and the negative probe of the tester.
  If resistance is infinite in both cases, the diode has open.
  If resistance is close to 0 Ω in both cases, the diode has shorted.
- If diode has open or shorted, replace the rear bracket.

CAUTION ⚠

- **Use the tester with large range.**



P126944E

■ **Inspection: Rotor**

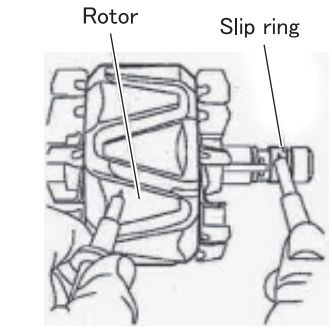
CAUTION ⚠

- **When replacing the rotor, replace also the front and rear bearing.**

- Perform the following checks, and if any fault is found, replace the rotor.

(1) Coil resistance between the slip rings

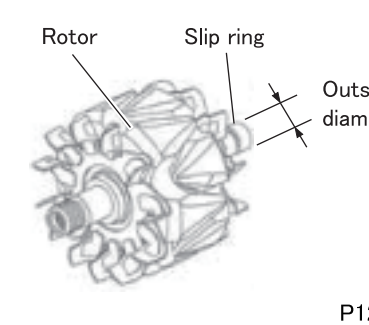
- Measure the resistance between the slip rings.
- If the measured value deviate from the standard value, replace the rotor.



P126945E

(2) Continuity between the slip ring and the rotor

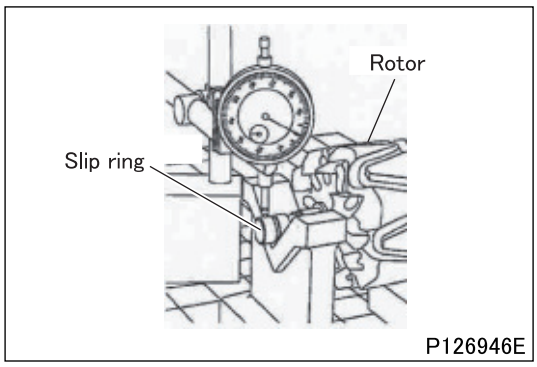
- Check that there is no continuity between the slip ring and the rotor.
- If there is continuity, replace the rotor because it has short-circuited.



P126963E

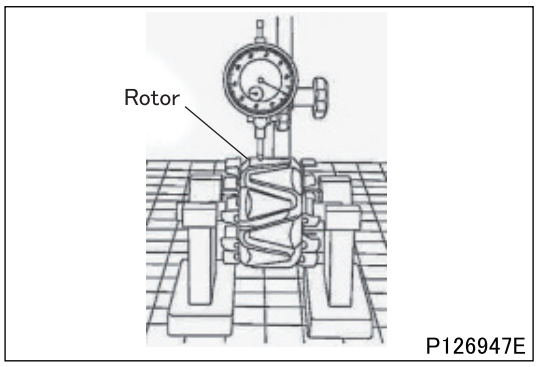
(3) Outside diameter of slip ring

- If the measured value is less than the limit value, replace the rotor.



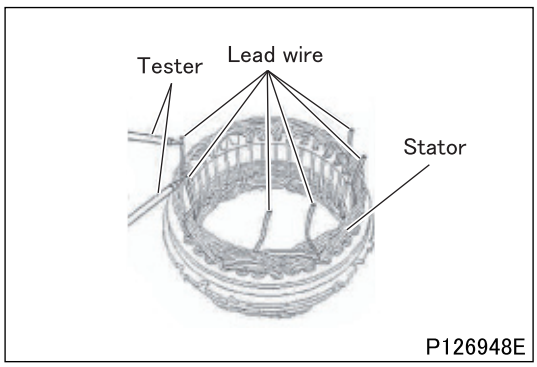
(4) Runout of slip ring periphery

- If the measured value is more than the limit value, replace the rotor.



(5) Runout of rotor periphery

- If the measured value is more than the limit value, replace the rotor.



■ Inspection: Stator

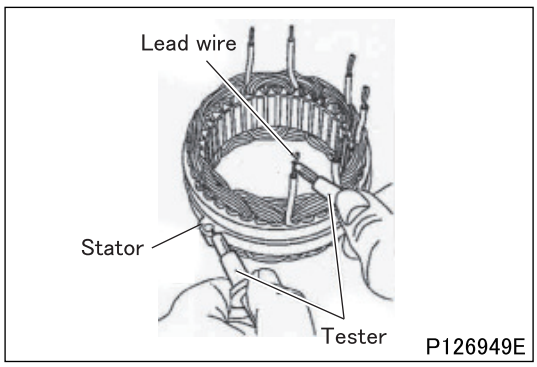
- Perform the following checks, and if any fault is found, replace the stator.

(1) Resistance between each lead wire

- Measure the resistance between each lead wire.

(2) Continuity between each lead wire

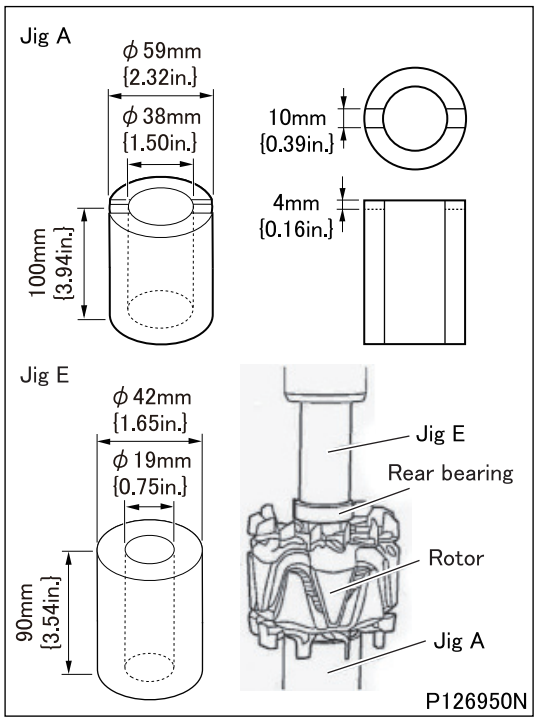
- Check that there is continuity between each lead wire.
- If there is no continuity, the lead wire has broken.



(3) Continuity between each lead wires and the core

- Check that there is no continuity between each lead wire and the core.
- If there is continuity, the lead wire has short-circuited.

◆Assembly procedure◆

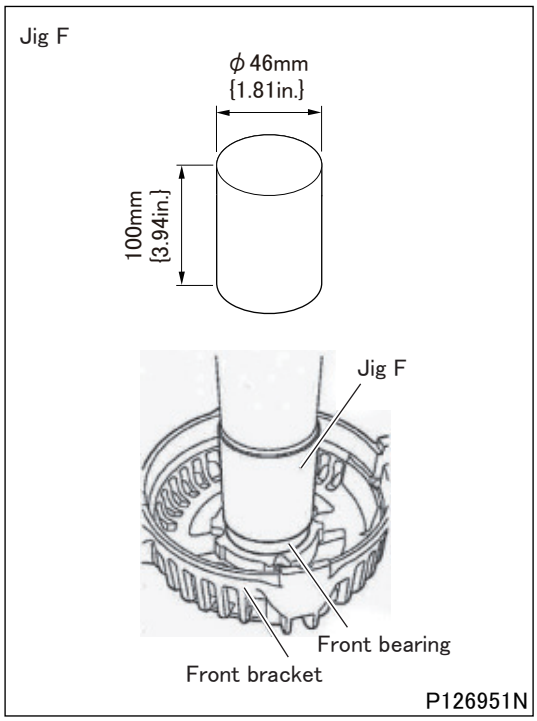


■Assembly: Rear bearing

- Make fixture jig A and jig E shown in the illustration.
- Put the rotor on the jig A, and press fit the rear bearing with the jig E.

CAUTION ⚠

- **Do not press more than necessary.**
- **Use the jig suitable for the operation.**

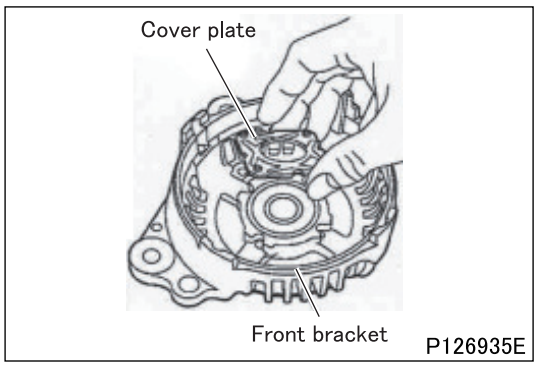


■Assembly: Front bearing

- Make a fixture jig F shown in the illustration.
- Press fit the front bearing into the front bracket with the jig F.

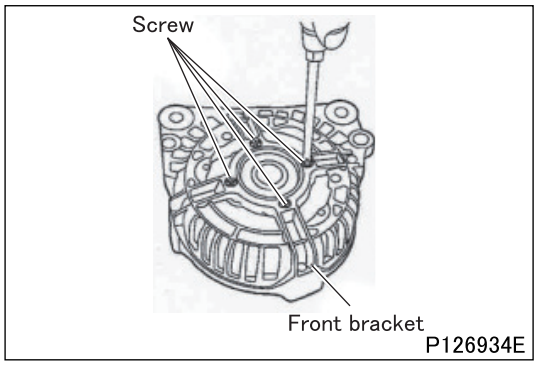
CAUTION ⚠

- **Do not press more than necessary.**
- **Use the jig suitable for the operation.**

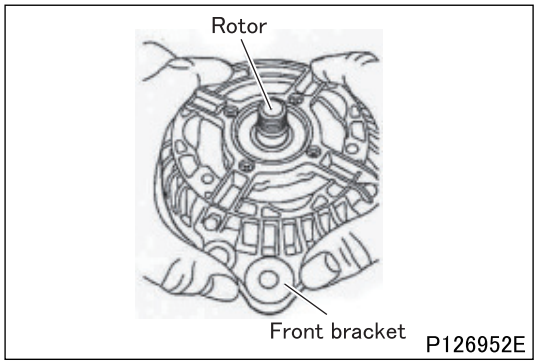


■ **Assembly: Cover plate**

- Install the cover plate on the back side of the front bracket.

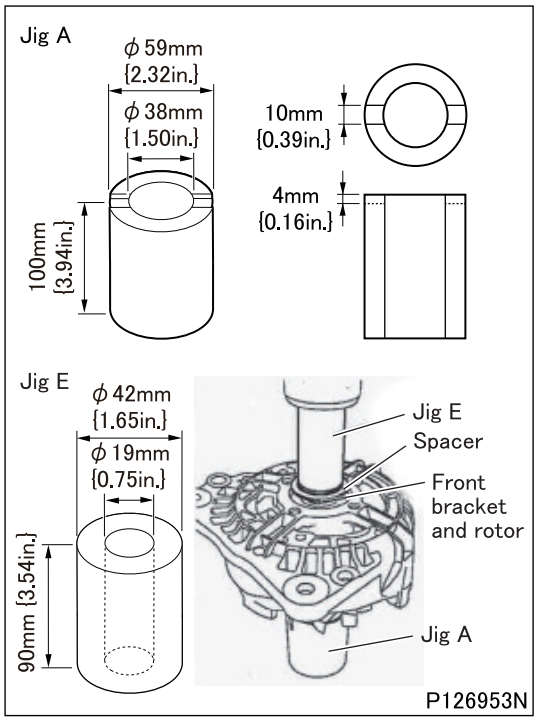


- Tighten screws.



■ **Assembly: Spacer**

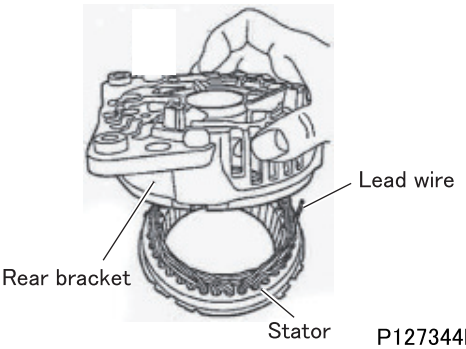
- Install the rotor on the front bracket.



- Make fixture jig A and jig E shown in the illustration.
- Put the front bracket and rotor on the jig A, and press fit the spacer with the jig E.

CAUTION ⚠

- **Do not press more than necessary.**
- **Be careful not to damage the rotor when operating.**
- **Install the spacer so that the small collar is facing to front bracket.**
- **Use the jig suitable for the operation.**

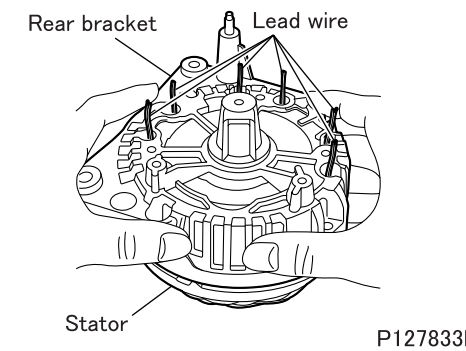


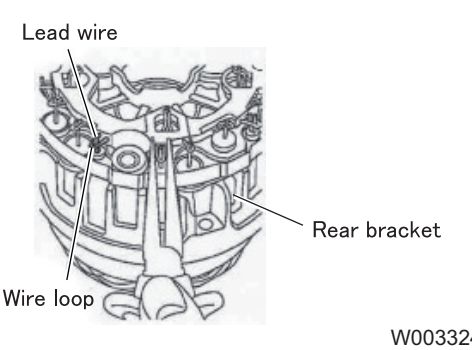
■ **Assembly: Stator**

- Clean the surface of the lead wire with a sandpaper, and install the stator on the rear bracket.

CAUTION ⚠

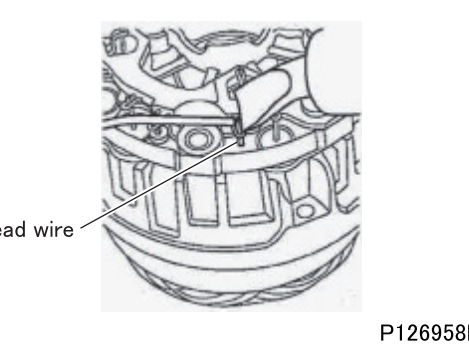
- **To prevent the peeling of a film, be careful not to file off too much when cleaning.**
- **Check that the lead wires pass through the specified position of rear bracket.**





■ **Assembly: Soldering**

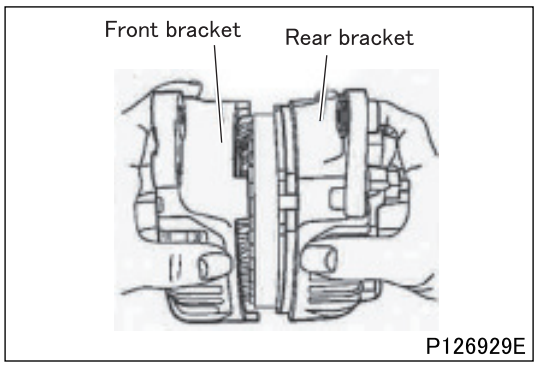
- Pass the lead wires through the wire loop of Rear bracket, and fix them.



- Solder the fixed lead wire.

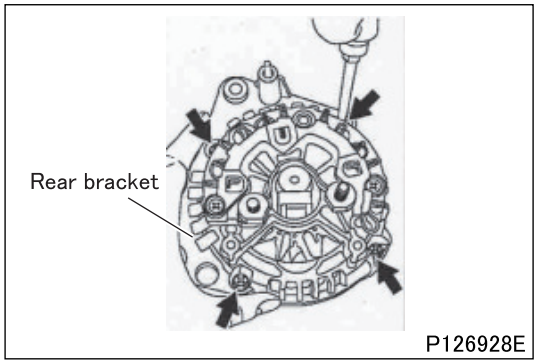
CAUTION ⚠

- **Be careful not to drop the solder on other parts.**



■ **Assembly: Rear bracket and front bracket**

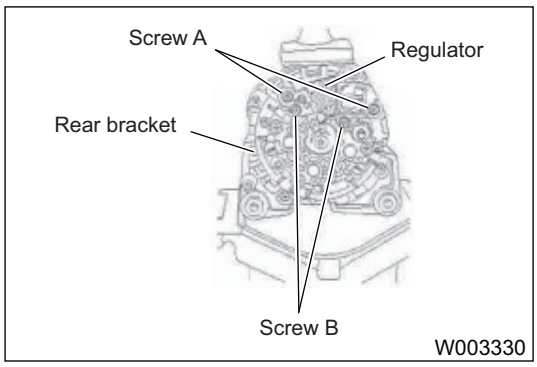
- Combine the rear bracket and front bracket aligning the position of each mating mark.



- Tighten mounting bolts.

CAUTION ⚠

- **After installing, check that the stator and rotor are not rubbed.**

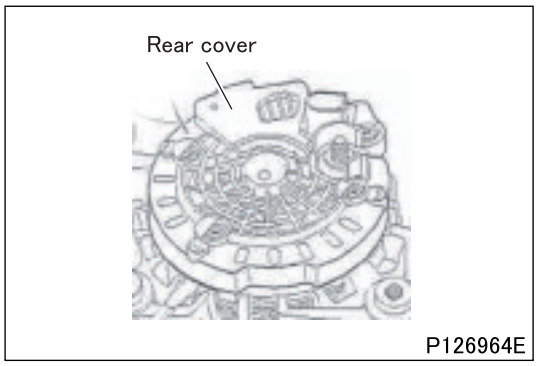


■ **Assembly: Regulator**

- Install the regulator on the rear bracket, and tighten the screw A and B.

CAUTION ⚠

- **Be careful not to damage the brush when installing.**



■ **Assembly: Rear cover**

- Install the rear cover.

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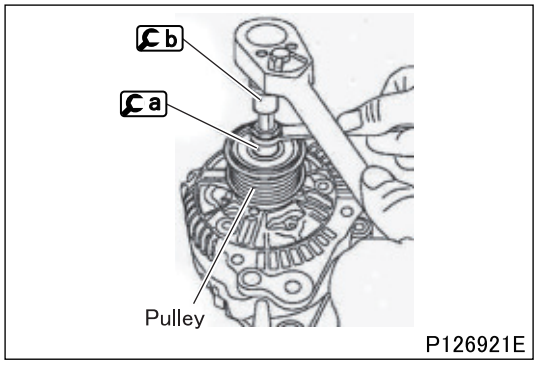
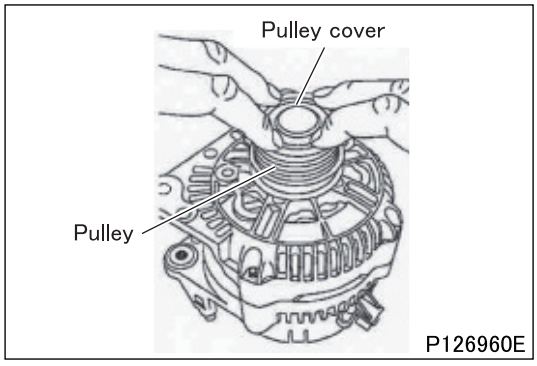


■ **Assembly: Pulley**

- Install the pulley on the rotor shaft.
- Install a on the pulley, and insert b.
- Hang a wrench on a, and tighten the pulley by setting a box wrench at b.



■ **Assembly: Pulley cover**

- Install the pulley cover on the pulley.

CAUTION ⚠

- **After installing, check that the pulley cover is installed surely in the groove of pulley.**

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