

MID UNIT

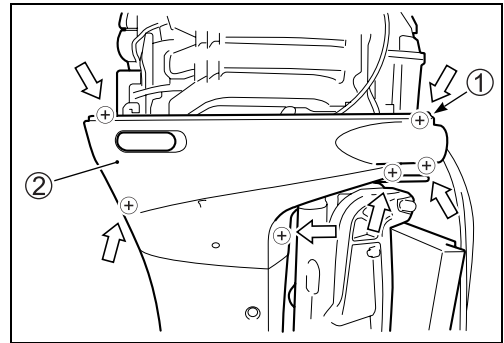
CONTENTS

ENGINE SIDE COVER	7- 2
REMOVAL	7- 2
INSTALLATION	7- 2
DRIVESHAFT HOUSING AND OIL PAN	7- 3
REMOVAL	7- 3
INSPECTION	7- 9
ASSEMBLY	7-12
SWIVEL BRACKET, STEERING BRACKET AND CLAMP BRACKET	7-19
REMOVAL	7-19
INSPECTION	7-22
REASSEMBLY	7-23
WATER PRESSURE VALVE	7-28
REMOVAL	7-28
INSPECTION	7-28
INSTALLATION	7-28

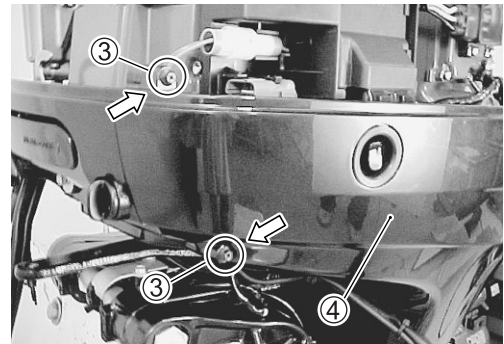
ENGINE SIDE COVER

REMOVAL

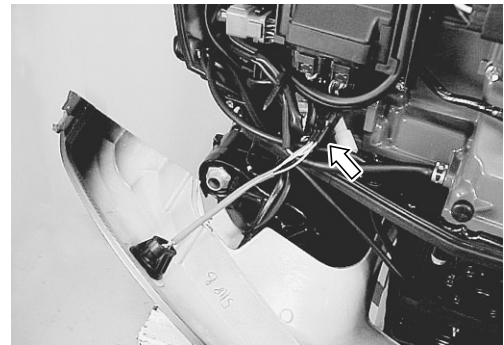
Remove six (6) screws ① and STBD side cover ②.



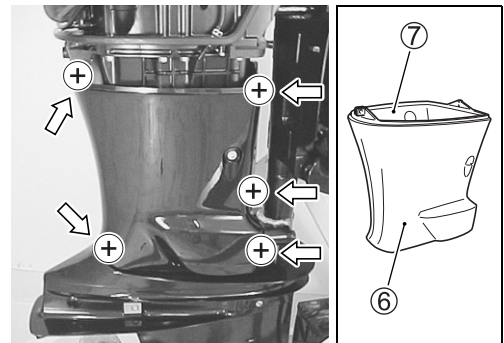
Remove two (2) screws ③ and PORT side cover ④.



Disconnect PTT switch lead connector.



Remove five (5) screws ⑤ and STBD/PORT oil pan covers ⑥/⑦.



INSTALLATION

Installation is reverse order of removal.

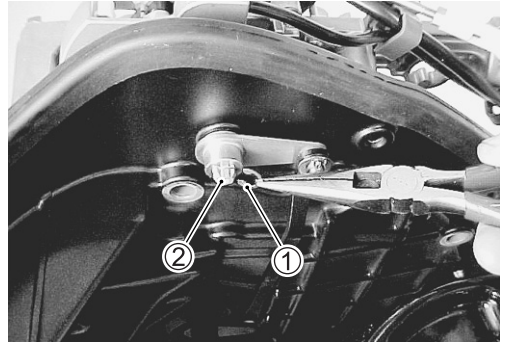
DRIVESHAFT HOUSING AND OIL PAN

REMOVAL

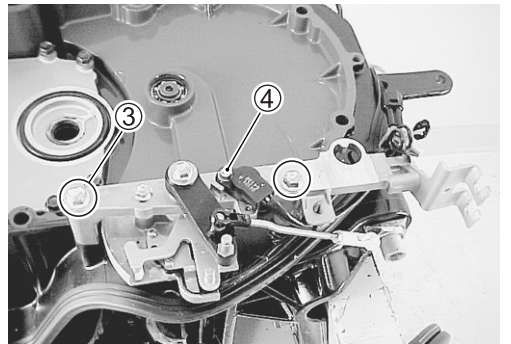
Remove power unit. (See page 6-15 to 6-20.)

Remove lower unit. (See page 9-2.)

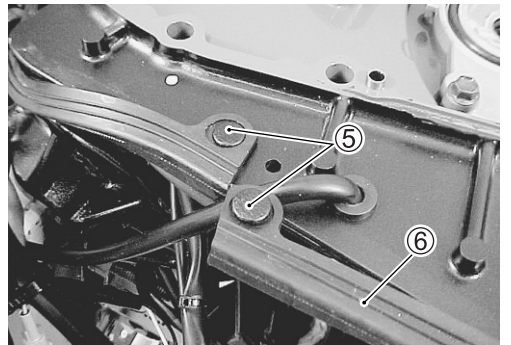
Remove E-ring ① from clutch lever shaft ②.



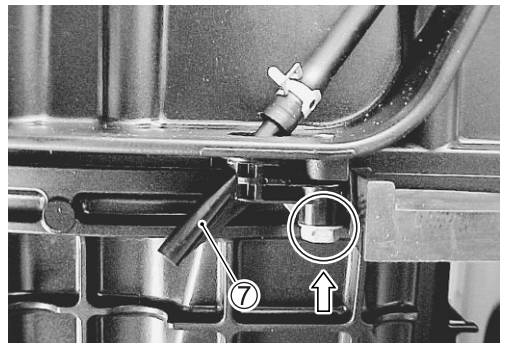
Remove two (2) bolts ③ and throttle lever holder ④.



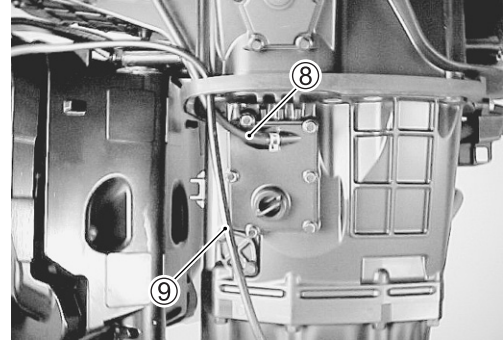
Remove pins ⑤ and side cover seal ⑥.



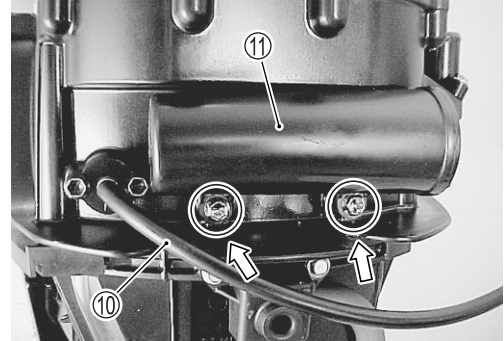
Remove bolt and pilot water tube ⑦.



Disconnect water outlet hose ⑧ from oil pan water jacket cover.
Remove speedometer pick up tube ⑨ from driveshaft housing.



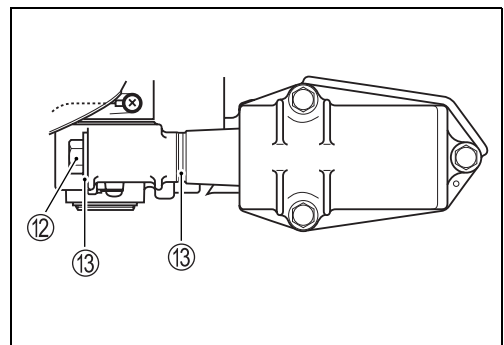
Remove water outlet hose ⑩ from engine holder.
Remove bolts and vacuum tank ⑪.



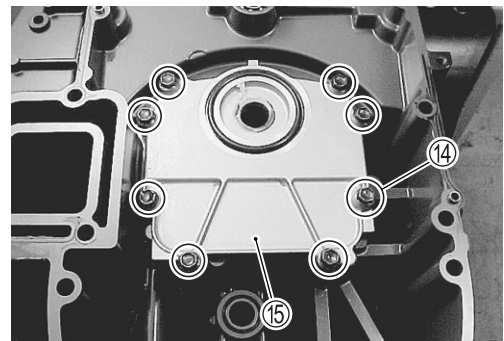
Operate the PTT motor to extend the PTT rod upward.

TOOL 09945-79310: PTT cable extension

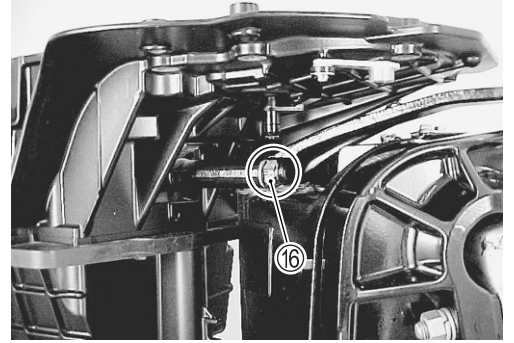
Unscrew and remove STBD/PORT lower mount bolts ⑫.
Account for washers ⑬.



Remove eight (8) bolts ⑭ and the mount-oil seal cover ⑮.
Account for two (2) dowel pins.



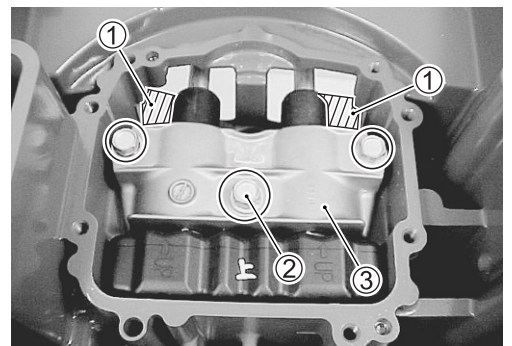
Remove STBD/PORT upper mount nuts ⑯ and washers.



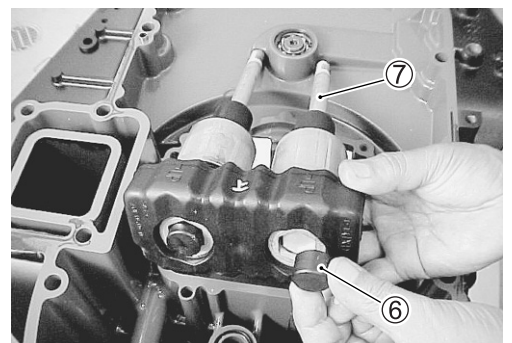
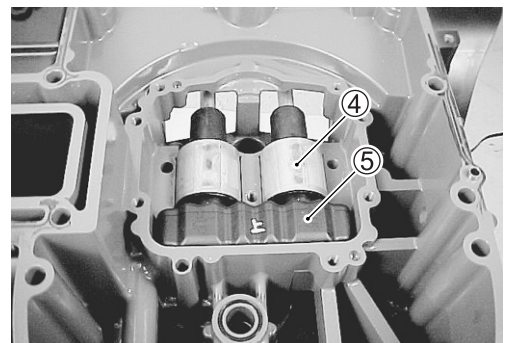
Remove driveshaft housing with oil pan.



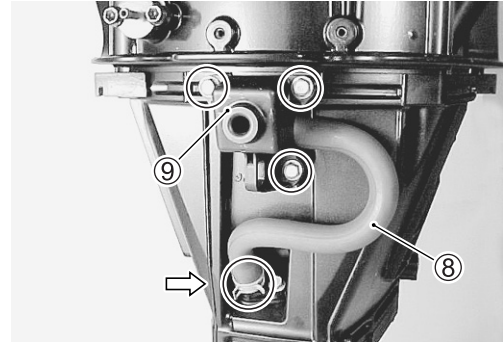
Remove the upper side mounts ①.
Remove three (3) bolts ② and upper mount cover ③.



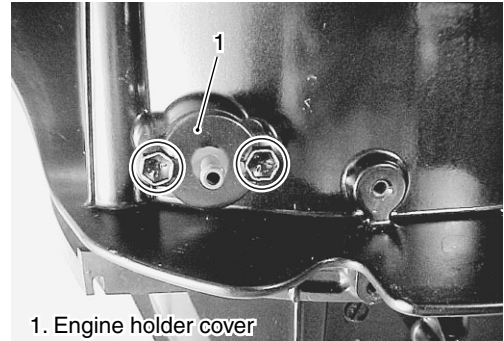
Remove upper mounts ④, thrust mount ⑤, stopper ⑥ and mount bolts ⑦.



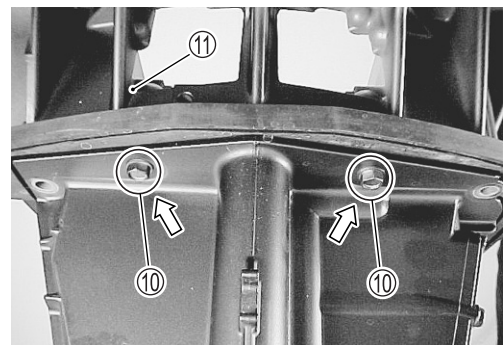
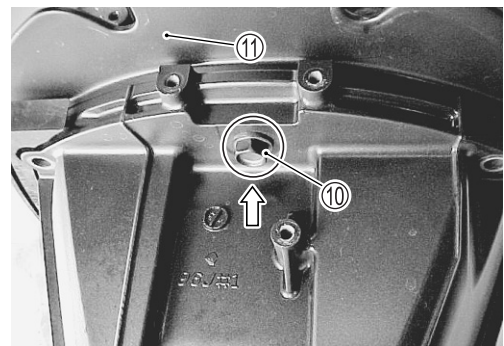
Loosen the clamp securing exhaust hose ⑧, then remove the exhaust hose from exhaust pipe.
 Remove the three (3) bolts securing exhaust relief pipe ⑨, then remove exhaust relief pipe.



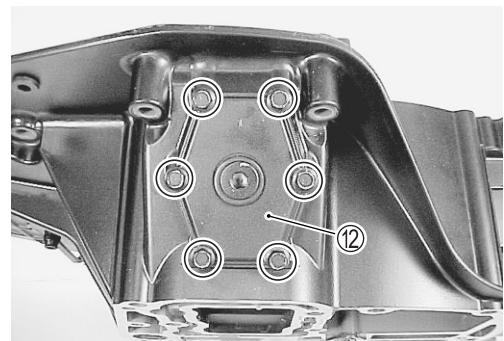
Remove two (2) bolts and engine holder cover.



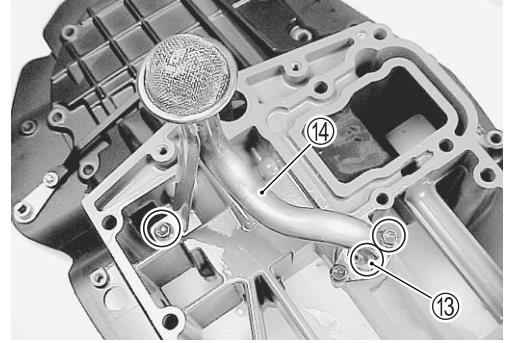
Remove three (3) bolts ⑩ and engine holder ⑪.



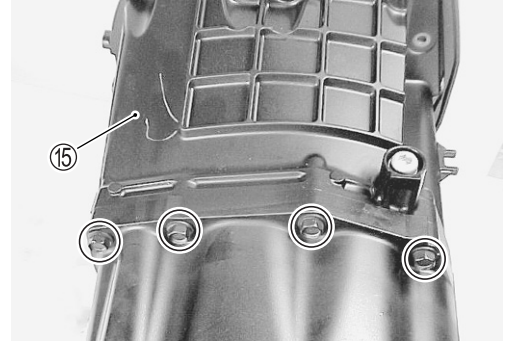
Remove six (6) bolts and water jacket cover ⑫.



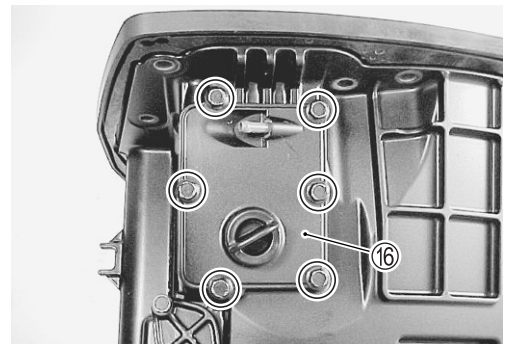
Remove three (3) bolts ⑬ and oil strainer ⑭.



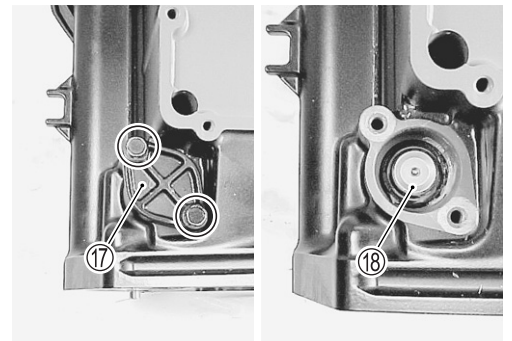
Remove eight (8) bolts, then remove oil pan ⑮.



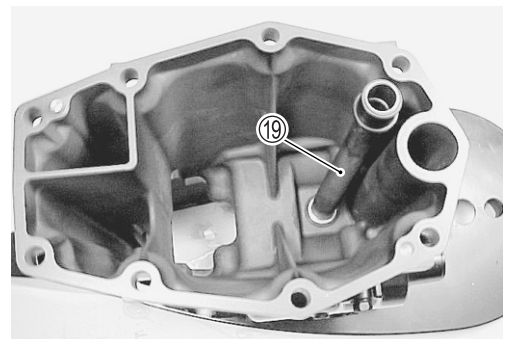
Remove six (6) bolts and oil pan water jacket cover ⑯.



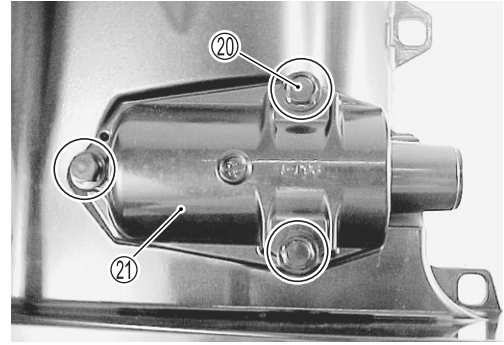
Remove bolts, water pressure valve cover ⑰ and water pressure valve ⑱.



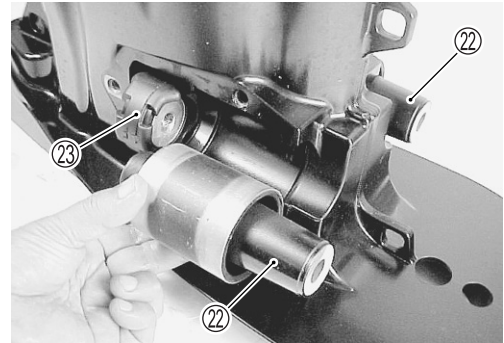
Remove water tube ⑲.



Remove bolts ⑳ and lower mount covers ㉑.



Remove lower mounts ㉒ and lower thrust mount ㉓.



INSPECTION

NOTE:

If any component is found to be excessively worn, cracked, defective or damaged in any way, it must be replaced.


ENGINE HOLDER

- Inspect engine holder. Replace if cracked, damaged, or other abnormal condition.
- Check water passage. If clogged or obstructed, clean water passage.
- Visually check the clutch shaft bearing. Replace if pitted, noisy, rough or other abnormal condition.
- Check clutch shaft oil seal. Replace oil seal if nicked, cut, worn or other abnormal condition.

Replacing bearing and oil seal

1. Loosen and remove clutch shaft plug ①.
Remove clutch shaft ②.
2. Remove circlip ③.


3. Extract oil seal ④ with oil seal remover.

 **09913-50121: Oil seal remover**

CAUTION

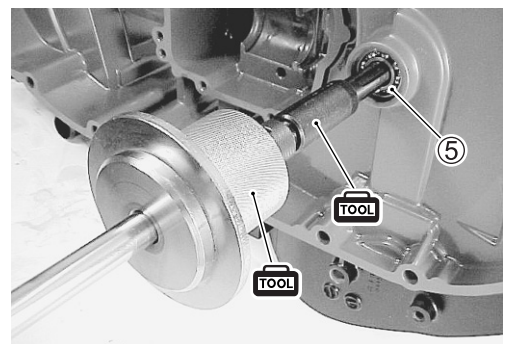
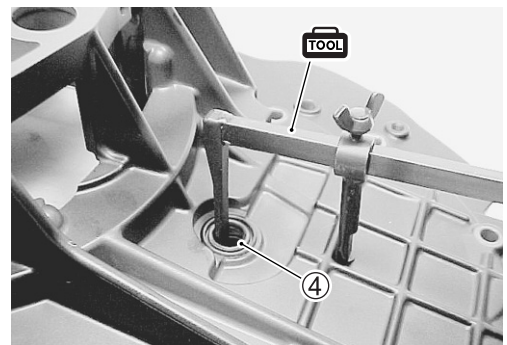
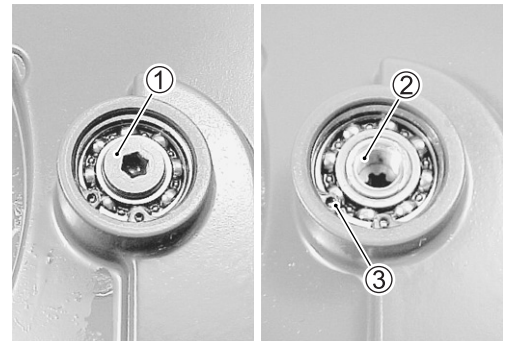
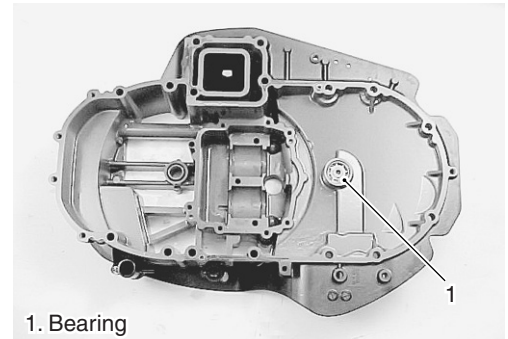
**Do not reuse oil seal once removed.
Always use a new oil seal.**

4. Remove bearing ⑤ with special tool and sliding hammer.

 **09923-73210: Bearing remover**
09930-30104: Sliding hammer

CAUTION

**Do not reuse the bearing once removed.
Always use a new bearing.**

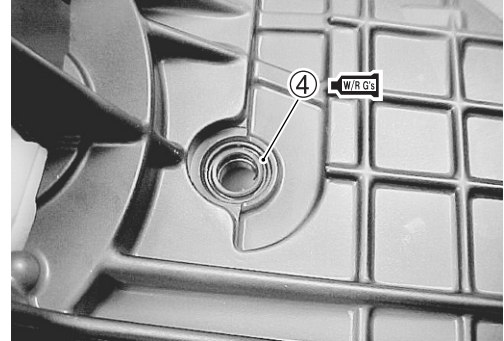


5. Apply engine oil to outer circumference of bearing ⑤.
Install bearing into engine holder.



6. Apply Water Resistant Grease to outer circumference of oil seal ④.
Drive oil seal into engine holder.
The lipped portion of seal must face towards the flywheel.
Apply Water Resistant Grease to the seal lip.

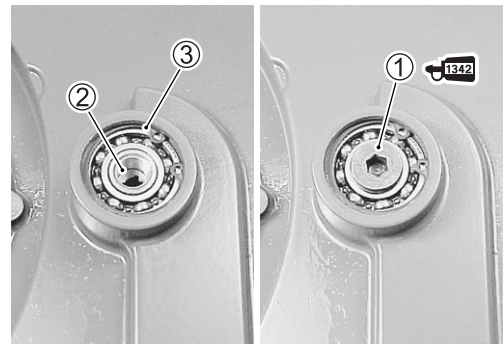
 **99000-25160: SUZUKI WATER RESISTANT GREASE**



7. Install circlip ③.
8. Install clutch shaft ②.
Tighten clutch shaft plug ①, pre-coated with thread lock, to specified torque.

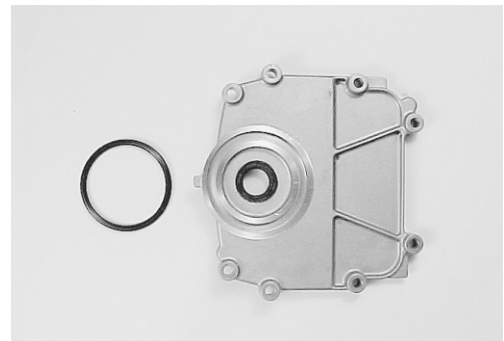
 **99000-32050: THREAD LOCK "1342"**

 **Clutch shaft plug: 85 N·m (8.5 kg·m, 61.5 lb·ft)**



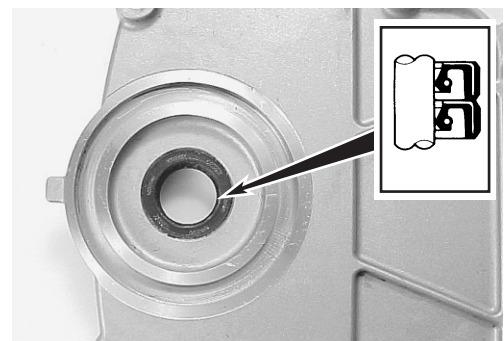
MOUNT-OIL SEAL COVER

- Inspect mount-oil seal cover. Replace if cracked, damaged or other abnormal condition.
- Check condition of O-ring. Replace O-ring if nicked, cut, worn or other abnormal condition.
- Check condition of oil seal. Replace oil seal if nicked, cut, worn or other abnormal condition.



NOTE:

Install oil seal with lip (spring side) facing downward (oil pan side).



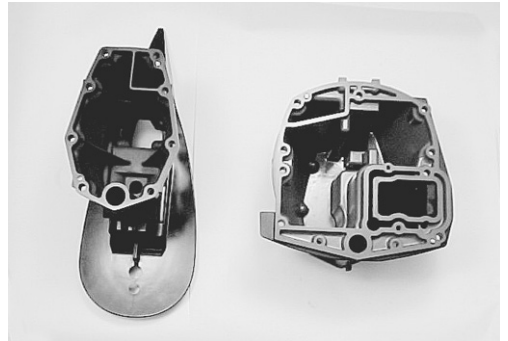
OIL STRAINER

- Inspect oil strainer. Replace if cracked, damaged or other abnormal condition.
If clog or obstruction, clean oil strainer.
- Check condition of O-ring. Replace O-ring if nicked, cut, worn or other abnormal condition.

**OIL PAN/DRIVESHAFT HOUSING**

Check oil pan, driveshaft housing.

If cracks, defects or other damage is found, replace it.

**MOUNT**

- Check upper, lower and thrust mounts.
If excessive wear, corrosion or other damage is found, replace mount.
- Inspect mount cover. Replace if cracked, damaged or other abnormal condition.

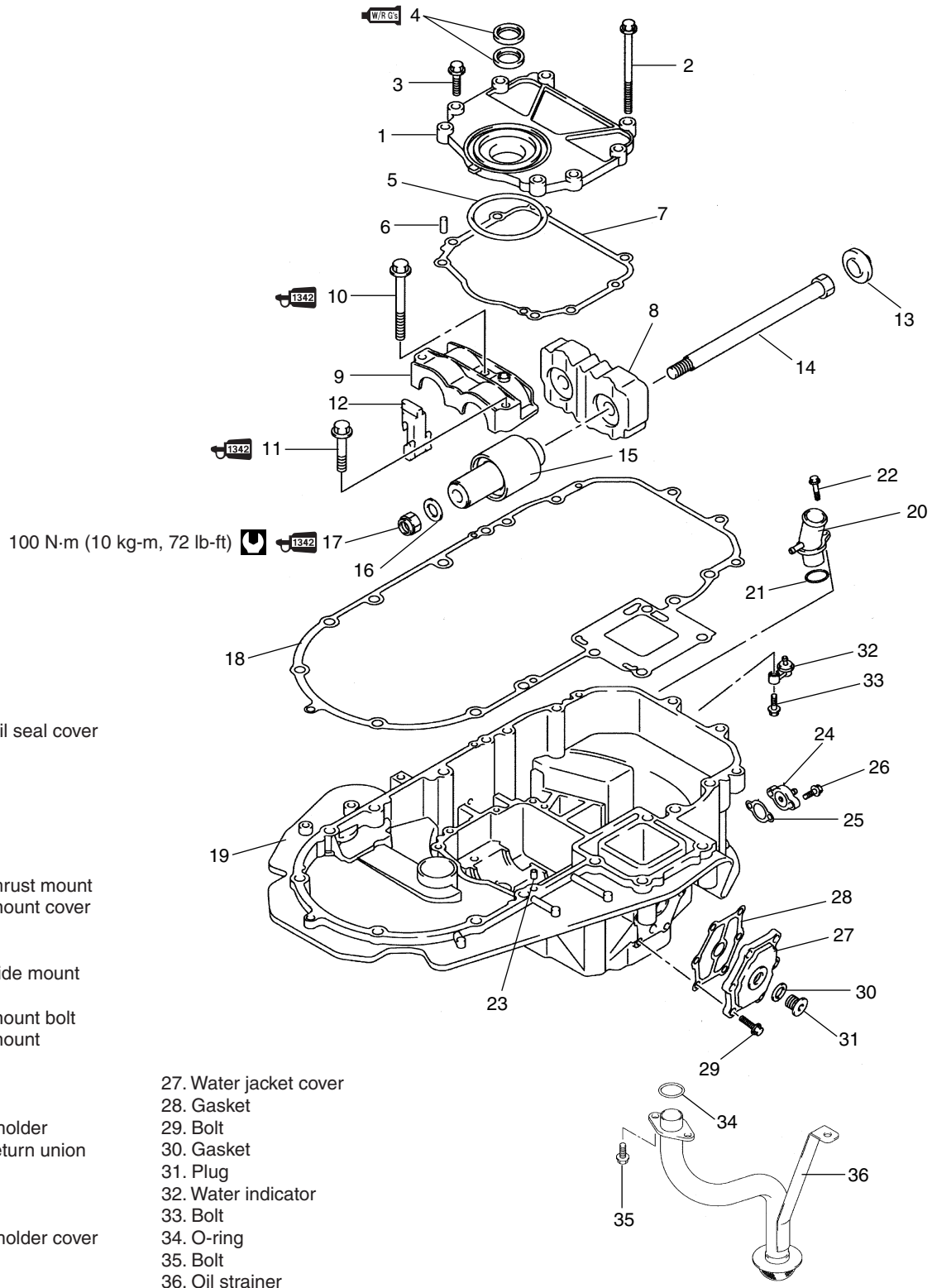
**WATER TUBE**

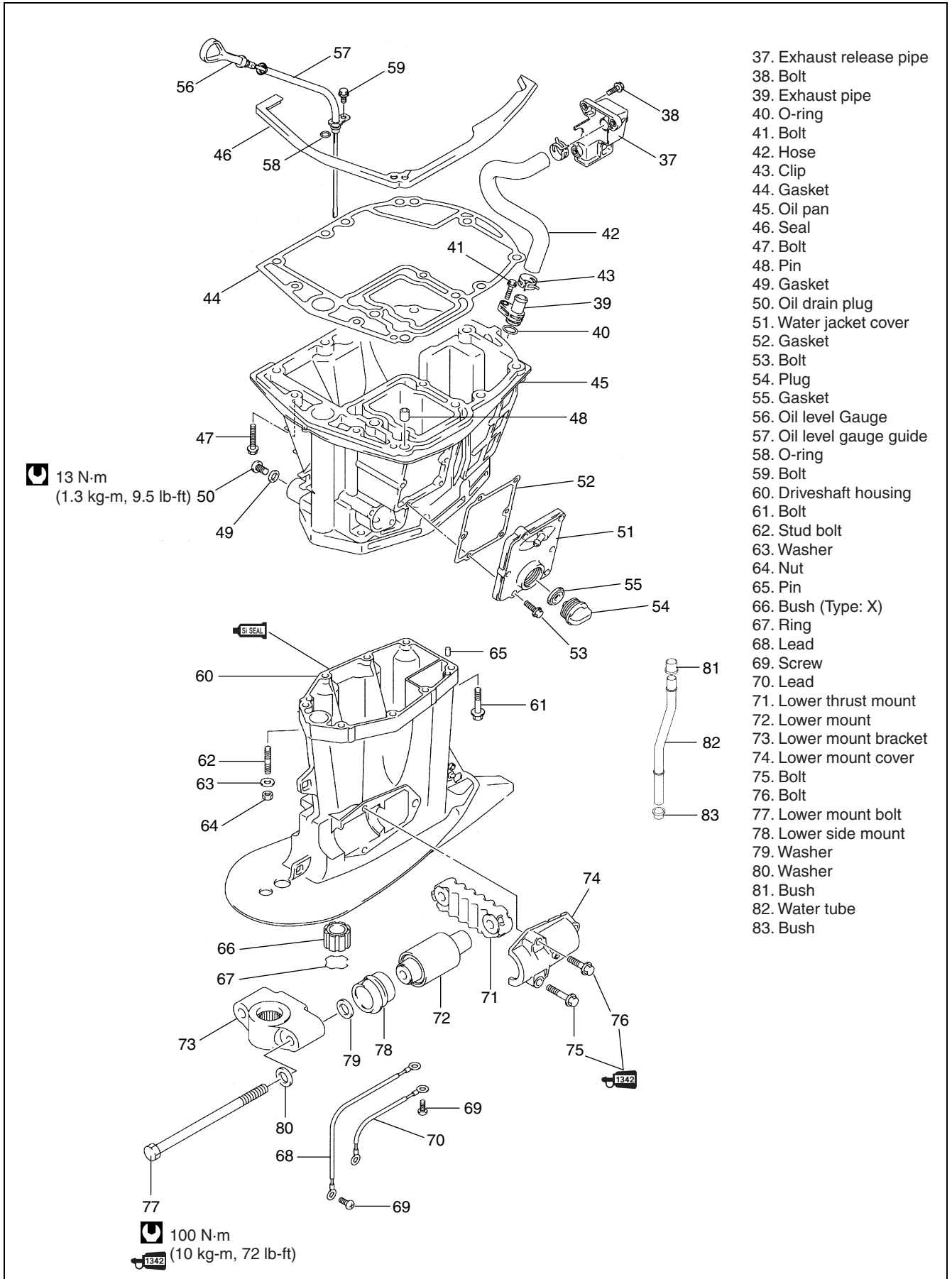
- Check water tube.
If a clog or obstruction is found, clean water tube.
If cracks, corrosion or other damage is found, replace water tube.
- Check water tube grommet.
If excessive wear or other damage is found, replace grommet.




ASSEMBLY


Assembly is reverse order of removal with special attention to the following steps.





- 37. Exhaust release pipe
- 38. Bolt
- 39. Exhaust pipe
- 40. O-ring
- 41. Bolt
- 42. Hose
- 43. Clip
- 44. Gasket
- 45. Oil pan
- 46. Seal
- 47. Bolt
- 48. Pin
- 49. Gasket
- 50. Oil drain plug
- 51. Water jacket cover
- 52. Gasket
- 53. Bolt
- 54. Plug
- 55. Gasket
- 56. Oil level Gauge
- 57. Oil level gauge guide
- 58. O-ring
- 59. Bolt
- 60. Driveshaft housing
- 61. Bolt
- 62. Stud bolt
- 63. Washer
- 64. Nut
- 65. Pin
- 66. Bush (Type: X)
- 67. Ring
- 68. Lead
- 69. Screw
- 70. Lead
- 71. Lower thrust mount
- 72. Lower mount
- 73. Lower mount bracket
- 74. Lower mount cover
- 75. Bolt
- 76. Bolt
- 77. Lower mount bolt
- 78. Lower side mount
- 79. Washer
- 80. Washer
- 81. Bush
- 82. Water tube
- 83. Bush


 13 N·m
(1.3 kg·m, 9.5 lb·ft) 50

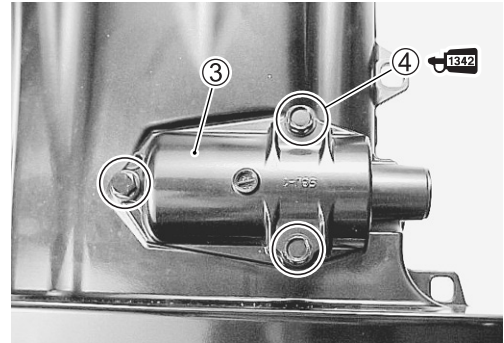
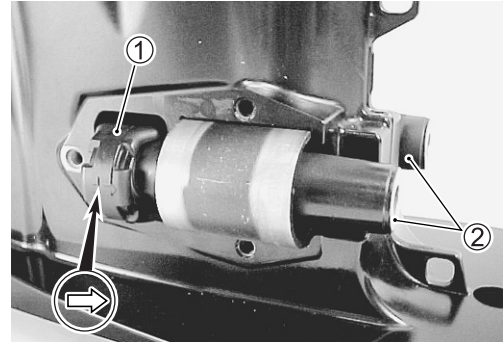
 100 N·m
(10 kg·m, 72 lb·ft) 76

LOWER MOUNT/MOUNT COVER

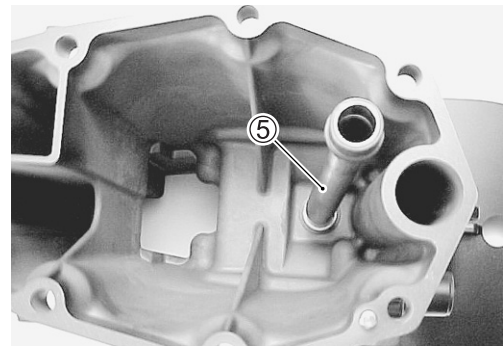
- Install lower thrust mount ① with the arrow mark facing forward.
- Install lower mounts ② and lower mount cover ③.
- Tighten mount cover bolts ④, pre-coated with thread lock, to specified torque.

 **99000-32050: THREAD LOCK "1342"**

 **Lower mount cover bolt: 50 N·m (5.0 kg·m, 36.0 lb·ft)**

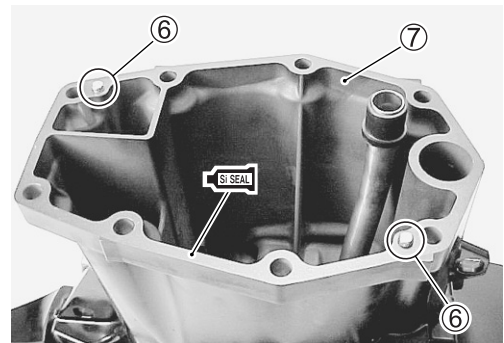
**OIL PAN TO DRIVESHAFT HOUSING**

- Install water tube ⑤.

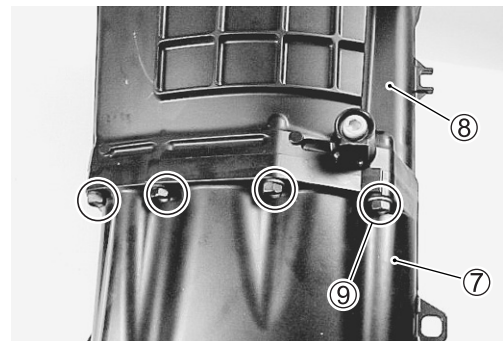


- Install two dowel pins ⑥ to driveshaft housing ⑦.
Apply sealant to mating surfaces of driveshaft housing and oil pan.

 **99000-31120: SUZUKI SILICONE SEAL**

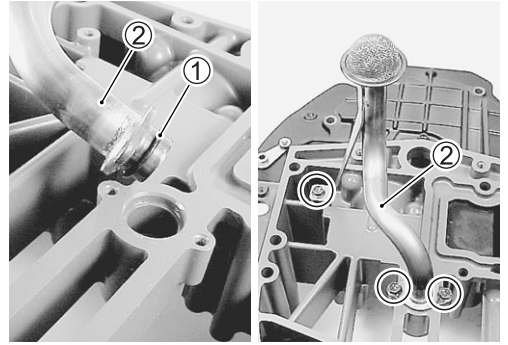


- Install oil pan ⑧ to driveshaft housing ⑦, then tighten eight (8) bolts ⑨ securely.



ENGINE HOLDER TO OIL PAN

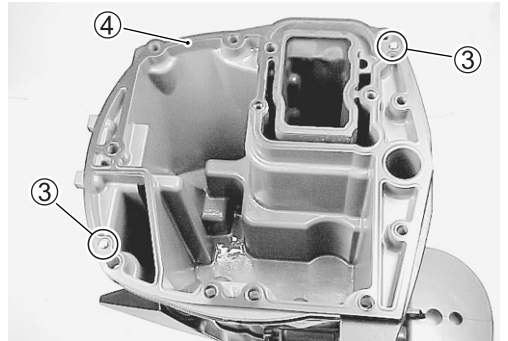
- Apply engine oil to O-ring ①, then install O-ring to oil strainer ②.
- Install oil strainer to engine holder, then tighten bolts securely.



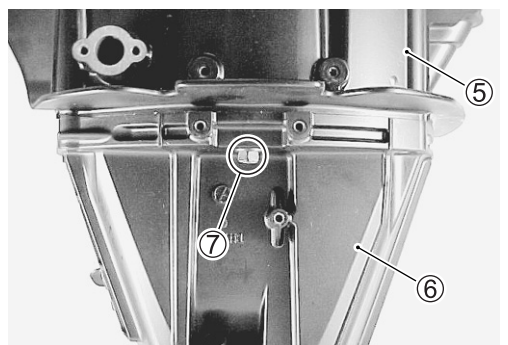
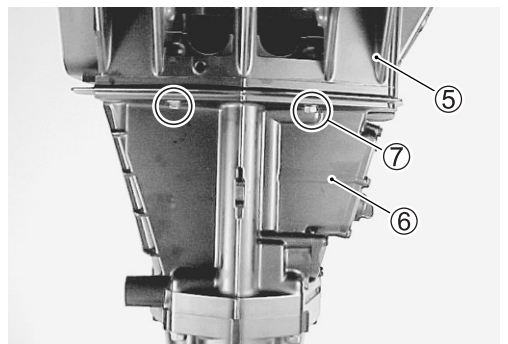
- Install two (2) dowel pins ③ and gasket ④ to oil pan.

CAUTION

Do not re-use gasket. Always assemble with a new gasket.



- Install engine holder ⑤ to oil pan ⑥, then securely tighten it with engine holder bolts ⑦.



UPPER MOUNT AND MOUNT COVER


- Assemble these items in the following sequence:
Place upper thrust mount ③ and upper mounts ② on upper mount bolts ①.
- Install spacer ④ to thrust mount.
- Place upper mount assembly and upper mount cover ⑤ into position.

NOTE:

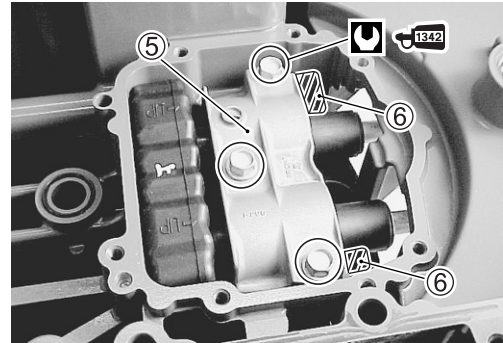
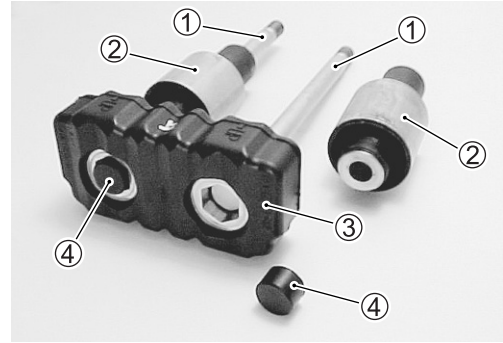
Install upper thrust mount with the lettered mark "UP" facing upward.

- Tighten upper mount cover bolts, pre-coated with thread lock, to specified torque.

 **99000-32050: THREAD LOCK "1342"**

 **Upper mount cover bolt: 50 N·m (5.0 kg·m, 36.0 lb-ft)**

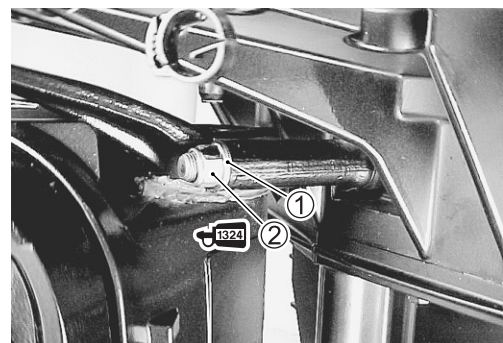
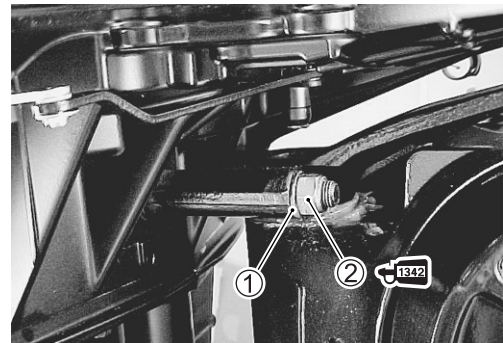
- Install the upper side mounts ⑥.

**DRIVESHAFT HOUSING/OIL PAN**

- Install driveshaft housing/oil pan to steering bracket.
- Install washer ① and upper mount nut ②, then tighten two (2) nuts, pre-coated with thread lock, to specified torque.

 **99000-32050: THREAD LOCK "1342"**

 **Upper mount nut: 100 N·m (10.0 kg·m, 72.3 lb-ft)**

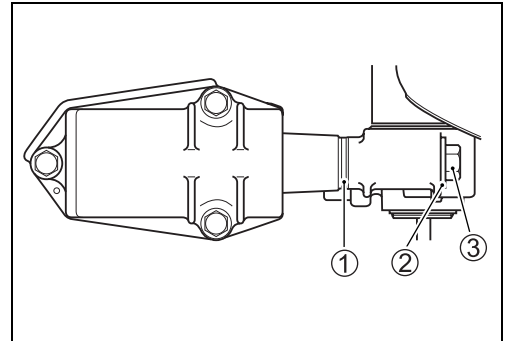
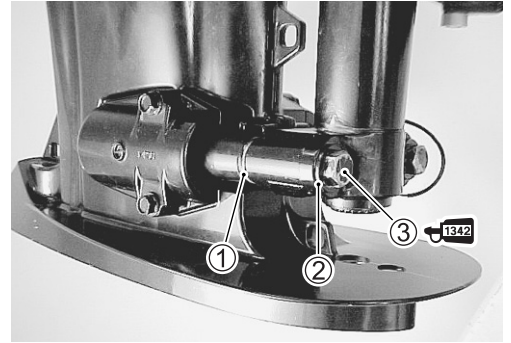


LOWER MOUNT BOLT

- Place washer ① between lower mount and lower mount bracket.
- Install washer ② and lower mount bolt ③, then tighten bolt, pre-coated with thread lock, to specified torque.

 **99000-32050: THREAD LOCK “1342”**

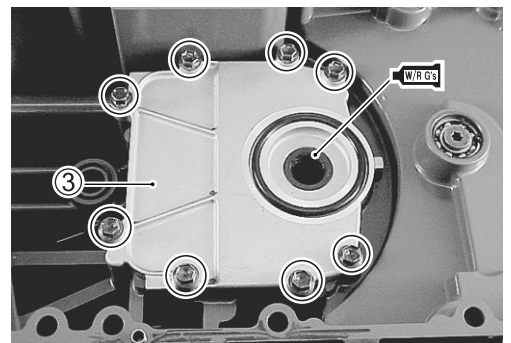
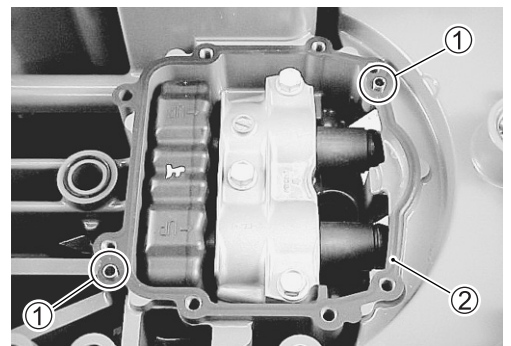
 **Lower mount bolt: 100 N·m (10.0 kg-m, 72.3 lb-ft)**

**MOUNT-OIL SEAL COVER**

- Apply Water Resistant Grease to oil seal.

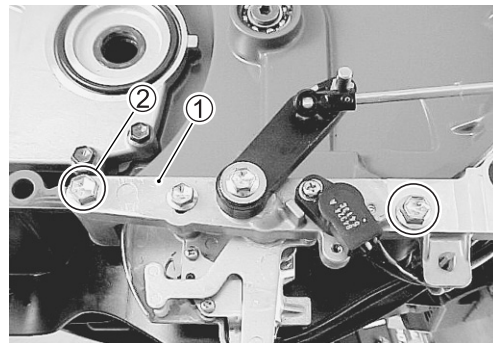
 **99000-25160: SUZUKI WATER RESISTANT GREASE**

- Install dowel pins ①, gasket ② and mount-oil seal cover ③, then tighten eight (8) cover bolts securely.

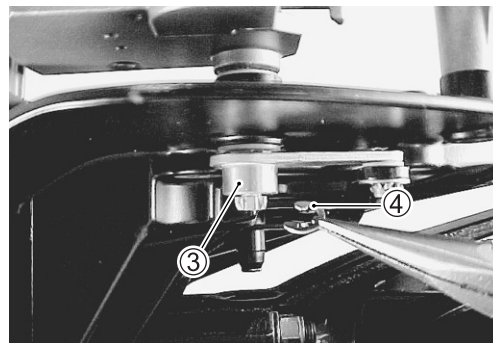


THROTTLE LEVER HOLDER

- Install throttle lever holder ① to engine holder, then tighten two (2) bolts ② securely.



- Install clutch lever shaft arm ③ and E-ring ④.



POWER UNIT

Install power unit. (See page 6-21 to 6-25.)

Tighten power unit mounting bolts and engine holder bolts to specified torque.

Power unit mounting bolt & Engine holder bolt:

8 mm 23 N·m (2.3 kg·m, 16.5 lb-ft)

10 mm 50 N·m (5.0 kg·m, 36.0 lb-ft)

SWIVEL BRACKET, STEERING BRACKET AND CLAMP BRACKET REMOVAL

Remove driveshaft housing/oil pan.

(See page 7-3.)

Remove screw and bonding wire.

Remove circlip ①.

Remove lower mount bracket ②, shims ③ and washer ④ from the steering shaft.

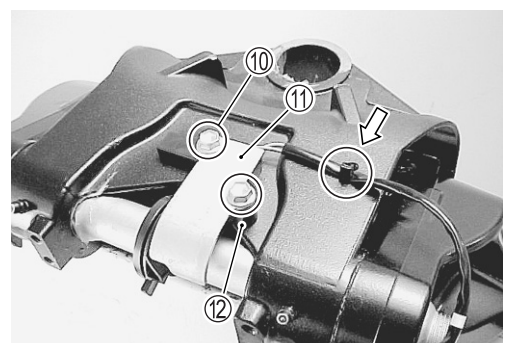
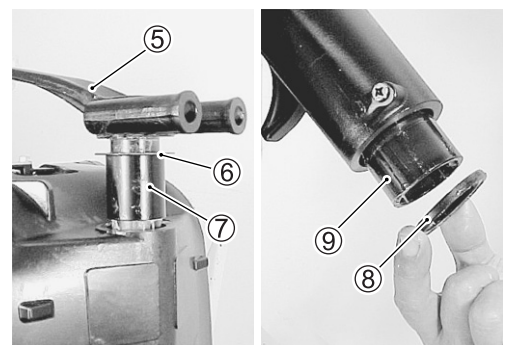
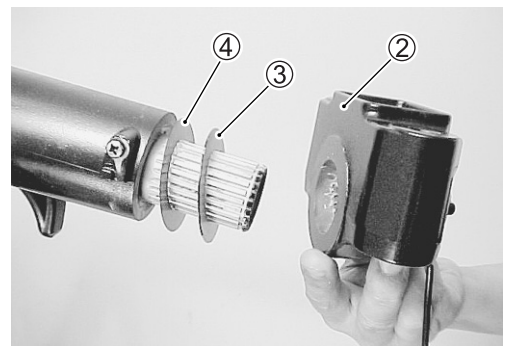
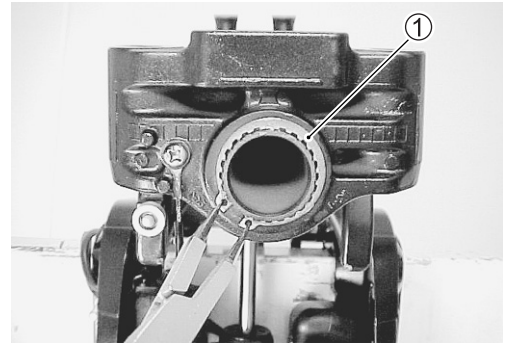
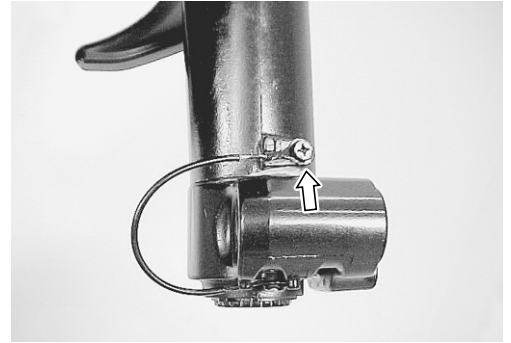
Lift steering bracket ⑤ upward to remove from swivel bracket.

Remove washer ⑥ and upper bushing ⑦.

Remove swivel bracket seal ⑧ and lower bushing ⑨.

Remove two (2) bolts ⑩, switch cover ⑪ and tilt limit switch ⑫.

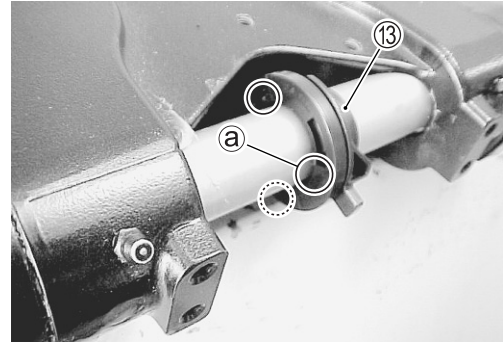
Cut the cable tie securing switch lead wire.



Remove tilt limit switch cam ⑬.

NOTE:

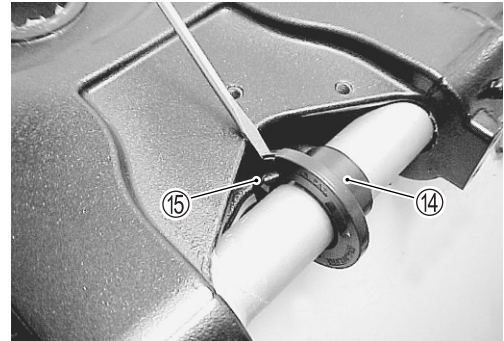
Unfasten three (3) stoppers ① from the tilt limit switch cam to remove it from cam holder.



Remove upper cam holder ⑭ and lower cam holder ⑮ from clamp bracket shaft.

NOTE:

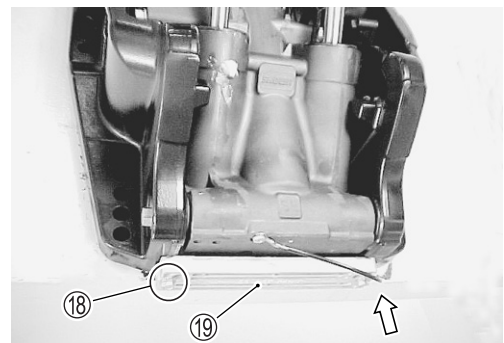
Use thin flat screw-driver to release the two hooks to separate the cam holder upper and lower halves.



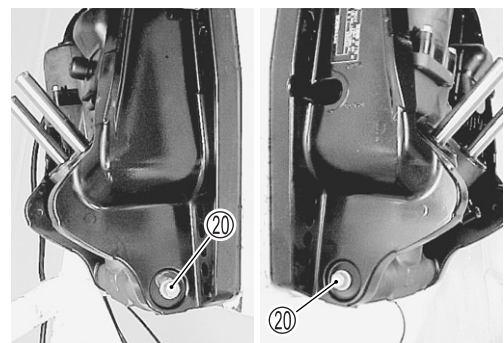
Remove circlip ⑯ and push out tilt cylinder upper rod ⑰.



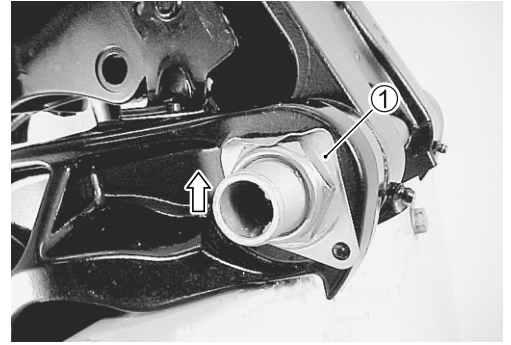
Remove bolts ⑱ and anode ⑲.



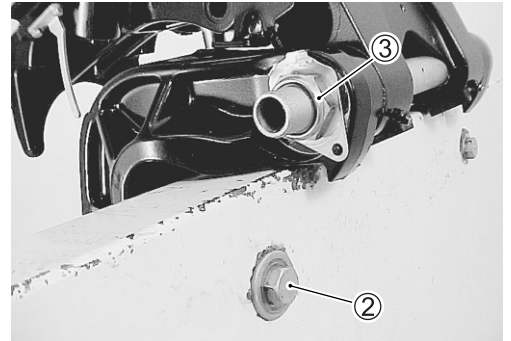
Remove bolts ⑳ securing PTT unit to the STBD and PORT clamp brackets.



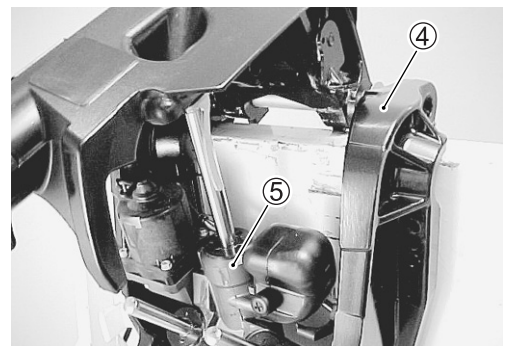
Using flat screw-driver, drive locking edge of lock washer ① to clamp bracket side.



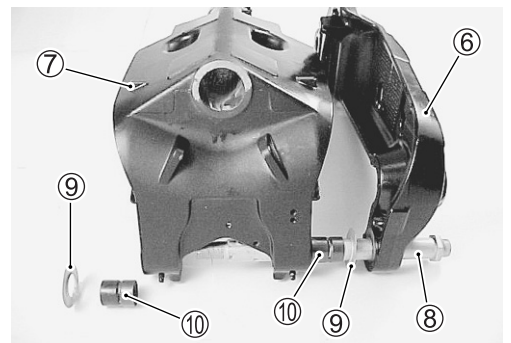
Remove the two STBD motor mounting bolts ②.
Remove the clamp bracket shaft nut ③ and washer.



Slide STBD clamp bracket ④ off clamp bracket shaft, then remove PTT unit ⑤.



Pull PORT clamp bracket ⑥ outward to remove clamp bracket and bracket shaft ⑧ from swivel bracket ⑦.
Remove washer ⑨ and bushing ⑩ from each side of swivel bracket.



INSPECTION

NOTE:

If any component is found to be excessively worn, cracked, defective or damaged in any way, it must be replaced.

BUSHINGS

Check all bushings.

If excessive wear or other damage is found, replace bushing.

If bushing fit is loose when installing, replace bushing.



OIL SEAL

Check swivel bracket seal.

If excessive wear or other damage is found, replace seal.



CLAMP BRACKET SHAFT

Check clamp bracket shaft.

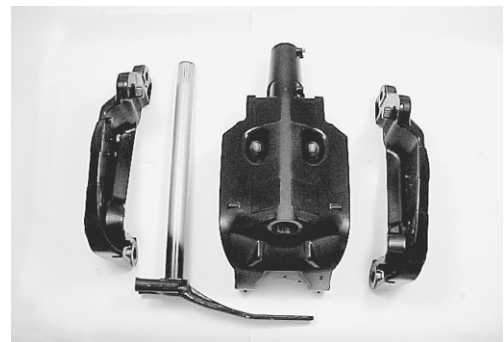
If clamp bracket shaft is bent or twisted, replace shaft.



BRACKET

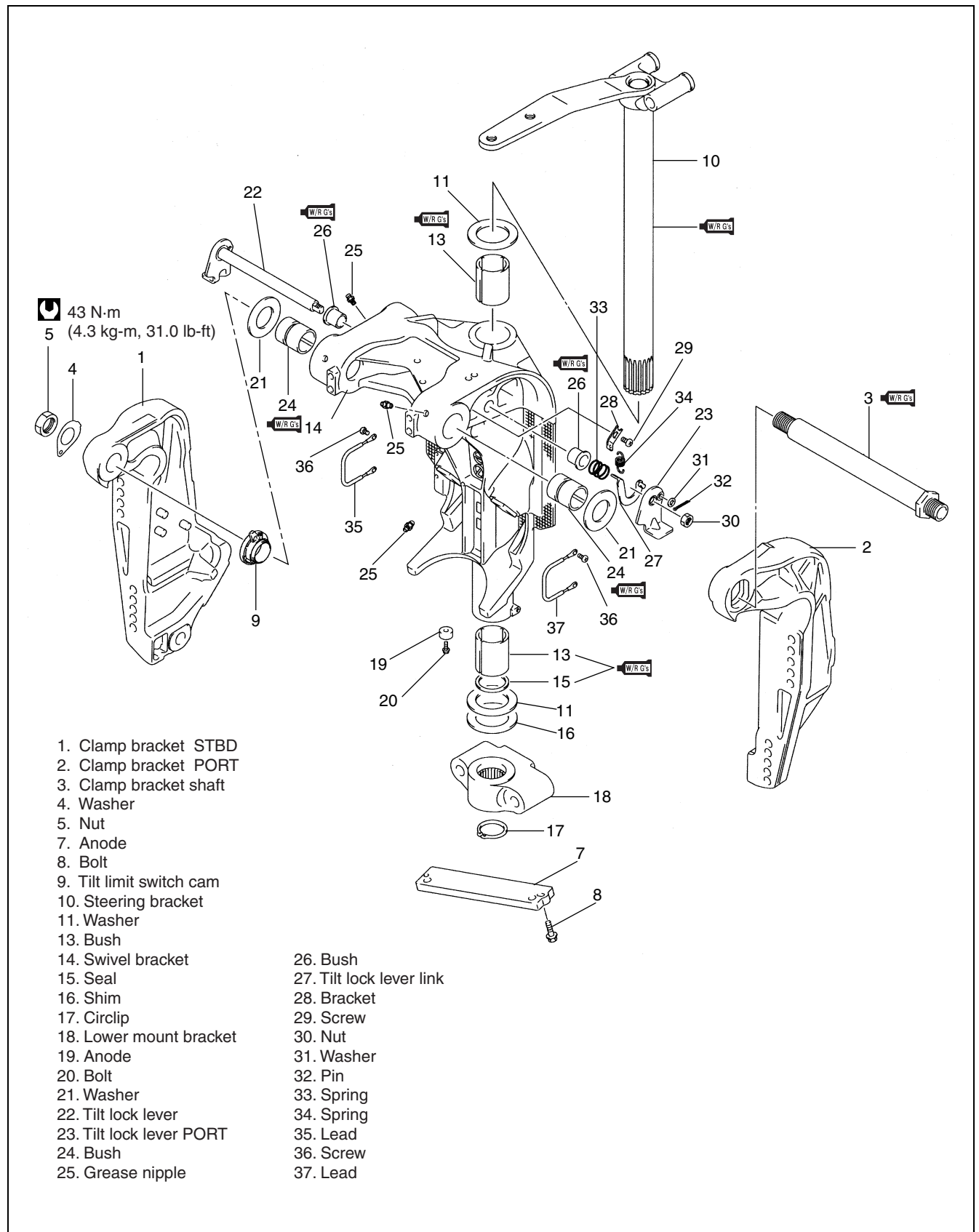
Check clamp brackets, steering bracket and swivel bracket.

If cracks or other damage is found, replace bracket (s).



REASSEMBLY

Reassembly is reverse order of removal with special attention to the following steps.

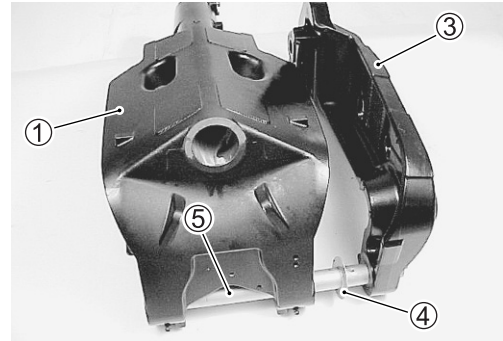
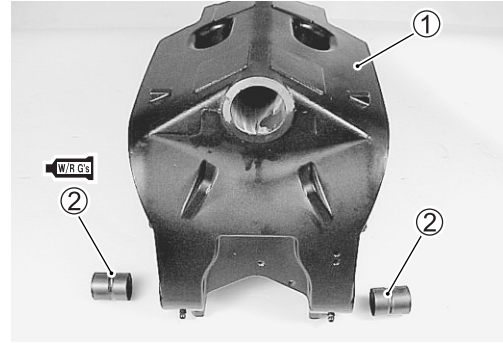


CLAMP BRACKET AND SWIVEL BRACKET**NOTE:**

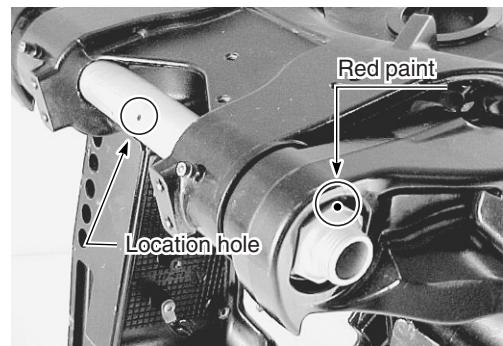
Before installing clamp bracket to swivel bracket, apply grease to clamp bracket shaft and bushings.

 **99000-25160: SUZUKI WATER RESISTANT GREASE**

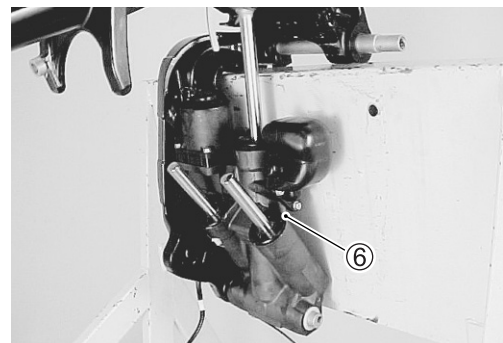
- Insert PORT and STBD bushings ② into the swivel bracket ①.
- Assemble port clamp bracket ③, washer ④, clamp bracket shaft ⑤ and swivel bracket ①.

**NOTE:**


For proper operation of the tilt limit device, install the clamp bracket shaft to the port clamp bracket so the red paint mark on the hex section and the cam holder location hole on the clamp bracket shaft are positioned as shown in the illustration.



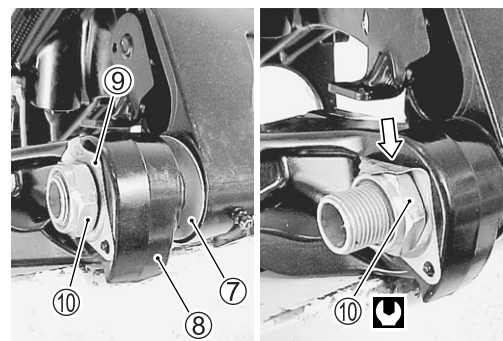
- Install PTT unit assembly ⑥.
(For PTT unit assembly installation, see page 8-17 to 8-18.)



- Install washer ⑦, STBD clamp bracket ⑧, lock washer ⑨ and clamp bracket shaft nut ⑩, then tighten clamp bracket shaft nut to specified torque.


 **Clamp bracket shaft nut: 43 N·m (4.3 kg-m, 31.0 lb-ft)**

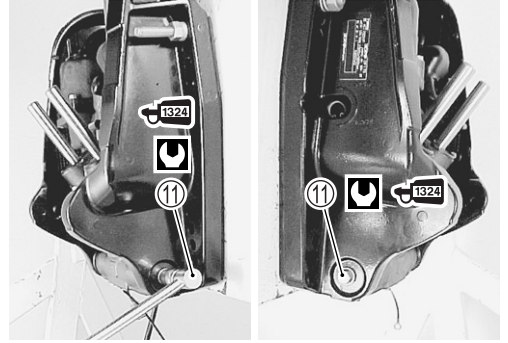
- After tightening clamp bracket shaft nut to specified torque, bend lock washer edge toward nut to secure nut.



- Tighten two (2) PTT unit retaining bolts ⑪, pre-coated with thread lock, to specified torque.

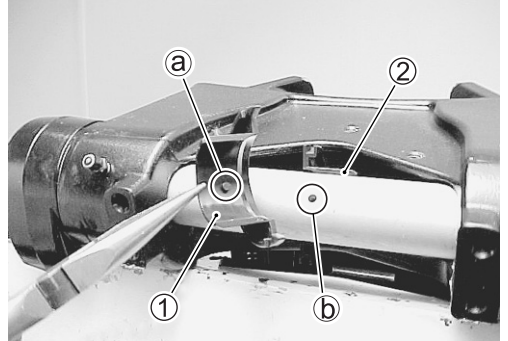
 99000-32050: THREAD LOCK “1342”

 PTT retaining bolt: 50 N-m (5.0 kg-m, 36.0 lb-ft)

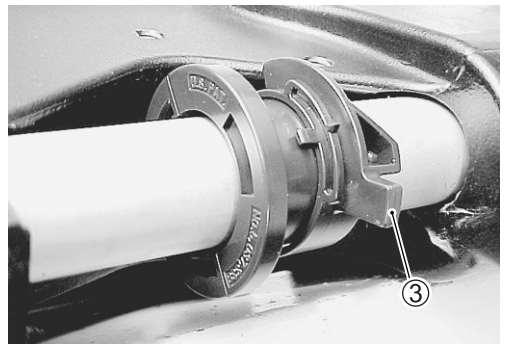


TILT LIMIT DEVICE

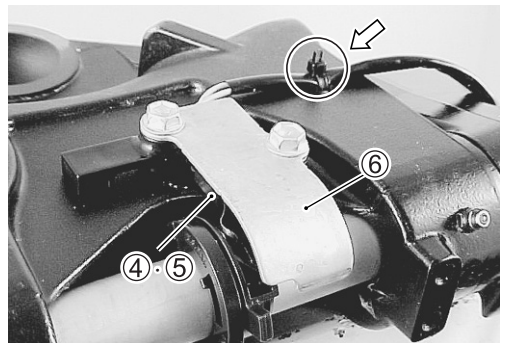
- Install the lower cam holder ① engaging its locating pin **a** with the clamp bracket shaft hole **b**, then install the upper cam holder ②.



- Install tilt limit switch cam ③.



- Install tilt limit switch ④, switch holder ⑤ and switch cover ⑥, then secure with bolts.
- Secure switch lead wire with cable tie.



STEERING BRACKET

- Apply Water Resistant Grease to steering bracket shaft.

W/R G's 99000-25160: SUZUKI WATER RESISTANT GREASE

NOTE:

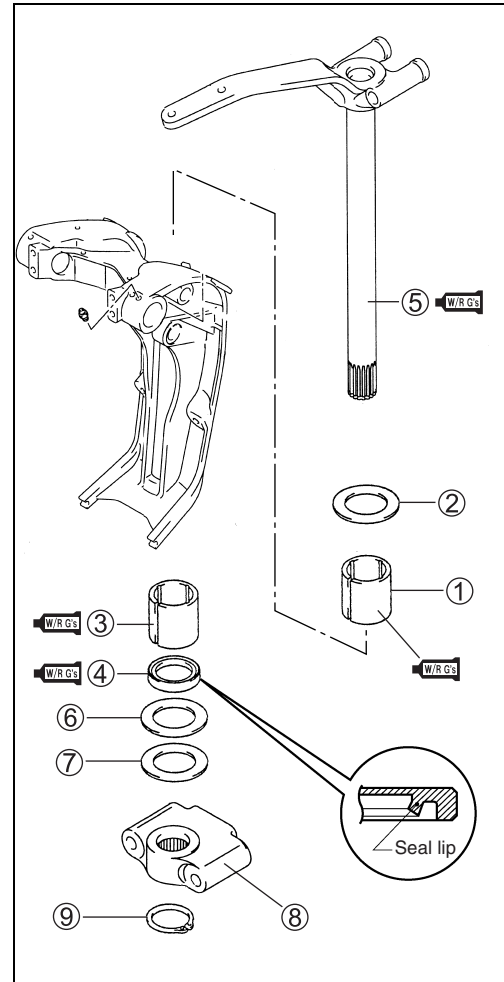
Apply grease to bushings, oil seal lip and pilot shaft portion of steering bracket.

- Install upper bushing ① and washer ② to swivel bracket.
- Install lower bushing ③ and swivel bracket seal ④ to swivel bracket.

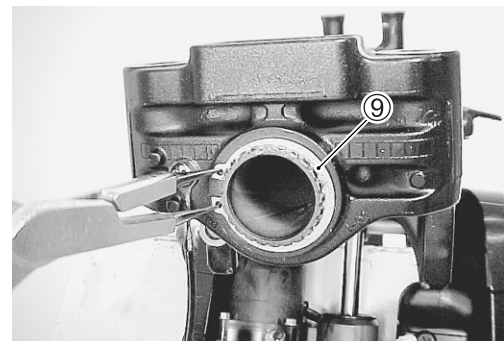
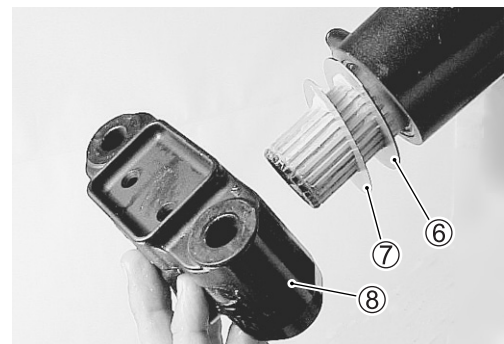
NOTE:

Install seal ④ with lip (spring side) facing downward.

- Install steering bracket ⑤ to swivel bracket.

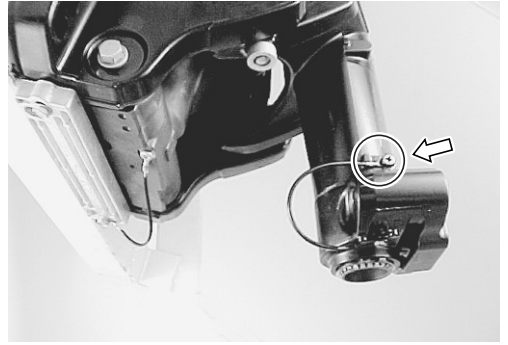
**LOWER MOUNT BRACKET**

- Install washer ⑥ and shim ⑦, and then slide the lower mount bracket ⑧ upward on the splines until it contacts the shim.
- Install circlip ⑨ to retain bracket.



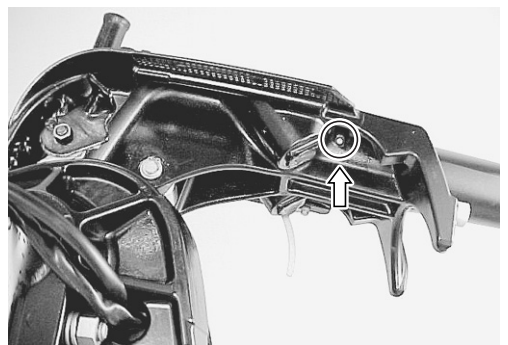
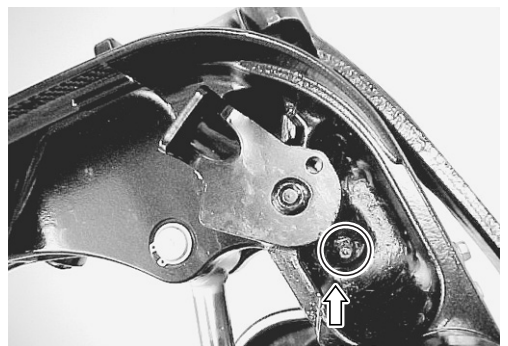
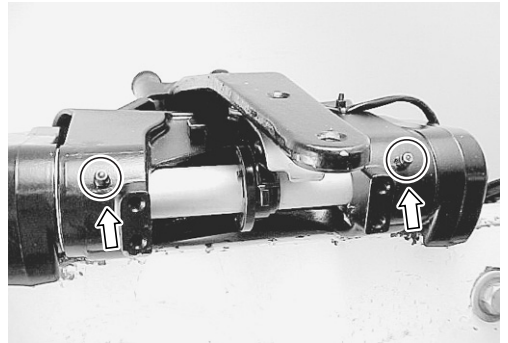
BONDING WIRE

Reattach bonding wire to swivel bracket and tighten screw securely.

**LUBRICATION**

After completing reassembly of the mid unit, apply grease through each grease nipple.

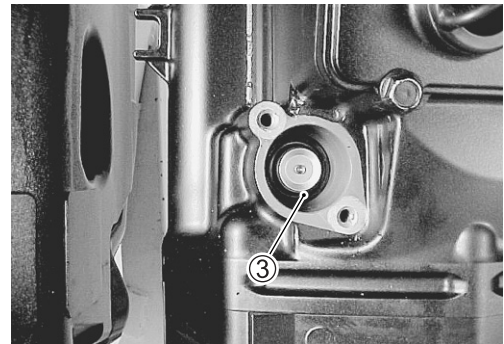
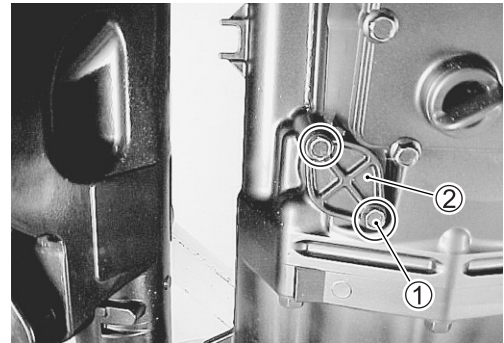
 99000-25160: SUZUKI WATER RESISTANT GREASE



WATER PRESSURE VALVE

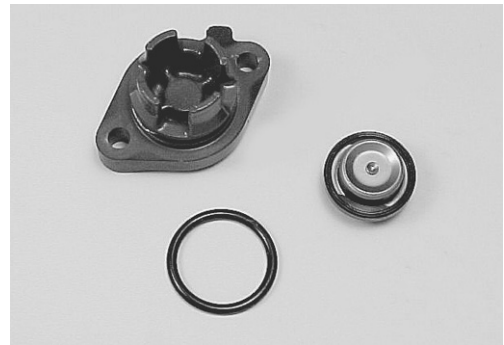
REMOVAL

- Remove oil pan cover. (See page 7-2.)
- Remove two bolts ①, pressure valve cover ② and water pressure valve ③.



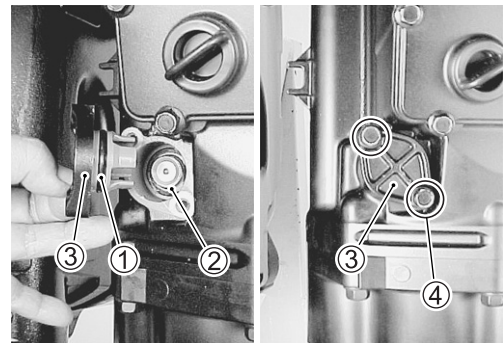
INSPECTION

- If salt deposits, corrosion, wear or other damage is found, clean or replace.
- Inspect O-ring. Replace if nicked, cut or torn.



INSTALLATION

- Install O-ring ① to pressure valve cover.
- Install pressure valve ② and pressure valve cover ③ to oil pan and secure with bolts ④.

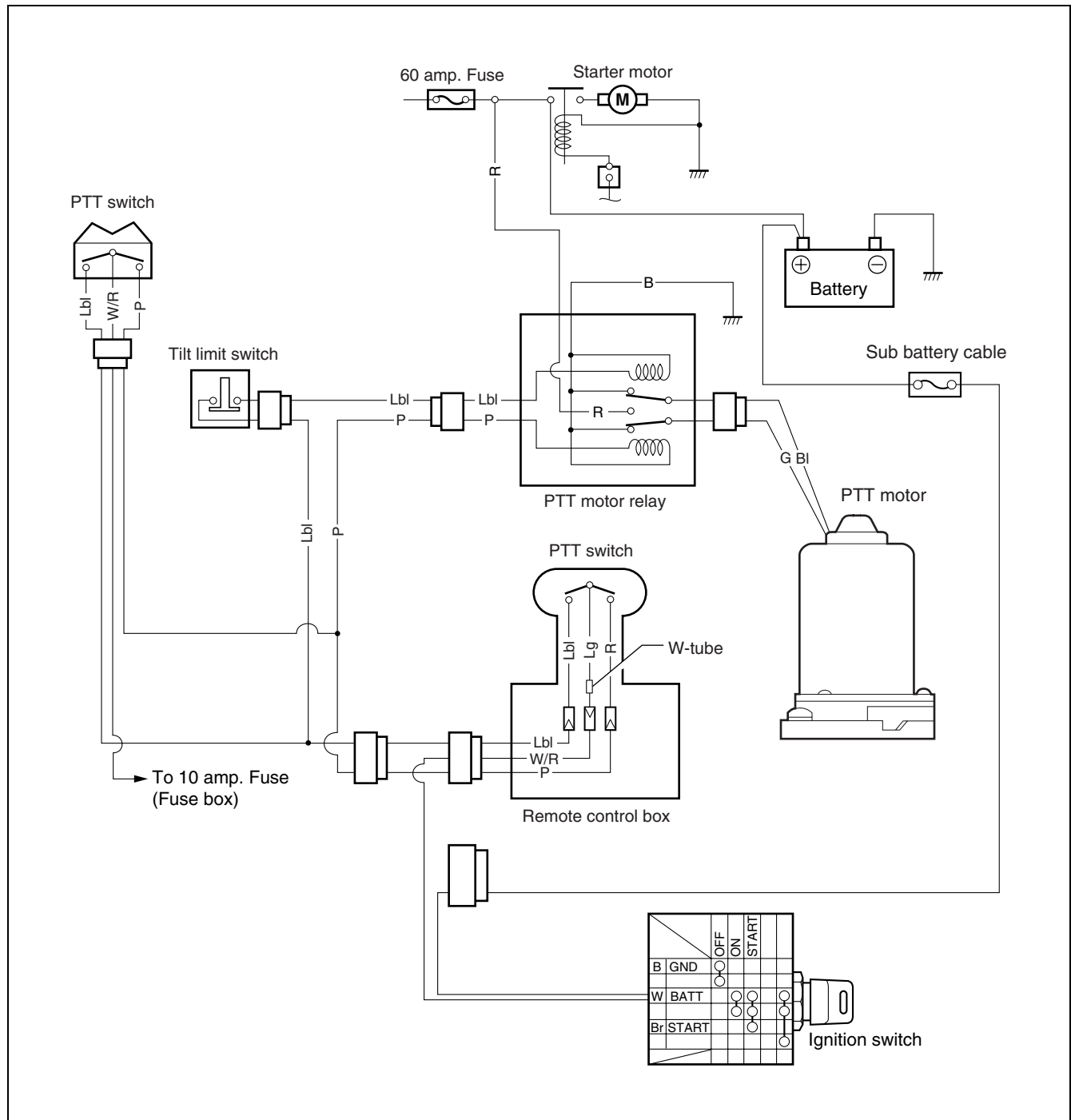


POWER TRIM AND TILT

CONTENTS

SYSTEM WIRING DIAGRAM	8- 2
SERVICE PROCEDURE	8- 3
OIL LEVEL	8- 3
AIR BLEEDING	8- 3
POWER TRIM AND TILT UNIT	8- 4
REMOVAL	8- 4
DISASSEMBLY	8- 6
CLEANING AND INSPECTING	8- 9
REASSEMBLY	8-10
PTT MOTOR	8-13
INSTALLATION	8-17
PTT MOTOR RELAY	8-19
PTT SWITCH	8-20
TILT LIMIT SWITCH	8-20
OPERATION	8-21
COMPONENT PARTS	8-21
PRINCIPLES OF OPERATION	8-21

SYSTEM WIRING DIAGRAM



SERVICE PROCEDURE

OIL LEVEL

To check the PTT oil level:

1. Raised the engine to a full-tilt position.
2. Lower the manual tilt lock lever ①.
3. Remove the oil filler plug ②.
4. If oil can be seen at filler plug level, the unit is full.
5. If oil level is low, refill with the recommended oil.

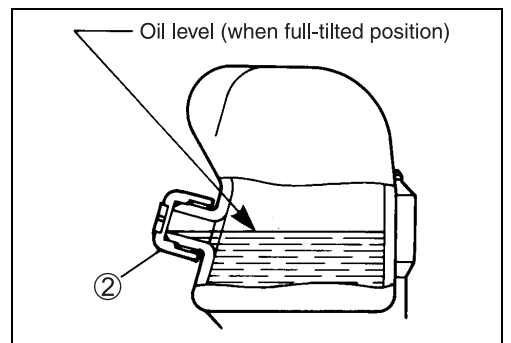
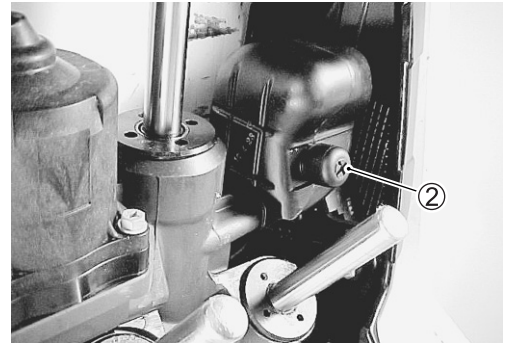
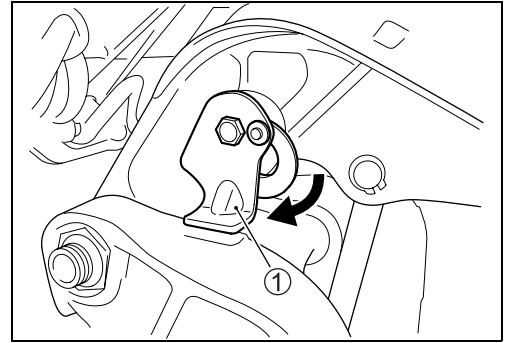
Recommended oil:

Dexron III automatic transmission fluid or equivalent

CAUTION

To ensure consistent pump operation, do not mix different types of oil.

6. Reinstall oil filler plug.



AIR BLEEDING

1. Check that the manual release valve is tightened to the specified torque.

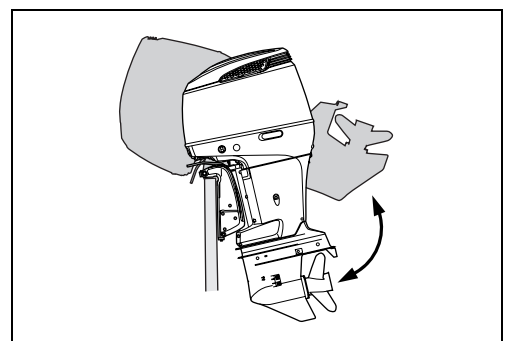
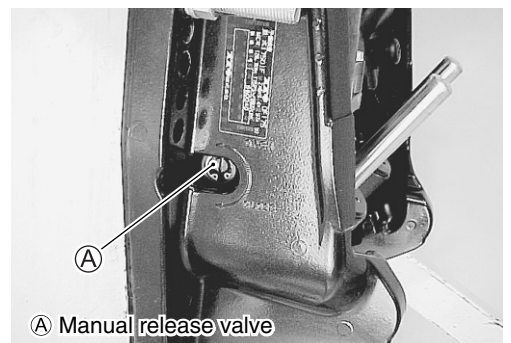
Manual release valve: 3.5 N-m (0.36 kg-m, 2.6 lb-ft)

CAUTION

Do not over-tighten manual release valve.

Counterclockwise = Open
Clockwise = Close

2. Operate the PTT switch, raising and lowering the motor up and down (full tilt position to full trim down position) 4 to 5 times.
3. Check oil level, topping off if necessary.
4. Reinstall oil filler plug.



POWER TRIM AND TILT UNIT

REMOVAL

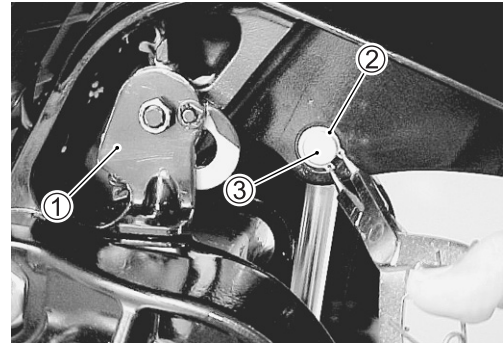
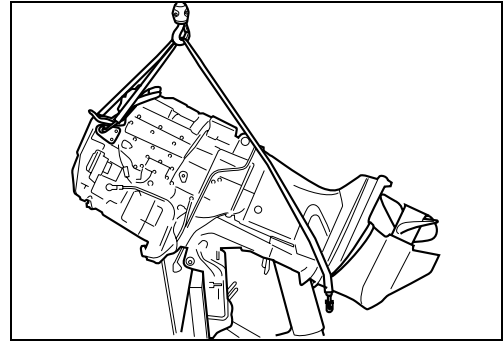
Remove side cover. (See page 7-2.)

Raise the engine to the full tilt position and lower the manual tilt lock levers ①.

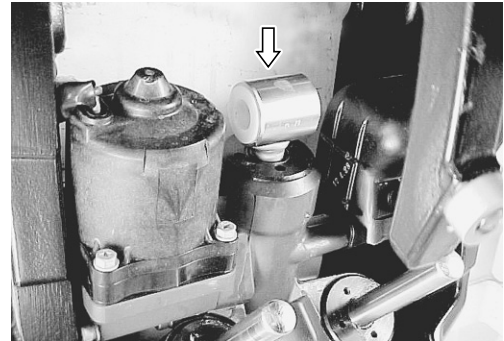
⚠ WARNING

During the following procedures, the engine must be firmly secured and its weight fully supported. (See right.)

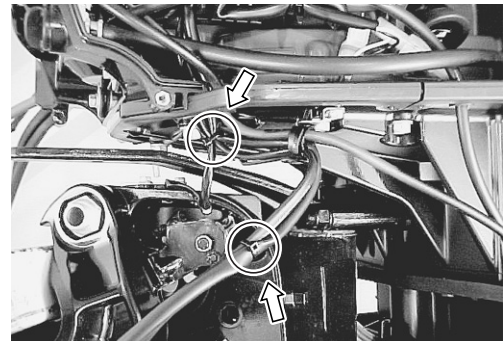
Remove the tilt rod snap ring ② and push tilt cylinder upper shaft pin ③ out.



Lower tilt rod to full down position and disconnect the battery cable.

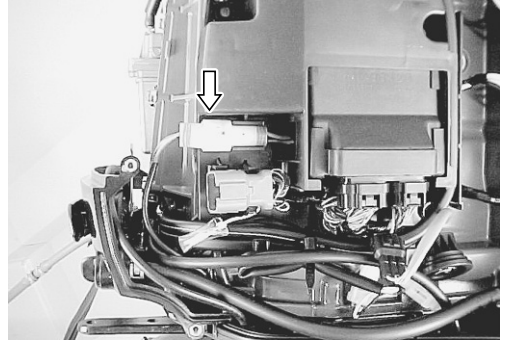


Cut the cable ties binding PTT motor cable and trim sender lead wire.



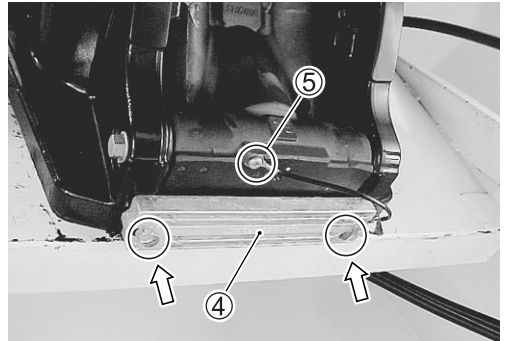
Disconnect the PTT motor cable wire connector from the PTT relay.

Remove the PTT motor cable from engine lower cover.

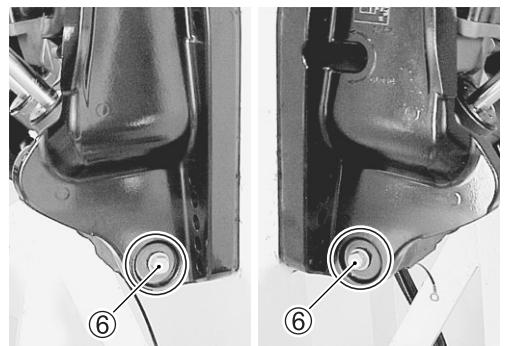


Remove two (2) bolts and anode (4).

Remove the screw (5) securing bonding wire.



Remove the two (2) bolts (6) securing PTT cylinder lower shaft to STBD/PORT clamp bracket.



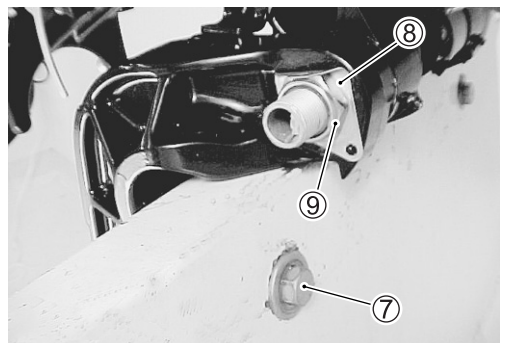
Remove two STBD motor mounting bolts (7).

Using flat screw driver, drive locking edge of lock washer (8) to clamp bracket side.

Loosen the clamp bracket shaft nut (9).

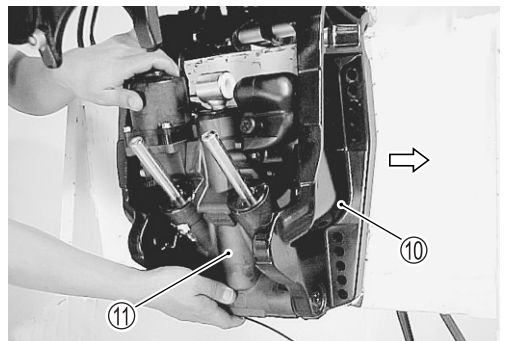
NOTE:

Complete removal of the clamp bracket shaft nut is not required. Nut should be loosened as far as the end of the shaft threads only to facilitate removal of the PTT unit.



Slide the STBD clamp bracket (10) fully outward to the right hand side.

Remove the PTT unit (11) from between the clamp brackets.



DISASSEMBLY

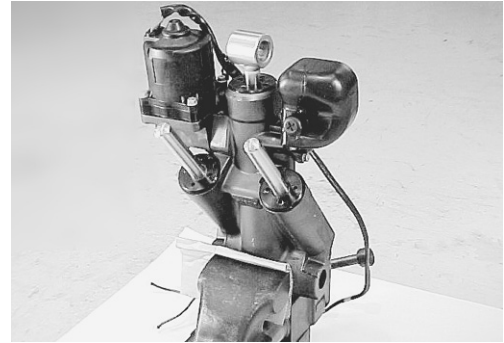
NOTE:

Before disassembly, wash the PTT body with a stiff bristle brush and hot, soapy water to remove sand or dirt and dry the PTT body with compressed air.

Place the lower of the PTT unit in a vise. Tighten the vise only enough to secure the PTT unit, DO NOT OVER TIGHTEN.

NOTE:

To prevent damage to the PTT cylinder use wood blocks, vise jaw protectors, etc., between the vise jaws and PTT components before tightening vise.

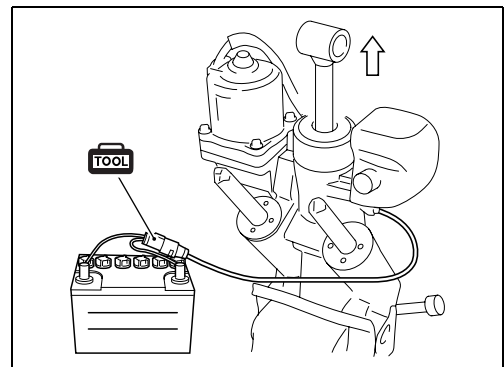


Connect the PTT cable extension to PTT motor cable connector.

09945-79310: PTT cable extension

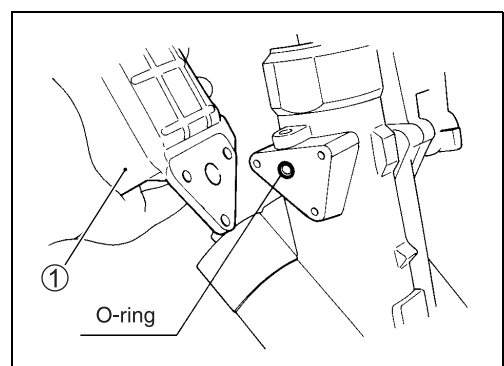
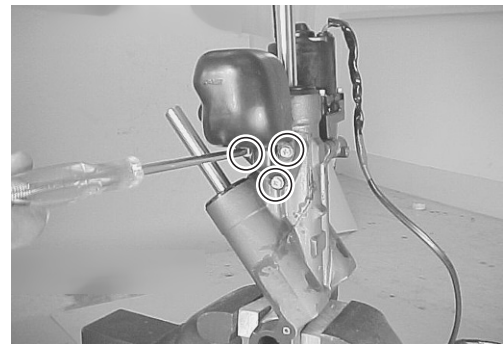
Connect the PTT cable extension leads (G, Bl) to battery and operate PTT motor until tilt piston rod is at maximum stroke. (full-tilt up position)

Unscrew the filler plug and drain PTT oil into suitable container.

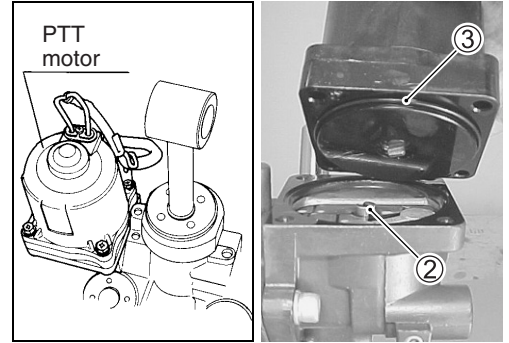


Remove the three (3) screws securing reservoir ①, then detach the reservoir from cylinder body.

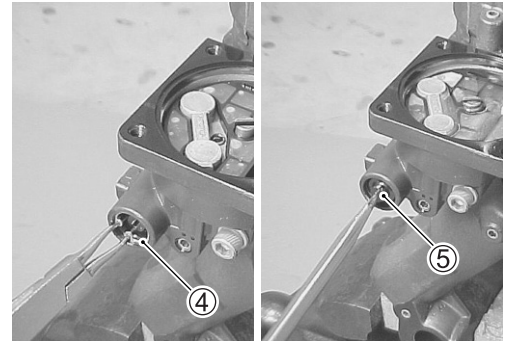
Note the position of O-ring and remove it.



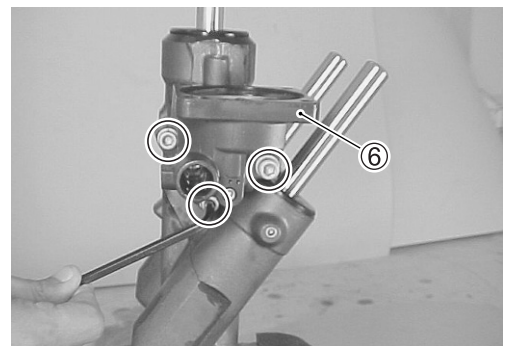
Remove the PTT motor assembly. (See page 8-13.)
 Note the position of drive joint ② and O-ring ③, before removing them.



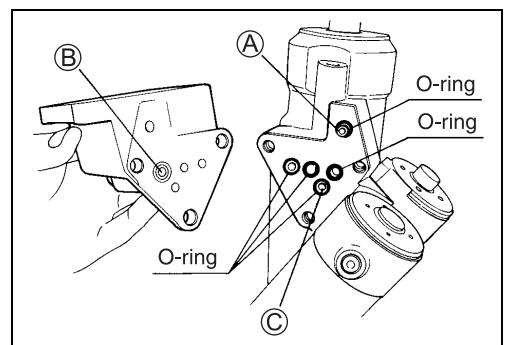
Remove the manual release valve snap ring ④, then unscrew the manual release valve ⑤.



Remove the three (3) screws securing the PTT pump case ⑥, then detach the PTT pump case from PTT cylinder body. Note the position of O-rings and orifices collars, before removing them.

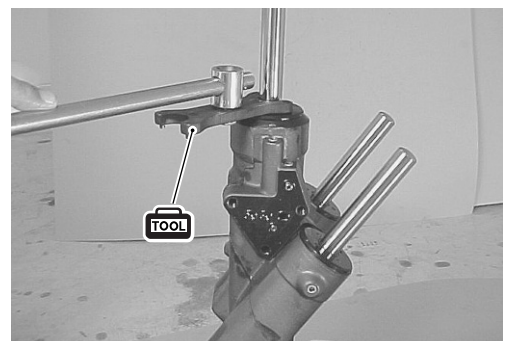


- Ⓐ: Orifice collar (with ball valve)
- Ⓑ: Orifice collar (with filter and ball valve)
- Ⓒ: Orifice collar

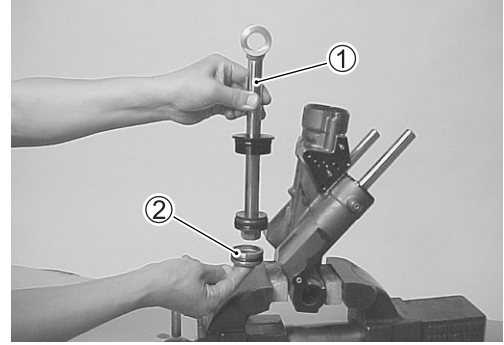


Using special tool, unscrew the PTT cylinder head.

 **09944-09420: PTT cylinder cap tool**

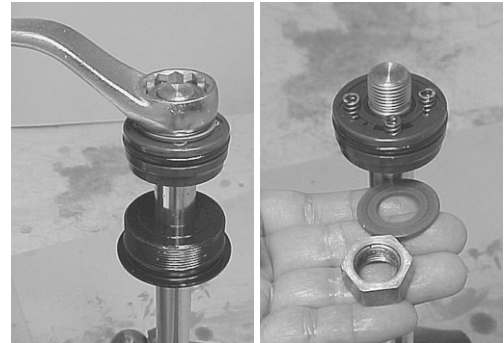


Pull the tilt rod/piston assembly ① out of the cylinder body.
Remove the free piston ② from the cylinder body.

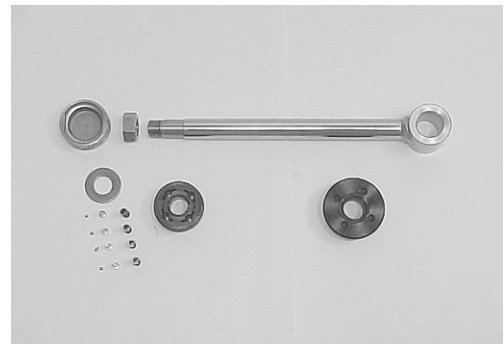


Disassembly of tilt rod/piston assembly

Unscrew the piston retaining nut from the bottom of the tilt rod and remove the washer.
Carefully retain and account for four shock valves, each composed of spring, rod and ball.



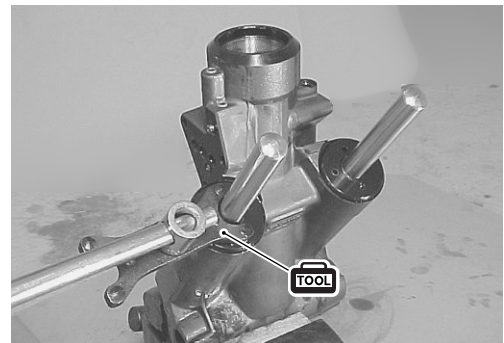
Remove the piston assembly and PTT cylinder head from the tilt rod by sliding them down and off the rod end.



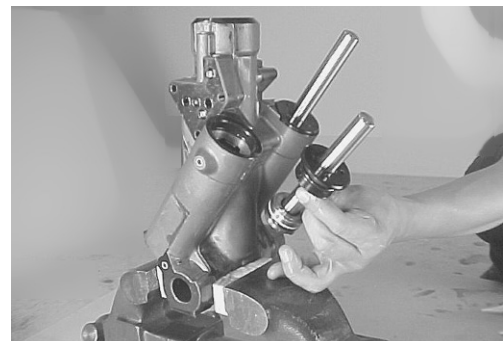
Disassembly of trim rod/piston assembly

Using special tool, unscrew the trim cylinder head.

 09944-09420: PTT cylinder cap tool



Pull the trim rod/piston assembly out of the trim cylinder.



CLEANING AND INSPECTING

Thoroughly wash all metal components with cleaning solvent and dry them with compressed air.

Arrange all components on a clean sheet of paper.

NOTE:

Do not lay PTT components out on a rag, as dirt or lint may be transferred to these items which may cause possible system operating problems.

Inspect tilt rod and trim rod, replace if damaged or bent.

Inspect the surface of tilt rod and trim rod for scores, grooves or roughness.

Slight roughness may be removed with fine emery paper.

A badly scored or grooved rod must be replaced.

Inspect the PTT cap seal and O-ring.

Replace if cuts, nicks, or excessive wear is found.

NOTE:

It is recommended that the O-ring always be replaced once the tilt/trim cylinder has been disassembled.

Inspect the shock valves (spring, rod and ball).

Replace if there are any signs of rust or pitting.

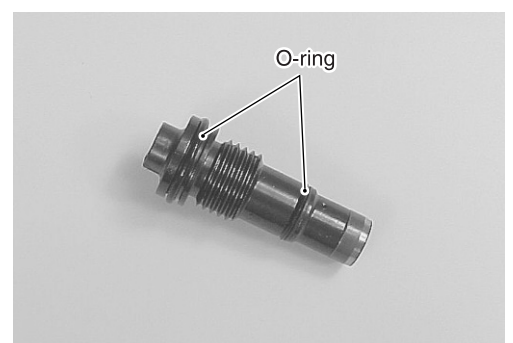
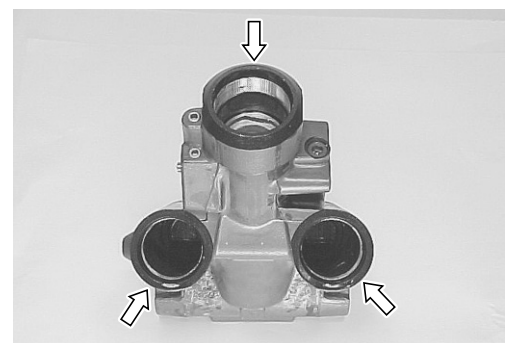
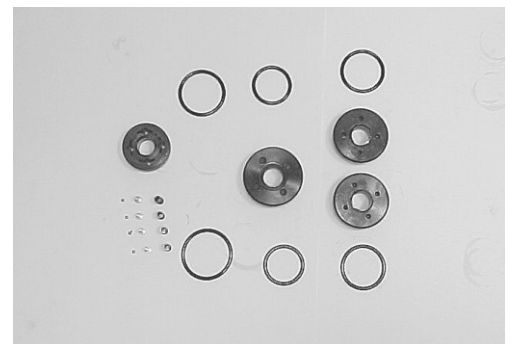
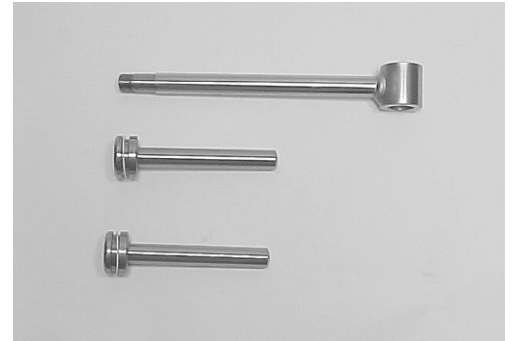
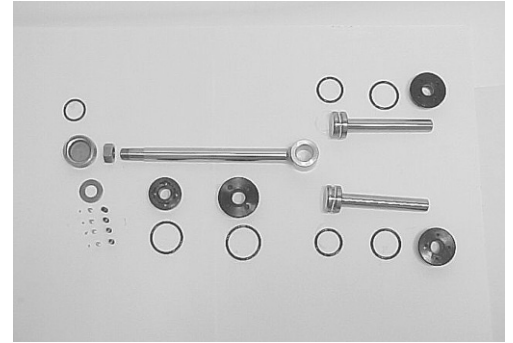
Inspect the cylinder bore for evidence of a rough or grooved surface.

Light honing may rectify slight surface roughness or scarring, but a deeply scarred surface will require replacement of the tilt cylinder.

Inspect manual release valve for damage.

Inspect manual release valve O-ring.

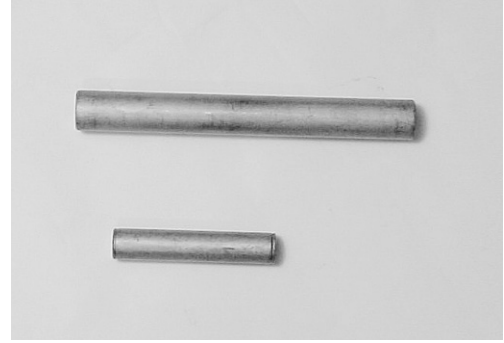
Replace if nicked or cut.



Inspect lower rod.

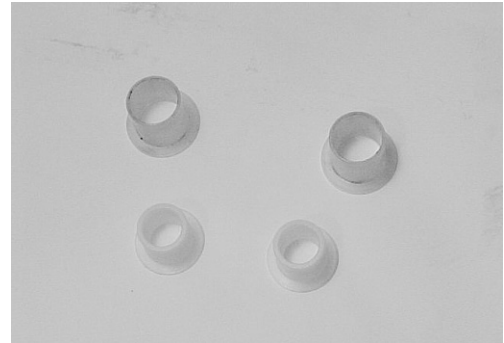
If bending, cracks, corrosion or other damage is found, replace lower rod.

Inspect upper shaft for bent, twist or other damage. Replace if necessary.



Inspect all bushings for excessive wear or other damage. Replace if necessary.

If bushing fit is loose when installing, replace bushing.



REASSEMBLY

Assembly is reverse order of disassembly with special attention to following steps.

CAUTION

- Do not reuse O-rings after removal, always use new O-rings.
- Lubricate all components and O-rings with PTT fluid before assembly.
- Do not reuse PTT fluid, always refill with new fluid.

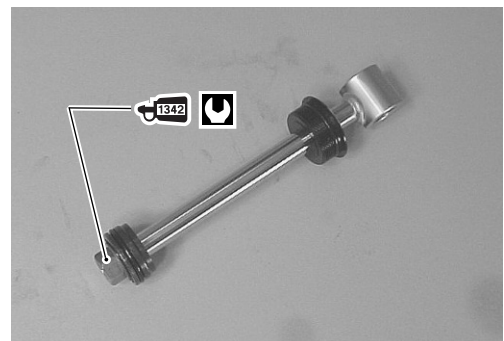
TILT ROD

When tightening the piston retaining nut on the tilt rod piston, apply THREAD LOCK “1342” to the threads.

Tighten the nut to specified torque.

 **1342** 99000-32050: THREAD LOCK “1342”

 **Piston retaining nut: 100 N-m (10 kg-m, 72 lb-ft)**



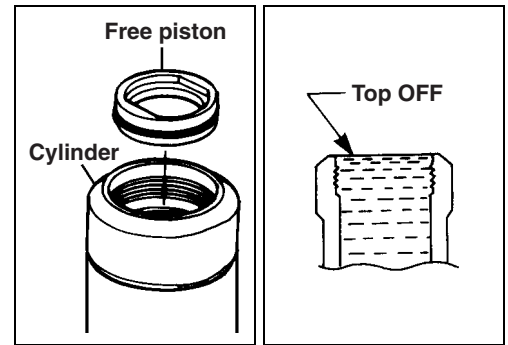
Installing tilt rod/piston

Pour 100 ml (3.4 oz.) of PTT fluid into cylinder.

Insert the free piston into cylinder and push it down to the bottom of the cylinder.

Pour PTT fluid into the cylinder until it is topped off.

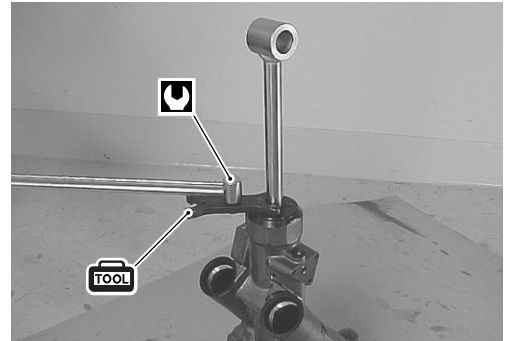
Insert the tilt rod/piston into cylinder and thread the tilt cylinder head by hand until fully seated.



Tighten the cylinder head to specified torque using special tool.

 **Tilt cylinder head: 160 N·m (16 kg·m, 115.7 lb·ft)**

 **09944-09420: PTT cylinder cap tool**




TRIM ROD

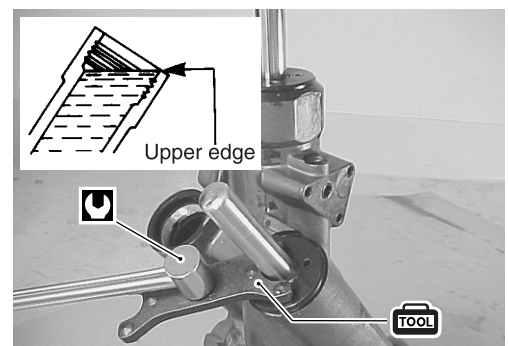
Pour PTT fluid into the trim cylinder until it is topped off.

Insert the trim rod/piston assembly into cylinder and thread the trim cylinder head by hand until fully seated.

Tighten the trim cylinder head to specified torque using special tool.

 **Trim cylinder head: 78 N·m (7.8 kg·m, 56.4 lb·ft)**

 **09944-09420: PTT cylinder cap tool**




PTT PUMP CASE

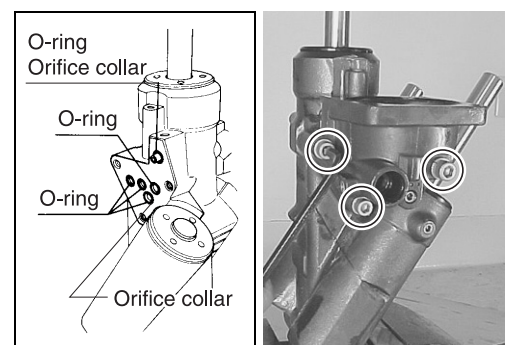
Install five (5) O-rings and orifice collars to PTT cylinder body.

NOTE:

Lubricate O-rings with PTT fluid before installing PTT cylinder body.

Install PTT pump case, then tighten three (3) screws to specified torque.

 **PTT pump case screw: 3.5 N·m (0.35 kg·m, 2.5 lb·ft)**




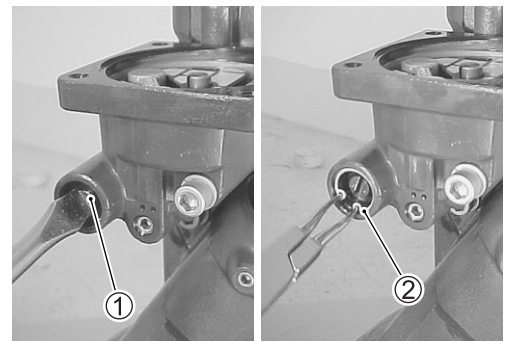
MANUAL RELEASE VALVE

Oil and install the manual release valve ①.

Tighten the valve to specified torque.

Install snap ring ②.

 **Manual release valve: 3.5 N·m (0.36 kg·m, 2.6 lb·ft)**



PTT MOTOR

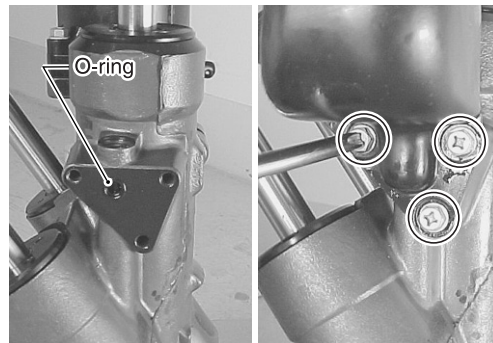
See the PTT motor installation section on page 8-16.

RESERVOIR

Install O-ring and reservoir, then tighten bolts to specified torque.

Pour recommended PTT fluid into reservoir until specified level.

 **Reservoir bolt: 5 N·m (0.5 kg-m, 3.5 lb-ft)**

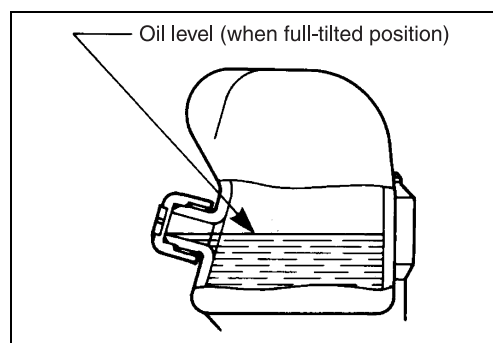
**AIR BLEEDING**

(Air bleeding on unit as alone)

Before installing the PTT unit on the outboard motor, use the following procedure to bleed air from the system.

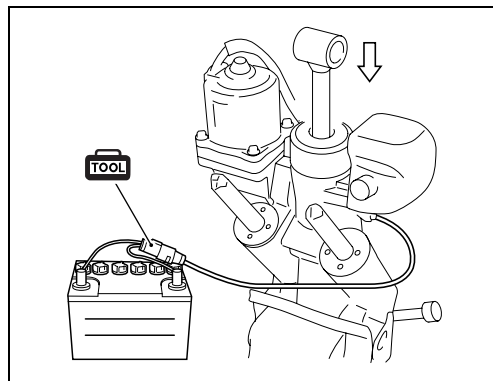
1. Support the PTT unit in an upright position in a vise.
2. Fill the reservoir with PTT oil to the specified level, then install oil filler plug.
3. Tighten the manual release valve to the specified torque.
4. Connect the PTT cable extension to the PTT motor cable connector.

 **09945-79310: PTT cable extension**



5. Connect the two extension cable lead wires (G to pos./BI to neg.) to the battery as shown in the illustration. Operate the PTT motor until the PTT rod is in the fully trimmed down position (completely contracted).

If the rod does not come down smoothly, push it in by hand while operating the motor.

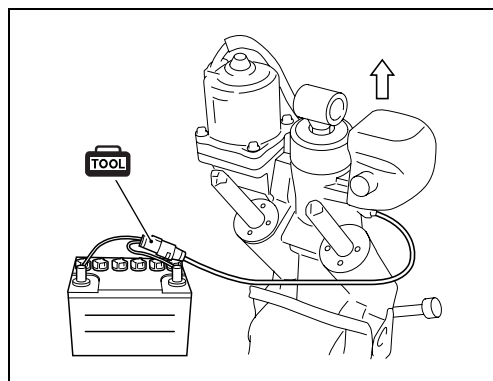


6. Reverse the two extension cable lead wires (BI to pos./G to neg.).

Operate the PTT motor until the PTT rod is in the full tilt up position (fully extended)

If the rod does not come up smoothly, pull it up by hand while operating the motor.

7. Remove the reservoir oil filler plug and fill with PTT fluid to the specified level.
8. Repeat procedures 5 – 7 until the fluid level in the PTT unit stabilizes at the specified position.

**NOTE:**

Repeat the air bleeding procedure after the PTT unit has been installed on the outboard motor.

(For air bleeding, see page 8-3.)

PTT MOTOR

REMOVAL

NOTE:

Before removing PTT motor, wash the PTT body with a stiff bristle brush and hot, soapy water to remove sand or dirt and dry the PTT body with compressed air.

Place the lower of the PTT unit in a vise.

Tighten the vise only enough to secure the PTT unit, DO NOT OVER TIGHTEN.

NOTE:

To prevent damage to the PTT cylinder use wood blocks, vise jaw protectors, etc., between the vise jaws and PTT components before tightening vise.

Remove the four (4) screws securing the PTT motor to the PTT pump case.

Detach the PTT motor from PTT pump case.

Note the position of drive joint ① and O-ring ② and remove them.

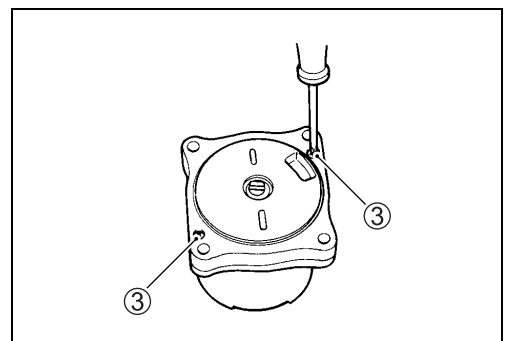
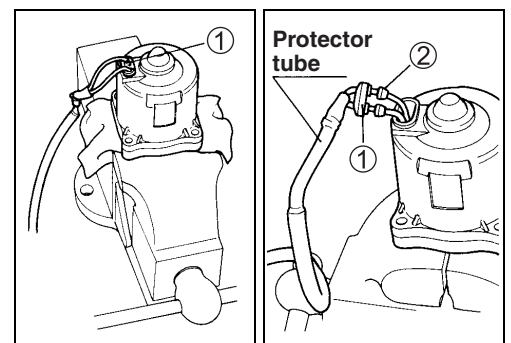
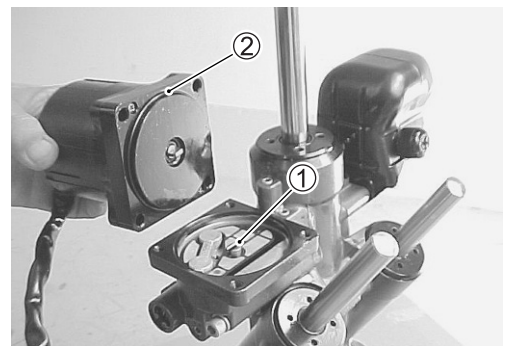
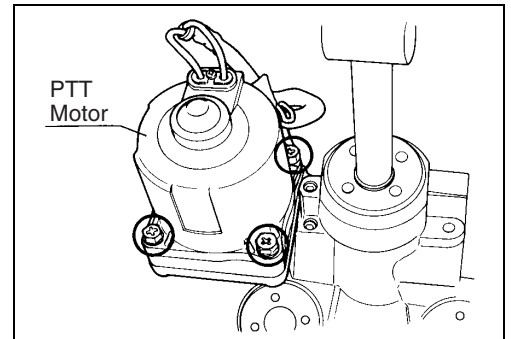
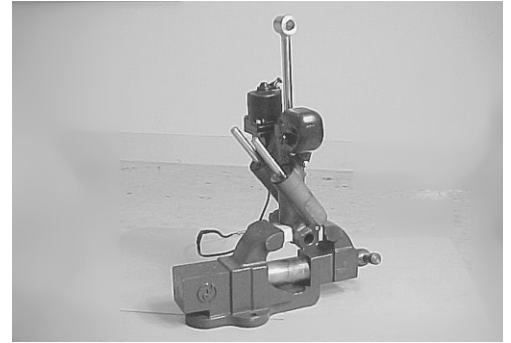
PTT MOTOR DISASSEMBLY

For correct assembly, scribe an alignment mark on the field case and brush holder.

Slide cable protector tube upward.

Remove the screw securing the motor cable holder ①, then slide motor cable holder and grommets ② out as shown in figure.

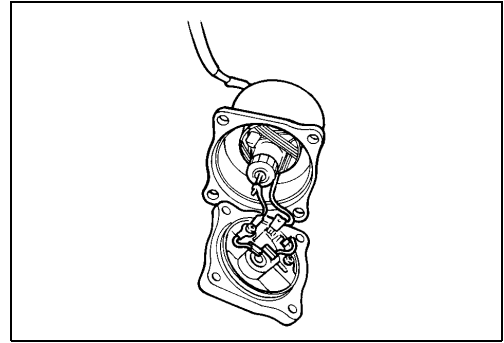
Remove the two (2) screws ③ securing the field case to the brush holder.



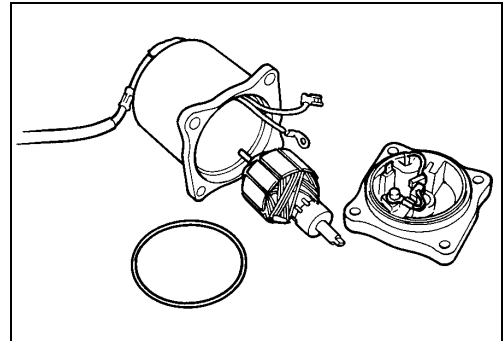
Slide the field case upward and away from the brush holder.

NOTE:

When separating field case from brush holder, push the PTT motor cables into brush holder as the field case is removed.



Disconnect PTT motor cables from brush holder.
Remove armature from field case.
Note the position of the O-ring encircling the brush holder.



INSPECTION

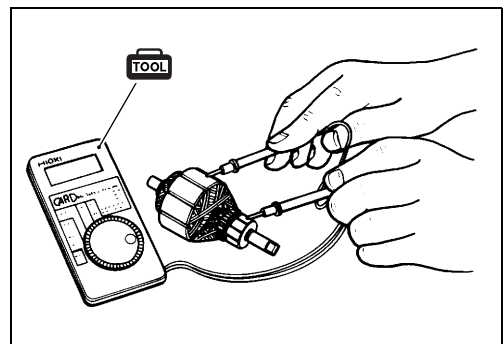
Armature and commutator

Check for continuity between the commutator and the armature core/shaft.

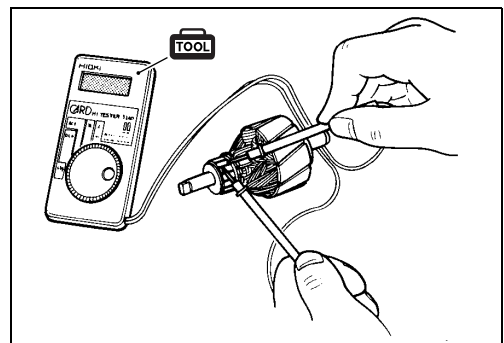
Replace armature if continuity is indicated.

TOOL 09930-99320: Digital tester

CONT Tester range: (Continuity)



Check continuity between adjacent commutator segments.
Replace armature if no continuity is indicated.



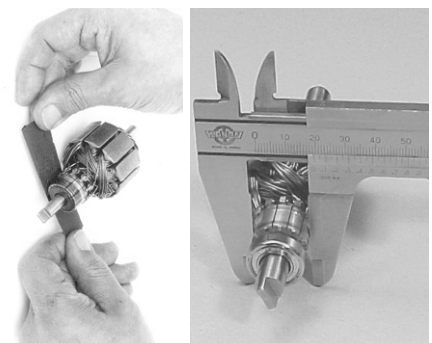
Inspect the commutator surface.
If surface is gummy or dirty, clean with 400 grit emery paper.

Measure commutator outside diameter.

TOOL 09900-20101: Vernier calipers

Commutator outside diameter:
Standard 22.0 mm (0.87 in)
Service limit 21.0 mm (0.83 in)

If measurement exceeds service limit, replace armature.



Ensure that the mica (insulator) between commutator segments is undercut to specified depth.

Commutator undercut:

Standard	1.6 – 1.9 mm (0.06 – 0.07 in)
Service limit	1.0 mm (0.04 in)

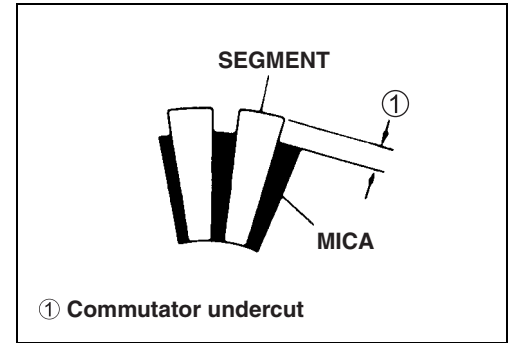
If undercut is less than service limit, cut to specified depth.

NOTE:

Remove all particles of mica and metal using compressed air.

⚠ WARNING

Wear safety glasses when using compressed air.



Brushes

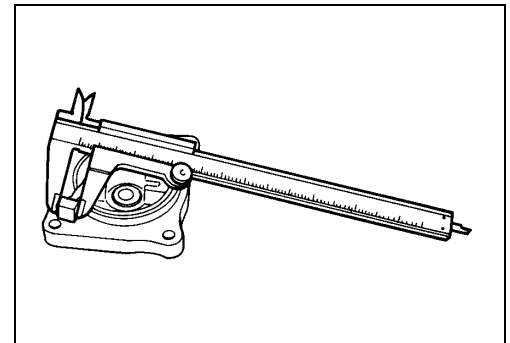
Check the length of each brush.

TOOL 09900-20101: Vernier calipers

Brush length:

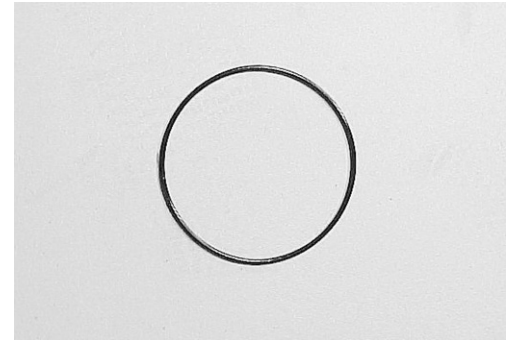
Standard	9.8 mm (0.39 in)
Service limit	5.5 mm (0.22 in)

If brushes are worn down to the service limit, they must be replaced.



O-Ring

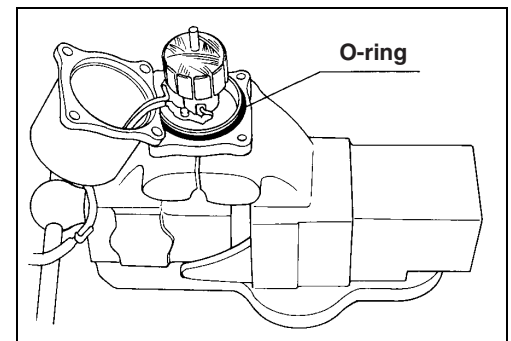
Inspect the O-ring between the PTT motor and PTT pump case. Replace if cuts, nicks or tears are found.



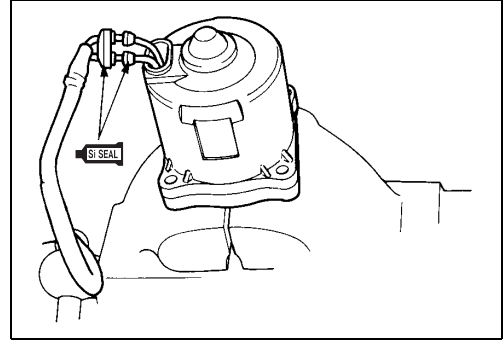
ASSEMBLY

Assembly is reverse of disassembly with special attention to following steps.

- Install armature to brush holder first.
When installing the armature, use care to avoid breaking the brushes.
- Match up previously scribed alignment marks.
- When assembling field case to brush holder, pull out on the PTT motor cables at the field case is assembled into position.



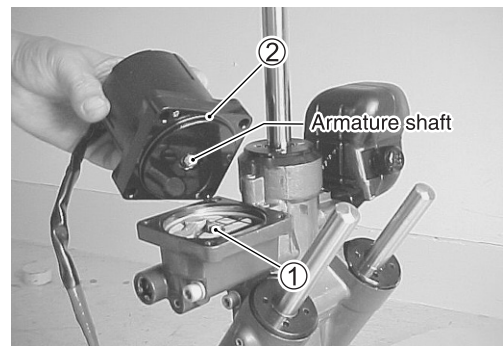
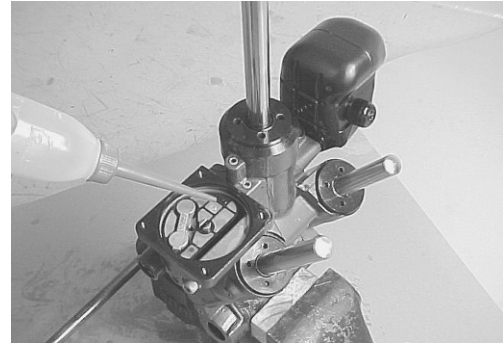
- Apply silicone seal to PTT motor cable holder and grommets and install cable holder screw.



PTT MOTOR INSTALLATION

Installation is reverse of removal with special attention to following steps.

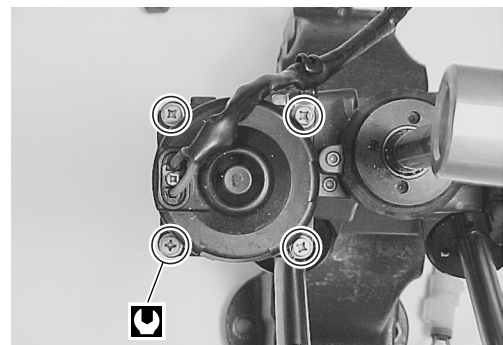
- Ensure that the drive joint ① is aligned and firmly inserted into the gear pump assembly.
- Fit O-ring ② to PTT motor.
- Check the level of PTT fluid contained in the PTT pump case. If level is low, add recommended PTT fluid until level with mating surface of PTT motor.
- Ensure that the faces of the PTT motor and pump unit are free of dirt or debris. When attaching the PTT motor to the PTT pump case, ensure that the tip of armature shaft fits firmly into the drive joint ①.



- Tighten the four (4) screws to specified torque.

PTT motor screw: 5 N·m (0.5 kg-m, 3.6 lb-ft)

- Pour recommended PTT fluid into reservoir until specified level.
- Perform the air bleeding procedure. For air bleeding, see page 8-12.



INSTALLATION

Installation is reverse order of removal with special attention to the following steps.


Lower tilt rod to full down position.

Apply Water Resistant Grease to the tilt cylinder lower shaft and lower shaft bushes.

Install bushes ① and cylinder lower shaft ② to PTT unit.

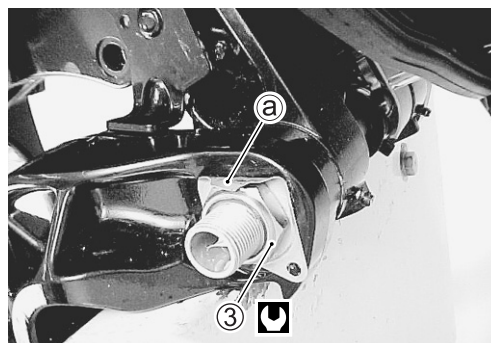
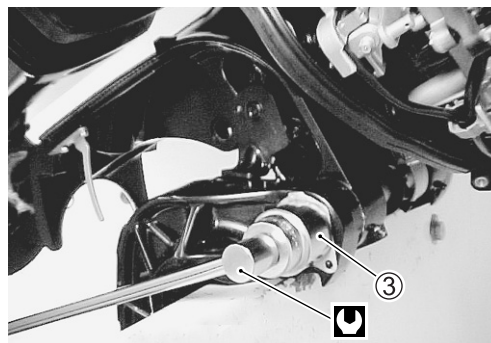
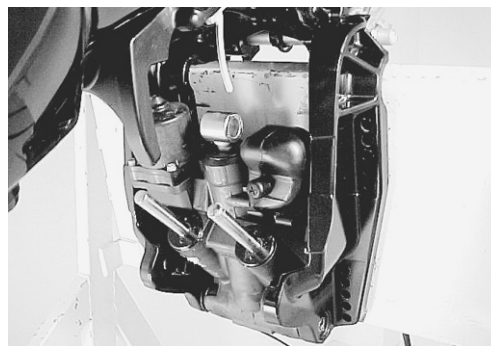
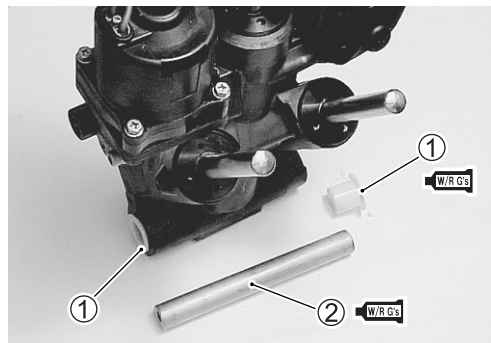
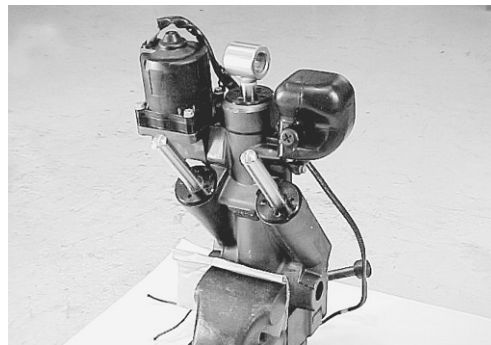
 99000-25160: SUZUKI WATER RESISTANT GREASE

Place the PTT unit in position between the clamp brackets. Tighten the clamp bracket shaft nut ③ to specified torque.

 **Clamp bracket shaft nut: 43 N-m (4.3 kg-m , 31.0 lb-ft)**

NOTE:

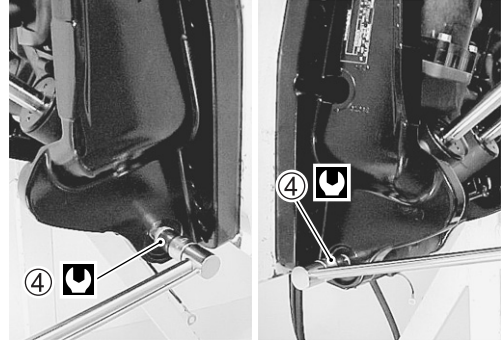
After tightening clamp bracket shaft nut ③ with specific torque, bend lock washer edge @ toward nut for locking.



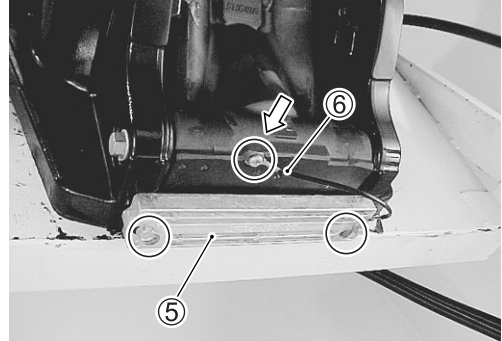
Tighten two (2) PTT cylinder lower shaft bolts ④, pre-coated with thread lock, to specified torque.

 99000-32050: THREAD LOCK "1342"

 PTT unit retaining bolt: 50 N-m (5.0 kg-m, 36.0 lb-ft)



Install anode ⑤, then tighten bolts securely.
Install bonding wire ⑥, then tighten screw securely.

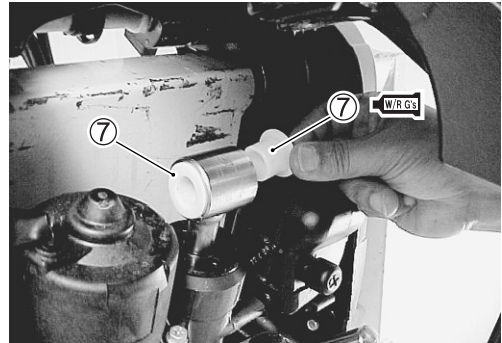


Apply Water Resistant Grease to tilt rod upper bushes ⑦, then install bushes in tilt rod.

Operate the PTT motor to extend the PTT rod upward.

Align the tilt rod with the hole in the swivel bracket as the tilt rod extends.

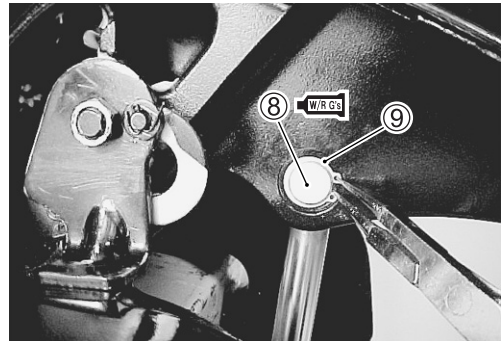
 99000-25160: SUZUKI WATER RESISTANT GREASE



Apply Water Resistant Grease to the PTT rod upper shaft ⑧, then insert the shaft through the swivel bracket and tilt rod.

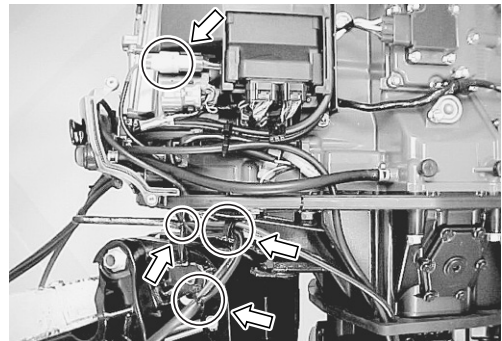
 99000-25160: SUZUKI WATER RESISTANT GREASE

Secure the upper shaft with the snap ring ⑨.



Route the PTT motor cable in through the lower cover and connect the PTT cable connector to the PTT relay.

(Cable routing – See the WIRE/HOSE ROUTING section on page 11-4 to 11-10.)



PTT MOTOR RELAY

INSPECTION

1. Disconnect battery cable from battery.
Remove the electric parts holder. (See page 4-30.)
2. Disconnect all cables/lead wires from PTT relay.
3. Check resistance between each two (2) lead wires.

TOOL 09930-99320: Digital tester

Tester range: Ω (Resistance)

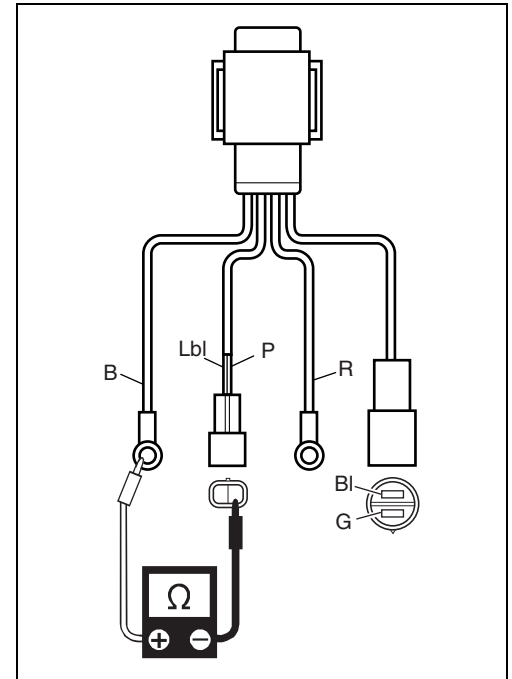
Between “P” wire and “B” wire: 25 – 37 Ω

Between “Lbl” wire and “B” wire: 25 – 37 Ω

4. Connect “R” wire to positive \oplus terminal, and black wire to negative \ominus terminal of 12 V battery.

CAUTION

Each operation test must be performed within 3 – 5 seconds to avoid overheat damage to the relay coil.



5. Temporarily connect a jumper wire from the “P” lead wire to the battery positive \oplus terminal, then check voltage between “G” wire and “B” wire.

TOOL 09930-99320: Digital tester

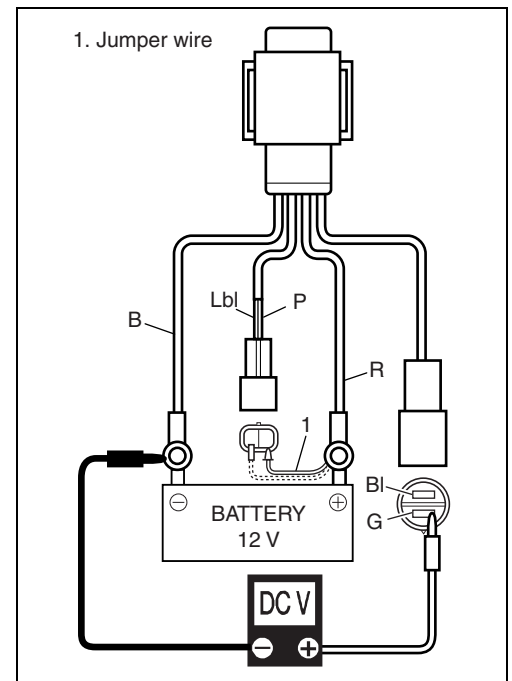
Tester range: DCV

Between “G” wire and “B” wire: 12 V (Battery voltage)

6. Temporarily connect a jumper wire from the “Lbl” lead wire to the battery positive \oplus terminal, then check voltage between “BI” wire and “B” wire.


Between “BI” wire and “B” wire: 12 V (Battery voltage)



7. If inspection in step 3 and/or step 5, 6 fails, replace PTT relay.



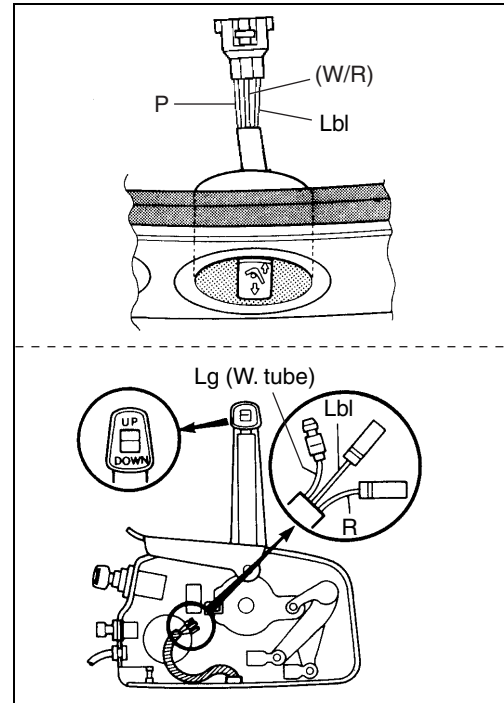
PTT SWITCH

Test continuity between the switch lead wires at each of the three switch positions.

 **09930-99320: Digital tester**

 **Tester range:**  (Continuity)


	Tester probe connection		Tester indicates
	Red ⊕	Black ⊖	
DN side depressed	• Red	• Lg (with white tube)	Continuity
	• Pink	• White/Red	
UP side depressed	Light Blue	• Lg (with white tube)	Continuity
		• White/Red	
Not depressed	• Red	• Lg (with white tube)	Infinity
	• Pink		
	Light Blue	• White/Red	





TILT LIMIT SWITCH

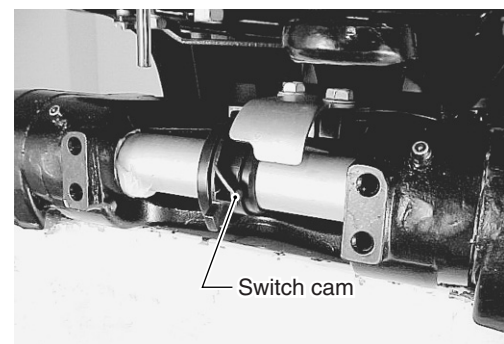
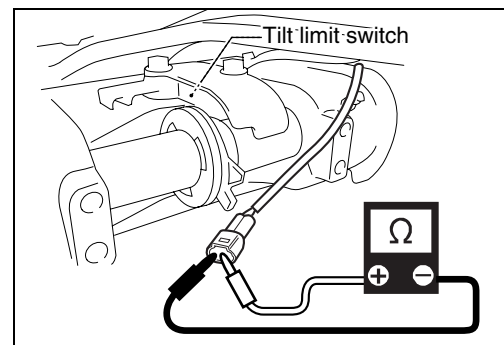
INSPECTION

Test continuity between wires.
If found defective, replace switch.

 **09930-99320: Digital tester**

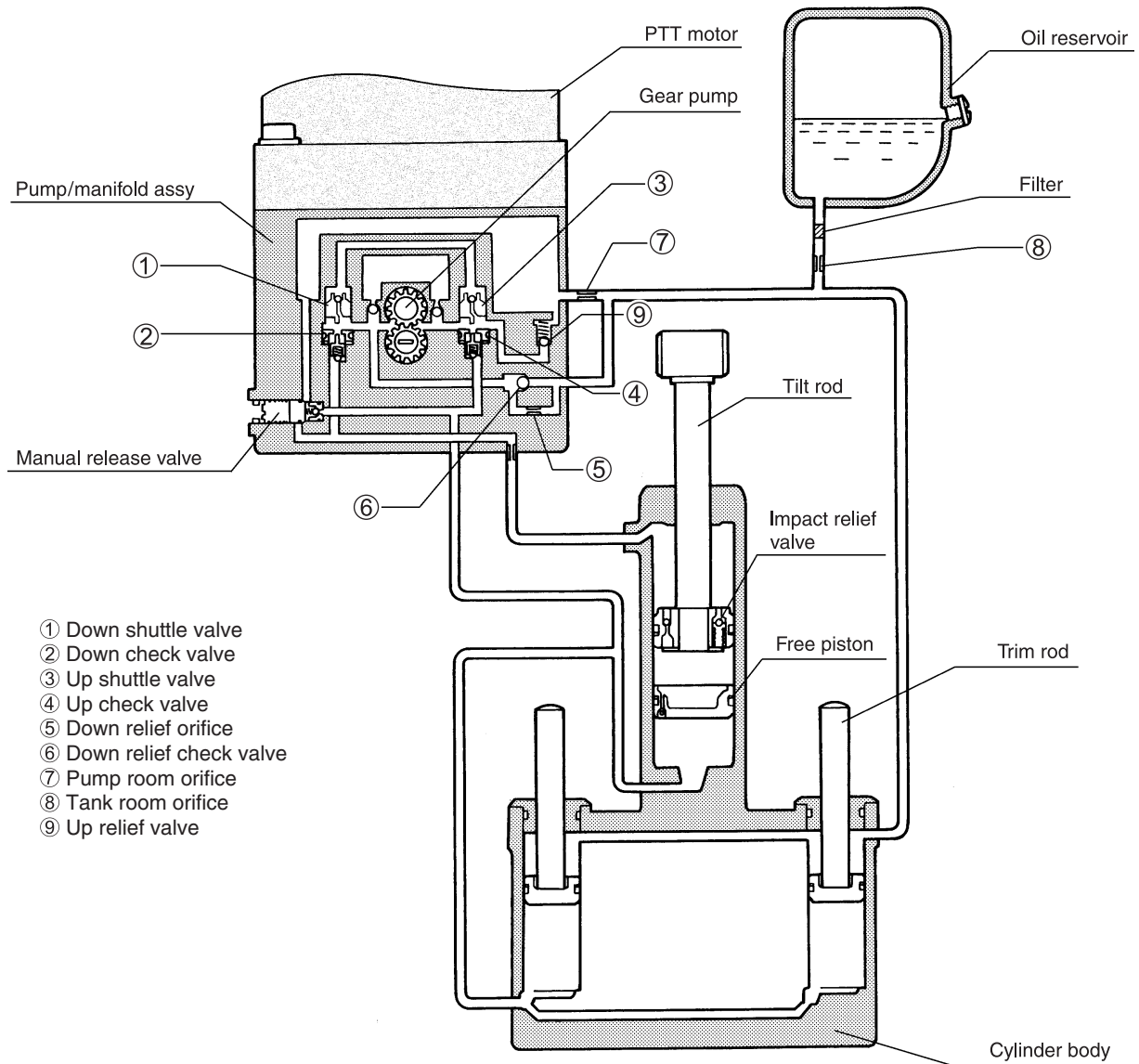
 **Tester range:**  (Continuity)

Push the switch actuator plate. (Full tilt up position)	No continuity
Release the switch actuator plate. (Except for full tilt up position)	Continuity



OPERATION

COMPONENT PARTS



* When the manual valve is to be opened, turn the manual release valve to the left about two turns.

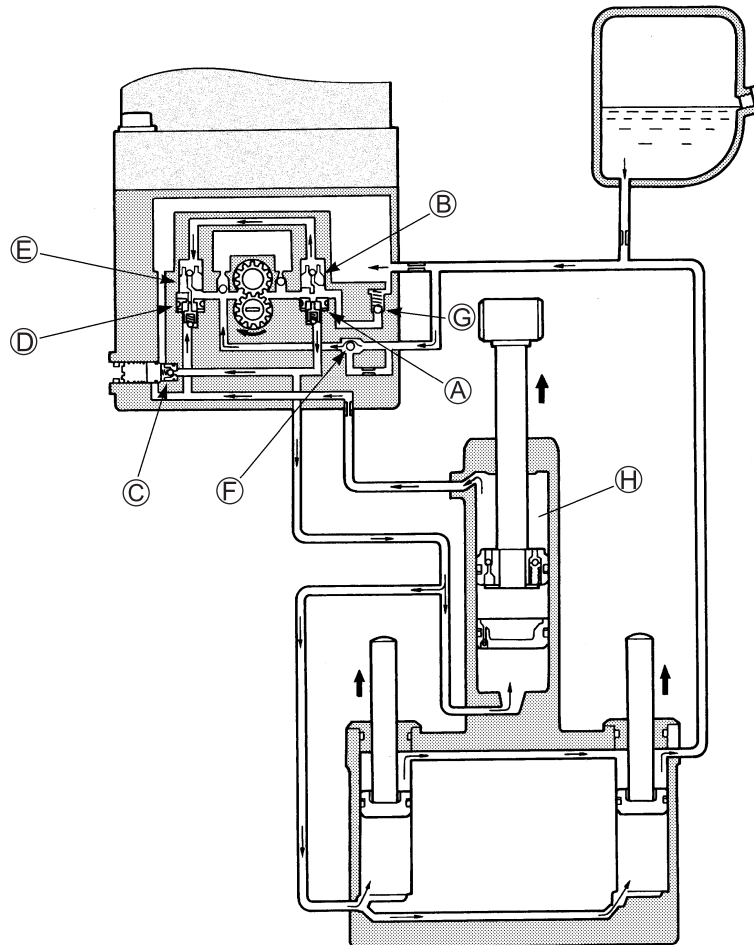
* When the oil level of the system should be checked, inspect the reservoir by placing the motor in the maximum tilt up position.

PRINCIPLES OF OPERATION

By motor operation, the geared pump will be driven, and by turning the motor to the right or to the left, oil flow will change its direction, and this causes up and down movements of the piston rod of the tilt cylinder and the trim rod of the trim cylinder.

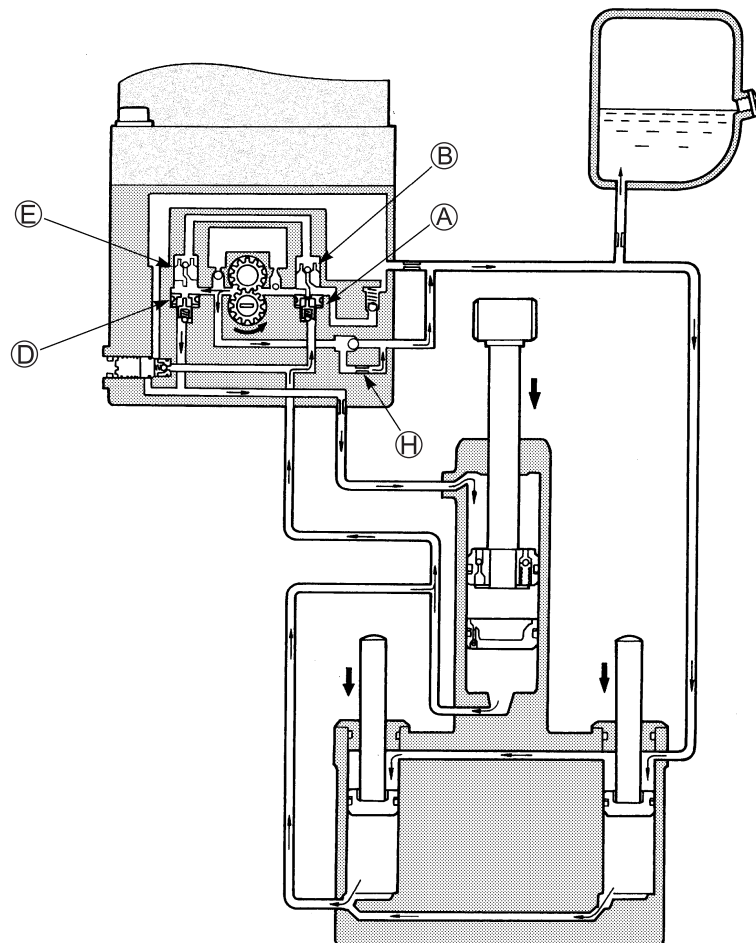
TRIM & TILT UP

- (1) When the PTT switch is operated in the "UP" position, the motor and gear pump will rotate in a clockwise direction.
- (2) Pressurized oil will open "Up" check valve (A) and the oil will flow through "Up" shuttle valve (B) to the "Down" shuttle valve (E). Following operation of valve (E), "Down" check valve (D) will open mechanically.
- (3) Pressurized oil flows through the "Up" check valve (A) to the bottom of the trim and tilt cylinders, thereby pushing the trim and tilt pistons upward.
- (4) Residual oil in the upper area of the tilt cylinder (H) is returned to the pump through "Down" check valve (D).
- (5) Any oil in the area above both trim cylinder pistons will be returned to the reservoir.
- (6) Oil will then flow from the reservoir to the pump to stabilize the balance of the oil volumes.
- (7) When the engine is fully tilted up, oil pressure will correspondingly increase in the lower chamber of the tilt and trim cylinders. But, to protect the PTT unit from excessively high pump pressure, the "Up" relief valve (C) begins to open.



TILT DOWN/TRIM IN

- (1) When the PTT switch is operated in the “DOWN” position, the motor and gear pump will rotate in a counterclockwise direction.
- (2) The oil pressure will open the “Down” check valve ④ and oil will be forced through the “Down” shuttle valve ⑤. When the oil reaches “Up” shuttle valve ③, the “Up” check valve ① will begin to open mechanically.
- (3) The pressurized oil flows through “Down” check valve ④ and then enters the upper area of the tilt cylinder. This thereby forces the tilt rod piston downward.
- (4) When the swivel bracket contacts the trim rams, this pressure forces the trim pistons downward and oil from the reservoir is then able to enter the area above both trim rod pistons.
- (5) Oil from the lower area of the trim and tilt cylinders now returns to the pump through “Up” check valve ①.
- (6) Throughout the tilt action operation range, there is a difference in oil volume between the upper and lower chambers of the tilt cylinder, and any surplus oil is therefore directed to the reservoir by means of the “Down” relief orifice ⑥.
- (7) Throughout trim operation range, oil will be discharged from the bottom of all three cylinders and the pump will only supply oil to the cylinder. Excess oil is then vented to the reservoir through the “Down” relief orifice ⑥.
- (8) To prevent damage from excessive oil pressure when all three rods are fully retracted, this pressure is relieved through the “Down” relief orifice ⑥.

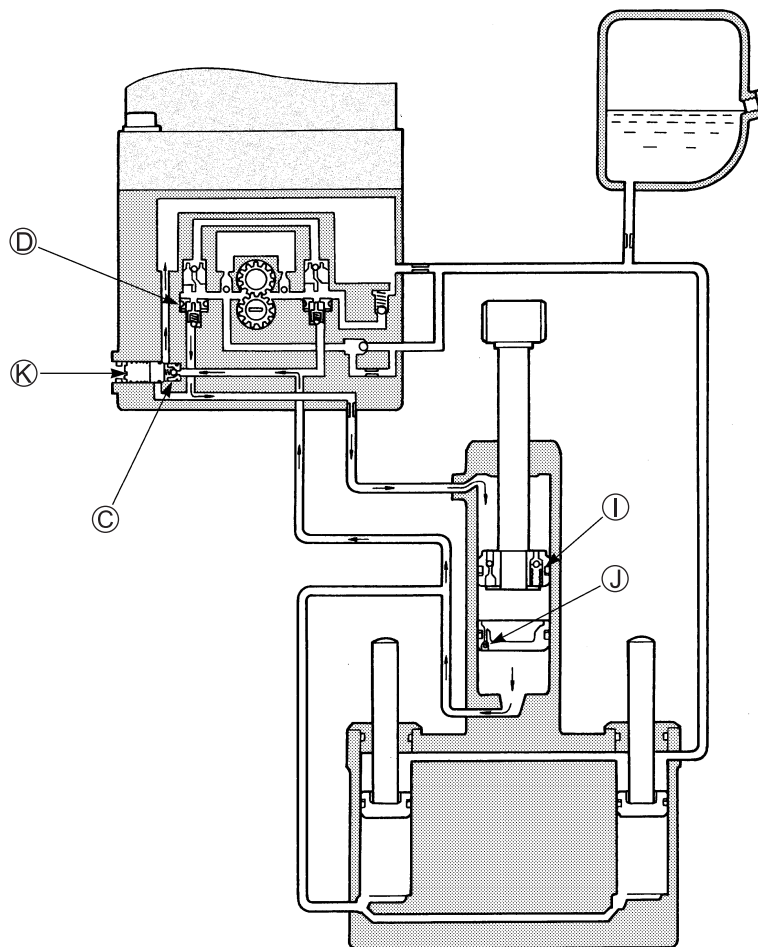


TILT SYSTEM PRESSURE RELIEF

- (1) If engine speed exceeds approx. 1 500 RPM when operating in shallow water drive mode, oil pressure will increase underneath the tilt piston. The relief valve © (incorporated in the manual release valve ®) will then open.
- (2) The oil below the tilt piston will then flow to the reservoir through the relief valve ©.
- (3) As the power of the engine continues to exert downward force on the tilt piston, this will open “Down” check valve Ɖ, thereby allowing oil from the reservoir to flow into the chamber above the tilt piston.
- (4) In this way, high internal pressure is relieved and the engine will slowly tilt downward until it reaches the highest position in the Trim range.

THERMAL EXPANSION RELIEF

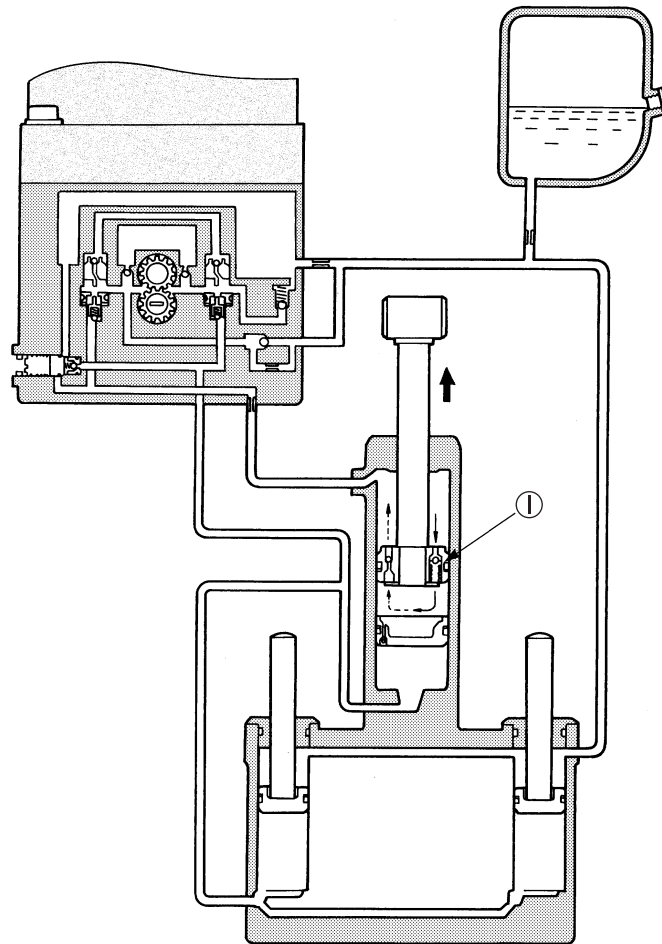
- (1) High ambient temperature will, through thermal expansion, induce a build-up of oil pressure inside the PTT unit.
 - (2) Expansion of the oil and the resulting high pressure will open the relief valve ©, thereby providing unit protection by directing oil back to the reservoir.
- Expanded oil in the tilt cylinder upper chamber will return to reservoir passing through impact relief valve Ɓ ⇒ free piston check valve Ɓ ⇒ thermal relief valve ©.



SHOCK ABSORBER CIRCUIT

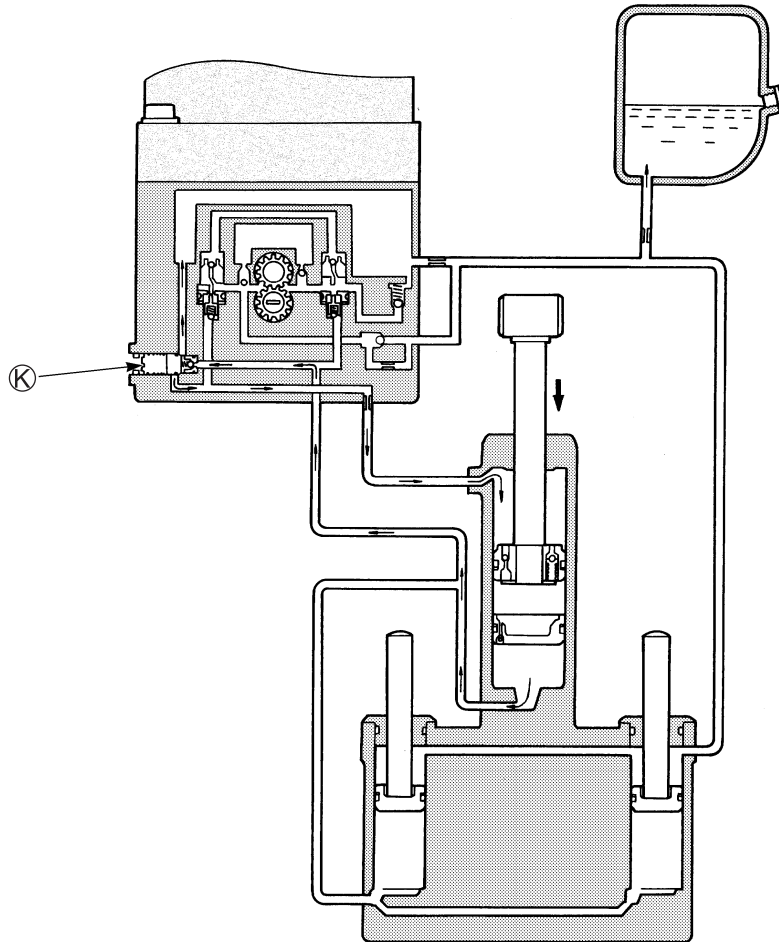
This incorporated safety feature is for protection of the gearcase and prevention of internal PTT pressure build-up in the event of an impact.

- (1) The pressure from a sudden impact will make impact relief valve ① open, allowing oil from the upper area of the tilt cylinder to flow into the area between the tilt rod piston and the free piston. The tilt rod will then extend.
- (2) When the moment of impact has passed, the PTT DOWN switch must be activated to return the engine to within the normal trim range. When the switch is pressed, the oil between the piston and free piston will be directed to the cylinder upper chamber via the return valve below the tilt piston.



MANUAL RELEASE CIRCUIT (DOWN MODE)

- (1) By opening the manual release valve (K), the engine can be lowered manually to a running position. Oil underneath the trim and tilt pistons will be directed through this valve into the area above the tilt rod piston.
- (2) The volume of oil flowing from under the trim rod pistons will be larger than the area above the tilt rod piston can accommodate. Excess oil therefore returns through the manual release valve (K) to the reservoir.



MANUAL RELEASE CIRCUIT (UP MODE)

- (1) With the manual release valve (K) open, the engine can also be raised manually to the fully tilted position.
- (2) Oil from the upper chamber of the tilt cylinder will flow through valve (K) into the lower chamber of the cylinder.
- (3) The upward movement of the piston rod will increase the cylinder area beneath it, thereby allowing oil from the reservoir to flow into this area.

