ZW310 WHEEL LOADER WORKSHOP MANUAL

PART NO. W4HA-E-00

HITACHI

Workshop Manual

ZW 310 Wheel Loader

Hitachi Construction Machinery
URL:http://www.hitachi-c-m.com

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Service Manual consists of the following separate Part No.

Technical Manual (Operational Principle)	: Vol. No.TO4HA-E
Technical Manual (Troubleshooting)	: Vol. No.TT4HA-E
Workshop Manual	: Vol. No.W4HA-E

OPERATE ONLY FROM OPERATOR'S SEAT

- Inappropriate engine starting procedures may cause the machine to runaway, possibly resulting in serious injury or death.
  - Start the engine only when seated in the operator's seat.
  - NEVER start the engine while standing on the track or on ground.
  - Do not start engine by shorting across starter terminals.
  - Before starting the engine, confirm that all control levers are in neutral.
  - Before starting the engine, confirm the safety around the machine and sound the horn to alert bystanders.

SA-431

012-E01B-0431

JUMP STARTING

- Battery gas can explode, resulting in serious injury.
  - If the engine must be jump started, be sure to follow the instructions shown in the “OPERATING THE ENGINE” chapter in the operator’s manual.
  - The operator must be in the operator’s seat so that the machine will be under control when the engine starts.
  - Jump starting is a two-person operation.
  - Never use a frozen battery.
  - Failure to follow correct jump starting procedures could result in a battery explosion or a runaway machine.

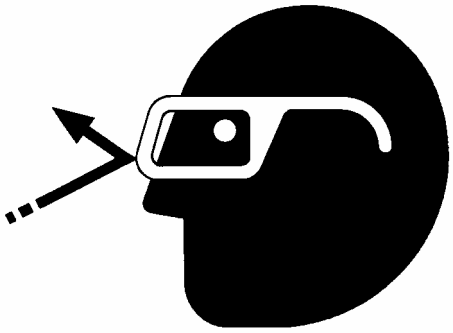
SA-032

S013-E01A-0032 SA-032

PROTECT AGAINST FLYING DEBRIS

- If flying debris hit eyes or any other part of the body, serious injury may result.
  - Guard against injury from flying pieces of metal or debris; wear goggles or safety glasses.
  - Keep bystanders away from the working area before striking any object.

031-E01A-0432



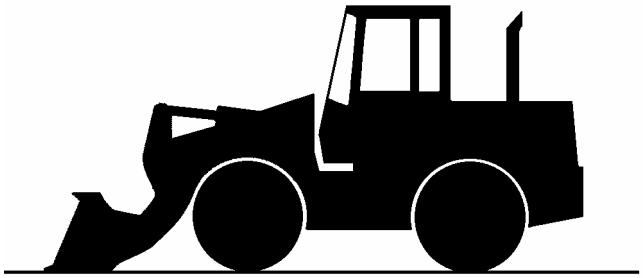
SA-432

PARK MACHINE SAFELY

To avoid accidents:

- Park machine on a firm, level surface.
- Lower bucket to the ground.
- Place the F-N-R lever in neutral, and put the park brake switch in the ON (parking brake) position.
- Run engine at slow idle speed without load for 5 minutes.
- Turn key switch to OFF to stop engine.
- Remove the key from the key switch.
- Lower the lock lever to the LOCK position.
- Close windows, roof vent, and cab door.
- Lock all access doors and compartments.

033-E07B-0456



SA-456

AVOID HEATING NEAR PRESSURIZED FLUID LINES

- Flammable spray can be generated by heating near pressurized fluid lines, resulting in severe burns to yourself and bystanders.
  - Do not heat by welding, soldering, or using a torch near pressurized fluid lines or other flammable materials.
  - Pressurized lines can be accidentally cut when heat goes beyond the immediate flame area. Install temporary fireresistant guards to protect hoses or other materials before engaging in welding, soldering, etc..

SA-030

AVOID APPLYING HEAT TO LINES CONTAINING FLAMMABLE FLUIDS

- Do not weld or flame cut pipes or tubes that contain flammable fluids.
- Clean them thoroughly with nonflammable solvent before welding or flame cutting them.

510-E01B-0030

REMOVE PAINT BEFORE WELDING OR HEATING

- Hazardous fumes can be generated when paint is heated by welding, soldering, or using a torch. If inhaled, these fumes may cause sickness.
  - Avoid potentially toxic fumes and dust.
  - Do all such work outside or in a well-ventilated area. Dispose of paint and solvent properly.
  - Remove paint before welding or heating:

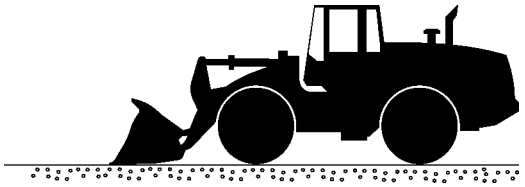
1. If you sand or grind paint, avoid breathing the dust. Wear an approved respirator.
2. If you use solvent or paint stripper, remove stripper with soap and water before welding. Remove solvent or paint stripper containers and other flammable material from area. Allow fumes to disperse at least 15 minutes before welding or heating.

SA-029

511-E01A-0029

- Bleeding Air from Hydraulic Circuit

  - After refilling hydraulic oil, start the engine. While operating each cylinder, operate the machine under light loads for 10 to 15 minutes. Slowly start each operation (never fully stroke the cylinders during initial operation stage). As the pilot oil circuit has an air bleed device, air trapped in the pilot oil circuit will be bled while performing the above operation for approx. 5 minutes.
  - Reposition the front attachment to check hydraulic oil level.
  - Stop the engine. Recheck hydraulic oil level. Replenish oil as necessary.



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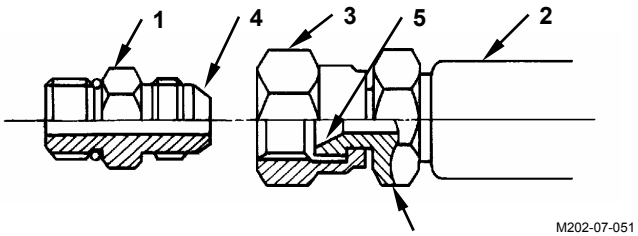
PIPING JOINT

IMPORTANT: The torques given in the chart below are for general use only.
Do not use these torques if a different torque is given for a specific application.



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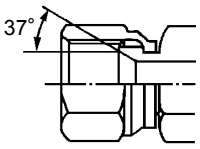
Union Joint

Metal sealing surfaces (4) and (5) of adapter (1) and hose (2) fit together to seal pressure oil. Union joints are used to join small-diameter lines.

IMPORTANT:
1. **Do not over-tighten nut (3). Excessive force will be applied to metal sealing surfaces (4) and (5), possibly cracking adapter (1). Be sure to tighten nut (3) to specifications.**
2. **Scratches or other damage to sealing surfaces (4) or (5) will cause oil leakage at the joint. Take care not to damage them when connecting/disconnecting.**



Female Union Joint

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Description	Wrench Size mm	Wrench Size mm	Tightening Torque
	Union Nut	Joint Body	N·m (kgf·m, lbf·ft)
37° female	17	14	24.5 (2.5, 18)
	19	17	29.5 (3.0, 21.5)
	22	19	39 (4.0, 28.5)
	27	22	93 (9.5, 69)
	32	27	137 (14.0, 101)
	36	32	175 (18.0, 129)

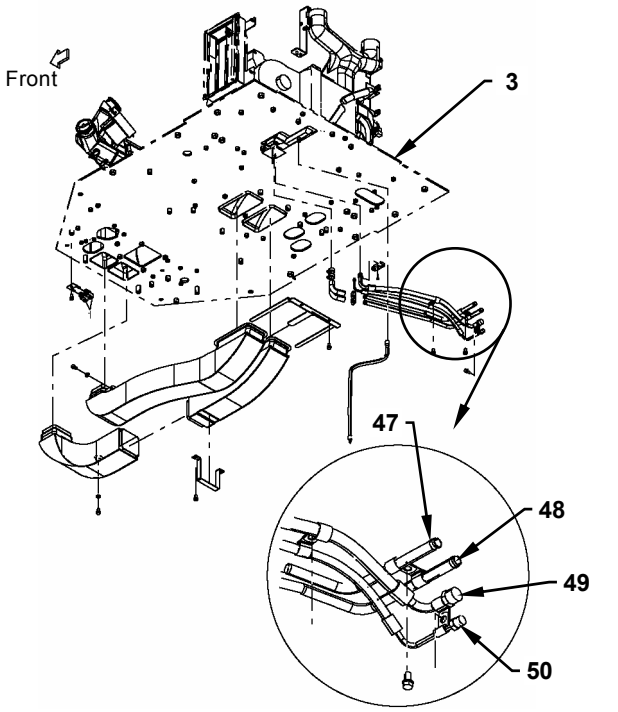
NOTE: Tightening torque of 37° male coupling without union is similar to tightening torque of 37° female.

MEMO

4. Connect hoses (49, 50) under cockpit (3). Connect heater pipings (47, 48).
   - : 17 mm
   - : 24.5 N·m (2.5 kgf·m, 18 lbf·ft)
   - : 19 mm
   - : 29.4 N·m (3 kgf·m, 21.5 lbf·ft)
   - : 24 mm
   - : 39 N·m (4 kgf·m, 28.5 lbf·ft)
   - : 27 mm
   - : 78 N·m (8 kgf·m, 57.5 lbf·ft)

5. This machine uses new freon R134a as refrigerant. Check for any gas leakage after injecting gas for the required amount.

Type	Refrigerant Number	Q'ty kg (lb)
HFC	R134a	1.05±0.05 (2.32±0.11)



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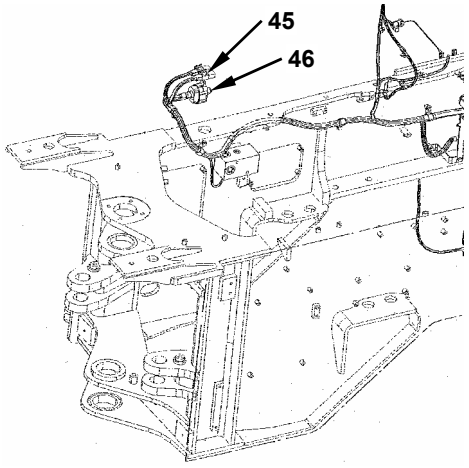
6. Connect connectors (45, 46) of the wire harness under the cab.



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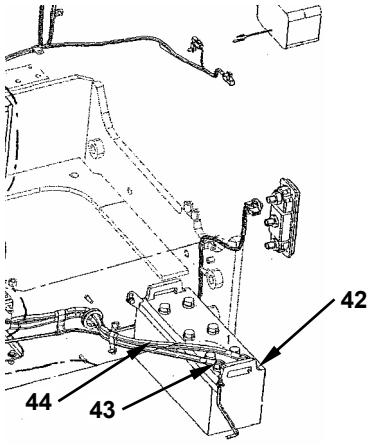
7. Connect battery cable (44) to terminal minus of battery (42) with bolt (43).
   - : 12 mm
   - : 10 N·m (1 kgf·m, 7.2 lbf·ft)



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Disassembly of Center Hinge

CAUTION: The center hinge is required to disassemble for the major maintenance work such as removal of the front frame from the rear frame. At this time, move the machine into the factory.

Preparation

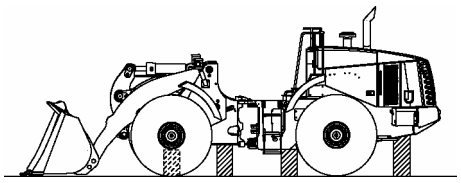
Carry out the following procedures before disassembling the center hinge.

1. Remove the cab and the cockpit.

2. Remove the mounting component between the front frame and the rear frame.
   - Propeller Shaft
   - Steering Cylinder
   - Hydraulic Hose
   - Brake Piping
   - Wire Harness

Removal of Hinge Pin

1. Support the front frame and the rear frame by using firm support stands.



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2. Remove bolts (2) (4 used) and bolts (3) (6 used) from flange (4) of the upper hinge part. Remove flange (4), shims (5) (2 used) and pin (22) from front frame (25).
   : 24 mm

3. Remove bolt (11) and washers (12, 13) from pin (14). Remove pin (14) from front frame (25).
   : 24 mm

4. Remove bushing (6) from front frame (25). (Remove bushing (6) after cutting by gas or pulling out by welding a cardboard.)

CAUTION: Front frame (25) weight: 2080 kg (4600 lb)

5. Attach a nylon sling onto front frame (25). Hoist and move front frame (25) so that bearing (10) can be removed.

6. Remove bushing (20) from front frame (25).

7. Remove bolts (21) (6 used) from cap (19). Remove caps (7, 19) and shim (8) from front frame (25).
   : 24 mm

8. Remove dust seals (9) (2 used) from caps (7, 19).

9. Remove bearing (10) from front frame (25).

REMOVAL AND INSTALLATION OF HYDRAULIC OIL TANK

CAUTION: Hydraulic oil tank (5) weight: 215 kg (475 lb)

Removal

1. Remove the hood. (Refer to W2-4-1.)
2. Remove the left and right side fenders.
   : 17 mm
3. Remove bolts (1) (6 used) and washers (2) (6 used) from cover (3). Remove cover (3) and suction filter (4) from hydraulic oil tank (5).
   : 14 mm
4. Drain hydraulic oil from the suction filter mounting part of hydraulic oil tank (5) by using a pump.

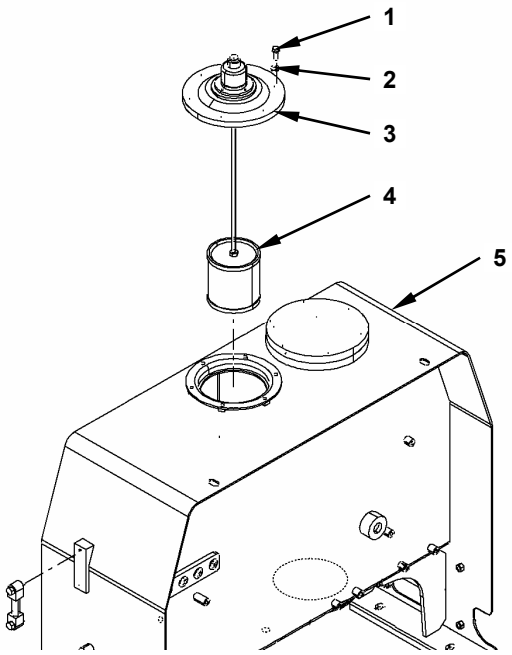
CAUTION: Drain hydraulic oil from the suction pipe at the bottom of hydraulic oil tank (5).

CAUTION: Attach an identification tag onto each hose connected to hydraulic oil tank (5) for assembling.

5. Disconnect hose (6) from hydraulic oil tank (5).
   : 22 mm
6. Disconnect hose (8) and remove O-ring (7) from hydraulic oil tank (5).
   : 36 mm

CAUTION: O-ring (7) cannot be reused.

7. Loosen hose clamps (9) (2 used). Disconnect hose (10) from hydraulic oil tank (5) and pipe (11).



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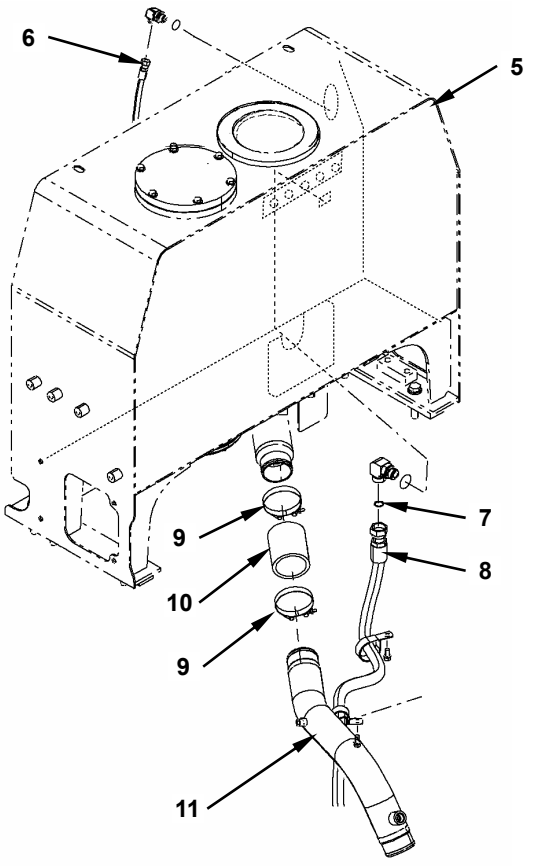

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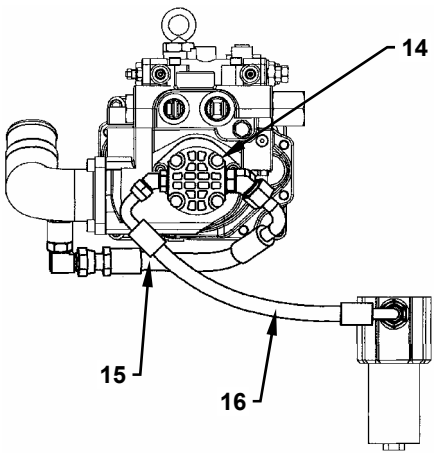
7. Disconnect hoses (15, 16) from pilot pump (14). Cap the open ends.
   : 27 mm, 36 mm



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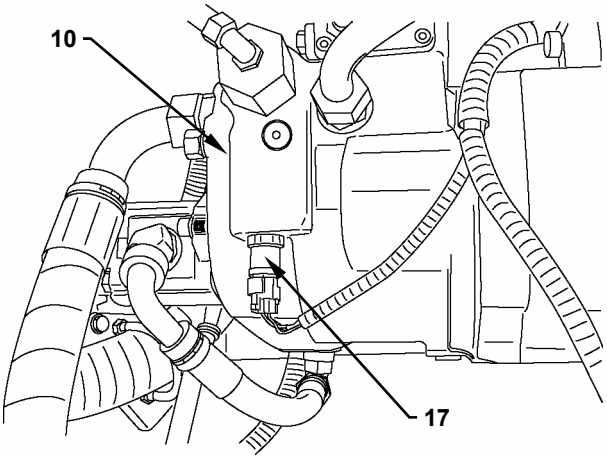
8. Disconnect the connector of pump delivery pressure switch (17) under priority valve (10).



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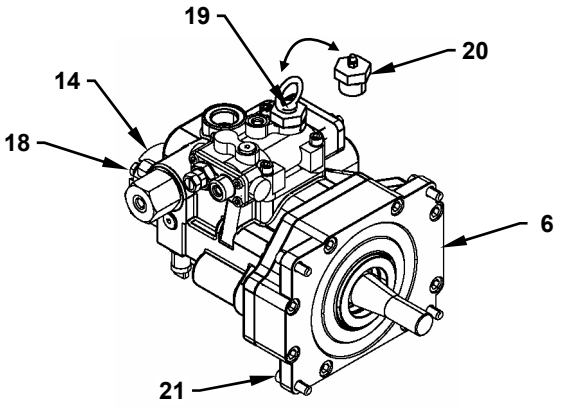
9. Remove socket bolts (18) (2 used) from pilot pump (14). Remove pilot pump (14) from main pump (6).
   Remove reducer (20) from the regulator. Install plug (19) (with an eyebolt attached) (screw size G1, wrench size 41 mm) to the regulator.
   : 8 mm
   : 41 mm

10. Attach a nylon sling onto the eyebolt. Hoist and hold main pump (6). Remove socket bolts (21) (4 used) from main pump (6). Hoist and remove main pump (6) from the engine.
    : 10 mm



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Disassembly of Main Pump

CAUTION: Pump device weight: 108 kg (240 lb)

1. Secure the pump device on a workbench with the pilot pump side facing downward.

CAUTION: Front casing (8) weight: 48 kg (110 lb)

2. Remove socket bolts (9) (8 used) from front casing (8).
   : 14 mm

IMPORTANT: Inner race (12) with drive shaft (11) attached cannot be replaced. Do not damage inner race (12).

3. Remove the front casing (8) assembly from pump casing (2). At this time, drive shaft (11), the rotor (4) assembly and restrictor pin (43) are removed with front casing (8) together.

NOTE: When removing front casing (8), raise the pump casing (2) side a little in order to prevent rotor (4) from falling off.

NOTE: Do not remove restrictor pin (43) unless necessary.
Restrictor pin (43) may stay in pump casing (2).

4. Place front casing (8) onto a wooden block of more than 30 mm square (1.2 in square) with the rotor (4) side facing upward.

IMPORTANT: The valve plate (3) side of rotor (4) is a sliding surface. Do not damage the sliding surface.

5. Put a hand on retainer (18) and remove the rotor (4) assembly from drive shaft (11). Place the rotor (4) assembly with the valve plate side facing downward.

6. Put a hand under retainer (18) and remove retainer (18) with servo piston (17) together from rotor (4).

7. Remove bushing (16) and springs (15) (4 used) from rotor (4).

8. Remove plate (19) from swash plate (6).

NOTE: By tapping the yoke part with plate (19) facing upward, plate (19) is floated.

9. Remove socket bolts (10) (4 used) from cradle plate (22). Remove cradle plate (22) from front casing (8).
   : 6 mm

10. Remove drive shaft (11) with roller bearing (34) together from front casing (8) by hands.

IMPORTANT: When removing retaining ring (32), do not damage the seal lip surface of drive shaft (11).

11. Remove retaining rings (32) (2 used) from drive shaft (11).

12. Remove the roller and the outer ring of roller bearing (34).

Assembly of Regulator

IMPORTANT: Inner diameters of two holes for the sleeve on casing (9) are the same. The shapes of each part is similar. Check the illustration when assembling.

1. Clean all parts and apply hydraulic oil.

IMPORTANT: Check the direction to install sleeve (7) and spool (8).

2. Insert spool (8) into sleeve (7). Install the sleeve (7) assembly to the center of casing (9) by using a round bar.

3. Install O-ring (24) to cylinder (11).

4. Insert piston (6) into cylinder (11). Install the cylinder (11) assembly to casing (9).

IMPORTANT: Check the direction to install sleeve (20) and spool (19).

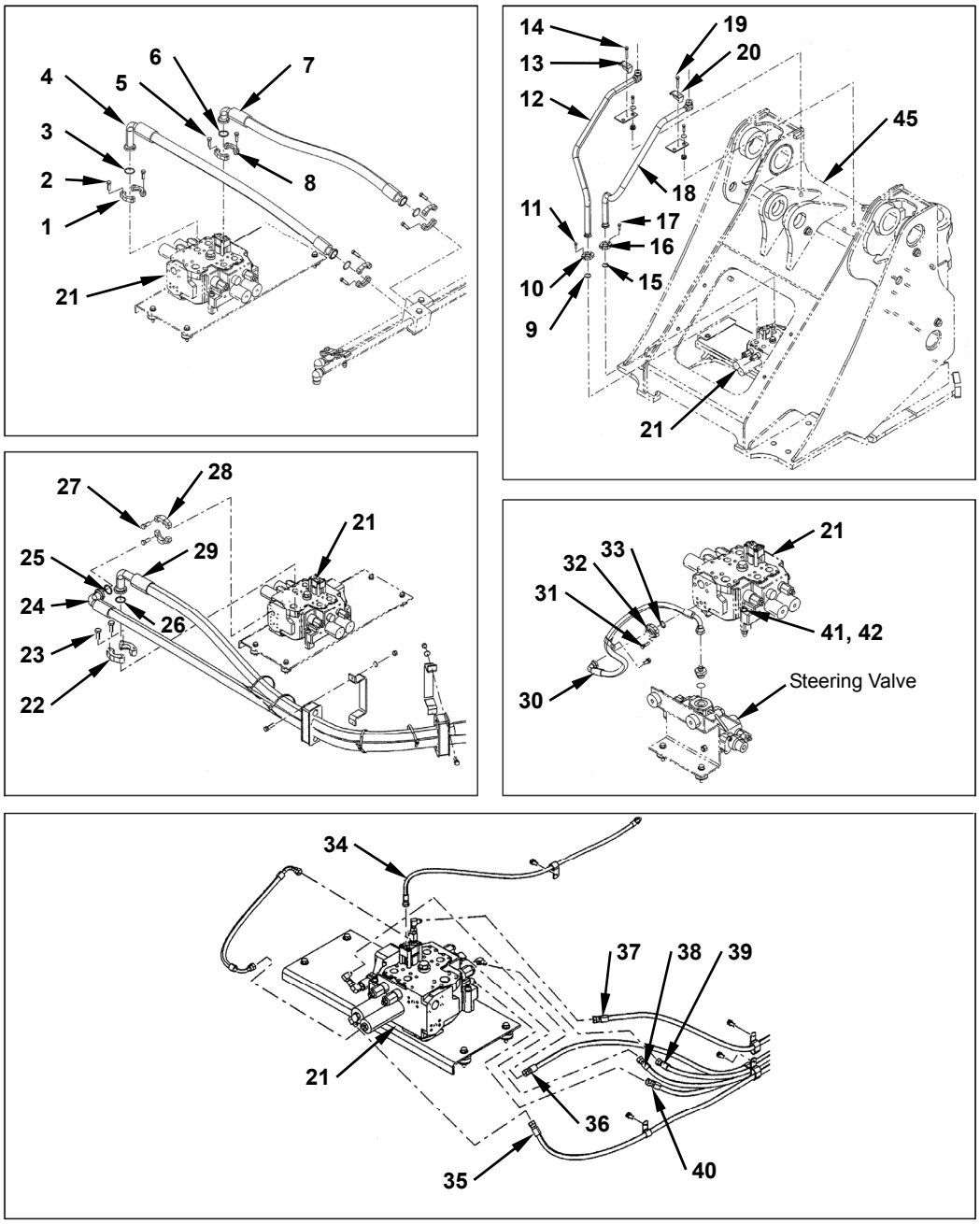
5. Insert spool (19) into sleeve (20). Install the sleeve (20) assembly to the center of casing (9) by using a round bar.

6. Install O-rings (14, 16) and backup ring (15) to cylinder (18).

7. Insert piston (17) into cylinder (18). Install the cylinder (18) assembly to casing (9).

8. Install O-ring (5) and piston (6) to the stopper (4) assembly which is installed to cover (30). Install the cover (30) assembly to casing (9) with socket bolts (29) (4 used).
   : 6 mm
   : 19.5 N·m (2 kgf·m, 14.5 lbf·ft)

9. Install O-ring (24) and springs (21, 22) to the stopper (23) assembly which is installed to cover (35). Install the cover (35) assembly to casing (9) with socket bolts (29) (4 used).
   : 6 mm
   : 19.5 N·m (2 kgf·m, 14.5 lbf·ft)



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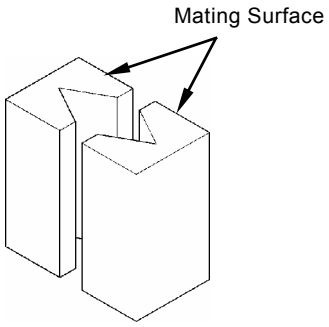
1 - Split Flange (2 Used)
2 - Bolt (4 Used)
3 - O-Ring
4 - Hose
5 - Bolt (4 Used)
6 - O-Ring
7 - Hose
8 - Split Flange (2 Used)
9 - O-Ring
10 - Split Flange (2 Used)
11 - Bolt (4 Used)
12 - Pipe
13 - Clamp
14 - Sems Bolt
15 - O-Ring
16 - Split Flange (2 Used)
17 - Bolt (4 Used)
18 - Pipe
19 - Sems Bolt
20 - Clamp
21 - Control Valve
22 - Split Flange (2 Used)
23 - Bolt (4 Used)
24 - Hose
25 - O-Ring
26 - O-Ring
27 - Bolt (4 Used)
28 - Split Flange (2 Used)
29 - Hose
30 - Hose
31 - Bolt (4 Used)
32 - Split Flange (2 Used)
33 - O-Ring
34 - Hose
35 - Hose
36 - Hose
37 - Hose
38 - Hose
39 - Hose
40 - Hose
41 - Socket Bolt (3 Used)
42 - Washer (3 Used)

Assembly of Control Valve

CAUTION: Check that the mating surface of wooden piece to the spool is free of metal chips. Secure the spool assembly at the position close to spring (20).

1. Clamp spool (35) in a vise by using wooden pieces as illustrated. Install spring seat (19), spring (20) and spring seat (19) to spool (35) with spool end (21).
   : 10 mm
   : 9.8 to 11.8 N·m
   (1 to 1.2 kgf·m, 7.2 to 8.7 lbf·ft)



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2. Apply hydraulic oil onto the polishing part of the spool (35) assembly. Slowly and carefully insert the spool (35) assembly into the hole on housing (32).

3. Install O-ring (18) to the groove on the cap (22) mounting position in housing (32). Install cap (22) to housing (32) with socket bolts (23) (2 used).
   : 5 mm
   : 39.2 to 44.1 N·m
   (4 to 4.45 kgf·m, 29 to 32.5 lbf·ft)

4. Install O-ring (18) to the groove on the cap (37) mounting position in housing (32).

5. Install spacer (36) to spool (35). Align the projection part of spacer (36) and the hollow inside cap (37). Secure cap (37) to housing (32) with socket bolts (23) (2 used).
   : 5 mm
   : 39.2 to 44.1 N·m
   (4 to 4.45 kgf·m, 29 to 32.5 lbf·ft)

6. Install poppet (5), spring (4) and O-ring (3) to housing (32). Install flange (2) to housing (32) with socket bolts (1) (4 used).
   : 5 mm
   : 58 to 64 N·m
   (6 to 6.5 kgf·m, 43 to 47 lbf·ft)

7. Install anti-void valve (34) to housing (32).
   : 32 mm
   : 78 to 88 N·m
   (8 to 9 kgf·m, 57.5 to 65 lbf·ft)

8. Install relief valve (17) to housing (32).
   : 32 mm
   : 78 to 88 N·m
   (8 to 9 kgf·m, 57.5 to 65 lbf·ft)

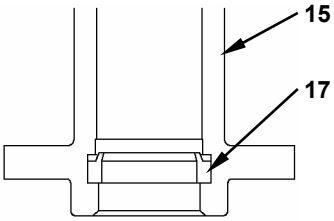
BODY (UPPERSTRUCTURE) / Pilot Valve

1 - Socket Bolt (4 Used)
2 - Lock Nut (4 Used)
3 - Screw (4 Used)
4 - Lever (2 Used)
5 - Boot (2 Used)
6 - Lock Plug (2 Used)
7 - Bushing (4 Used)
8 - Cam Shaft (2 Used)
9 - Cover (2 Used)
10 - Detent Ring (3 Used)
11 - Spring (3 Used)
12 - Push Rod (3 Used)
13 - O-Ring (4 Used)
14 - Bushing (4 Used)
15 - Detent Bushing (4 Used)
16 - Steel Ball (12 Used)
17 - Scraper (4 Used)
18 - Push Rod
19 - Solenoid
20 - Detent Casing
21 - Spring Guide (4 Used)
22 - Spring (4 Used)
23 - Plate (2 Used)
24 - Seal (4 Used)
25 - Plug (4 Used)
26 - O-Ring (4 Used)
27 - Push Rod (4 Used)
28 - Spring Seat (4 Used)
29 - Spring (2 Used)
30 - Spring (4 Used)
31 - Washer (4 Used)
32 - Spool (4 Used)
33 - Plug
34 - Casing
35 - Socket Bolt (2 Used)
36 - Bushing (2 Used)
37 - O-Ring (2 Used)
38 - Port Plate (2 Used)
39 - Socket Bolt (4 Used)
40 - O-Ring (4 Used)
41 - Sub Plate
42 - Solenoid
43 - Solenoid
44 - Detent Casing
45 - Spring
46 - Spring
47 - Nut (2 Used)
48 - Casing

Assembly of Standard Pilot Valve for Front Attachment

1. Apply grease onto scrapers (17) (4 used). Install scrapers (17) (4 used) to detent bushings (15) (4 used).

NOTE: Check the install direction to scrapers (17) (4 used).



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2. Apply grease onto the sliding parts of detent bushings (15) (3 used) and detent rings (10) (3 used).
   Install detent rings (10) (3 used) and springs (11) (3 used) to detent bushings (15) (3 used).

[A port with a detent]

3. Install push rods (12) (3 used) to detent bushings (15) (3 used). (Check the up and down directions of the rod.)

CAUTION: Prevent detent rings (10) (3 used) from flying out by springs (11) (3 used).

4. Hold detent rings (10) (3 used) and compress springs (11) (3 used). Install steel balls (16) (12 used).

NOTE: Apply grease onto steel balls (16) (12 used). Grease prevents steel balls (16) (12 used) from falling off. Thus, the installation is carried out easily.
Adjust the positions of push rods (12) (3 used) so that the steel balls (16) (12 used) can be inserted into the constriction part of push rods (12) (3 used).

[A port without a detent]

5. Install push rod (18) to detent bushing (15). (Check the up and down directions of the rod.)

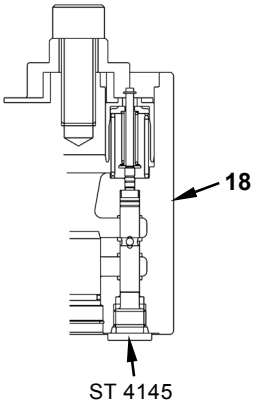
6. Install O-rings (13) (4 used) to covers (9) (2 used).

7. Install detent bushings (15) (4 used) to cover (9) (2 used) at the original position.

8. Temporarily tighten screws (3) (4 used) and nuts (2) (4 used) temporarily to levers (4) (2 used).

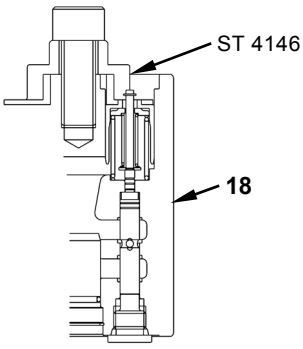
9. Apply grease onto the top and bottom sides of push rods (12) (3 used) and push rod (18), the sliding part at the side surfaces of levers (4) (2 used) and the sliding parts of cam shafts (8) (2 used).
   Secure covers (9) (2 used) in a vise. Install levers (4) (2 used) and cam shafts (8) (2 used) to covers (9) (2 used).

7. Prevent the spool from lowering when compressing the spring. Install special tool (ST 4145) to the port hole on casing (18) as illustrated.
   : 6 mm



W178-02-07-048

8. Install special tool (ST 4146) to the pusher hole on casing (18). Push the special tool and compress the spring. Tighten special tool (ST 4146) by using the socket bolt (M14, Pitch 2.0 mm). Remove retaining rings (8) (4 used) from spools (19) (4 used) by using a screwdriver.
   : 12 mm



W178-02-07-048

IMPORTANT: The quantity of shims (2) has been determined for each port during the performance testing at the factory. Do not lose shim (2). Keep shim (2) carefully in order to install the shim to the original port when assembling.

9. Remove special tool (ST 4146). Remove spring guides (7) (4 used), return springs A (5) (2 used), return springs B (6) (2 used), balance springs A (3) (2 used) and balance springs B (4) (2 used) from spools (19) (4 used).

10. Remove shim (2) and spacers (1) (4 used) from spools (19) (4 used).

IMPORTANT: Spool (19) has been selected to match the hole of casing (18). Replace spool (19) and casing (18) as an assembly.

11. Remove special tool (ST 4145) from casing (18). Slowly rotate and remove spool (19) from casing (18).

IMPORTANT: Retaining ring (22) may come off while disassembling. Prevent retaining ring (22) from fall inside casing (18). If retaining ring (22) falls inside casing (18), remove retaining ring (22) completely. Removed retaining ring (22) cannot be reused.

12. Remove retaining ring (22) from casing (18) by using a screwdriver. Install the bolt (M8, Pitch 1.25 mm) to plug (21). Remove plug (21) from casing (18).
    : 13 mm

REMOVAL AND INSTALLATION OF PILOT SHUT-OFF VALVE

CAUTION: Bleed air from the hydraulic oil tank before doing any work. (Refer to BLEED AIR FROM HYDRAULIC OIL TANK on W1-4-1.)

Removal

1. Remove screws (2) (2 used) from cover (3). Remove cover (3) from bracket (6).

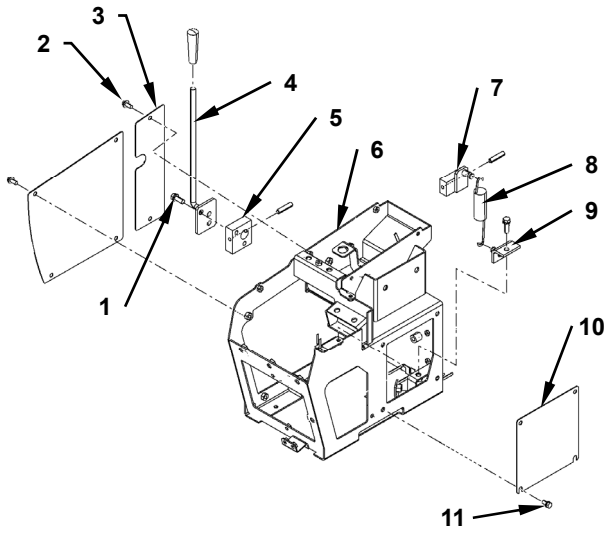
2. Remove sems bolts (11) (4 used) from cover (10). Remove cover (10) from bracket (6).
   : 13 mm

3. Remove spring (8) from block (7) and bracket (9).

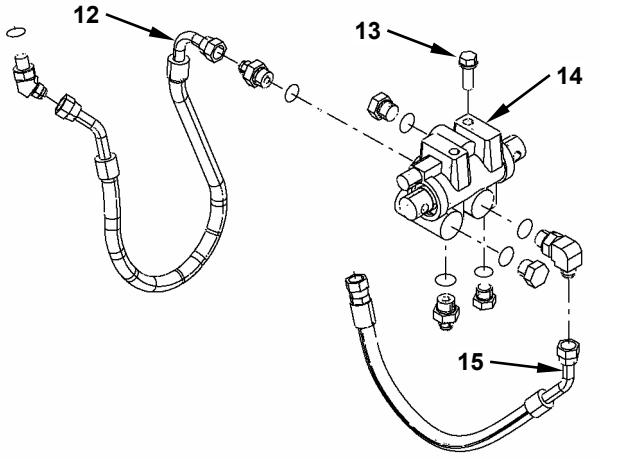
4. Remove bolt (1) from lever (4). Remove lever (4) from block (5).
   : 14 mm

5. Disconnect hoses (12, 15, 16 and 17) from pilot shut-off valve (14). Cap the open ends.
   : 19 mm, 22 mm

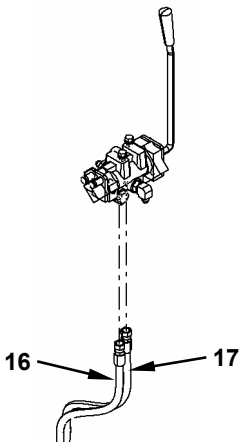
6. Remove bolts (13) (2 used) from the cockpit. Remove pilot shut-off valve (14) from the cockpit.
   : 17 mm



W4GB-02-07-001



W4GB-02-07-002



W4GB-02-07-003

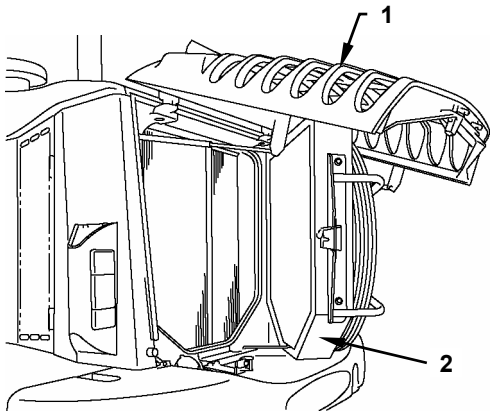
REMOVAL AND INSTALLATION OF HYDRAULIC FAN MOTOR

Removal

CAUTION: Bleed air from the hydraulic oil tank before doing any work. (Refer to BLEED AIR FROM HYDRAULIC OIL TANK on W1-4-1.)

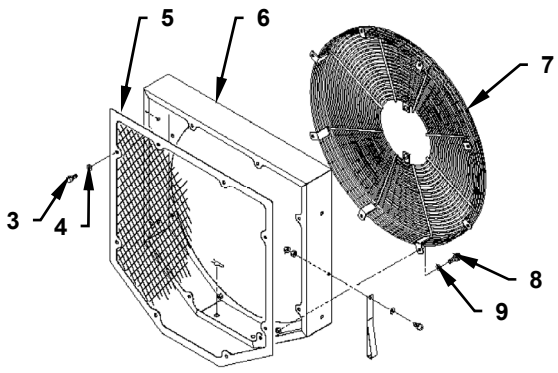
1. Open rear grill (1). Remove cooling fan (2) outside.

2. Remove bolts (3) (8 used) and washers (4) (8 used) from guard (5). Remove guard (5) from cover (6).
   : 14 mm



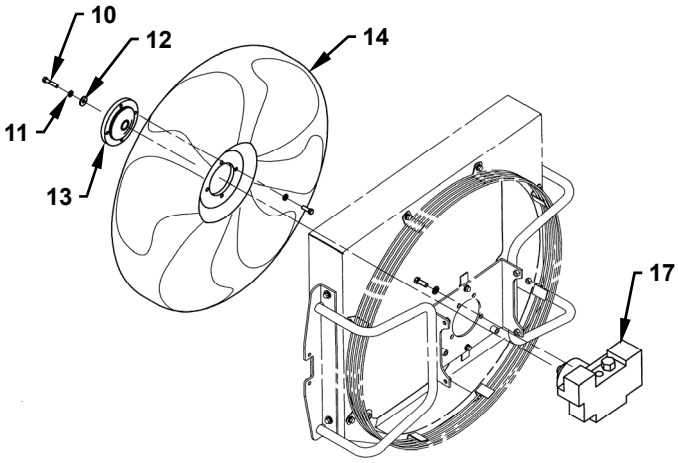
W4GB-02-08-300

3. Remove bolts (8) (8 used) and spring washers (9) (8 used) from cover (7). Remove cover (7) from cover (6).
   : 14 mm



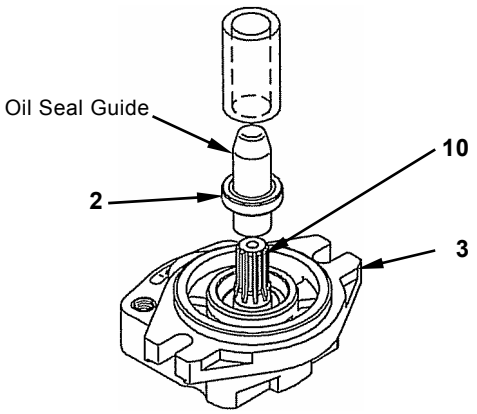
W4GB-02-08-301

4. Remove bolt (10), spring washer (11) and washer (12) from retainer (13). Remove the fan (14) assembly from hydraulic fan motor (17) by using a puller.
   : 14 mm



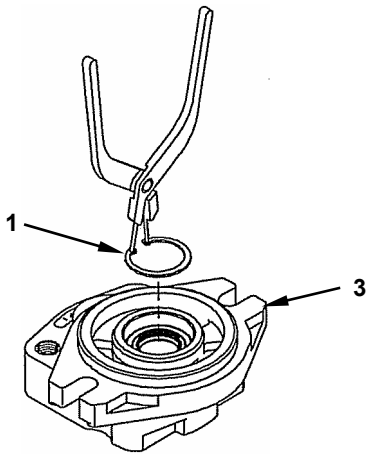
W4GB-02-08-003

9. Tap and install oil seal (2) to front cover (3) until oil seal (2) comes in contact with the bottom of the hole.



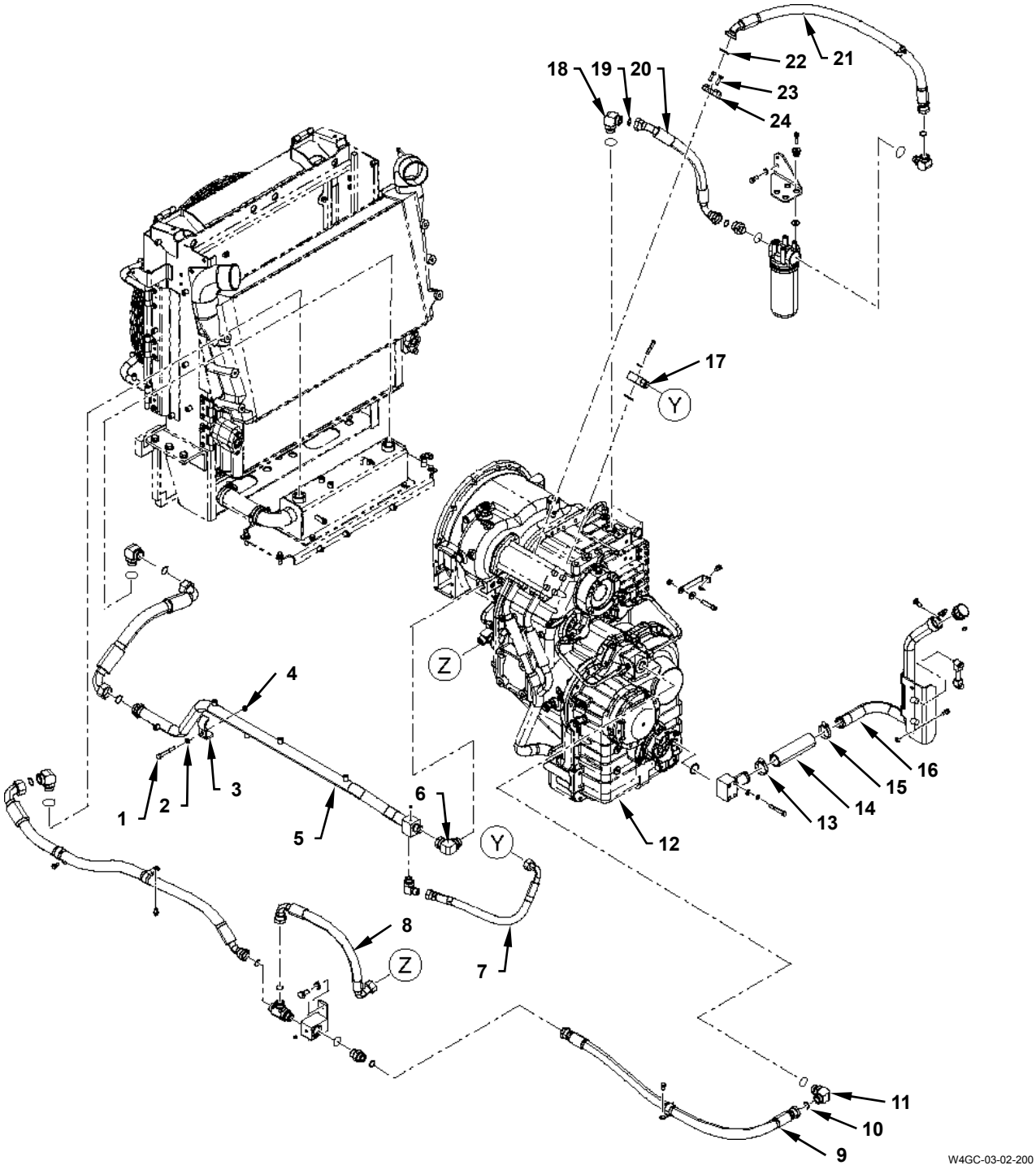
W4GB-02-08-018

10. Install retaining ring (1) to front cover (3).



W4GB-02-08-019

REMOVAL AND INSTALLATION OF DRIVE UNIT



1 - Bolt
2 - Washer
3 - Clamp
4 - Nut
5 - Tube
6 - Elbow
7 - Hose
8 - Hose
9 - Hose
10 - O-Ring
11 - Elbow
12 - Drive Unit
13 - Hose Clamp
14 - Hose
15 - Hose Clamp
16 - Filler Tube
17 - Block
18 - Elbow
19 - O-Ring
20 - Hose
21 - Hose
22 - O-Ring
23 - Bolt
24 - Split Flange

Installation

CAUTION: Engine weight: 1050 kg (2350 lb)
Drive unit (12) weight: 890 kg (2000 lb)

1. Install a gasket to the engine mounting part of the torque converter housing.

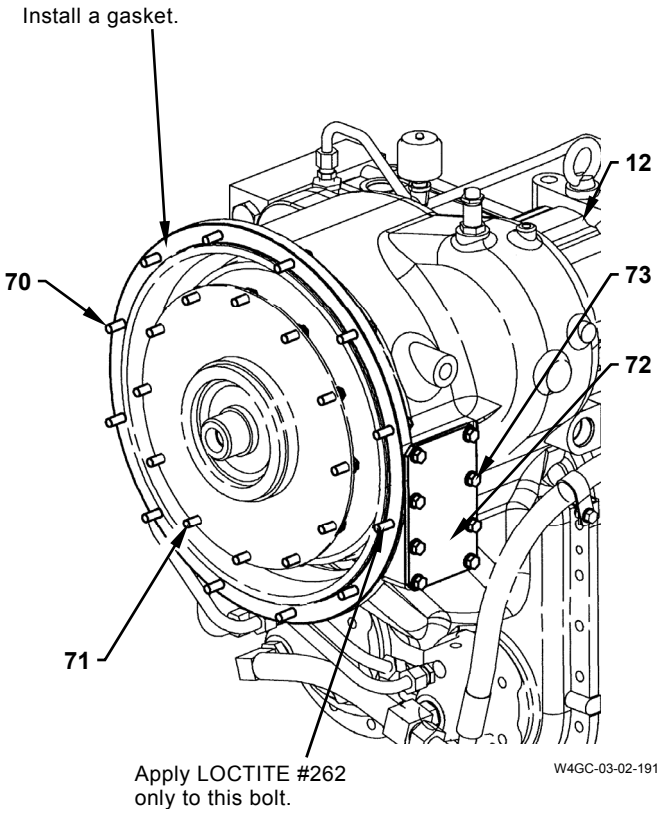
2. Hoist and align drive unit (12) with the mounting holes on the engine.

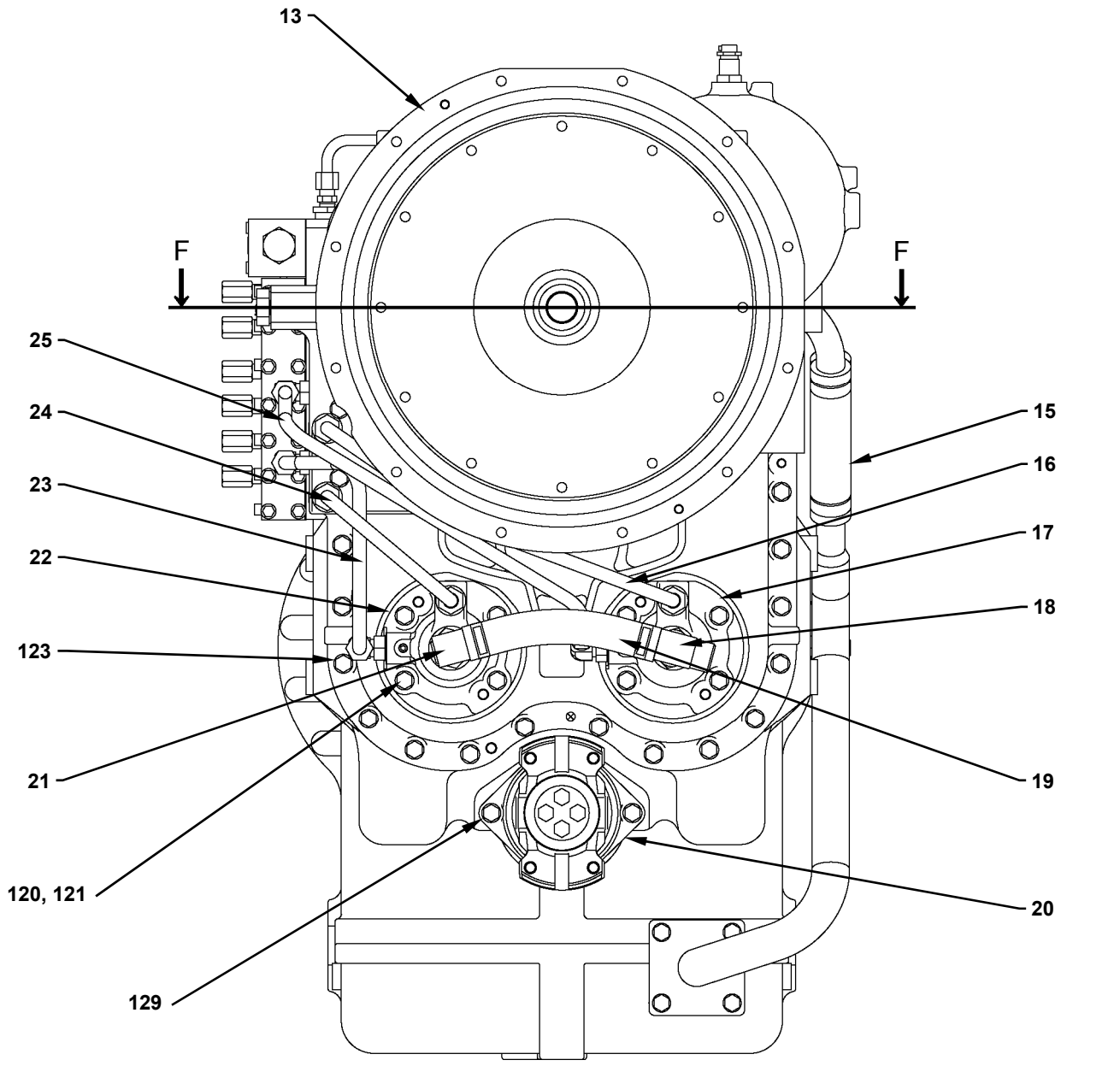
IMPORTANT: Apply LOCTITE #262 onto the thread part of 1 bolt only as illustrated in the right.

3. Install the flywheel housing of the engine and the torque converter housing of the drive unit with bolts (70) (12 used).
   : 14 mm
   : 41 N·m (4.2 kgf·m, 30 lbf·ft)

4. Apply LOCTITE #262 onto bolts (71) (12 used). Connect the input plate of the torque converter to the flywheel of the engine with bolts (71) (12 used).
   : 14 mm
   : 30.6 to 45.9 N·m
   (3.1 to 4.7 kgf·m, 22.5 to 34 lbf·ft)

5. Apply liquid gasket onto the cover (72) mounting surface of the torque converter housing. Install cover (72) to the torque converter housing with bolts (73) (8 used).
   : 14 mm
   : 41 N·m (4.2 kgf·m, 30 lbf·ft)



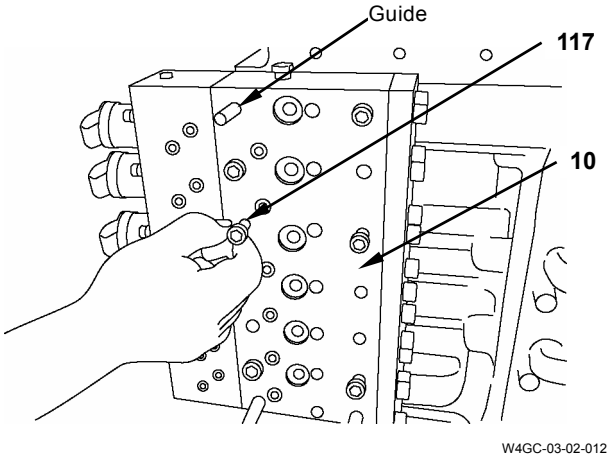


13- Torque Converter Housing
15 - Rubber Hose
16 - Pipe
17 - Distributor Cap
(for 1-Speed to 2-Speed)
18 - Three Way
19 - Rubber Hose
20 - Seal Retainer
21 - Elbow
22 - Distributor Cap
(for 3-Speed to 4-Speed)
22 - Pipe
23 - Pipe
24 - Pipe
120- Bolt (8 Used)
121 - Washer (8 Used)
123 - Bolt (30 Used)
129 - Bolt (2 Used)

CAUTION: Control valve (10) weight: 21 kg (46.5 lb)

9. Remove the 4-corner bolts among socket bolts (117) (21 used) from control valve (10). Install the guides (4 used) at that position.
   (Mounting hole: M8)
   : 6 mm

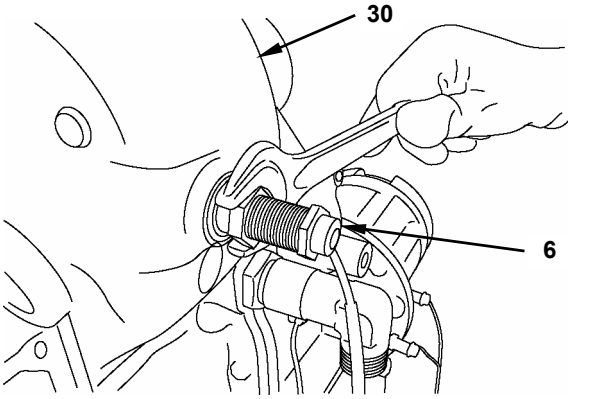
10. Remove other socket bolts (117) (17 used). Remove control valve (10) from transmission case (30).
    : 6 mm



W4GC-03-02-012

Removal of Speed Sensor

11. Remove speed sensors (6) (4 used) from transmission case (30).
    : 27 mm



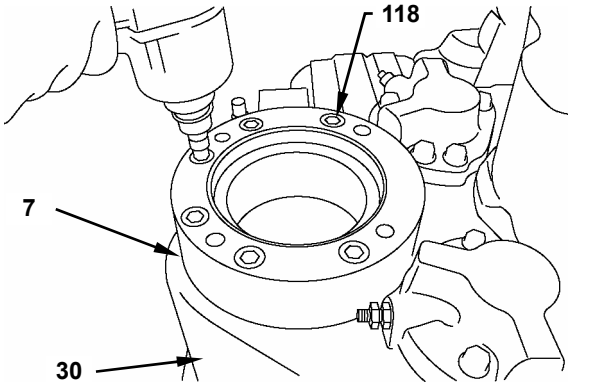
W4GC-03-02-014

Removal of Spacer and Cap

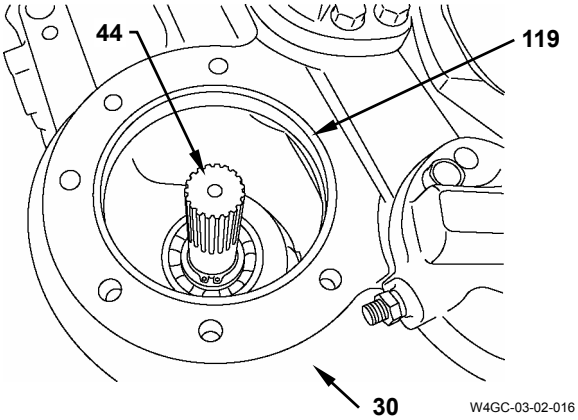
12. Remove socket bolts (118) (6 used) from pump spacer (7). Remove pump spacer (7) from transmission case (30).
    : 10 mm

13. Remove O-ring (119) from transmission case (30).

14. Remove shaft (44) from torque converter housing (13).



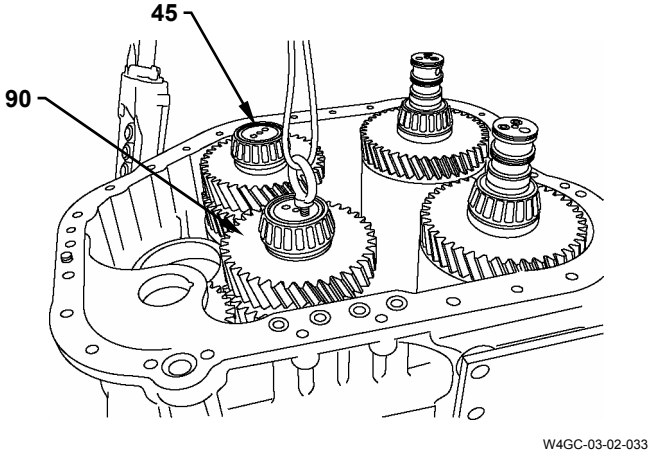
W4GC-03-02-015



W4GC-03-02-016

CAUTION: Forward clutch assembly (45), reverse clutch assembly (90) weight: 41 kg (90.5 lb) for each

33. Install an eyebolt (M10, Pitch 1.25 mm) to the shafts of forward clutch assembly (45) and reverse clutch assembly (90). Attach a nylon sling onto an eyebolt. Remove them from transmission case (30).



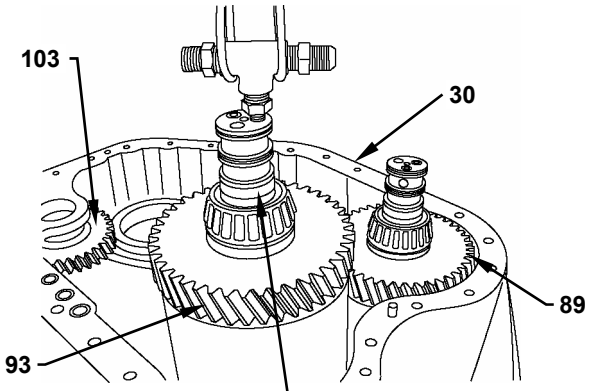
W4GC-03-02-033

CAUTION: 1-speed to 2-speed clutch assembly (89), 3-speed to 4-speed clutch assembly (93) weight: 68 kg (150 lb) for each

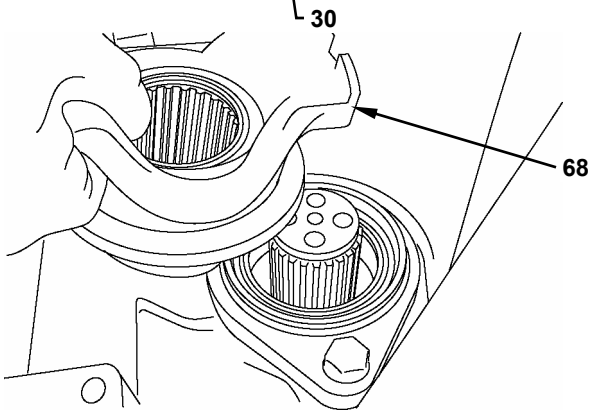
34. Remove 1-speed to 2-speed clutch assembly (89) and 3-speed to 4-speed clutch assembly (93) from transmission case (30) in the same way.

35. In the final step, remove reverse gear (103) and spacer (104) without shaft (105) from transmission case (30).

36. Remove bolts (87) (4 used) from retainer plate (70) at the transmission case (30) side. Remove flange (68), retainer plate (70), O-ring (69) and shim (88).
: 19 mm



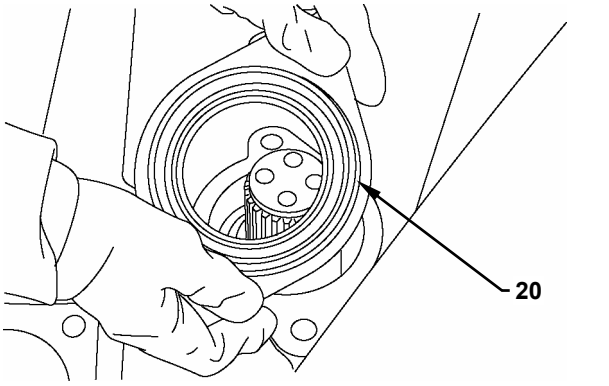
W4GC-03-02-034



W4GC-03-02-035

37. Remove bolts (129) (2 used) of seal retainer (20). Remove seal retainer (20) from transmission case (30).
(Refer to W3-2-17 as for bolt (129)).

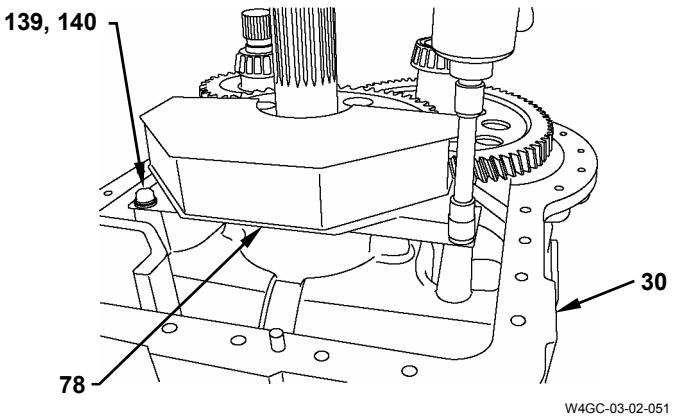
38. Remove spacer (85) from output shaft (71).



W4GC-03-02-036

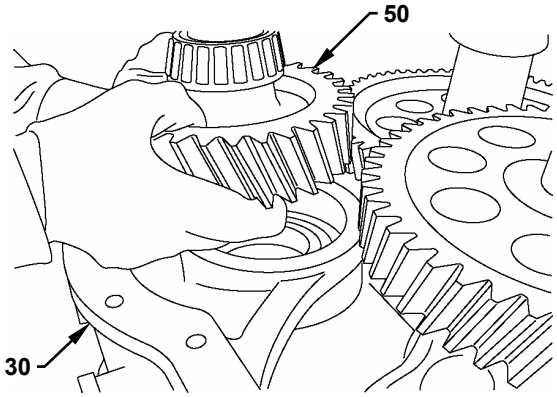
Removal and Disassembly of Gears and Shafts

54. Remove bolts (139) (2 used) and washers (140) (2 used) from oil buffle (78). Remove oil buffle (78) from transmission case (30).
    : 19 mm



W4GC-03-02-051

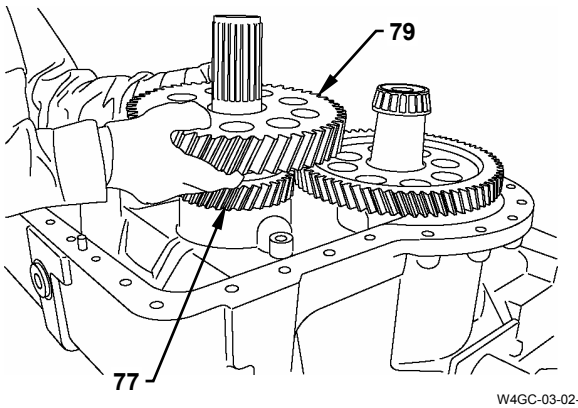
55. Remove low gear (50) on top of transmission case (30).



W4GC-03-02-052

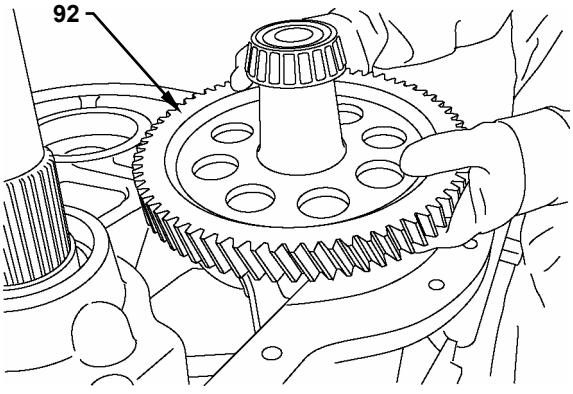
56. Remove spacer (76) from output shaft (71)

57. Remove gears (77, 79) from output shaft (71)



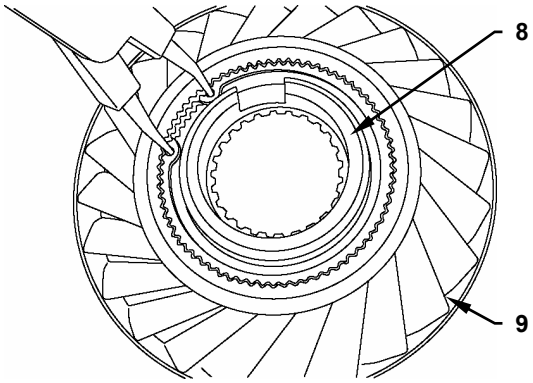
W4GC-03-02-053

58. Remove high gear (92) on top of transmission case (30).



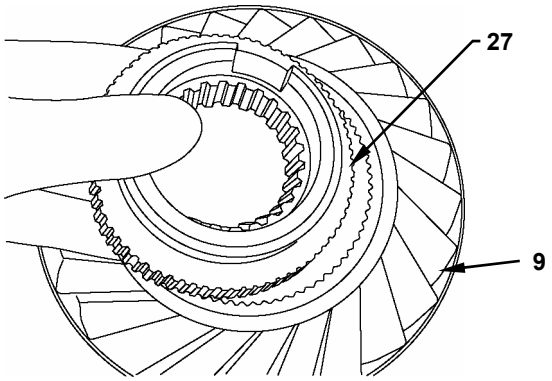
W4GC-03-02-054

15. Remove retaining ring (8) from stator wheel (9).



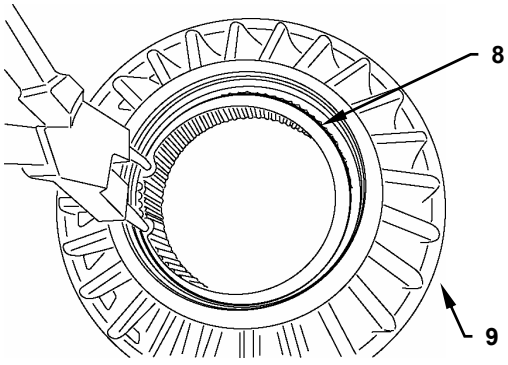
W4GC-03-02-071

16. Remove stator hub (27) from stator wheel (9).



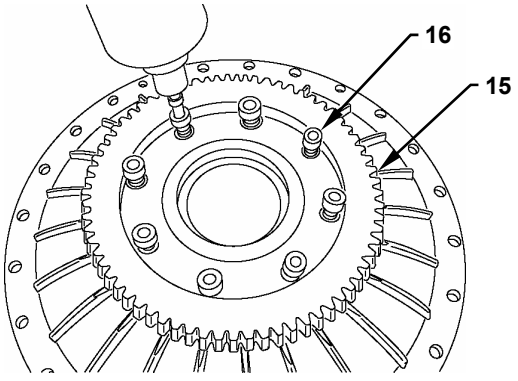
W4GC-03-02-072

17. Remove retaining ring (8) from stator wheel (9).



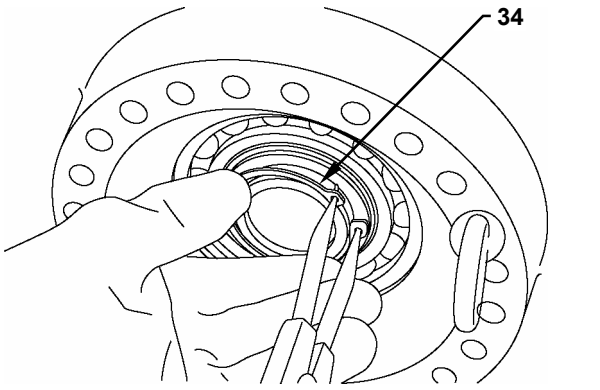
W4GC-03-02-073

18. Remove socket bolts (16) (8 used) from pump drive gear (15).
    : 8 mm



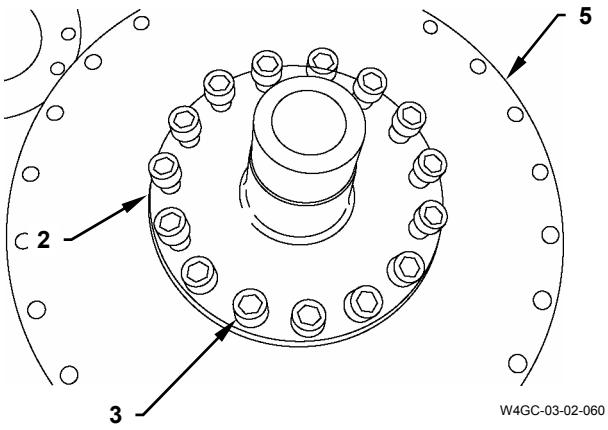
W4GC-03-02-074

14. Install spacer (31), O-ring (32), spacer (33) and retaining ring (34) to turbine shaft (18).



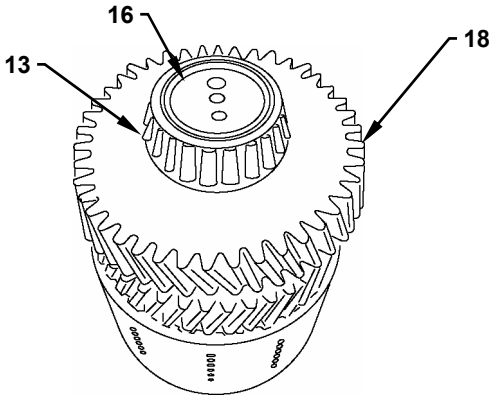
W4GC-03-02-062

15. Install input plate (5) and input guide (2) to cover wheel (6). Secure input plate (5) and input guide (2) to cover wheel (6) with socket bolts (3) (15 used).
    - : 10 mm
    - : 96.8 to 111 N·m (9.88 to 11.3 kgf·m, 71 to 82 lbf·ft)



W4GC-03-02-060

10. Install spacer (1) and bearing (13) to shaft / drum (16).



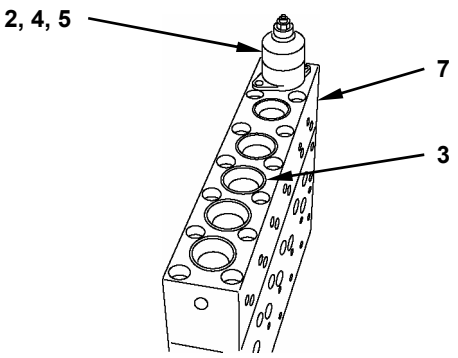
W4GC-03-02-116

Disassembly of Control Valve

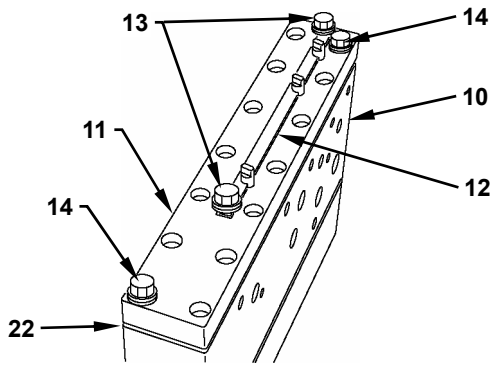
1. Remove socket bolts (24) (12 used) from solenoid valves (2) (6 used). Remove solenoid valves (2) (6 used) from solenoid valve body (7).
   : 4 mm

2. Remove O-rings (3) (6 used), plates (4) (6 used) and wave springs (5) (6 used) from solenoid valve body (7).

3. Turn over solenoid valve body (7). Remove bolts (14) (14 used) from valve cover (11). Remove valve cover (11) and gasket (22) from valve body (10).
   : 13 mm



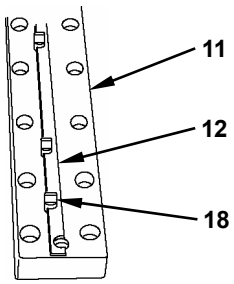
W4GC-03-02-091



W4GC-03-02-092

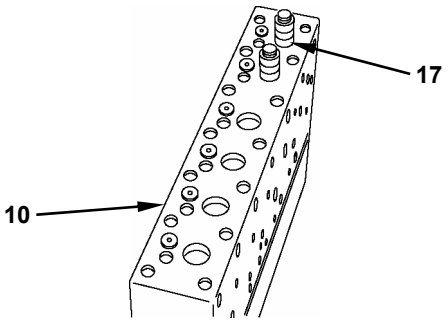
4. Remove bolts (13) (2 used) from plate (12). Remove plate (12) from valve cover (11).
   : 13 mm

5. Remove rods (18) (3 used) from valve cover (11). Remove O-rings (19) (3 used) from rods (18) (3 used).



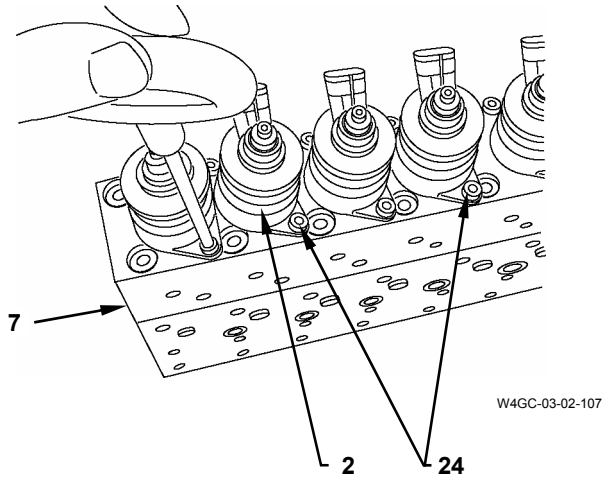
W4GC-03-02-093

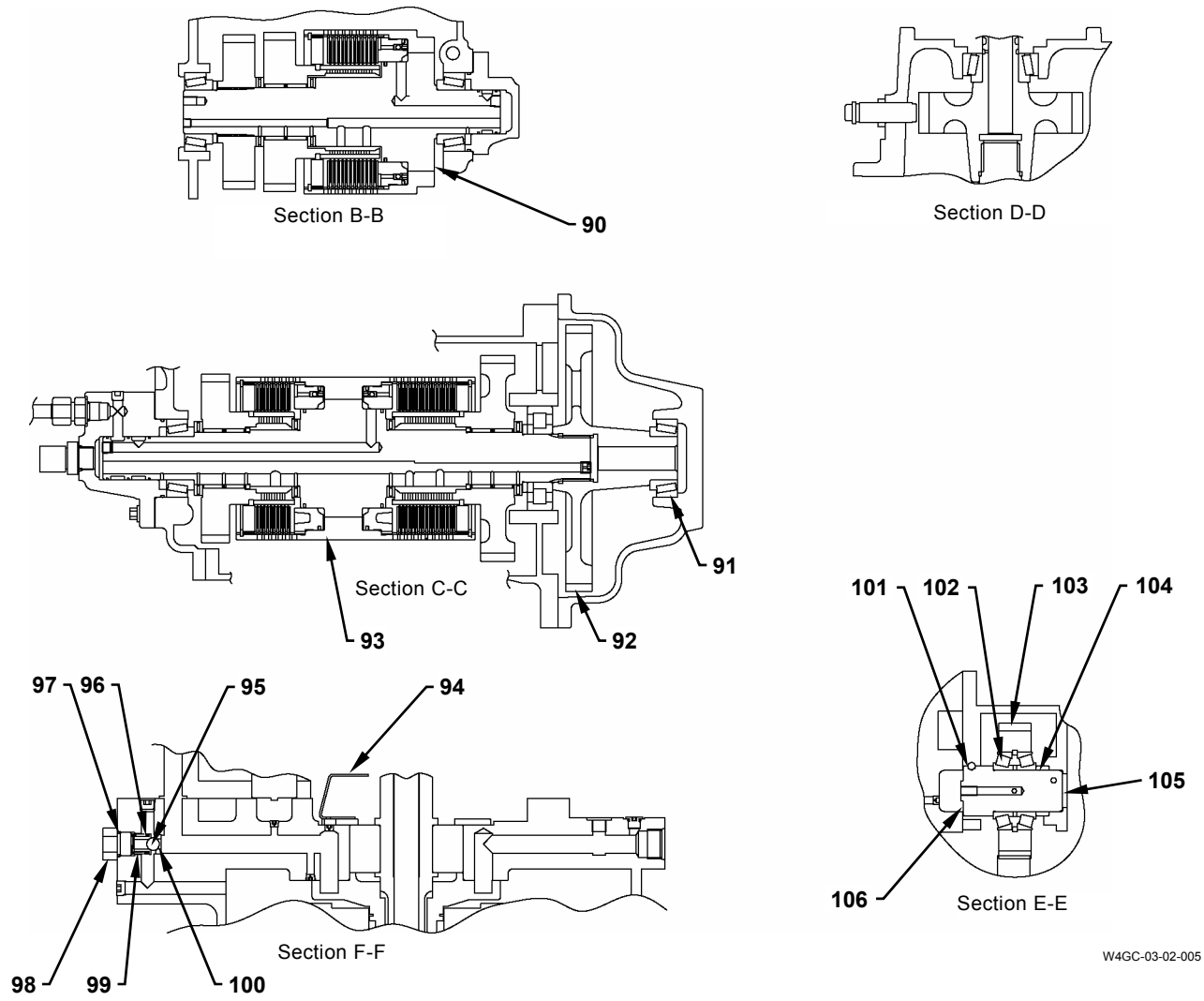
6. Remove spools (17) (6 used) from valve body (10). Remove springs (16) (6 used) by using a magnet.



W4GC-03-02-094

13. Install solenoid valves (2) (6 used) to solenoid valve body (7) with socket bolts (24) (12 used).
    : 4 mm

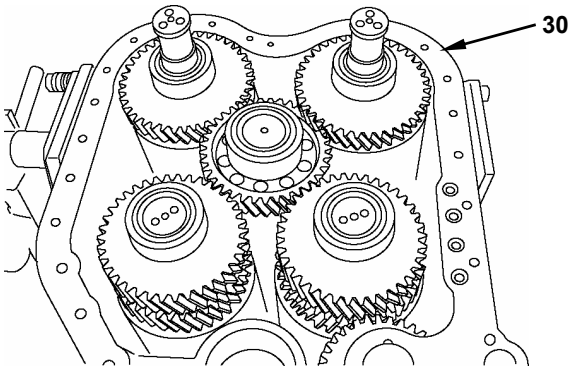




90 - Reverse Clutch Assembly
91 - Bearing
92 - High Gear
93 - 3-Speed to 4-speed Clutch Assembly
94 - Bracket
95 - Ball
96 - Spring
97 - O-Ring
98 - Plug
99 - Spring Seat
100 - Seat
101 - Ball
102 - Bearing
103 - Reverse Gear
104 - Spacer
105 - Shaft
106 - Shim

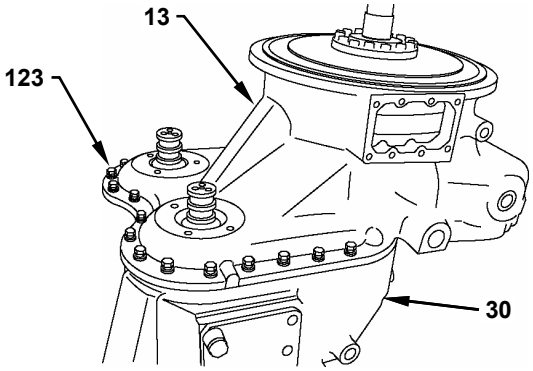
20. Install the bearing outer races for forward, reverse and idler to the torque converter housing (13) case.

21. Apply LOCTITE (FMD-127) onto the mounting surface of transmission case (30).



W4GC-03-02-136

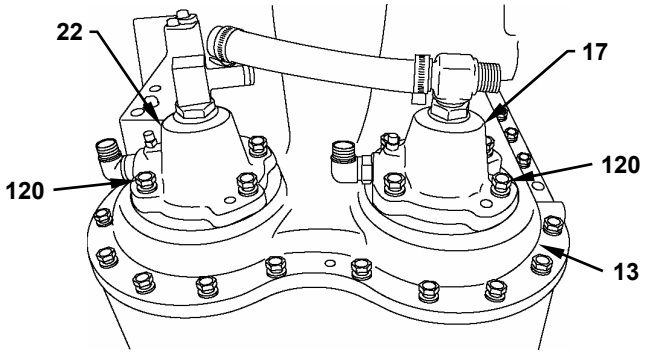
22. Hoist torque converter housing (13). Align torque converter housing (13) with transmission case (30) by using a plastic hammer while aligning the bearing inserting holes, the bolt mounting holes and the pin mounting holes. Install torque converter housing (13) to transmission case (30) with bolts (123) (30 used).
    : 19 mm
    : 34 N·m (3.5 kgf·m, 25 lbf·ft)



W4GC-03-02-137

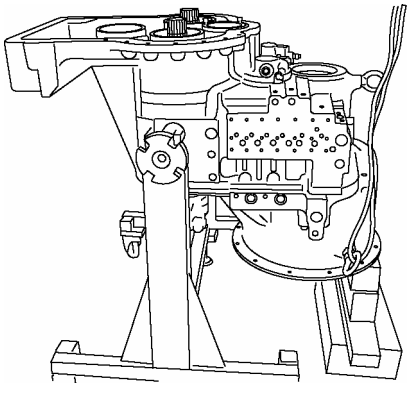
Adjustment of Rolling Torque of Idler Shaft

23. Temporarily tighten 1-speed to 2-speed and 3-speed to 4-speed distributer caps (17, 22) to torque converter housing (13) with bolts (120) (4 used).



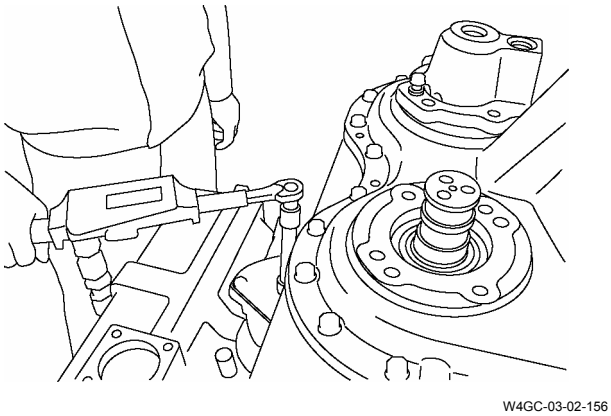
W4GC-03-02-138

24. Turn over the transmission case (30) assembly.

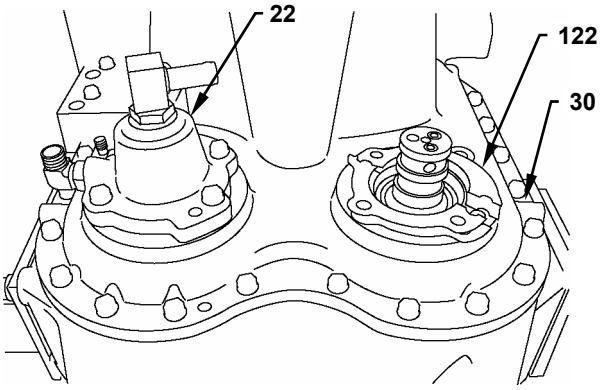


W4GC-03-02-139

50. Install a special tool to flange (68). Adjust shim (122) between 1-speed to 2-speed and 3-speed to 4-speed distributor caps (17, 22) and rear case (31) when installing 1-speed to 2-speed and 3-speed to 4-speed distributor caps (17, 22) so that the specified rolling torque range is applied to output shaft (71).
    3-speed to 4-speed speed clutch: 14.9 to 17.1 N·m (1.52 to 1.75 kgf·m, 11 to 12.5 lbf·ft)
    1-speed to 2-speed speed clutch: 21.3 to 28.7 N·m (2.17 to 2.93 kgf·m, 15.5 to 21 lbf·ft)
    (3-speed to 4-speed speed)+(1-speed to 2-speed speed): 26.0 to 32.0 N·m (2.65 to 3.27 kgf·m, 19 to 23.5 lbf·ft)


W4GC-03-02-156

51. Install shims (122) (several) to 1-speed to 2-speed and 3-speed to 4-speed distributor caps (17, 22). Install 1-speed to 2-speed and 3-speed to 4-speed distributor caps (17, 22) to transmission case (30) with bolts (120) (8 used) and washers (121) (8 used).
    : 19 mm
    : 34 N·m (3.5 kgf·m, 25 lbf·ft)



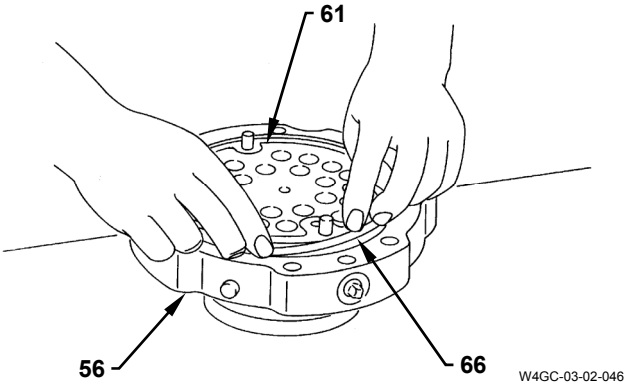
W4GC-03-02-157

Assembly and Installation of Parking Brake

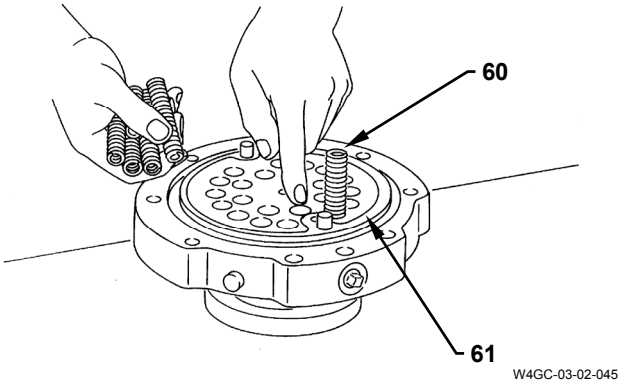
52. Install D-rings (64, 65) to the large diameter and the small diameter of brake piston (61) respectively. Install brake piston (61) to piston housing (56) by aligning the matching marks.

53. Install O-ring (66) to the groove on piston housing (56).

54. Install springs (60) (22 used) to the drill hole on brake piston (61).



W4GC-03-02-046



W4GC-03-02-045

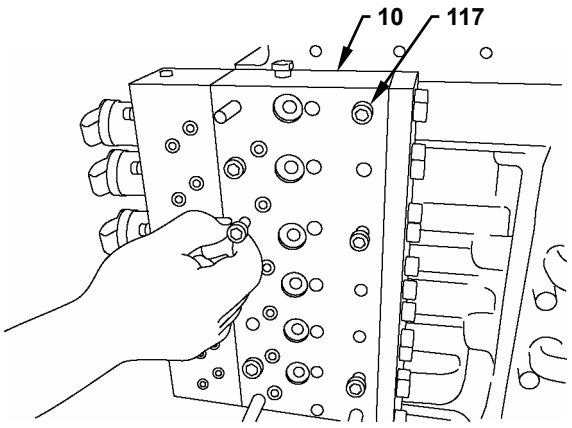
Installation of Control Valve

72. Install the gasket to the mounting surface of control valve (10).

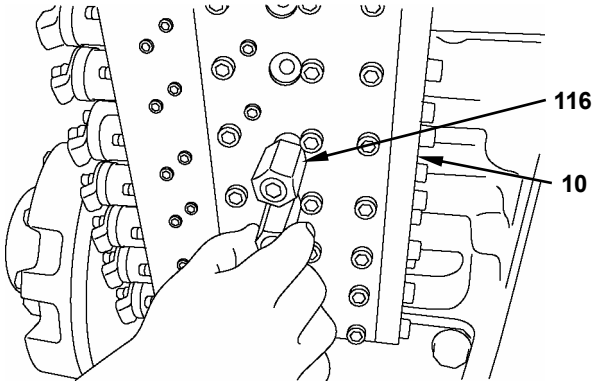
73. Install control valve (10) to transmission case (30) with socket bolts (117) (21 used).
    : 6 mm
    : 9.8 N·m (1 kgf·m, 7.2 lbf·ft)

IMPORTANT: Apply LOCTITE #572 onto the connector plug.

74. Install the plug and O-ring to connectors (116) (6 used). Install connectors (116) (6 used) to control valve (10).
    : 21 mm
    : 9.8 N·m (1 kgf·m, 7.2 lbf·ft)



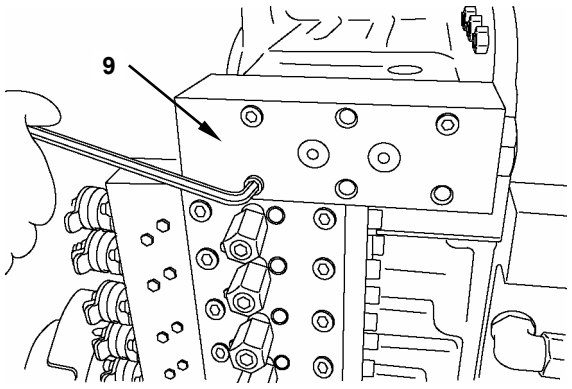
W4GC-03-02-012



W4GC-03-02-013

75. Install the gasket to the mounting surface of regulator valve (9).

76. Install regulator valve (9) to transmission case (30) with the socket bolts (6 used).
    : 6 mm
    : 9.8 N·m (1 kgf·m, 7.2 lbf·ft)

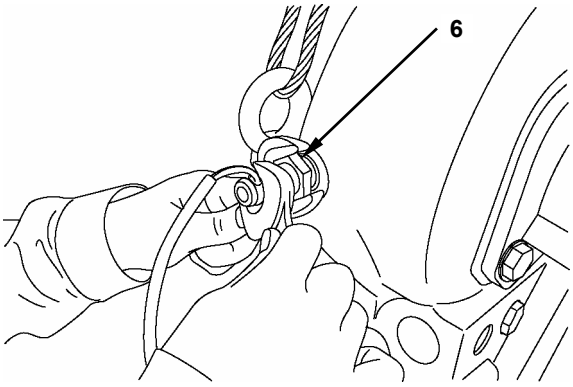


W4GC-03-02-011

Installation of Speed Sensor

IMPORTANT: Apply LOCTITE #572 onto speed sensor (6).

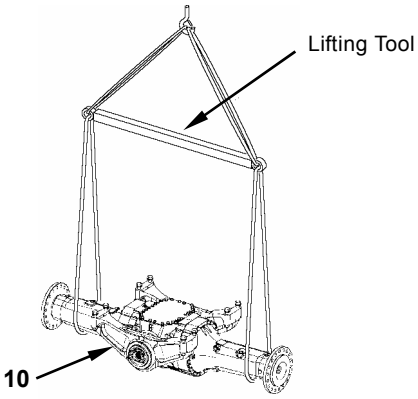
77. Install speed sensors (6) (4 used) to transmission case (30).
    Attach speed sensor (6) to the gear and secure it at the position after 2 backward turnings.
    : 27 mm



W4GC-03-02-165

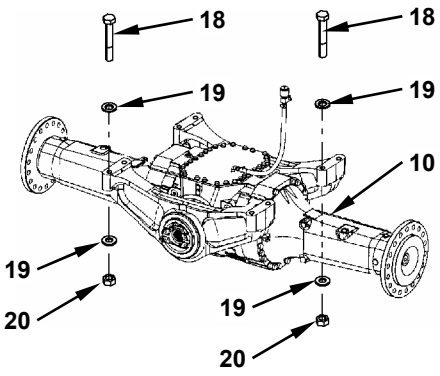
5. Hoist and hold rear axle (10) by using a lifting tool.

CAUTION: Rear axle (10) weight: 1510 kg (3330 lb)



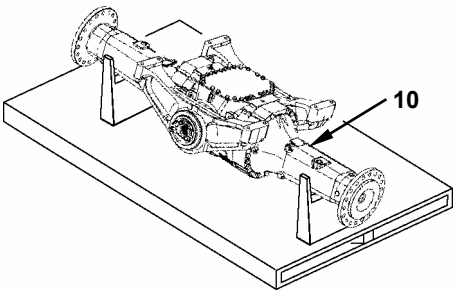
W4GB-03-03-111

6. Remove nuts (20) (8 used), washers (19) (16 used) and bolts (18) (8 used) from rear axle (10) and rear frame (2).
: 27 mm



W4GB-03-03-112

7. Slowly lower rear axle (10) from rear frame (2). Place rear axle (10) onto a stand. Move rear axle (10) away from the machine.



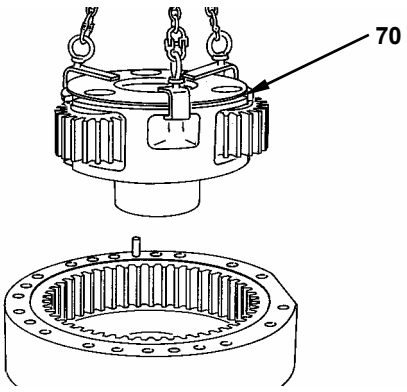
W4GB-03-03-113

Disassembly of Axle Tube

8. Place axle tube (2) with the differential gear mounting side facing upward. Secure axle shaft (73) to the plate.
   : 36 mm

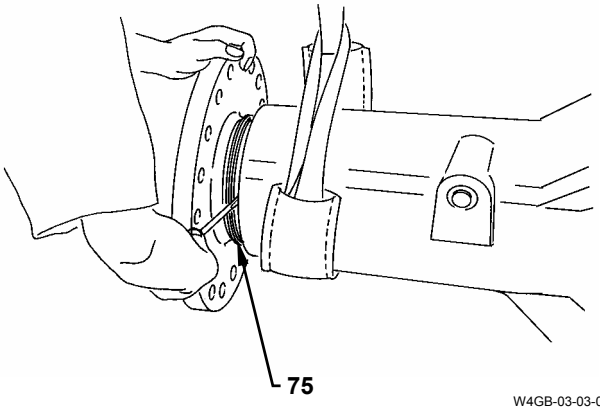
CAUTION: Planet carrier assembly (70) weight: 83 kg (185 lb)

9. Remove planet carrier assembly (70) from the axle shaft (73) spline by using a pry bar.



W4GB-03-03-007

10. Place axle tube (2) horizontally. Remove oil seal (75) from axle tube (2).

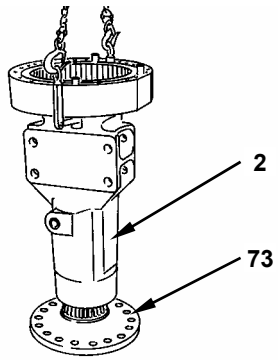


W4GB-03-03-008

11. Remove the bearing (72) inner parts from axle tube (2).

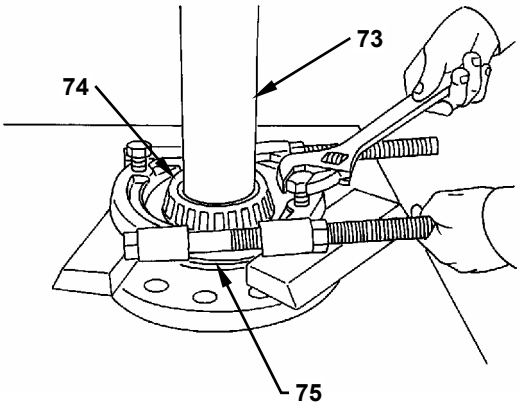
CAUTION: Axle tube (2) weight:
Front: 321 kg (710 lb)
Rear: 271 kg (600 lb)

12. Place axle tube (2) with the differential gear body (5) side facing upward. Hoist axle tube (2). Drop down and remove axle shaft (73).



W4GB-03-03-009

13. Remove the bearing (74) inner parts and oil seal (75) from axle shaft (73) as shown in the figure by using the special tool for removing the bearing (separator).

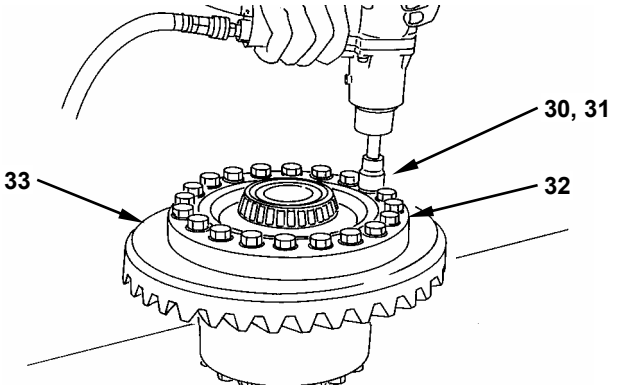


W4GB-03-03-010

14. Remove the outer parts of bearings (72, 74) on the differential gear side and the wheel side from axle tube (2).
    Evenly tap and remove the outer parts of the bearings.

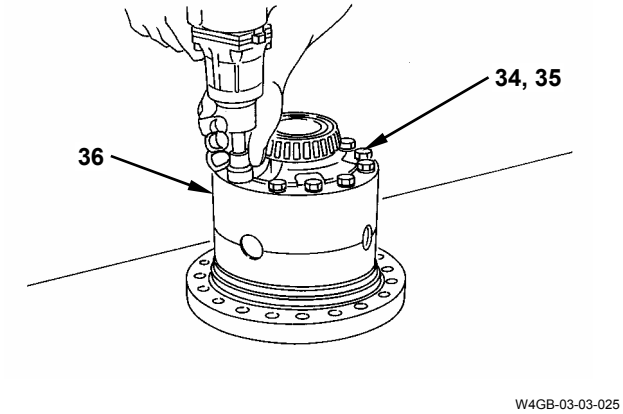
Disassembly of Differential Case (only axle with TPD attached)

48. Remove bolts (30) (24 used) and washers (31) (24 used) from flange half case (32). Remove ring gear (33) from flange half case (32).
    : 24 mm



W4GB-03-03-024

49. Turn over the case and remove bolts (34) (12 used) and washers (35) (12 used) from plain half case (36).
    : 22 mm

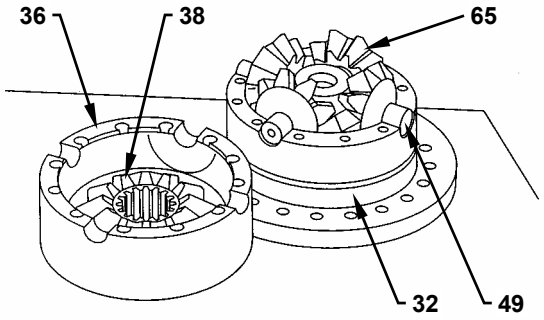


W4GB-03-03-025

50. Tap the center of spider (49) lightly and remove flange half case (32).

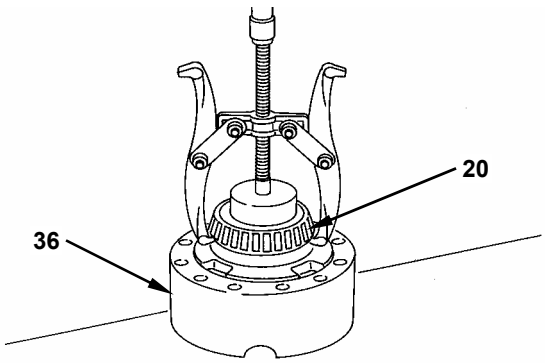
NOTE: Put the matching marks on flange half case (32) before separating for assembling.

51. Remove side gears (38) (2 used), spider (49), pinion gears (65) (4 used), thrust washers (37) (2 used) for the guide gear and thrust washers (66) (4 used) for the pinion gear from the insides of flange half case (32) and plain half case (36).



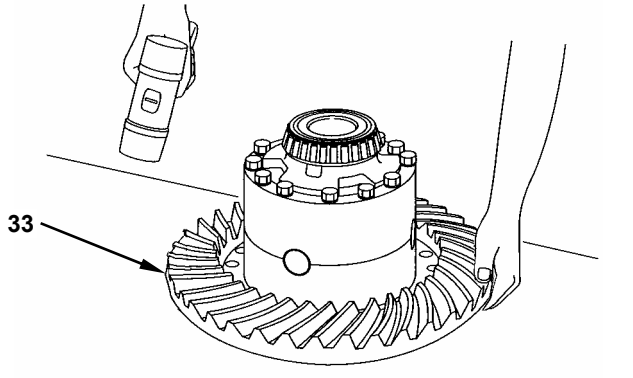
W4GB-03-03-026

52. Remove the inner of bearing (20) from plain half case (36) and flange half case (32) by using a bearing puller.



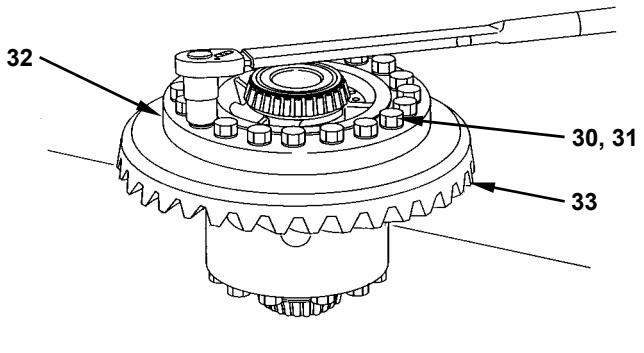
W4GB-03-03-027

8. Install ring gear (33) to flange half case (32) with the gear side facing upward. Contact ring gear (33) to the flange surface of the case by using a plastic hammer. Temporary tighten bolts (30) (2 used) and washers (31) (2 used) from the bottom side.



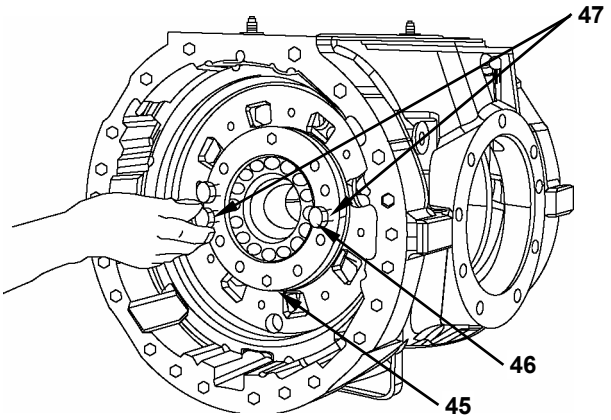
W4GB-03-03-036

9. Turn over the flange half case (32) assembly. Apply LOCTITE #262 onto the bolts (30) (24 used) thread part. Secure ring gear (33) to flange half case (32) with bolts (30) (24 used) and washers (31) (24 used).
   : 24 mm
   : 225 N·m (23 kgf·m, 165 lbf·ft)



W4GB-03-03-037

27. Apply LOCTITE #262 onto bolt (46). Install bearing nuts (45) (2 used) to right and left sides of differential gear body (5). Support the hoisted differential case and secure bearing nuts (45) (2 used) to differential gear body (5) with bolt (46) and washer (47).
    - Quantity of the bolts: 12 used
    - : 19 mm
    - : 98 N·m (10 kgf·m, 72 lbf·ft)

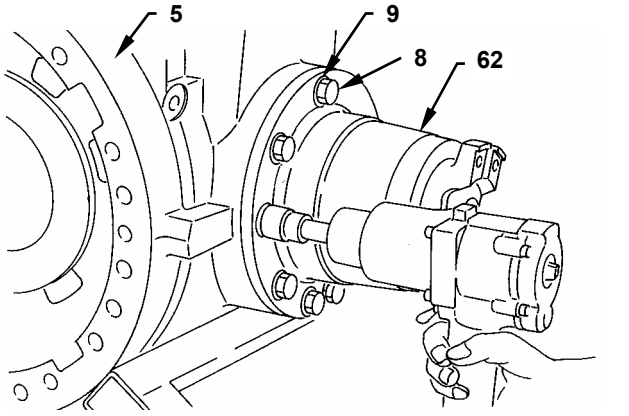


W4GB-03-03-049

Installation of Bearing Cage

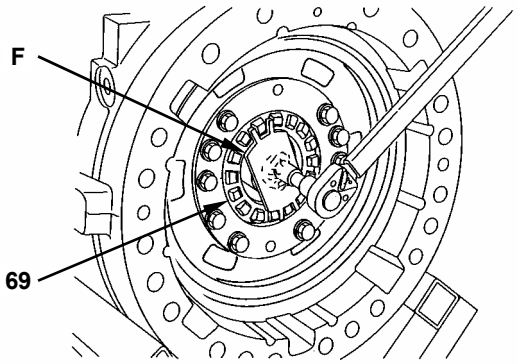
28. Put shim (64) between bearing cage (62) and differential gear body (5). Install the bearing cage (62) assembly to differential gear body (5).

29. Apply LOCTITE #262 onto bolt (8).
    Secure the bearing cage (62) assembly to differential gear body (5) with bolt (8) and washer (9).
    Quantity of the bolts
    Front : 14 used
    Rear : 14 used
    : 24 mm
    : 225 N·m (23 kgf·m, 165 lbf·ft)



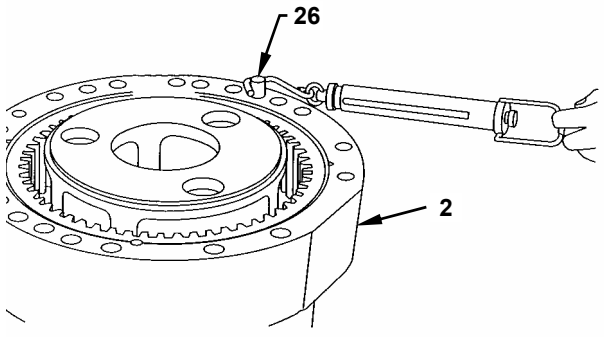
W4GB-03-03-050

30. Tighten adjusting nut (69) to both right and left sides by using special tool (F).
    : 120 N·m (12 kgf·m, 87 lbf·ft)



W4GB-03-03-051

57. Install selected shim (19) and retainer plate (87) to the end of axle shaft (73). Secure retainer plate (87) to axle shaft (73) with bolt (71).
    : 36 mm
    : 49 N·m (5 kgf·m, 36 lbf·ft)
58. Attach a spring balance onto knock pin (26) of axle tube (2). Pull the top of installation pitch circle and measure rotation resistance of the bearing.
    If measured values are out of 20 to 39 N (2 to 4 kgf, 4.5 to 8.78 lbf), perform shim adjustment again. If the value is small, reduce thickness of the shim. If the valve is big, increase thickness of the shim.



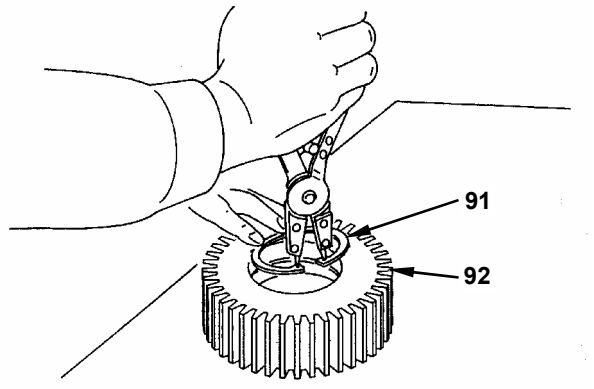
W4GB-03-03-068

59. When thickness of shim (19) is determined, loosen bolt (71). Remove temporary installed planet carrier (85).
    : 36 mm

CAUTION: Planet carrier (85) weight: 48 kg (106 lb)

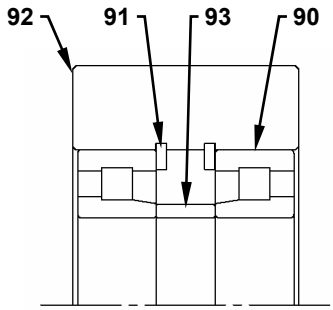
Assembly and Installation of Planet Carrier Assembly (70)

60. Install retaining rings (91) (2 used) to planet gear (92).



W4GB-03-03-069

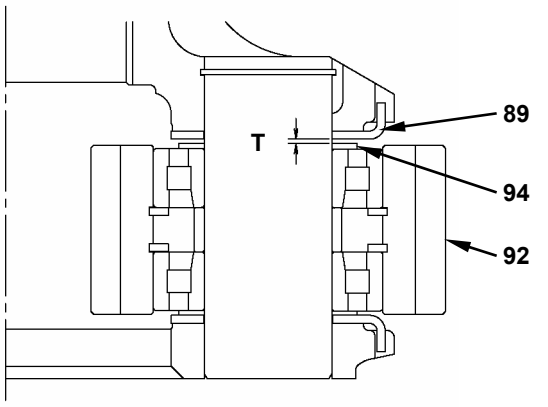
61. Install the outer part of bearing (90) (2 used) from both sides of planet gear (92). Insert collar (93) into the center of planet gear (92). Install the inner part of bearing (90) from both sides.
    When installing the outer part, do not push retaining ring (91) too strong.



W4GB-03-03-070

62. Install thrust washers (89) (2 used) to planet carrier (85). Set the stoppers of thrust washers (89) to the outer groove of planet carrier (85) at this time.

63. Install thrust bearings (94) (2 used) for clearance adjustment and planet gear (92) between thrust washers (89).
    Adjust thickness of thrust bearing (94) so that clearance (T) is less than 0.5 mm (0.02 in) at this time. (Thickness of 2 mm (0.079 in), 2.5 mm (0.098 in), and 3 mm (0.12 in).)



W4GB-03-03-071

Installation (between front axle and transmission)

1. Install propeller shaft (7) to the body.

IMPORTANT: Apply LOCTITE #262 onto the mounting bolts except for support bearing (3).

IMPORTANT: Align the flanges of propeller shafts (7) at the front and the rear. Install propeller shaft (7) so that grease fittings (6) of propeller shafts (7) at the front and the rear are on the same side. At this time, raise the body so that the tire can be rotated. (Refer to W3-4-1.)

2. Install support bearing (3) to the body with bolts (13) (2 used).
   : 30 mm
   : 196.2 to 215.8 N·m
   (20 to 22 kgf·m, 145 to 159 lbf·ft)

3. Install bolts (2, 9) (4 used for each).
   : 17 mm
   : 143 N·m (15 kgf·m, 105 lbf·ft)

4. Install grease fitting (6). Apply grease.

BODY (TRAVEL SYSTEM) / Brake Valve

1 - Spool (2 Used)
2 - Plunger (2 Used)
3 - O-Ring (2 Used)
4 - Orifice
5 - Body
6 - Plug (2 Used)
7 - O-Ring (2 Used)
8 - Spring Seat (2 Used)
9 - Retaining Ring (2 Used)
10 - Spring (2 Used)
11 - Orifice
12 - Body
13 - Socket Bolt (4 Used)
14 - O-Ring
15 - Plug
16 - C-Ring
17 - Spring
18 - Spring Seat
19 - Spring
20 - Spring
21 - Socket Bolt
22 - Retainer
23 - Spring Seat
24 - Cover
25 - Input Spool
26 - Oil Seal
27 - Stopper
28 - C-Ring
29 - Dust Cover
30 - Seat
31 - Mounting Plate
32 - Washer (3 Used)
33 - Bolt (3 Used)
34 - L Pin (2 Used)
35 - Pedal Pin (2 Used)
36 - Collar (4 Used)
37 - Roller (2 Used)
38 - Pedal (2 Used)
39 - Pedal Cover (2 Used)
40 - Washer
41 - Pin (2 Used)
42 - Bolt (2 Used)
43 - Nut
44 - Screw
45 - Washer (2 Used)
46 - Nut (2 Used)
47 - Pin (2 Used)
48 - Mounting Plate
49 - Nut
50 - Bolt
51 - Bushing (4 Used)
52 - Collar (2 Used)
53 - Pedal Shaft
54 - Retaining Ring (2 Used)
55 - Boot
56 - Joint
57 - Shaft (2 Used)

IMPORTANT: Use a protective layer. In order not to damage the outer diameter of input spool (25) when tightening a socket bolt while securing input spool (25) in a vise.

11. Install spring seat (23), spring (20) and retainer (22) to input spool (25) with socket bolt (21).
    At this time, install spring (20) with the small diameter side facing to the retainer (22) side.
    : 4 mm
    : 6.9 to 8.8 N·m
    (0.7 to 0.9 kgf·m, 5.1 to 6.5 lbf·ft)

12. Apply grease onto the periphery of input spool (25). Insert input spool (25) into cover (24).

IMPORTANT: Check that spool (1) is installed in the hole of spring seat (18) completely.
Install spring (19) into the hole on of spring seats (18, 23) completely. Install spring (17) into the hole on spring seat (23) and body (5) co mpletely.

13. Install springs (19, 17) and spring seat (18) to cover (24). Check the direction of the port. Install cover (24) to body (12) with socket bolts (13) (4 used).
    : 6 mm
    : 19.5 to 25.5 N·m
    (2 to 2.6 kgf·m, 14.5 to 19 lbf·ft)

BODY (TRAVEL SYSTEM) / Charging Block

1 - Plug (5 Used)
2 - O-Ring (5 Used)
3 - Plug (7 Used)
4 - O-Ring (7 Used)
5 - Plunger (4 Used)
6 - Spring (4 Used)
7 - O-Ring (5 Used)
8 - Plug (4 Used)
9 - Plug
10 - Spring
11 - Plunger
12 - Sleeve
13 - Plug (11 Used)
14 - O-Ring (11 Used)
15 - Filter
16 - Body
17 - Stopper
18 - Spring
19 - Washer
20 - Spool
21 - Sleeve
22 - O-Ring
23 - Socket Bolt (4 Used)
24 - Solenoid
25 - Solenoid
26 - O-Ring
27 - Sleeve
28 - O-Ring
29 - O-Ring
30 - O-Ring
31 - Spool
32 - Spring
33 - O-Ring (3 Used)
34 - Plug (3 Used)
35 - Plunger
36 - Spring
37 - Screw
38 - Nut
39 - Spring
40 - Needle Valve
41 - Body
42 - O-Ring
43 - Backup Ring
44 - O-Ring
45 - Sleeve
46 - Backup Ring
47 - O-Ring
48 - Piston
49 - Nut
50 - O-Ring
51 - Adjusting Screw
52 - Poppet
53 - Spring
54 - Shim
55 - Shim
56 - O-Ring
57 - Plug
58 - Orifice

7. Install O-rings (7) (2 used) to plugs (8) (2 used). Install poppets (5) (2 used), springs (6) (2 used), and plugs (8) (2 used) to body (16).
   : 6 mm
   : 21 N·m (2.14 kgf·m, 15.5 lbf·ft)

8. Apply LOCTITE #242 to the thread part of orifice (58). Install orifice (58) to body (16).
   Install O-rings (14) (11 used) to plugs (13) (11 used). Install plugs (13) (11 used) to body (16).
   : 4 mm
   : 5.9 N·m (0.6 kgf·m, 4.4 lbf·ft)
   : 5 mm
   : 98 N·m (10 kgf·m, 72 lbf·ft)

9. Install O-ring (7) to plug (9). Install sleeve (12), poppet (11), spring (10), and plug (9) to body (16).
   : 6 mm
   : 21.0 N·m (2.14 kgf·m, 15.5 lbf·ft)

10. Install O-rings (4) (7 used) to plugs (3) (7 used). Install O-rings (2) (5 used) to plugs (1) (5 used). Install plugs (3) (7 used) and plugs (1) (5 used) to body (16).
    : 3 mm
    : 4.9 N·m (0.5 kgf·m, 3.6 lbf·ft)
    : 6 mm
    : 26.5 N·m (2.7 kgf·m, 19.5 lbf·ft)

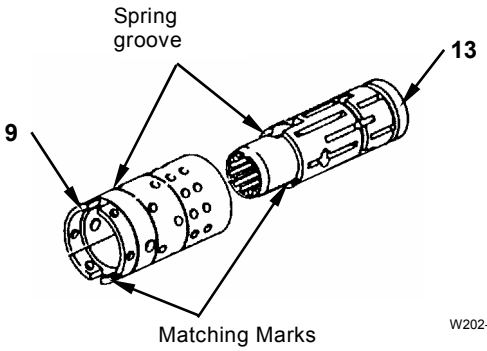
Assembly of Steering Pilot Valve

Precautions for Assembling

- Check all parts. If there are scratches or rough sides, polish by an oil stone and make the sides smooth.

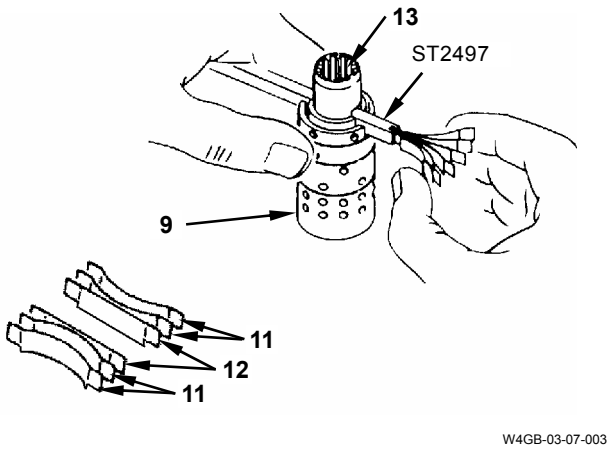
IMPORTANT: Turn spool (13) and sleeve (9) to the side with the same spring groove.

1. Turn and install spool (13) to sleeve (9). Align the matching marks on sleeve (9) and spool (13).

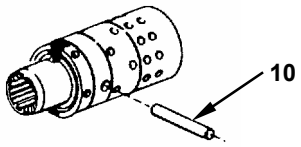


2. Align the spring groove positions of spool (13) and sleeve (9), and place them on a flat plate. Align 2 center springs (11) back to back, and 2 flat springs (12) in the center, and install them to a special tool (ST 2497). Install center springs (11) (4 used) and flat springs (12) (2 used) to the spring grooves of spool (13) and sleeve (9) by using a special tool.

IMPORTANT: As the spring may fly out, always wear safety glasses.



3. Install pins (10) in the holes of spool (13) and sleeve (9). Align the ends of the pins and the outer diameter surface of the sleeve.



4. Install the sleeve (9) assembly from the cap (21) side of housing (8).

NOTE: When installing the sleeve (9) assembly, prevent binding.
Keeping the pin horizontal, turn the pin right and left little by little. Insert the pin until the ends behind the sleeve (9) assembly and housing (8) come to the same position.

Assembly of Steering Valve

- Excessive torque at the time of bolting will cause deformation of the spool and operational failure.
- Apply hydraulic oil to the thread part of the bolts.

1. Install backup rings (13) (2 used) and O-rings (14) (2 used) to capscrews (12) (2 used).

2. Secure spool (19) with the batten (refer to W3-8-3) used at the time of disassembling in a vise. Install poppets (16) (2 used) and springs (15) (2 used) to spool (19), and install capscrews (12) (2 used) (both ends).
   : 17 mm
   : 39 to 41 N·m
   (4 to 4.2 kgf·m, 29 to 30.5 lbf·ft)

3. Install O-ring (3) to plug (2). Install plug (2) to valve housing (17).
   : 36 mm
   : 205 to 225 N·m
   (21 to 23 kgf·m, 152 to 167 lbf·ft)

4. Install overload relief valves (1) (2 used) to valve housing (17).
   : 32 mm
   : 78 to 88 N·m (8 to 9 kgf·m, 58 to 65 lbf·ft)

5. Turn and insert the spool (19) assembly in valve housing (1) in the same direction as before disassembling. Turn slowly and check that there is no seizure.

6. Install O-ring (4) to sleeve assembly (5). Install sleeve assembly (5) to cap assembly (7).

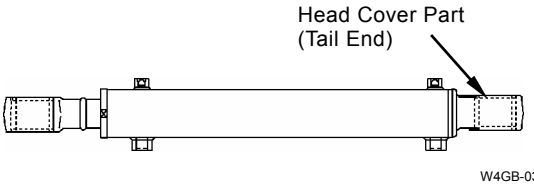
7. Install O-rings (9) (2 used), (8) (2 used), and (4) (2 used) to cap (18) and cap assembly (7). Install cap (18) and cap assembly (7) to valve housing (17) with socket bolts (9) (4 used) together with springs (10) (2 used) and spring seats (11) (2 used).
   : 6 mm
   : 39 to 44 N·m
   (4 to 4.5 kgf·m, 29 to 33 lbf·ft)

Disassembly of Steering Cylinder

CAUTION: Steering cylinder weight:
ZW220: 32 kg (71 lb)
ZW250: 36 kg (80 lb)

1. Secure the steering cylinder assembly on the workbench. Use the parallel surface as a fixing position and secure the head cover (tail end) part, so that it dose not move.

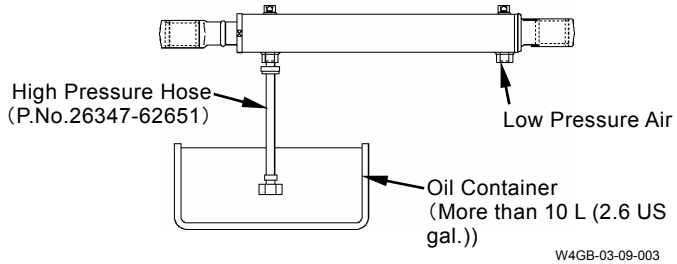
IMPORTANT: Do not secure by using the port part of cylinder tube (8).
Using processed wooden block with V- groove is recommended.



W4GB-03-09-002

CAUTION: Supply air with low pressure in order to adjust the rod (10) extending speed. Check that there are no co-workers and obstacles in the direction in which rod (10) is extended.

2. Temporary connect the high pressure hose to the piston rod (10) side port. Route one side to the oil reservoir container.
   Supply air with low pressure from the bottom side of cylinder tube (8), and discharge oil from the rod cover (15) side.



W4GB-03-09-003

3. Support extended rod (10) with a crane or a wooden block so that it is aligned with cylinder tube (8) in a straight line.

4. Reform the bending part of the lock washer on rod cover (15) to a flat surface.

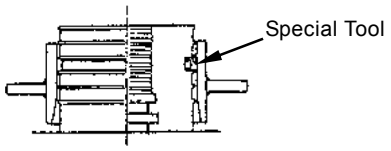
5. Attach a R spanner to the notched groove of rod cover (15). Remove rod cover (15) from cylinder tube (8).
   R spanner: For dia. 84 mm

6. Support piston rod (10) with a crane. Slowly remove the piston rod (10) assembly from cylinder tube (8) by swaying it vertically and horizontally.

IMPORTANT: Securing the chrome plating part of rod (10) is strictly prohibited.
Secure the rod head part only.

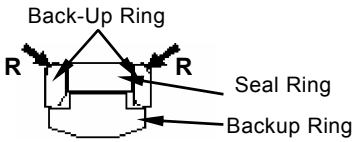
7. Secure the piston rod (10) assembly by using the parallel surface of the rod head in order to prevent it from moving.

10. Adjust the seal ring of packing (2) by using specials tool. (Special tool: Refer to W3-9-23)



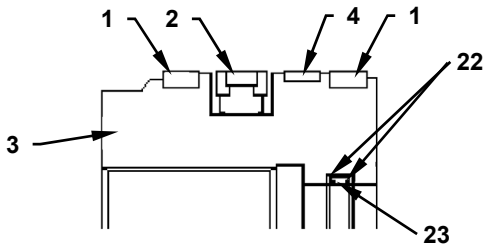
W4GB-04-02-019

11. Install the Backup ring of packing (2) to the both sides of seal ring on packing (2).



Direction of Piston Seal Component Parts W4GB-04-02-020

12. Install O-ring (23) and backup rings (22) (2 used) to the inner side of piston (3).



W4GB-04-02-021

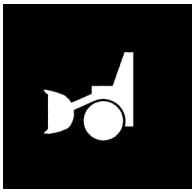
IMPORTANT: Wear ring (4) and dust ring (1) are not used until the installation to the cylinder tube (8).
The figure shows final assembly stage of the piston.

13. Secure piston rod (10) onto a workbench.

IMPORTANT: Apply a film of hydraulic oil to special tool and piston rod (10) surface and protect seals.
Special tool for rod insertion. Refer to W3-9 -20.

14. Install rod cover (15) to piston rod (10) by using special tool for rod cover (15) insertion.

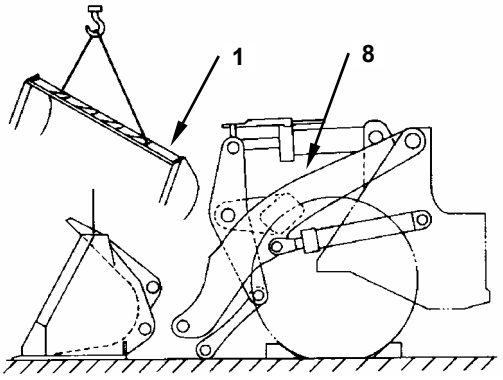
SECTION 4
FRONT ATTACHMENT



— CONTENTS —

CAUTION: Bucket (1) weight:
EU spec.: 2210 kg (4875 lb)
(4.2 m^3 (5.5 yd^3) bolt on cutting edges)
Standard spec.: 2160 kg (4765 lb)
(4.0 m^3 (5.2 yd^3) bolt on cutting edges)

9. Attach a nylon sling to the spill guard part of bucket (1). Hoist, and place the bucket onto the mounting position on lift arm (8).



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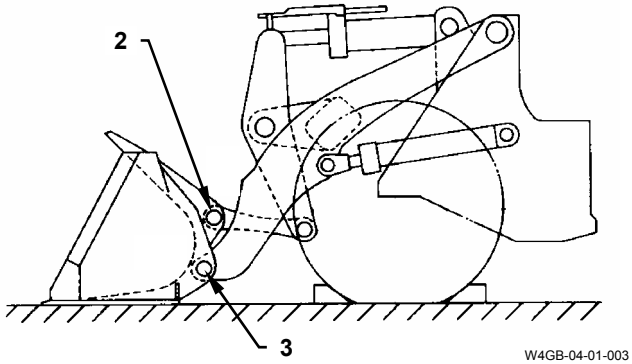
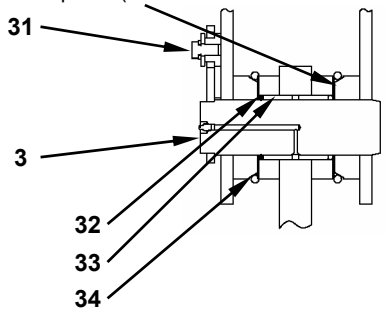


W4GB-04-01-003

(The connection part between bucket and lift arm: E)

10. The connection part between bucket and lift arm: E
    Install bushing (33) to the center of the boss. Apply grease onto the lip part of dust seal (32). Install dust seal (32) and O-ring (34) to both sides of bushing (33). Apply grease and insert pin (3). Install the spring washer, the washer and bolt (31).
    : 24 mm
    : 86.9 N·m (9 kgf·m, 64 lbf·ft)

Spacer (Maximum clearance is 1.5 mm (0.06 in) or less.)

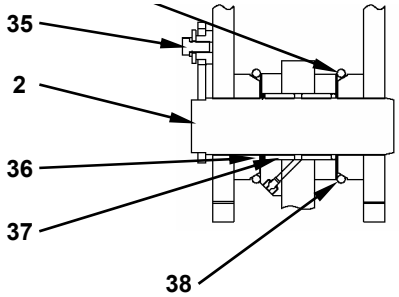


W4GB-04-01-013

(The connection part between bucket and bucket link: F)

11. The connection part between bucket and bucket link: F
    Install bushing (37) to the center of the boss. Apply grease onto the lip part of dust seal (36). Install dust seal (36) and O-ring (38) to both sides of bushing (37). Apply grease and insert pin (2). Install the spring washer, the washer and bolt (35).
    : 24 mm
    : 86.9 N·m (9 kgf·m, 64 lbf·ft)

Spacer (Maximum clearance is 1.5 mm (0.06 in) or less.)

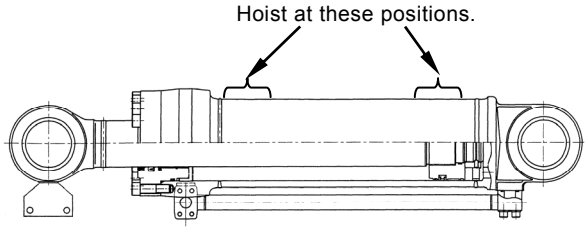


W4GB-04-01-014

Installation

CAUTION: Bucket cylinder (15) weight: 247 kg (545 lb)

1. Attach a nylon sling onto the rod side and the bottom side of bucket cylinder (15). Hoist and hold bucket cylinder (15).



W4GB-04-02-035

2. Align the bottm side of bucket cylinder (15) with the mounting hole on front frame (21).

IMPORTANT: Spacer (16) thickness: 2.3 mm (0.091 in)

3. Align the hole on the bottom side of bucket cylinder (15) with the pin hole on front frame (21). Install spacer (16).

4. Apply grease onto the outer periphery of pins (17). Install pins (17). Secure the bottom sides of bucket cylinders (15) to front frame (21).

5. Secure pin (17) to front frame (21) with washer (18), spring washer (19) and bolt (20).
   : 24 mm
   : 210 N·m (22 kgf·m, 155 lbf·ft)

6. Install O-ring (7) to hose (8). Connect hose (8) to bucket cylinder (15) with split flanges (5) (2 used) and socket bolts (6) (4 used).
   : 14 mm
   : 210 N·m (22 kgf·m, 155 lbf·ft)

7. Install O-ring (2) to hose (3). Connect hose (3) to bucket cylinder (15) with split flanges (4) (2 used) and socket bolts (1) (4 used).
   : 14 mm
   : 210 N·m (22 kgf·m, 155 lbf·ft)

8. Start the engine and extend the piston rods of bucket cylinders (15). Align bucket cylinders (15) with the pin holes on bell crank (9).

IMPORTANT: Spacer (14) thickness: 2.3 mm (0.091 in)

9. Insert spacer (14) between bell crank (9) and the rod end. Apply grease onto the outer periphery of pin (10). Install pin (10) to bell crank (9).

10. Secure pin (10) to bell crank (9) with washer (11), spring washer (12) and bolt (13).
    : 24 mm
    : 210 N·m (22 kgf·m, 155 lbf·ft)

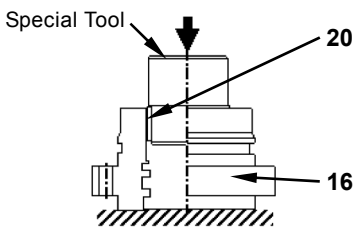
(Blank)

(Blank)

Assembly of Lift Cylinder

1. Install rod bushing (20) by using a press and a special tool.
   Special tool: Refer to W3-9-24.

IMPORTANT: Align rod bushing (20) with the mounting hole and place vertically. Apply oil onto the inner surface of the mounting hole. Install rod bushing (20). After installation, clean again and remove metal powder.



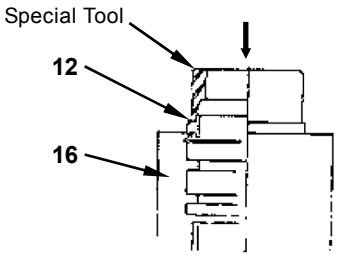
W4GB-04-02-012

2. Install retaining ring (21).

IMPORTANT: Check that rod bushing (20) and retaining ring (21) are installed completely.

3. Install dust seal (12) by using a special tool and a hammer.
   Special tool: Refer to W3-9-25.

IMPORTANT: Align dust seal (12) with the mounting hole and place vertically. Evenly contact the special tool with the metal part of dust seal (12). Before installation, apply oil onto the inner surface of the hole. After installation, clean again and remove metal powder.



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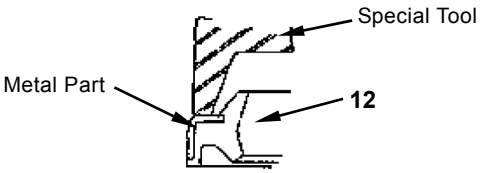

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4. Install retaining ring (13).

IMPORTANT: Check that dust seal (12) and retaining ring (13) are installed completely.