WEAR PROTECTIVE CLOTHING

- Wear close fitting clothing and safety equipment appropriate to the job.

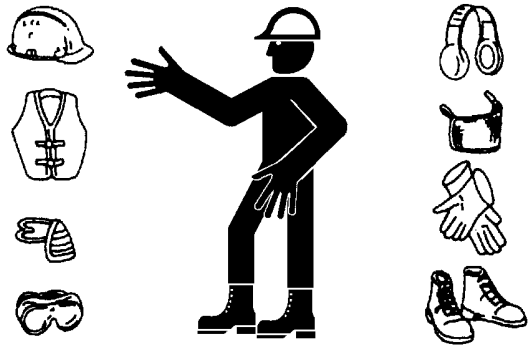
  You may need:
  A hard hat
  Safety belt
  Safety shoes
  Safety glasses, goggles, or face shield
  Heavy gloves
  Hearing protection
  Reflective clothing
  Wet weather gear
  Respirator or filter mask.

  Be sure to wear the correct equipment and clothing for the job. Do not take any chances.

  - Avoid wearing loose clothing, jewelry, or other items that can catch on control levers or other parts of the machine.

- Operating equipment safely requires the full attention of the operator.

  - Do not wear radio or music headphones while operating the machine.



SA-438

PROTECT AGAINST NOISE

- Prolonged exposure to loud noise can cause impairment or loss of hearing.

  - Wear a suitable hearing protective device such as earmuffs or earplugs to protect against objectionable or uncomfortably loud noises.

SA-434

INSPECT MACHINE DAILY

- If any abnormality is found, be sure to repair it immediately before operating the machine.

  - In the walk-around inspection, be sure to cover all points described in the “PRE-START INSPECTION” chapter in the operator’s manual.

SA-435

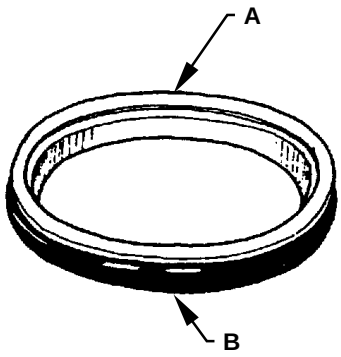
Floating Seal Precautions

1. In general, replace the floating seal with a new one after disassembling.
   If the floating seal is to be reused, follow these procedures:

   (1) Keep seal rings together as a matched set with seal ring faces together. Insert a piece of cardboard to protect surfaces.

   (2) Check the slide surface on seal ring (A) for scuffing, scoring, corrosion, deformation or uneven wear.

   (3) Check O-ring (B) for tears, breaks, deformation or hardening.



W105-03-05-019

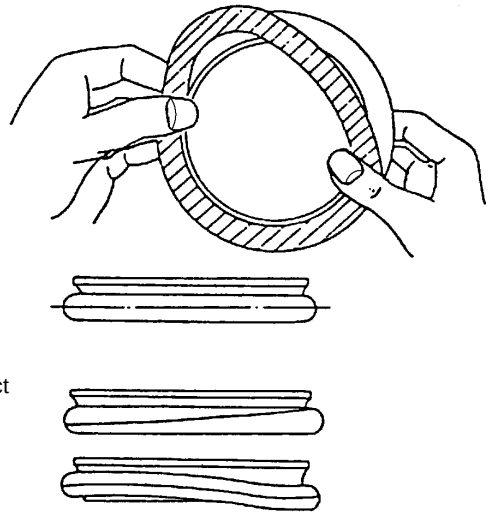
2. If incorrectly assembled, oil leakage or damage will occur. Be sure to do the following, to prevent trouble.

   (1) Clean the floating seal and seal mounting bores with cleaning solvent.
   Use a wire brush to remove mud, rust or dirt.
   After cleaning, thoroughly dry parts with compressed air.

   (2) Clean the floating seal and seal mounting bores. Check the bore surface for scuffing or scoring by touching the surface with touch.

   (3) Check that the O-ring is not twisted, and that it is installed correctly on the seal ring.

   (4) After installing the floating seal, check that seal ring surface (A) is parallel with seal mating face (C) by measuring the distances (A) and (C) at point (a) and (b), as illustrated. If these distances differ, correct the O-ring seating.



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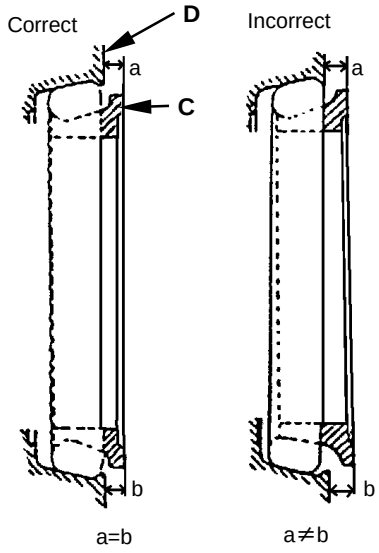


W110-03-05-004

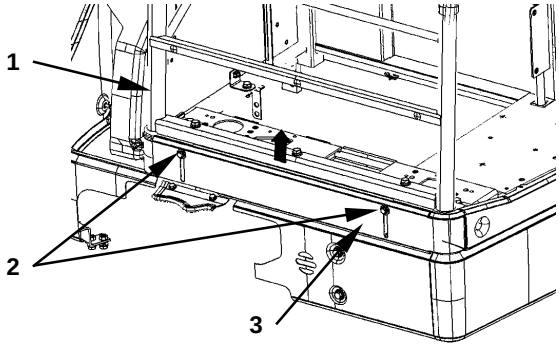
PROCEDURE FOR FLOOR TILTING UP

CAUTION: If tilting up operation is made with the door open, it interferes with the cover (3).

1. Remove two bolts (2), and remove (3) from the canopy or cab (1).
   : 17 mm

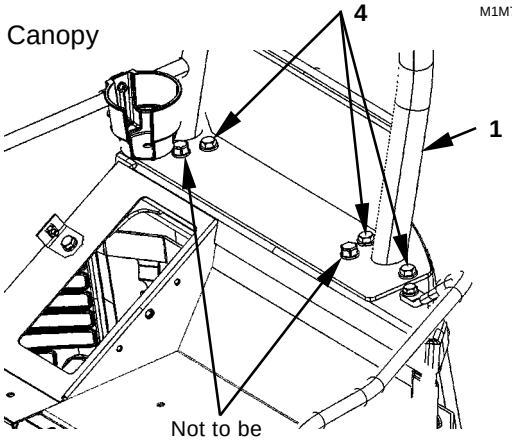
IMPORTANT: Near bolts (4), two bolts for fixing the canopy or cab (1) are fitted. Never remove these two bolts in tilting up operation.
A bolt never to be removed can be identified by the attached cap or red paint.

2. Remove three bolts (4) from the canopy or cab (1).
   : 19 mm



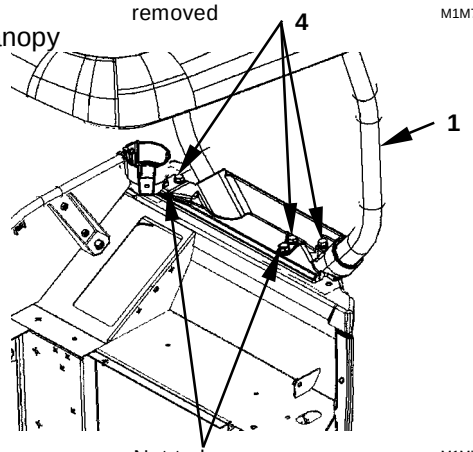
M1M7-07-061

4-Pillar Canopy



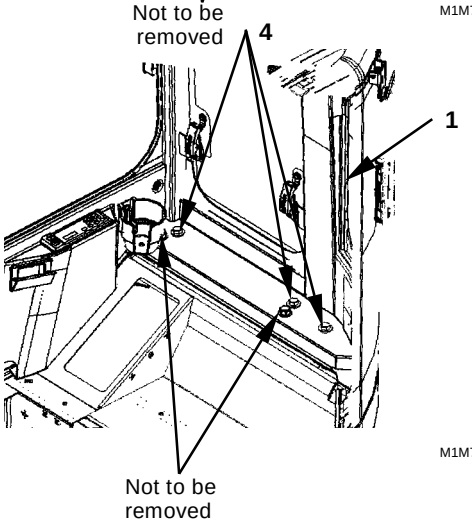
M1M7-07-063

2-Pillar Canopy



M1M7-07-062

Cab

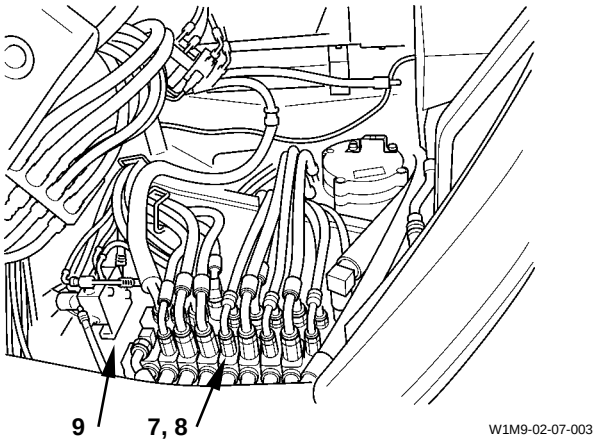


M1M7-07-064

Installation

CAUTION: Control valve (7) weight: 58 kg (130 lb)

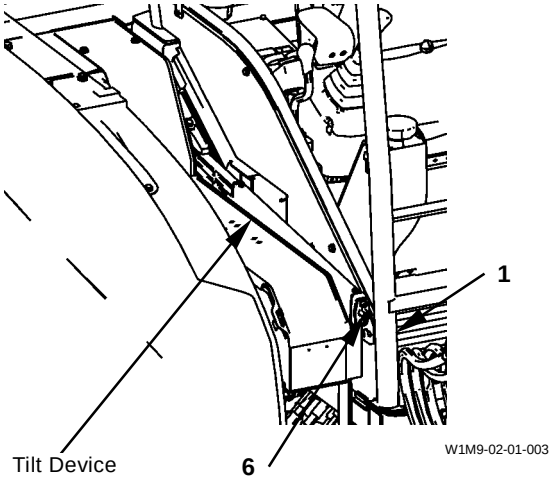
1. Pass a nylon sling under the cap on control valve (7).
   Hoist and install control valve (7) onto main frame (9) with bolts (4) (4 used).
   : 17 mm
   : 50 N·m (5.1 kgf·m, 37 lbf·ft)



W1M9-02-07-003

2. Install all the hoses onto control valve (7).
   : 19 mm
   : 29.5 N·m (3.0 kgf·m, 22 lbf·ft)
   : 22 mm
   : 39 N·m (4.0 kgf·m, 29 lbf·ft)
   : 27 mm
   : 78 N·m (8.0 kgf·m, 58 lbf·ft)
   : 36 mm
   : 175 N·m (18 kgf·m, 129 lbf·ft)
   : 41 mm
   : 205 N·m (21 kgf·m, 151 lbf·ft)

3. Turn adjusting screw (6). Lower the canopy (1) assembly.

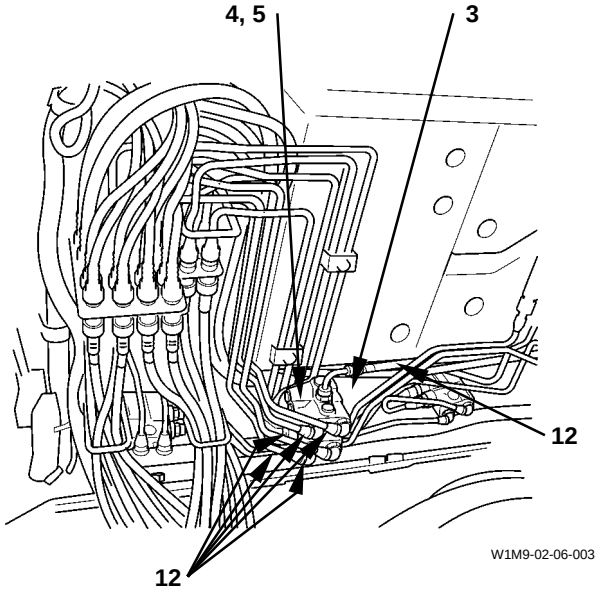


W1M9-02-01-003

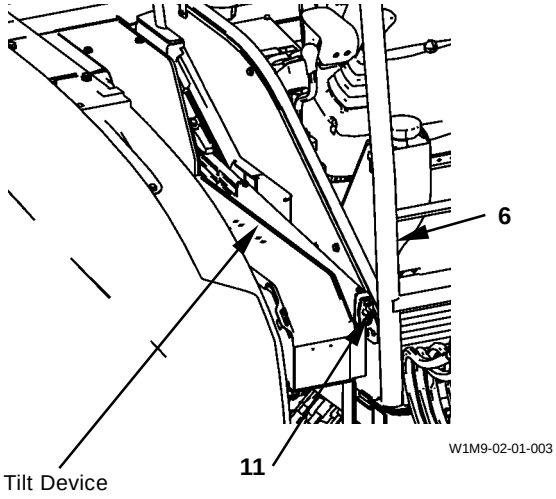
Installation

1. Install pilot valve (4) to bracket (3) with bolts (5) (2 used).
   : 17 mm
   : 50 N·m (5.1 kgf·m, 37 lbf·ft)

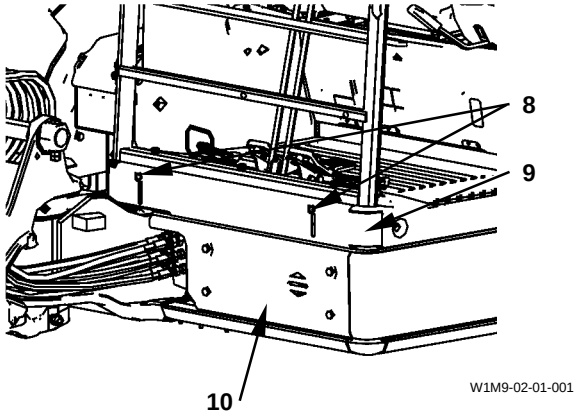
2. Install hoses (12) (6 used) onto pilot valve (4).
   : 19 mm
   : 29.5 N·m (3.0 kgf·m, 22 lbf·ft)

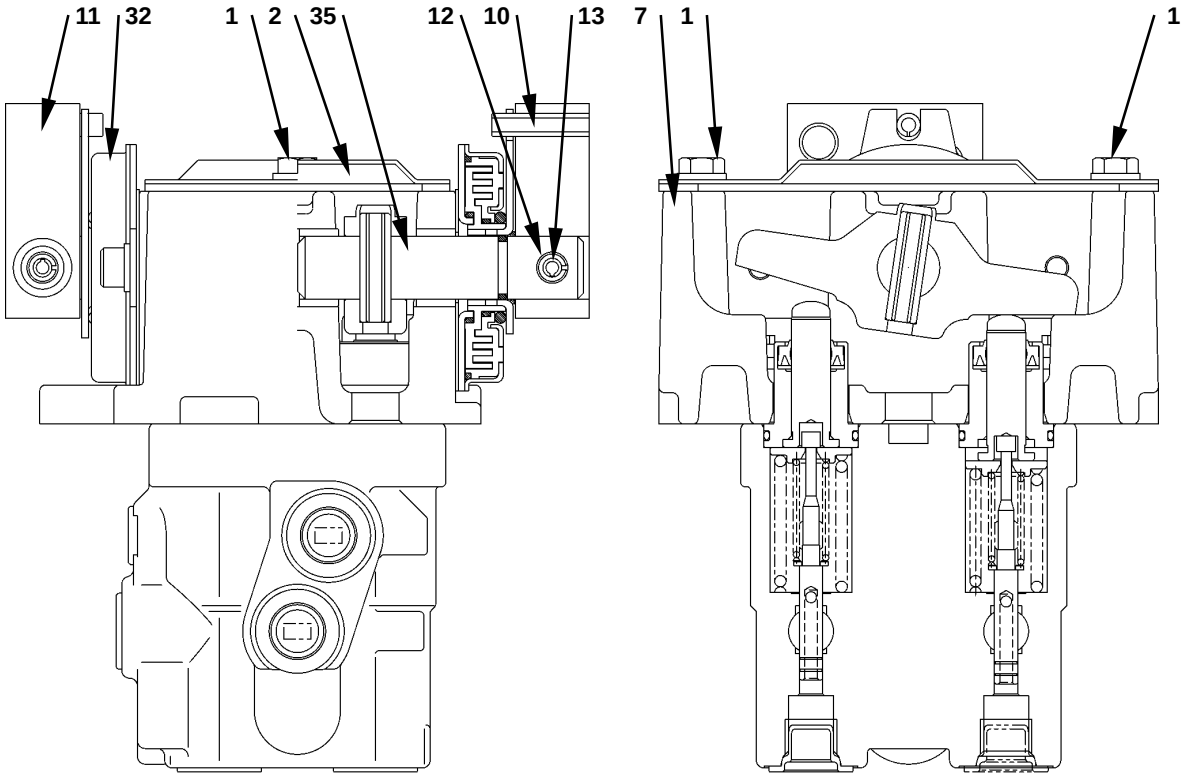


3. Turn adjusting screw (11). Lower the canopy (6) assembly.



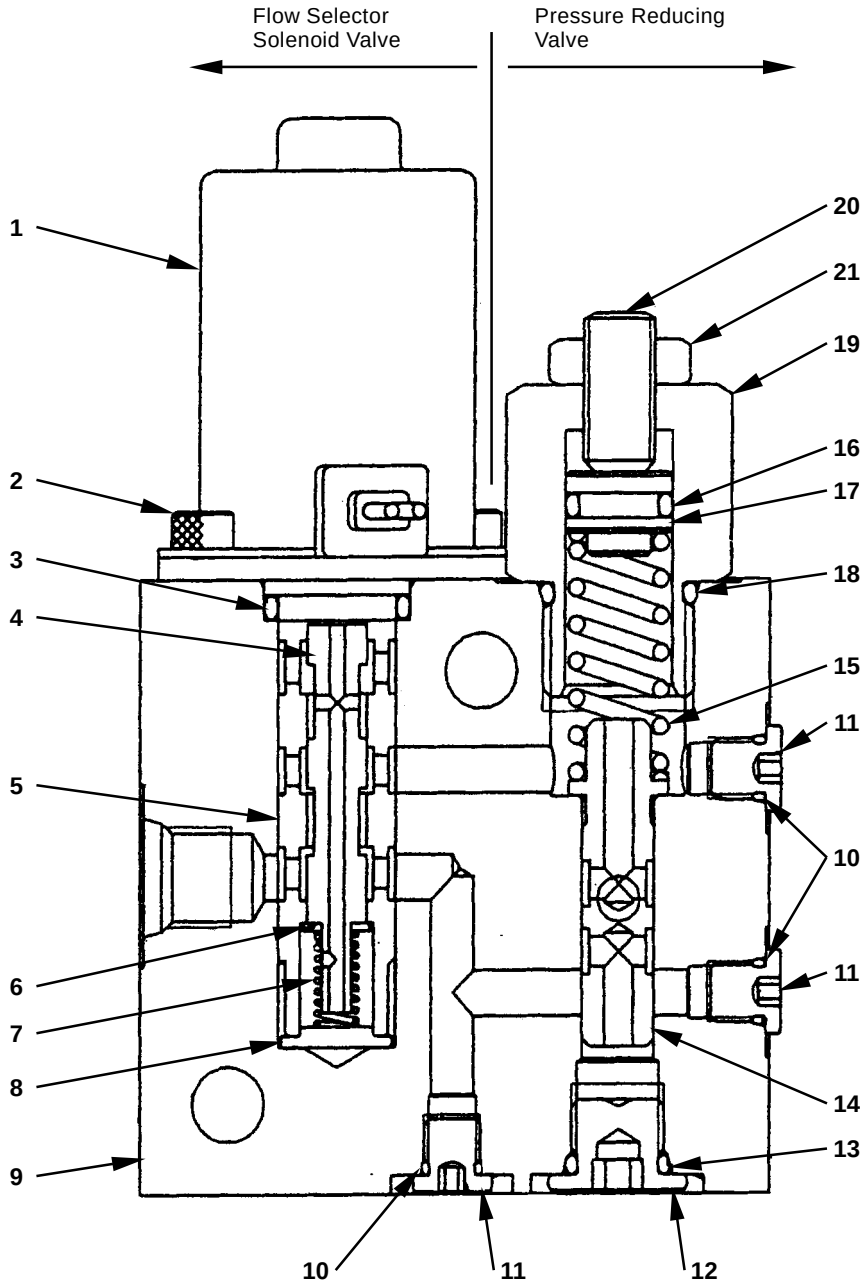
4. Install cover (9) onto main frame (10) with bolts (8) (2 used).
   : 17 mm
   : 50 N·m (5.1 kgf·m, 37 lbf·ft)





W178-02-06-056

ASSEMBLE AUXILIARY FLOW SELECTOR VALVE



1 - Solenoid
2 - Socket Bolt (2 Used)
3 - O-Ring
4 - Spool
5 - Sleeve
6 - Washer
7 - Spring
8 - Stopper
9 - Body
10 - O-Ring (4 Used)
11 - Plug (4 Used)
12 - Plug
13 - O-Ring
14 - Spool
15 - Spring
16 - O-Ring
17 - Plug
18 - O-Ring
19 - Plug
20 - Adjusting Screw
21 - Lock Nut

Disassemble Brake Valve

1. Remove plugs (61) (2 used), springs (63) (2 used), spring seat (64) and spool (65) from valve body (66).
   : 8 mm
2. Remove socket bolts (67) (3 used) and remove valve body (66) from brake valve body (70).
   : 6 mm
3. Remove plug (53), spring seat (52) and spring (51) from brake valve body (70).
   : 8 mm
4. Remove plug (69), sleeve (49) and spool (50) from brake valve body (70).
   : 22 mm
5. Remove caps (54) (2 used) from brake valve body (70) and remove springs (56) (2 used).
   : 36 mm

NOTE: Counterbalance valve (57) cannot be disassembled. When removing counterbalance valve (57), do not fall off collars (86) (2 used).

6. Remove counterbalance valves (57) (2 used) in brake valve body (70) straightly. Remove collars (86) (2 used) from counterbalance valve (57).
7. Remove plug (59) from brake valve body (70).
   : 8 mm

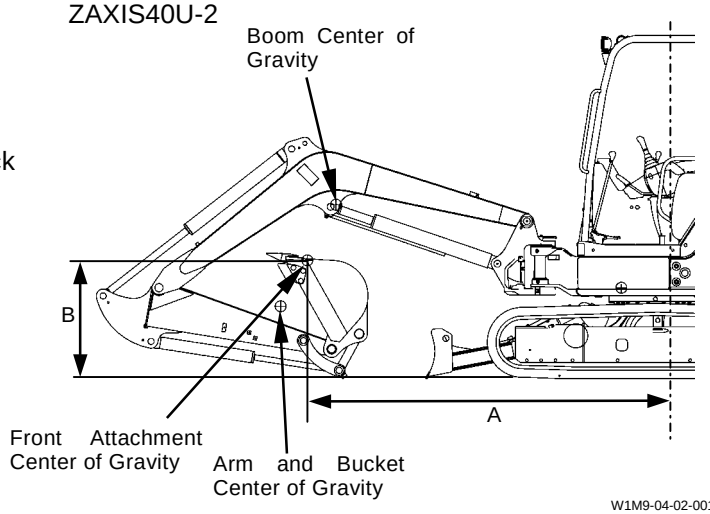
Assemble Brake Valve

1. Install plugs (59) (2 used) to brake valve body (70).
   : 12 mm
   : 31.9±2.45 N·m
   (3.3±0.2 kgf·m, 23.5±1.8 lbf·ft)
2. Install counterbalance valves (57) (2 used), collars (86) (2 used) and springs (56) (2 used) to brake valve body (70) with caps (54) (2 used).
   : 36 mm
   : 240±5.0 N·m
   (24.5±0.5 kgf·m, 175±3.7 lbf·ft)
3. Install plug (69) to brake valve body (70).
   : 22 mm
   : 53.9±4.9 N·m
   (5.5±0.5 kgf·m, 40±3.6 lbf·ft)
4. Install spool (50), sleeve (49), spring (51) and spring seat (52) to brake valve body (70). Tighten plug (53) to brake valve body (70).
   : 8 mm
   : 53.9±4.9 N·m
   (5.5±0.5 kgf·m, 40±3.6 lbf·ft)
5. Install valve body (66) to brake valve body (70) with socket bolts (67) (3 used).
   : 6 mm
   : 36.9±1.9 N·m
   (3.8±0.2 kgf·m, 27±1.4 lbf·ft)
6. Install spool (65), spring seat (64) and spring (63) to valve body (66). Tighten plug (61) to valve body (66).
   : 8 mm
   : 53.9±4.9 N·m
   (5.5±0.5 kgf·m, 40±3.6 lbf·ft)

CAUTION: Front attachment weight:
ZAXIS40U-2: 555 kg (1230 lb)
ZAXIS50U-2: 582 kg (1290 lb)

5. Attach a nylon sling onto the boom. Take up slack of nylon sling.

ZAXIS40U-2



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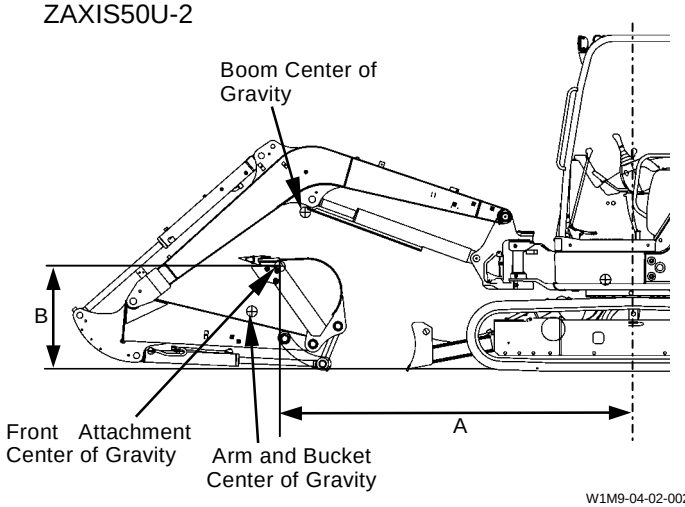
ZAXIS50U-2



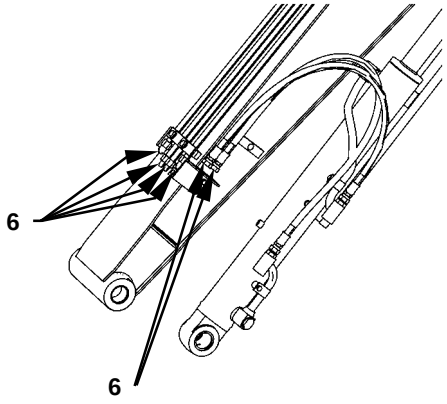
W1M9-04-02-002

NOTE: Attach an identification tag onto the removed hoses for assembling.

6. Remove hoses (6) (6 used). Cap the open ends.
: 22 mm, 27 mm

Unit: mm (in)

	ZAXIS40U-2	ZAXIS50U-2
A	2579 (101.5)	2660 (104.7)
B	867 (34.1)	783 (30.8)



W1M9-04-02-006

Disassemble Boom Cylinder

- The procedures start on the premise that the pipe has been removed.

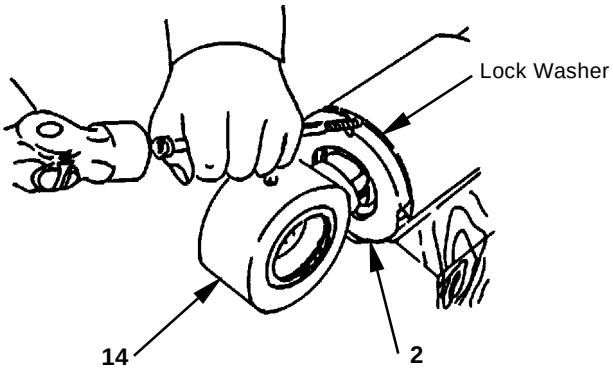
CAUTION: Boom cylinder weight:
ZAXIS40U-2: 55 kg (120 lb)
ZAXIS50U-2: 60 kg (130 lb)

IMPORTANT: Move piston rod (14) slowly and drain hydraulic oil from the cylinder.

1. Clamp the bottom side of cylinder tube (15) horizontally in a vise. Drain hydraulic oil from the cylinder.

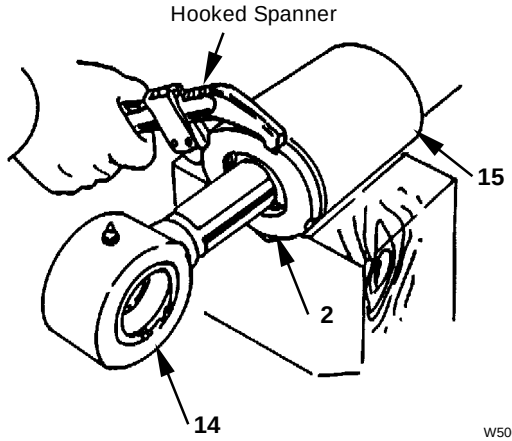
IMPORTANT: The lock washer in cylinder head (2) is provided on cylinder tube (15) and forms an integral part. Do not damage cylinder tube (15) and cylinder head (2) when bending and extending the lock washer.

2. Pull out piston rod (14) approximately 200 mm (7.87 in). Install a protective cover on piston rod (14). Extend the lock washer in cylinder head (2).



W506-04-02-003

3. Loosen cylinder head (2) by using a hooked spanner with the protective cover attached on piston rod (14). Remove piston rod (14) from cylinder tube (15).
   Diameter of cylinder head (2)
   ZAXIS40U-2: 110 mm
   ZAXIS50U-2: 115 mm



W506-04-02-004

IMPORTANT: Set screw (21) was crimped by using a punch at two places. Loosen set screw (21) after cutting the crimped part by using a hand drill.

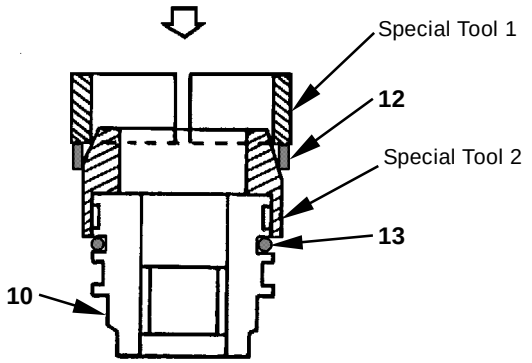
4. Secure piston rod (14) horizontally. Remove set screw (21) and steel ball (22) from piston (17).
   : 5 mm

5. Remove piston (17) and cushion bearing (16) from piston rod (14).
   : 65 mm

IMPORTANT: Check that O-ring (13) is not twisted.

5. Install O-ring (13) to piston (10). Install seal ring (12) by using special tool 1 and 2.

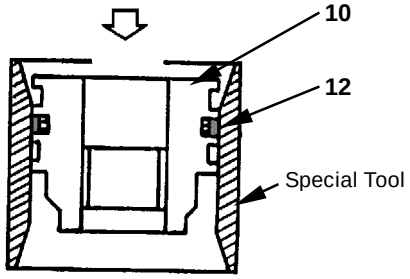
Special tool 1
ZAXIS40U-2: ST 2624
ZAXIS50U-2: ST 2596
Special tool 2
ZAXIS40U-2: ST 2622
ZAXIS50U-2: ST 2592



W566-04-02-010

IMPORTANT: If not adjusting seal ring (12), piston (10) cannot be installed to cylinder tube (9).

6. Install special tool through piston (10). Adjust seal ring (12).
   Special tool
   ZAXIS40U-2: ST 2626
   ZAXIS50U-2: ST 2600



W566-04-02-011

7. Install slide rings (11) (2 used) to piston (10) in order not to align their split portions.

8. Wind the tape onto the thread of piston rod (8). Rotate and install the cylinder head (2) assembly to piston rod (8).

9. Install the piston (10) assembly to piston rod (8).
   ZAXIS40U-2
   : 50 mm
   : 679 N·m (69 kgf·m, 500 lbf·ft)
   ZAXIS50U-2
   : 55 mm
   : 861 N·m (88 kgf·m, 640 lbf·ft)

10. Install steel ball (15) into piston (10). Install set screw (14). Crimp set screw (14) at two places by using a punch in order not to loosen.
    : 4 mm
    : 16.2 N·m (1.7 kgf·m, 12 lbf·ft)

Precautions for Service Work

(1) Precautions for Safety

Read the safety precautions given at the beginning of this manual carefully and always mind safety in work.

(2) Preparation for Service Work

Preparation is necessary for accurate, efficient service work. Check the customer ledger file for the history of the engine.

- Preceding service date
- Period/operation hours after preceding service
- Problems and actions in preceding service
- Replacement parts expected to be required for service
- Recording form/check sheet required for service

(3) Preparation before Disassembly

- Prepare general tools, special service tools, measuring instruments, oil, grease, nonreusable parts, and parts expected to be required for replacement.
- When disassembling complicated portions, put match-marks and other marks at places not adversely affecting the function for easy reassembly.

(4) Precautions in Disassembly

- Each time a parts is removed, check the part installed state, deformation, damage, roughening, surface defect, etc.
- Arrange the removed parts orderly with clear distinction between those to be replaced and those to be used again.
- Parts to be used again shall be washed and cleaned sufficiently.
- Select especially clean locations and use clean tools for disassembly of hydraulic units such as the fuel injection pump.

(5) Precautions for Inspection and Measurement

Inspect and measure parts to be used again as required to determine whether they are reusable or not.

(6) Precautions for Reassembly

- Reassemble correct parts in correct order according to the specified standards (tightening torques, and adjustment standards). Apply oil important bolts and nuts before tightening when specified.
- Always use genuine parts for replacement.
- Always use new oil seals, O-rings, packing and cotter pins.
- Apply sealant to packing depending on the place where they are used. Apply of grease to sliding contact portions, and apply grease to oil seal lips.

(7) Precautions for Adjustment and Check

Use measuring instruments for adjustment to the specified service standards.

How to Read this Manual

(1) Range of Operation Explanation

This manual explains the troubleshooting, installation/removal, replacement, disassemble/reassembly, inspection, adjustment and adjusting operation procedures for the TNV series engines with direct injection system.

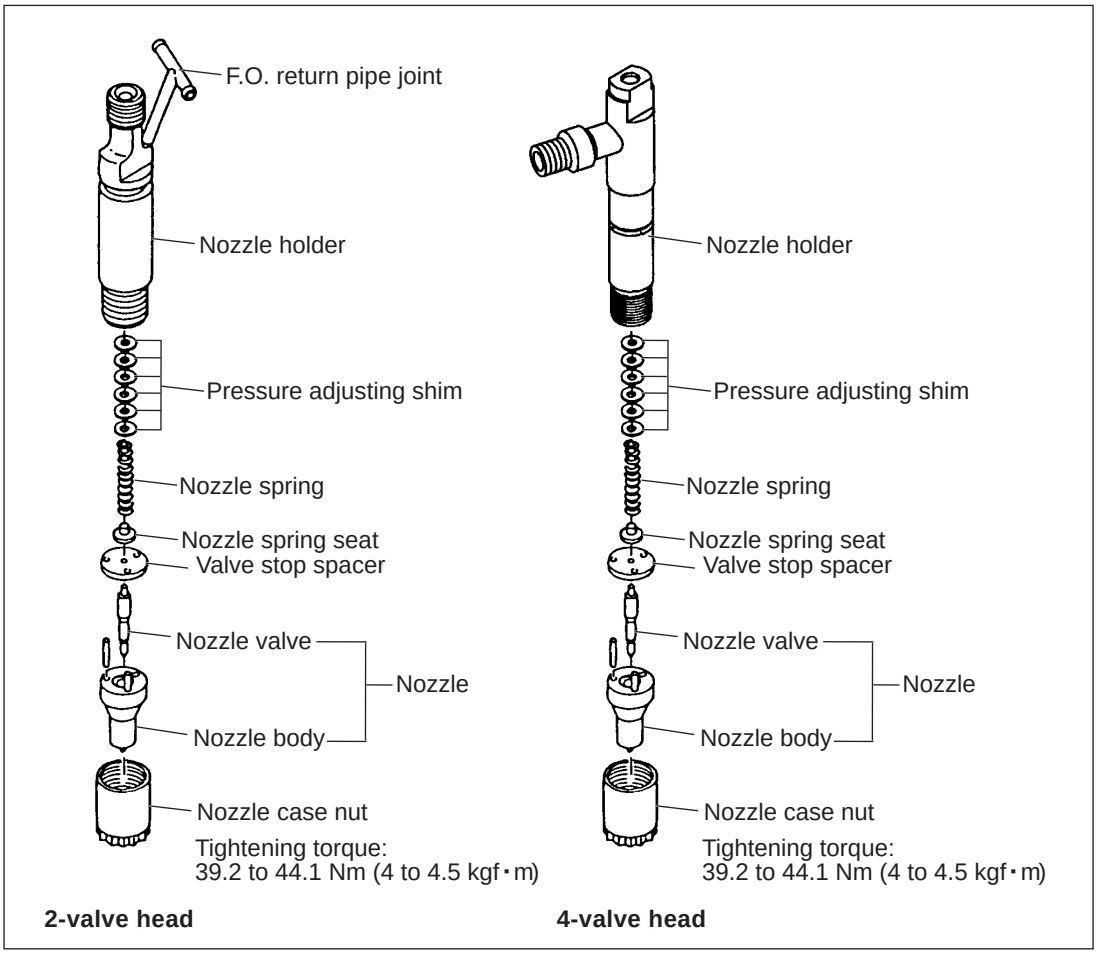
Refer to the manufacturer’s manual for each of the fuel injection pump, governor, starting motor and alternator except for their installation.

(12)4TNV106T

Engine name		Unit	4TNV106T			
Engine specification class		-	CL		VM	
Type		-	Vertical, in-line, 4-cycle, water-cooled diesel engine			
Combustion chamber		-	Direct injection			
Number of cylinders		-	4			
Cylinder bore × stroke		mm × mm	106 × 125			
Displacement		L	4.412			
Continuous rating	Revolving speed	Min^{-1}	1500	1800	-	
	Output	kW (ps)	51.5 (70.0)	61.8 (84.0)	-	
Rated output	Revolving speed	Min^{-1}	1500	1800	2000	2200
	Output	kW (ps)	56.8 (77.2	68.0 (92.5)	69.9 (95.0)	72.0 (97.9)
Max. no-load speed (± 25)		min^{-1}	1600	1895	2180	2400
Ignition order		-	1-3-4-2-1(No.1 cylinder on flywheel side)			
Power take off		-	Flywheel			
Direction of rotation		-	Counterclockwise (viewed from flywheel)			
Cooling system		-	Radiator			
Lubrication system		-	Forced lubrication with trochoid pump			
Starting system		-	Electric			
Applicable fuel		-	Diesel oil-ISO 8217 DMA, BS 2869 A1 or A2 (Cetane No.45 min.)			
Applicable lubricant		-	API grade class CD or CF			
Lubricant capacity (oil pan) *	Total	L	14.0			
	Effective	L	9.0		7.5	
Cooling water capacity (engine only)		L	6.0			
Engine dimensions ** (with flywheel housing) *	Overall length	mm	808		776	
	Overall width	mm	629		629	
	Overall height	mm	866		866	
Engine mass (dry) *, ** (with flywheel housing)		kg	355 (equivalent to SAE # 3)		340 (equivalent to SAE # 3)	
Cooling fan (std.) *		mm	500 mm O/D, 7 blades pusher type		500 mm O/D, 7 blades suction type	
Crankshaft V pulley diameter & Fun V pulley diameter (std.) *		mm	150 × 150			

* Items marked * may differ from the above depending on an engine installed on a machine unit.
** Engine mass and dimensions without radiator

[Informative: Fuel injection valve structure]

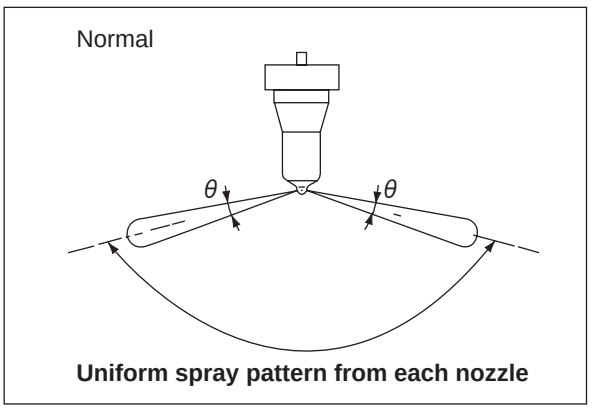


(b)Spray pattern inspection

After adjustment to the specified valve opening pressure, use a nozzle tester and check the spray pattern and seat oil-tightness.

Seat oil tightness check

- After injecting a few times, increase the pressure gradually. Hold the pressure for about 5 seconds at a little before the valve opening pressure of 1.96 MPa (20 kgf/cm^2), and check to see that oil does not drip from the tip end of the nozzle.
- If extreme oil leak from the overflow joint exists during injection by the nozzle tester, check after retightening. If much oil is leaking, replace the nozzle assembly.



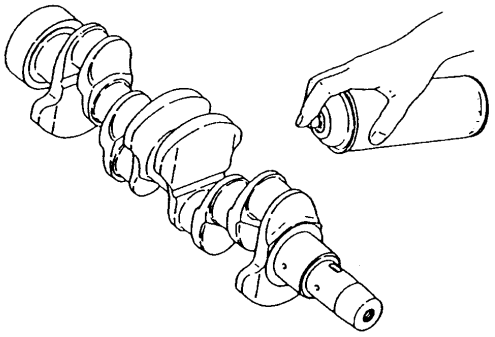
Uniform spray pattern from each nozzle

(2) Crankshaft

Mainly check seizure and wear of the crankpins and journals. Since the crankshaft gear is shrink-fitted, heat to 180 to 200°C when extraction is necessary.

(a)Shaft portion color check

After washing the crankshaft, inspect it by means of color check or a magnaflux inspector. Replace it if cracked or heavily damaged. Slight defects shall be corrected by grinding.

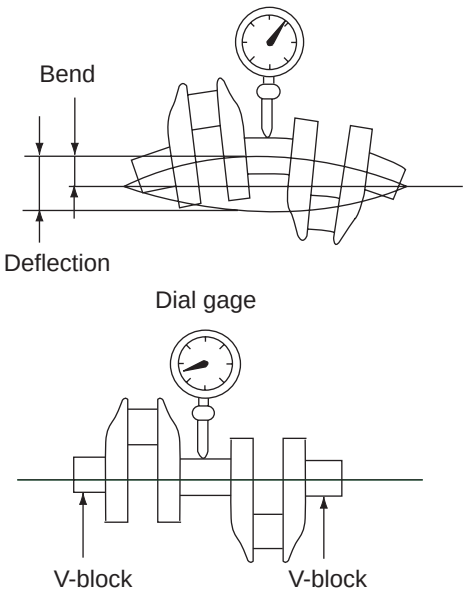


Inspection by color check

(b)Crankshaft bend

Support the crankshaft journals at both ends with V-blocks. Use a dial gage and measure the runout at the center journal while rotating the shaft to inspect the bend.

Limit	0.02 mm or less



Crankshaft bend measurement

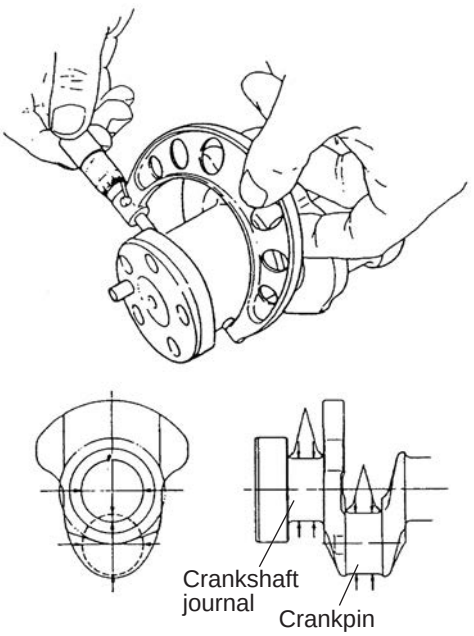
(c)Crankpin and journal measurement

Measure the outside diameter, roundness and taper at each crankpin and journal.

Correct by grinding if unevenly wear, roundness exceeding the limit or insufficient outside diameter is found. Replace if the defect is excessive.

Item	Limit (Diameter) (mm)
Roundness Taper	0.01

To look for the oil clearance of crank pin, measure the inside diameter of crank pin metal according to (5) (d) described later and calculate.



Measuring position of the crankpin and crank journal