

WORKSHOP MANUAL

TB215R

Seral No.215000003~

Book No. CC8E005

WETB215R_A-XI

MINI EXCAVATOR

TAKEUCHI

FOREWORD

This manual, which is written for engineers who service the machine, describes procedures for disassembly and assembly, inspection and maintenance, and troubleshooting, as well as maintenance reference values and an outline of the specifications. Refer to this manual during daily work to improve your services. Note that the information is subject to change without notice due to design modifications made to the machine from time to time by the manufacturer.

Directional terms: front, rear, left, right

In this manual, front and back/left and right are based on orientations when sitting in the driver's seat with the blade being at the front.

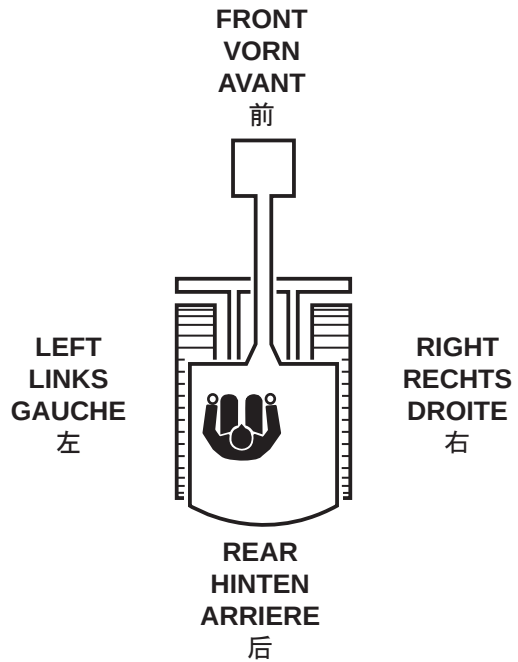
Machine serial number

The machine serial number is stamped on the identification plate. Be sure to include this number when sending a report or inquiry or when ordering parts.

Symbols used in this manual

The symbols used in this manual have the following meanings.

-  Indicates the machine serial number.
-  Means "Refer to the section quoted."
-  Indicates the mass of the equipment or machine.
-  Means "Tighten to the torque specified here."
-  Indicates the use of thread-locking compound. (Three-Bond #1324, or an equivalent)
-  Indicates the use of grease. (Lithium grease EP2/NLGI No.2)



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Manual structure

This manual consists of the following parts.

1. Safety
2. Service data
3. Function
4. Disassembly and assembly
5. Troubleshooting
6. Other

SAFETY **1**

SAFETY ALERT SYMBOL



This symbol represents the safety alert.

The message that follows the symbol contains important information regarding human safety.

Read and understand the message to avoid personal injury or death.

Safety label

Safety labels are used to alert operators or other people exposed to the risks of injury or damage. There are the following three types of labels.

Read the labels carefully as they are important for your safety.



DANGER

The word “DANGER” indicates an imminently hazardous situation which, if not avoided, is likely to result in serious injury or death.



WARNING

The word “WARNING” indicates a potentially hazardous situation which, if not avoided, could result in serious injury or death.



CAUTION

The word “CAUTION” indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury.

IMPORTANT: The word “IMPORTANT” is used to alert operators and maintenance personnel about any information which requires special attention or guidance; information that needs to be highlighted; and situations which could result in damage to the machine and its components.

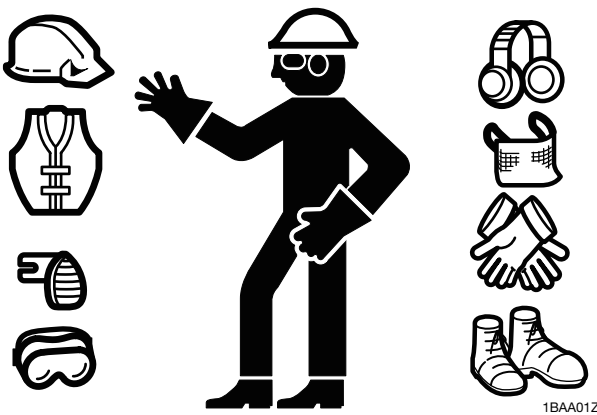
This manual is intended for trained and qualified personnel only. Warnings or cautions described in this manual do not necessarily cover all safety measures. It is also impossible to cover all hazards and risks which may be associated with the maintenance of the machine in every environment. For maintenance work, each person must take adequate safety precautions against possible hazards in the respective working environment.

SAFETY PRECAUTIONS

Observe all safety rules

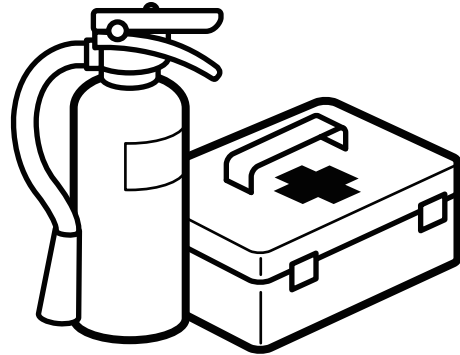
- Operation, inspection and maintenance of this machine must be performed only by a trained and qualified person.
- All rules, regulations, precautions and safety procedures must be understood and followed when performing operation, inspection and maintenance of this machine.
- Do not perform any operation, inspection or maintenance of this machine when under the influence of alcohol, drugs, medication, fatigue or insufficient sleep.

Wear safe clothing and protective gear



- Do not wear loose clothing or any accessory that can catch on the controls or the moving parts of the machine.
- Do not wear clothing stained with oil or grease that can easily catch fire.
- Wear protective gear such as helmet, safety shoes, protective goggles, respirator, gloves and earmuffs, as appropriate, depending on the work involved. Especially make sure to wear protective eye-wear and mask when working with a grinding/polishing/sanding machine, hammer or compressed air, as metal fragments or other objects could scatter in such an environment.
- Wear hearing protectors when operating the machine. Loud and prolonged noise can damage or destroy your hearing.

Install an extinguisher and a first aid kit



- Install an extinguisher to fight a fire, and learn how to use it.
- Prepare a first aid kit and keep it at a designated place.
- Decide on the procedures to be used in case of fire or other hazards.
- Decide on and take note of the contact(s) in case of emergency.

Place a “Do not operate” alert sign

Serious injury or death may result if an unauthorized person starts the engine or touches the controls during inspection or maintenance.

- Before performing maintenance, stop the engine, remove the key and store it in a safe place.
- Prominently display a “Do not operate” alert sign on places such as the starter switch and the control lever. Place another sign outside of the machine as necessary.

Use the correct tools



Do not use damaged or weakened tools or tools designed for other purposes. Use only the correct tools for the work involved.

Regularly replace the safety-critical parts

- Regularly replace fuel hoses to prevent a fire hazard. Hoses wear out over time, even if they do not show any symptom of wear.
- Regardless of the replacement schedule, replace immediately if a symptom of wear is found.

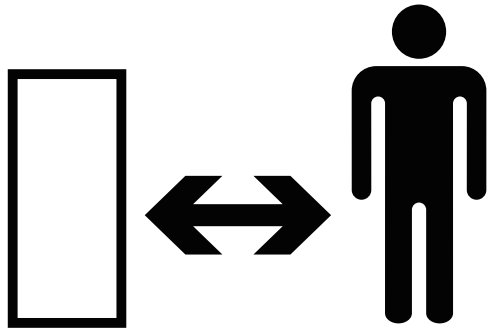
Explosionproof lighting



1BAA04Z

To prevent an ignition or explosion, use explosion-proof lights when inspecting fuel, oil, coolant or battery fluid.

Prohibit access by unauthorized persons



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Do not allow unauthorized personnel in the work area while working.

Take particular care that no unauthorized person is present when grinding, welding or using a hammer.

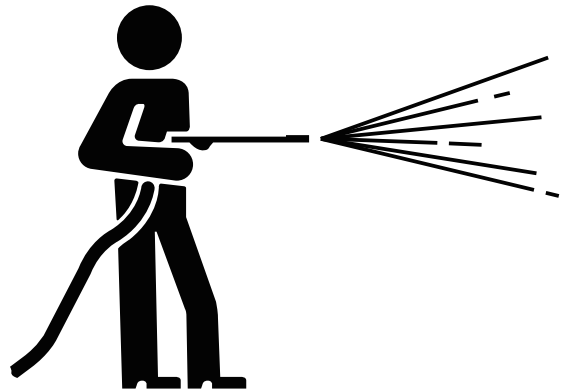
Prepare the work area

- Select a level and firm ground on which to perform maintenance work. Make sure that the work area is light enough and well ventilated.
- Straighten any obstacle or dangerous object, remove any spill of oil or grease and clean the work area.

When the canopy is tilted up

- If the canopy is raised or lowered while the engine is moving, the machine may accidentally start moving, resulting in severe injury to the maintenance personnel. Make sure that the working equipment has been lowered to the ground and the engine has been turned off before raising/lowering the canopy.
- When the canopy is tilted up, firmly secure the canopy with a stopper to prevent it from falling.

Keep the machine clean



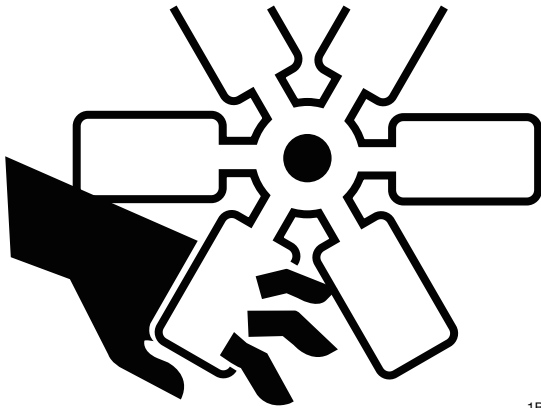
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- Clean the machine before performing maintenance and try to keep it clean.
- Before washing, cover the electrical parts with vinyl to prevent water from entering, as this could cause a short-circuit or malfunction. Do not use water or steam to wash the battery, sensors, connectors or the operator's seat area.

Stop the engine before performing maintenance

Make sure the engine is stopped before starting inspection or maintenance. If maintenance must be performed with the engine running, always work as a 2-person team, communicating with each other.

- One of them must sit at the operator's seat and stop the engine whenever necessary. He/she must take care not to touch the lever or pedal unless necessary.
- The one who performs maintenance must make sure to keep his/her body or clothing away from the moving part of the machine.

Keep clear of the moving fan and belt

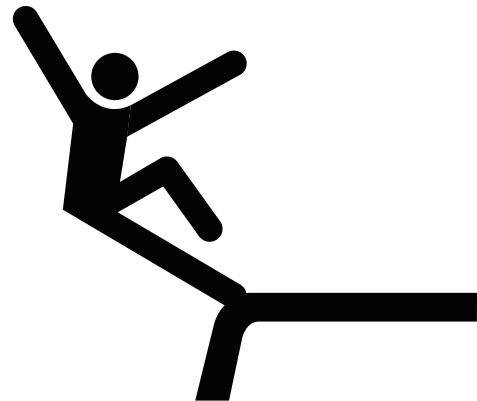
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- Any object that can be easily caught in moving parts must be kept away.
- If a hand or tool becomes trapped in the fan or fan belt, you could lose your finger. Do not touch the fan or belt while they are moving.

When working under the machine

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- Before performing maintenance or repairs under the machine, set all movable equipment against the ground or in the lowermost position.
- Place chocks under the crawler tracks to secure the machine.
- If it is unavoidably necessary to work under the raised machine or working equipment, be sure to firmly support it by using an arm stopper, wooden block, stand or safety brace. Never go under the raised machine or working equipment without such protection measures.

When working on the machine

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- To prevent slipping/falling from machine, clear the footing and observe the following:
 - a. Do not spill oil or grease on the machine.
 - b. Keep the machine tidy and clean.
 - c. Be careful when walking around the machine.
- Never jump down from the machine. Climb up/down the ladder (steps) holding the handrail to support your weight in a three point secure stance (hand and feet).
- Wear protective gear according to the work involved.

Securing the working equipment

When replacing/repairing the bucket teeth or side cutter, secure the relevant equipment to prevent any accidental movement.

Secure the engine hood and guard when they are open

Firmly secure the machine when the engine hood or guard is left open. Do not keep the hood or guard open on a windy day or if the machine is parked on a slope.

Place heavy components in a stable position

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When it is necessary to temporally place a heavy component, such as the hoe attachment, on the ground during removal or installation, be sure to place it in a stable position.

Caution when filling with fuel or oil

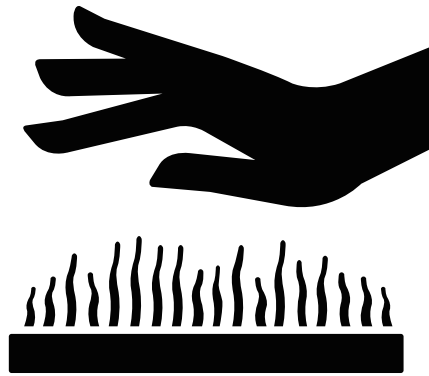
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- Keep away from heat, sparks and flame while filling with fuel or oil.
- Never remove the fuel cap or try to fuel when the engine is running or still hot.
- Maintain control of the fuel filler nozzle when filling the tank.
- Refill with fuel or oil outdoors or in a well ventilated place, with the engine turned off.
- Clean up spilled fuel or oil immediately.
- Do not overfill the tank.
- Firmly tighten the fuel cap or oil cap. If the fuel cap is lost, replace it only with the original manufacturer's approved cap. Use of a non-approved cap without proper venting may result in pressurization of the tank.
- Never use fuel for cleaning.
- Use the correct grade of fuel for the operating season.

Handling of hoses

Oil leak or fuel leak can cause a fire.

- Do not twist, bend or hit the hoses.
- Never use twisted, bent or cracked pipes, tubes or hoses; otherwise, they may burst.
- Retighten loose connections.

Be careful with hot and pressurized components

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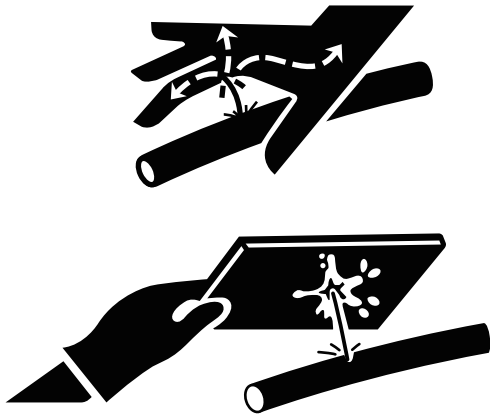
Before performing inspection and maintenance, stop the engine and allow the machine to cool down.

- The engine, muffler, radiator, hydraulic lines, sliding parts and many other parts of the machine are hot immediately after the engine is stopped. Wait until it cools before making any inspection or adjustments.
- The engine coolant, hydraulic oil and other oils are also hot and under high pressure. Touching these liquids will cause burns.

Handling of radiator

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Do not remove the radiator cap when the coolant is hot. Wait until it cools down, and then remove the radiator cap by loosening it slowly to release the internal pressure.

Be careful with oils under pressure

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Pressure is maintained in the hydraulic circuit long after the engine has been shut down.

- Do not fill with, dispose of fuel/oil, or perform the inspection and maintenance until the internal pressure is completely released.
- The hydraulic oil escaping from a small hole can be hazardous if contacted. It is under high enough pressure to penetrate the skin or eyes and cause serious injury. If leak is suspected, protect your eyes and skin by wearing protective glasses and thick gloves to search for a leak. Also use a paperboard or plywood to keep your skin from oil spurting. If oil penetrates the skin, it must be surgically removed within a few hours by a doctor familiar with this type of injury.

Release internal pressure before working on the hydraulic system

Oil may spurt out if caps or filters are removed or pipes are disconnected before releasing the pressure in the hydraulic system.

- Gradually loosen the vent plug to release the internal pressure of the hydraulic oil tank.
- Move all the control levers and pedals several times in all directions to release the pressure from the circuit of the working equipment (for link type controls).
- When removing plugs or screws, or when disconnecting hoses, stand to the side and loosen them slowly to gradually release the internal pressure before removing.

Be careful with grease under pressure

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In the track adjuster, the grease has been injected under high pressure. If the tension is adjusted without following the prescribed procedure, the grease discharge valve may fly off, resulting in injury.

- Loosen the grease discharge valve slowly.
- Do not put your face, arms, legs or body in front of the grease discharge valve.

Handling of the accumulator

1BAA16Z

Be sure to handle the high-pressure nitrogen gas enclosed in the accumulator with care according to procedure. If handled incorrectly, it could explode and cause serious injury. Strictly observe the following precautions:

- Do not disassemble.
- Do not allow flame near it or throw it into a fire.
- Do not drill, weld or fuse.
- Do not subject it to physical shock such as hitting, rolling or dropping.
- Before disposing of the unit, the sealed gas must be drained. Contact your sales or service dealer for help with this.

Disconnect the battery

Disconnect the wiring from the both terminals (+ and -) on the battery before working on the electrical system or doing electric welding. Otherwise, short-circuit and explosion of the battery can result.

Use caution when handling batteries

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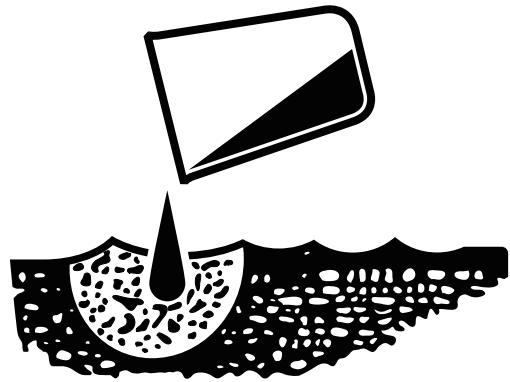
- Batteries contain sulfuric acid which will damage eyes or skin if contacted.
 - If eye contact occurs, flush immediately with clean water and get prompt medical attention.
 - If accidentally swallowed, drink large quantities of water or milk and call a physician immediately.
 - If acid contacts skin or clothing, wash off immediately with a lot of water.
- Wear protective glasses and gloves when working with batteries.
- Batteries generate flammable hydrogen gas which may explode. Keep away from flame and sparks.
- Do not use or charge the battery when the electrolyte level is lower than the lower limit: otherwise, it could cause an explosion.
- Be sure to stop the engine by turning off the starter switch before inspecting or handling the battery.
- Be careful not to let metal tools (or any metal objects) such as a hammer or spanner come into contact with the battery terminals.
- When disconnecting the battery wiring, always disconnect it from the earth side (-). When connecting, connect the earth side last.
- Loose battery terminals may result in sparks. Be sure to fasten terminals tightly.
- Make sure the battery caps are tightened securely.
- Do not charge a battery or jump-start the engine if the battery is frozen; otherwise it may explode. Warm the frozen battery to 15°C (59°F) before use.

Have a service agent repair welding cracks or other damage

Ask a service agent to make any repairs that require welding. If the agent is unavailable, make sure the welding is done by a qualified person in a properly equipped workplace.

Checks after maintenance

- Gradually raise the engine speed from low idle to maximum and check that no oil or water is leaking from the parts serviced.
- Move the controls and check that the machine is operating properly.

Disposing of wastes

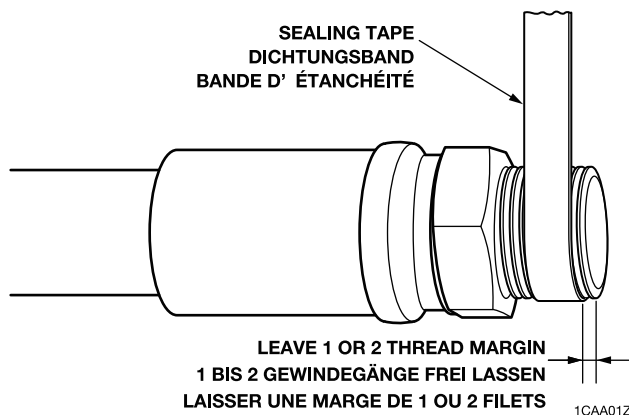
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- Always collect oil that is drained from the machine in containers. Improperly disposed waste oil can cause environmental harm.
- Follow appropriate laws and regulations when disposing of harmful objects such as oil, fuel, coolant, solvent, filters and batteries.

CAUTIONS WHEN WORKING

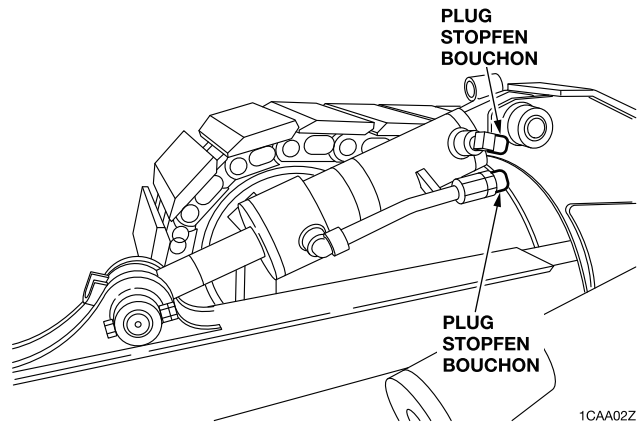
When disassembling or assembling

- Clean the machine before disassembly.
- Check the following items and record the results:
 - a. Model, machine serial number, hour meter.
 - b. Reason for repair, repair history.
 - c. Are the filters dirty?
 - d. The conditions of the fuel and oil.
 - e. Any damage or looseness to any part?
- Where necessary, draw alignment indicators to avoid assembly errors. To avoid misconnection, place indicators such as reference tags on pipes.
- Clean all disassembled parts and new parts, arrange them neatly, and place indicators as necessary.
- Be sure to replace all seals and cotter pins with new ones.
- Keep those parts that should not come in contact with water or oil away from those with oil on the surface.
- When installing bearings, bushings and oil seals, a press tool should be used. If a hammer is used, use a cushioning material to avoid damage.
- Wipe all joining surfaces clean until there is no dirt or dust adhering to them.
- Wrap the thread tight with seal tape starting 1 or 2 threads away from the thread end. The tape should be overlapped by about 10 mm (0.39 in).



When removing/installing the hydraulic unit

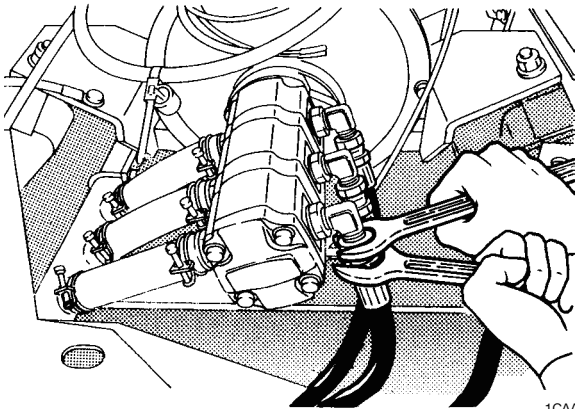
- Make sure that the temperature of the hydraulic oil has dropped and is cool enough to work with.
- To prevent the hydraulic oil from escaping under pressure, release the residual pressure in the piping.
- Be sure to install caps or plugs on all openings in the hydraulic unit to prevent dirt from getting into the unit through them.



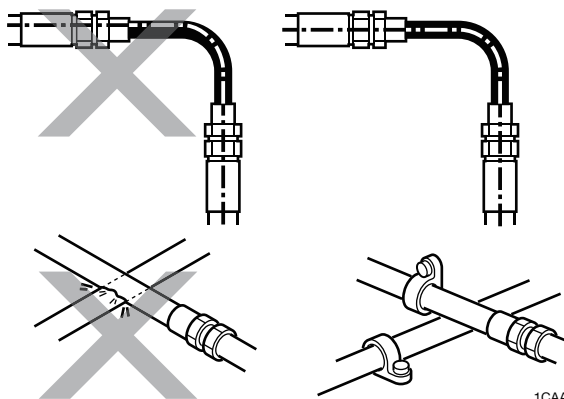
- The hydraulic oil adhering to the unit is often mistaken for an oil leak, so wipe off the unit thoroughly.
- Be sure that no damage is caused to the plating on the rod in the hydraulic cylinder.
- Removal and installation of the hydraulic cylinder should be done with the rod fully retracted.
- Be sure to bleed the air after installing the hydraulic cylinder. (☞ "4. Disassembly and assembly: Cylinder")
- Always bleed the air when hydraulic oil is changed or a hydraulic device is replaced. (☞ "4. Disassembly and assembly: Drive system")

When connecting/disconnecting the hoses or pipes

- When hydraulic hoses or pipes are connected, tighten them once to the prescribed torque, then loosen them slightly and retighten them to the prescribed torque.
 - Tighten the fittings after the installation surfaces fit snugly together.
 - The above procedures do not apply to fittings with seal tape.
- Use two spanners, one to tighten/loosen and the other to secure the mating hose/pipe to ensure that the hose is not twisted.

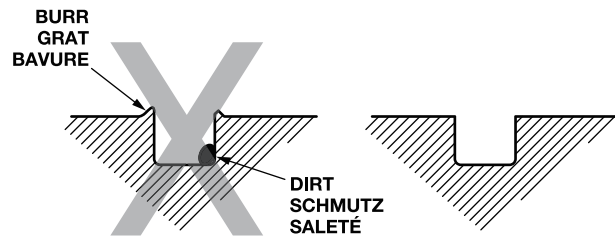


- After connecting the hydraulic hoses or pipes, apply the maximum working pressure five or six times to check for leakage.
- If high pressure, vibration or shock is applied to a twisted hose, oil leak, hose breakage or damage to the hose fitting can result.
- Be sure that the hydraulic hoses are not contacting sharp objects or each other. This could cause surface flaws on the hoses, resulting in breakage.



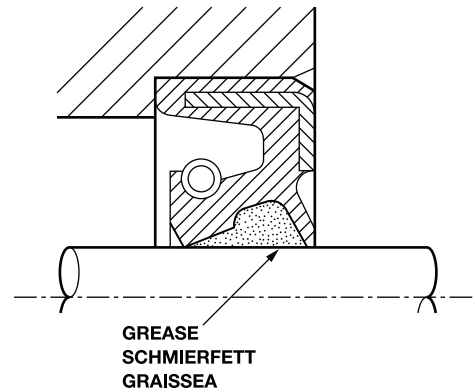
Handling of seals

- Clean the grooves for O-rings and remove any burrs.



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- Be careful not to twist the O-rings. If twisted, remove it with your fingertips.
- When inserting, be careful not to damage the seal.
- Handling of the floating seal
 - After removal, wipe all oil off the O-ring and housing of the floating seal.
 - When assembling, apply a thin coating of gear oil to the contact surface of the housing.
 - After assembly, turn the seal two or three times to get it to fit snugly.
- Apply grease to the lip of the oil seal.
 - This is to prevent wear from occurring upon first start up after assembly.



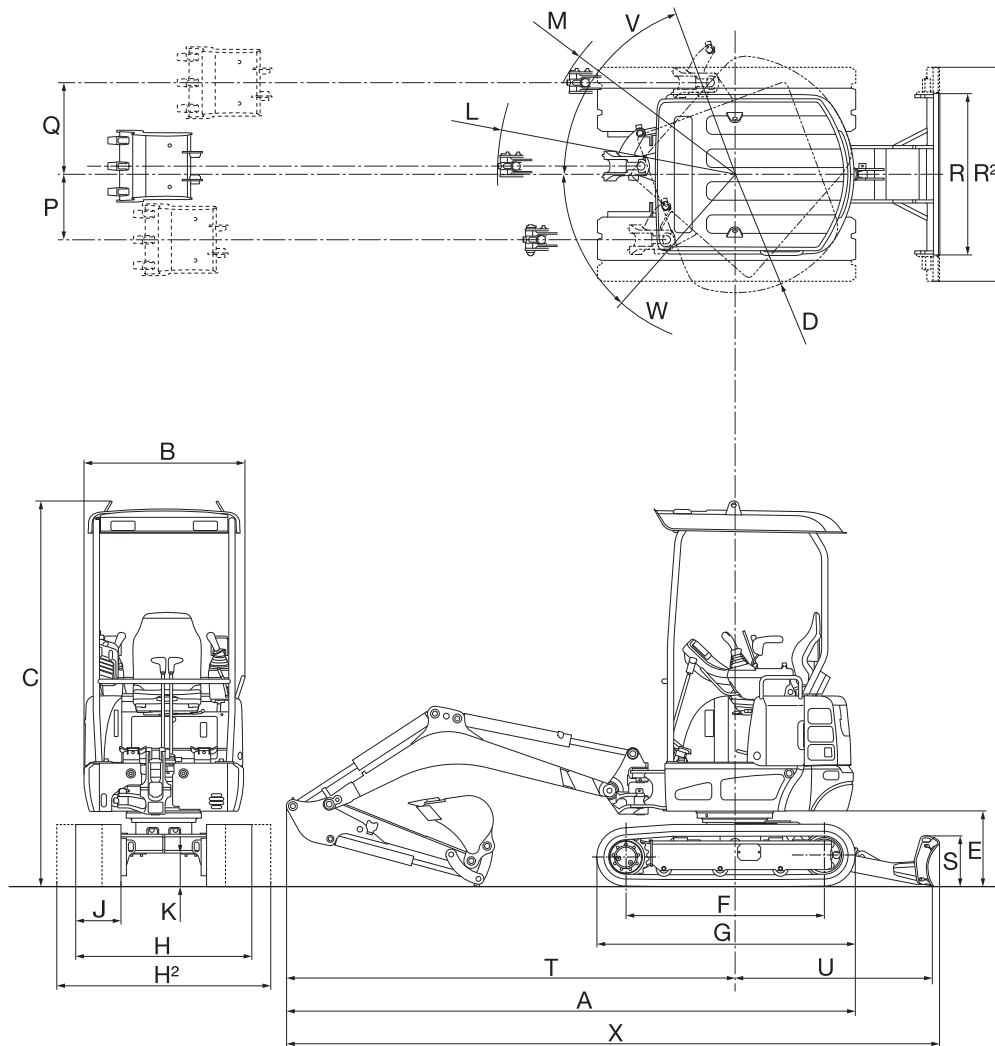
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Pressure adjustment for hydraulic devices

- The pressure for hydraulic devices is adjusted by Takeuchi Mfg. to optimal conditions before products are shipped for delivery to the customer. The pressure will not need to be adjusted again except in products that undergo disassembly and assembly procedures.

SERVICE DATA **2**

Machine dimensions



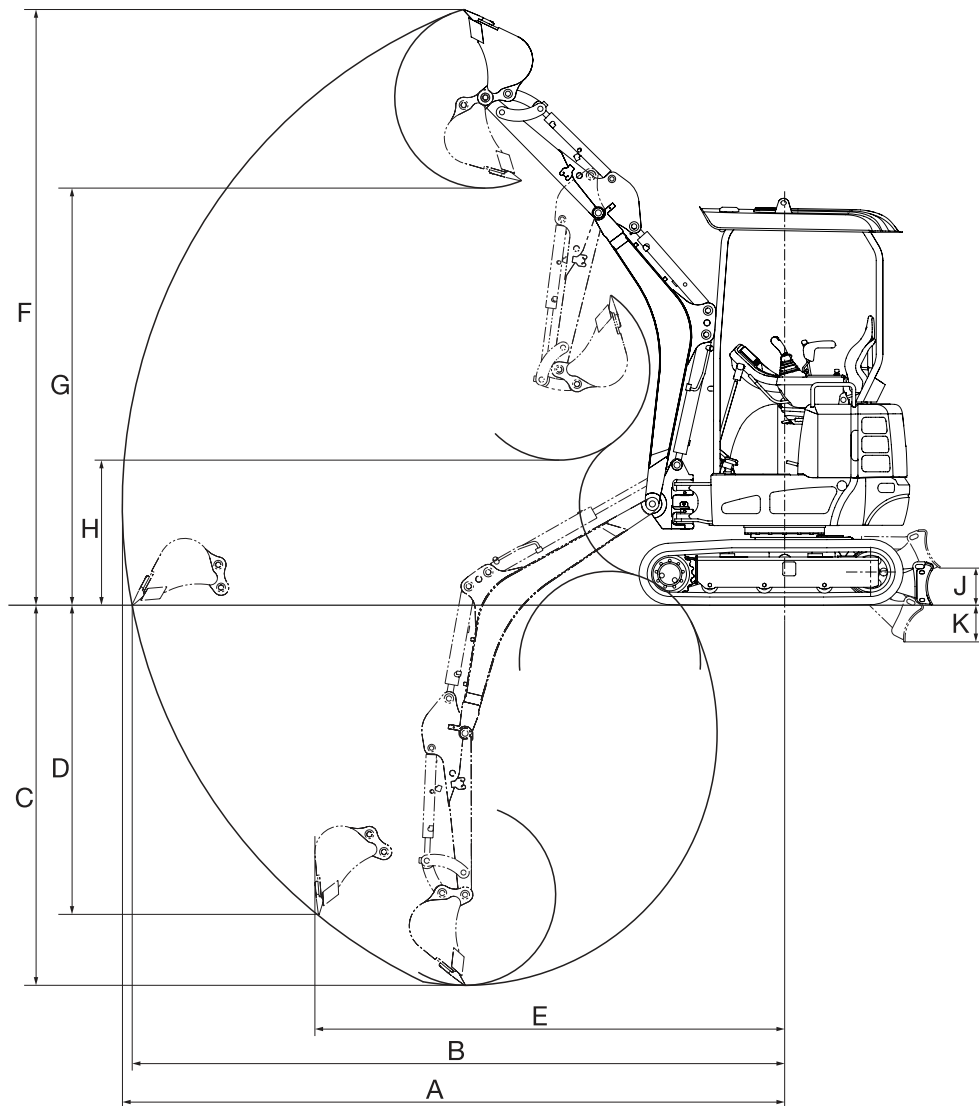
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Unit: mm (in.)

	Standard arm		Long arm	
	 215000003 to 215002407	 from 215002408	 215000003 to 215002407	 from 215002408
	Rubber crawler		Rubber crawler	
A	3445 (135.6)	3455 (136.1)	3440 (135.5)	3450 (135.9)
B	980 (38.5)	980 (38.5)	980 (38.5)	980 (38.5)
C	2345 (92.2)	2345 (92.2)	2345 (92.2)	2345 (92.2)
D	720 (28.3)	720 (28.3)	720 (28.3)	720 (28.3)
E	460 (18.1)	460 (18.1)	460 (18.1)	460 (18.1)
F	1155 (45.6)	1205 (47.4)	1155 (45.6)	1205 (47.4)
G	1520 (59.9)	1570 (61.8)	1520 (59.9)	1570 (61.8)
H	1300 (51.2)	1300 (51.2)	1300 (51.2)	1300 (51.2)
H ²	980 (38.6)	980 (38.6)	980 (38.6)	980 (38.6)
J	230 (9.1)	230 (9.1)	230 (9.1)	230 (9.1)
K	205 (8.0)	205 (8.0)	205 (8.0)	205 (8.0)
L	1450 (57.0)	1450 (57.0)	1470 (57.9)	1470 (57.9)
M	1185 (46.7)	1185 (46.7)	1210 (47.6)	1210 (47.6)
P	395 (15.6)	395 (15.6)	395 (15.6)	395 (15.6)
Q	555 (21.9)	555 (21.9)	555 (21.9)	555 (21.9)
R	980 (38.6)	980 (38.6)	980 (38.6)	980 (38.6)
R ²	1300 (51.2)	1300 (51.2)	1300 (51.2)	1300 (51.2)
S	250 (9.8)	-	250 (9.8)	-
S ²	310 (12.1)	310 (12.1)	310 (12.1)	310 (12.1)
T	2725 (107.3)	2725 (107.3)	2720 (107.1)	2720 (107.1)
U	855 (33.6)	-	855 (33.6)	-
U ²	1200 (47.2)	1200 (47.2)	1200 (47.2)	1200 (47.2)
V	70	70	70	70
W	50	50	50	50
X	3585 (141.1)	-	3580 (140.9)	-
X ²	3970 (156.2)	3970 (156.2)	3965 (156.1)	3965 (156.1)

H²: With the crawler extendedR²: Side plate attachedS²: Long blade specificationsU²: Long blade specificationsX²: Long blade specifications

Operating range



2A0AX02

Unit: mm (in.)

	Standard arm		Long arm	
	 215000003 to 215002407	 from 215002408	 215000003 to 215002407	 from 215002408
	Rubber crawler		Rubber crawler	
A	3815 (150.2)	3815 (150.2)	4000 (157.5)	4000 (157.5)
B	3760 (148.0)	3760 (148.0)	3945 (155.4)	3945 (155.4)
C	2190 (86.2)	2190 (86.2)	2390 (94.1)	2390 (94.1)
D	1780 (70.1)	1780 (70.1)	1970 (77.6)	1970 (77.6)
E	2705 (106.5)	2705 (106.5)	2760 (108.7)	2760 (108.7)
F	3430 (135.1)	3430 (135.1)	3570 (140.6)	3570 (140.6)
G	2400 (94.6)	2400 (94.6)	2545 (100.2)	2545 (100.2)
H	835 (32.9)	835 (32.9)	635 (25)	635 (25)
J	215 (8.4)	-	215 (8.4)	-
J ²	310 (12.1)	310 (12.1)	310 (12.1)	310 (12.1)
K	210 (8.3)	-	210 (8.3)	-
K ²	365 (14.3)	365 (14.3)	365 (14.3)	365 (14.3)

J²: Long blade specificationsK²: Long blade specifications

SPECIFICATION TABLES

Operating mass	 215000003 to 215002407	Rubber crawler	kg (lb)	1575 (3470)
		Steel crawler	kg (lb)	1670 (3680)
	 from 215002408	Rubber crawler	kg (lb)	1610 (3550)
		Steel crawler	kg (lb)	1675 (3695)
Rated output	Net (ISO 14396) kW/min ⁻¹ (hp/rpm)			11.5/2400 (15.4/2400)
	Net (ISO 9249/SAEJ 1349) kW/min ⁻¹ (hp/rpm)			11/2400 (14.8/2400)
Bucket capacity	Heaped capacity		m ³ (ft ³)	0.038 (1.34)
	Struck capacity		m ³ (ft ³)	0.028 (0.99)

Performance

Standard loading mass			kg (lb)	70 (150)
Slew speed			min ⁻¹ (rpm)	9.2 (9.2)
Travel speed	Rubber crawler	1st	km/h (mph)	2.2 (1.37)
		2nd	km/h (mph)	4.2 (2.61)
	Steel crawler	1st	km/h (mph)	2.1 (1.3)
		2nd	km/h (mph)	4 (2.49)
Maximum tractive force			kN (lbf)	19.4 (4360)
Gradeability			%	58
			deg.	30
Ground pressure	 215000003 to 215002407	Rubber crawler	kPa (psi)	26.2 (3.8)
		Steel crawler	kPa (psi)	28.2 (4.09)
	 from 215002408	Rubber crawler	kPa (psi)	26 (3.77)
		Steel crawler	kPa (psi)	27.3 (3.96)
Noise level	Sound-power level		dB (A)	93
	Sound-pressure level*		dB (A)	80

*: At the operator location as stipulated by ISO 6396: 2008.

Dimensions of completed machine

Overall length	 215000003 to 215002407	Standard arm	Rubber crawler	mm (in.)	3445 (135.6)
			Steel crawler	mm (in.)	3445 (135.6)
	 from 215002408		Rubber crawler	mm (in.)	3455 (136)
			Steel crawler	mm (in.)	3445 (135.6)
Overall width		During normal operation		mm (in.)	1300 (51.2)
		Track retracted		mm (in.)	980 (38.6)
Overall height		Rubber crawler		mm (in.)	2345 (92.3)
		Steel crawler		mm (in.)	2350 (92.5)

Dimensions of base machine

Overall length of base machine	S/N 215000003 to 215002407	Rubber crawler	mm (in.)	1560 (61.4)
		Steel crawler	mm (in.)	1565 (61.6)
	S/N from 215002408	Rubber crawler	mm (in.)	1570 (61.8)
		Steel crawler	mm (in.)	1565 (61.6)
Overall width of base machine	During normal operation		mm (in.)	1300 (51.2)
	Track retracted		mm (in.)	980 (38.6)
Upper structure overall width			mm (in.)	980 (38.6)
Upper structure overall width	Left		mm (in.)	490 (19.3)
	Right		mm (in.)	490 (19.3)
Cab overall width			mm (in.)	-
Overall height of base machine	Rubber crawler		mm (in.)	2345 (92.3)
	Steel crawler		mm (in.)	2350 (92.5)
Swing radius			mm (in.)	720 (28.3)
Upper structure rearmost distance from axis of rotation			mm (in.)	720 (28.3)
Clearance height under upper structure	Rubber crawler		mm (in.)	460 (18.1)
	Steel crawler		mm (in.)	450 (17.7)
Crawler base	S/N 215000003 to 215002407	Rubber crawler	mm (in.)	1155 (45.5)
		Steel crawler	mm (in.)	1135 (44.6)
	S/N from 215002408	Rubber crawler	mm (in.)	1205 (47.4)
		Steel crawler	mm (in.)	1180 (46.5)
Crawler overall length	S/N 215000003 to 215002407	Rubber crawler	mm (in.)	1520 (59.8)
		Steel crawler	mm (in.)	1500 (59.1)
	S/N from 215002408	Rubber crawler	mm (in.)	1570 (61.8)
		Steel crawler	mm (in.)	1550 (61)
Undercarriage overall width	During normal operation		mm (in.)	1300 (51.2)
	Track retracted		mm (in.)	980 (38.6)
Track gauge	During normal operation		mm (in.)	1070 (42.1)
	Track retracted		mm (in.)	750 (29.5)
Track shoe width			mm (in.)	230 (9.1)
Ground clearance of undercarriage	Rubber crawler		mm (in.)	205 (8.1)
	Steel crawler		mm (in.)	195 (7.7)

Engine

Model			Yanmar 3TNV70
Type			4-cycle, vertical, water-cooled, in-line, 3-cylinder, indirect injection
Cylinders	Number of cylinders	Quantity	3
	Bore	mm (in.)	70 (2.76)
	Stroke	mm (in.)	74 (2.91)
Total displacement		mL (cu. in.)	854 (52.1)
Maximum torque		N·m (ft-lb)	48.2 to 52.6 (35.6 to 38.8)
		min ⁻¹ (rpm)	1800 (1800)
Specific fuel consumption (at rated output)		g/(kW·h) (lb/hp-hr)	280 (0.46)
Fuel/air cleaner			Centrifugal, filter paper-type
Cooling system	Fan		Exhaust system
	Radiator		Pressurized
Starting system	Voltage	V	12
	Output	kW	1.0
Generator	Voltage	V	12
	Output	kW	0.48
Battery	Voltage	V	12
	Capacity	A·h	38
	Quantity		1

Hydraulic system

Hydraulic pump drive system				Engine direct coupling
Hydraulic pump	Type			Variable displacement type double axial piston + double gear
	Quantity			1
	Delivery	P1	L/min (US gal/min)	16.8 (4.44)
		P2	L/min (US gal/min)	16.8 (4.44)
		P3	L/min (US gal/min)	10.8 (2.85)
		P4	L/min (US gal/min)	6.5 (1.72)
	Hydraulic pump control system			Total horsepower control
Main relief valve pressure setting			MPa (psi)	21.0 (3050)
			MPa (psi)	21.0 (3050)
			MPa (psi)	20.0 (2900)
			MPa (psi)	3.4 (490)
Hydraulic tank pressure				Pressure tank
Control valve	Type			Directional control valve with 10 valves in series
	Operation type			-
Hydraulic oil filter	Type			Glass fiber filter type
	Filter precision			BETA10 = 1.4
	Installation position			Return circuit (in hydraulic tank)
Hydraulic oil cooler	Cooling system			Air cooling
	Radiation surface area	m ² (ft ²)		1.45 (15.6)

Operating device

Cab	Position	Center
	Construction	Suspension seat
Cab or canopy	Construction	Canopy with steel support columns
Control levers and pedals	Shifting operation	Variable travel speed switch (handle grip of operating lever)
	Travel operation	Mechanical system, 2 levers
	Slew operation	Hydraulic pilot-operated
	Arm operation	Hydraulic pilot-operated
	Bucket operation	Hydraulic pilot-operated
	Boom operation	Hydraulic pilot-operated
	Boom swing operation	Hydraulic pilot-operated, pedal-operated system
	Other	Blade, spanner function operation: Mechanical, lever-operated system Auxiliary line piping operation: Mechanical, pedal-operated system
Instruments, switches		Water temperature gauge, fuel gauge, low fuel level warning indicator, clock, hour meter, charge, engine oil, water temperature, glow, and 2nd speed travel
Lighting device		Headlight, boom light (12V-55W H3 halogen bulb)
Warning, safety devices		Horn (12 V, 110 dB)
Others		-

Slew equipment

Slew bearing	Type	Ball bearing-type
Slew motor	Type	Differential reduction gear type, internal trochoid gear motor
	Quantity	1
Reduction gears	Type	None (pinion-linked)
Slew brake	Type	Brake valve with a shockless relief
	Quantity	1
Slew parking brake	Type	Wet friction plate type
Slew lock	Type	-

Lower machinery

Power transmission device				
Travel motor		Type		Variable displacement (2-speed) piston motor, with counterbalance valve
		Quantity		2
Reduction gears		Type		Epicyclic gearing (2-stage)
Travel brake		Type		Counterbalance valve, differential delay type
Parking brake		Type		Wet friction plate type
Undercarriage				
Track shoe	S/N 215000003 to 215002407	Type		Rubber crawler
		Number of core metal (on one side)	Quantity	68
		Shoe width	mm (in.)	230 (9.06)
		Lug height	mm (in.)	25 (0.91)
		Type		Steel crawler, double grouser
		Number of shoes (on one side)	Quantity	35
		Shoe width	mm (in.)	230 (9.06)
		Grouser height	mm (in.)	15 (0.65)
	S/N from 215002408	Type		Rubber crawler
		Number of core metal (on one side)	Quantity	70
		Shoe width	mm (in.)	230 (9.06)
		Lug height	mm (in.)	25 (0.91)
		Type		Steel crawler, double grouser
		Number of shoes (on one side)	Quantity	36
		Shoe width	mm (in.)	-
		Grouser height	mm (in.)	15 (0.65)
Roller		Carrier roller (on one side)	Quantity	2 (slide plate)
		Track roller (on one side)	Quantity	3
Track adjuster		Type		Grease cylinder type (with cushion spring)
Track gauge extension mechanism				Hydraulic system

Working equipment

Backhoe attachment			
Bucket capacity	Heaped capacity	m ³ (ft ³)	0.038 (1.34)
	Struck capacity	m ³ (ft ³)	0.028 (0.99)
Bucket width	Standard	mm (in.)	405 (16.0)
	With side cutter	mm (in.)	435 (17.1)
Bucket mass		kg (lb)	34 (75)
Boom length		mm (in.)	1705 (67.1)
Arm length	Standard	mm (in.)	930 (36.6)
Bucket wrist radius		mm (in.)	520 (20.5)
Bucket wrist angle		deg.	190
Boom swing angle	Left	deg.	70
	Right	deg.	50
Eccentricity of boom swing pivot		mm (in.)	50 (2.0)

Working dimensions (Standard arm)

Maximum reach		mm (in.)	3815 (150.2)
Maximum reach at ground reference plane		mm (in.)	3760 (148)
Minimum radius of ground level finishing		mm (in.)	1325 (52.2)
Maximum digging depth	Rubber crawler	mm (in.)	2190 (86.2)
	Steel crawler	mm (in.)	2200 (86.6)
Reach at maximum digging depth		mm (in.)	1840 (72.4)
Maximum vertical digging depth	Rubber crawler	mm (in.)	1780 (70.1)
	Steel crawler	mm (in.)	1790 (70.5)
Maximum height of cutting edge	Rubber crawler	mm (in.)	3430 (135)
	Steel crawler	mm (in.)	3420 (134.6)
Reach at maximum height		mm (in.)	1845 (72.6)
Maximum dumping height	Rubber crawler	mm (in.)	2400 (94.5)
	Steel crawler	mm (in.)	2390 (94.1)
Reach at maximum dumping height		mm (in.)	1725 (67.9)
Minimum dumping height	Rubber crawler	mm (in.)	835 (32.9)
	Steel crawler	mm (in.)	825 (32.5)
Minimum radius of equipment and attachment		mm (in.)	1450 (57.1)
Minimum radius of equipment at maximum front offset		mm (in.)	1185 (46.7)
Overall height at minimum radius of equipment and attachment		mm (in.)	2515 (99)
Overall height of equipment at maximum front offset		mm (in.)	2515 (99)
Max. bucket offset distance	Left	mm (in.)	395 (15.6)
	Right	mm (in.)	555 (21.9)

Main structure

Boom			Integrated hydraulic cylinder, drive swing type
Arm			-
Bucket	Type		-
	Number of teeth	Quantity	3

Hydraulic cylinder

Boom cylinder	Number of cylinders	Quantity	1
	Bore	mm (in.)	60 (2.4)
	Stroke	mm (in.)	480 (18.9)
Arm cylinder	Number of cylinders	Quantity	1
	Bore	mm (in.)	60 (2.4)
	Stroke	mm (in.)	385 (15.2)
Bucket cylinder	Number of cylinders	Quantity	1
	Bore	mm (in.)	50 (2)
	Stroke	mm (in.)	355 (14)
Swing cylinder	Number of cylinders	Quantity	1
	Bore	mm (in.)	60 (2.4)
	Stroke	mm (in.)	340 (13.4)

Digging force

Maximum digging force	Bucket cylinder	kN (lbf)	14 (3150)
	Arm cylinder	kN (lbf)	9.5 (2140)
Maximum lifting force	Boom cylinder	kN (lbf)	7.7 (1730)
Attachment (optional)			-

Dozer blade

Type			Straight type		
Operation type			Hydraulic hoisting type		
Dozer blade cylinder	Number of cylinders	Quantity	1		
	Bore	mm (in.)	60 (2.4)		
	Stroke	mm (in.)	120 (4.7)		
Dimensions					
Dozer blade dimensions	Width	mm (in.)	1300 (51.2)		
	Height	mm (in.)	Standard blade	Rubber crawler	250 (9.8)
				Steel crawler	205 (8.1)
		mm (in.)	Long blade	Rubber crawler	310 (12.2)
				Steel crawler	300 (11.8)
	Cutting angle		deg.	55	
Distance between the front end of the dozer blade and the axis of rotation		mm (in.)	Standard blade		855 (33.6)
		mm (in.)	Long blade		1200 (47.2)
Dozer blade maximum lifting		mm (in.)	Standard blade	Rubber crawler	215 (8.5)
				Steel crawler	205 (8.1)
		mm (in.)	Long blade	Rubber crawler	360 (14.2)
				Steel crawler	350 (13.8)
Dozer blade maximum lowering		mm (in.)	Standard blade	Rubber crawler	210 (8.3)
				Steel crawler	220 (8.7)
		mm (in.)	Long blade	Rubber crawler	365 (14.4)
				Steel crawler	375 (14.8)
Dozer blade approach angle		deg.	Standard blade	Rubber crawler	31
				Steel crawler	29
			Long blade	Rubber crawler	30
				Steel crawler	29

TABLE OF MASSES

Upper structure

kg (lb.)

Part name	Remarks	Mass
Engine	Dry mass	103 (227)
Radiator	With assembly parts attached	13 (28)
Main pump		13 (29)
Gear pump		–
Hydraulic tank	With assembly parts attached	20 (43)
Fuel tank	With assembly parts attached	3 (6)
Control valve (2nd, 3rd auxiliary line piping specifications)	With adapter attached	38 (84)
Pilot valve		2 (4)
Slew motor		22 (49)
Cab		–
Canopy	With roof attached	48 (105)
Counterweight		100 (220)
Counterweight (with added weight)		–
Boom bracket		30 (65)
Swing cylinder		17 (37)

Lower structure

kg (lb.)

Part name	Remarks	Mass
Swivel joint		12 (27)
Slew bearing		18 (40)
Rubber crawler	One side	55 (120)
Steel crawler	One side	–
Segmented rubber crawler		–
Travel motor		18 (40)
Carrier roller		–
Track roller		3 (7)
Front idler		14 (31)
Track adjuster		6 (12)
Dozer blade		50 (111)
Dozer blade cylinder		11 (23)
Spanner cylinder		6.4 (14.1)

Hoe attachment

kg (lb.)

Part name	Remarks	Mass
Boom		57 (125)
Arm		31 (68)
Arm (middle model)		–
Arm (long model)		–
Bucket (450-mm-wide model)	With teeth	34 (76)
Boom cylinder		20 (44)
Arm cylinder		17 (37)
Bucket cylinder		9 (20)

LUBRICANT AND FUEL CHART

Select the appropriate fuel, lubricant, and grease according to temperature by referring to the table below.

- Regardless of the specified time, change the oil if it becomes too dirty or degraded.
- When refilling, never mix oils of different brands. If a brand is to be changed, replace all of the fuel/oil.

Part	Type	Selection by air temperature							When to change/ replenish	Capacity
		-4	14	32	50	68	86	104°F		
		-20	-10	0	10	20	30	40°C		
Engine oil pan	Diesel engine oil API: CD class ACEA: E3/E4/E5 class JASO: DH1 class		SAE 10W-30						Every 250 hrs.	Upper limit: 2.8 L (3.0 US qt.) Lower limit: 1.5 L (1.6 US qt.)
		SAE 15W-40								
Hydraulic tank	Takeuchi genuine hydraulic oil 46		ISO VG46						Every 4000 hrs.***	Total amount of oil: 24 L (6.3 US gal.) Tank level capacity: 16.1 L (4.3 US gal)
	Anti-wear hydrau- lic oil		ISO VG32						Every 2000 hrs.***	
			ISO VG46							
			ISO VG68							
Engine cooling system	Cooling water (water + coolant)** SAE-J814C, J1034		Mixture of 50% coolant						Every 2000 hrs.	3.9 L (4.1 US qt.)
			Mixture of 30% coolant							
Travel reduction gear	Gear oil API: GL-4	SAE 90							Every 1000 hrs. after the first 250 hrs.*	0.33 L (0.35 US qt.)
Track roller	Gear oil	SAE 90							—	0.060 L (2.0 fl. oz.)
Idler	Gear oil	SAE 90							—	0.045 L (1.5 fl. oz.)
Slew motor pinion	Lithium grease EP-2 NLGI No. 2	—							Every 50 hrs.	As required
Slew bearing									Every 50 hrs.	
Working equip- ment									Daily or every 10 hrs.	
Levers									When required	

* If the ratio of traveling time to total operating time is high, replace the gear oil earlier than the specified time.

** For water, use tap water (soft). Do not use well or river water.

When the ambient temperature drops below 0°C (32°F), add coolant (antifreeze). Follow the coolant manufacturer's instructions to determine the mixture ratio.

*** The replacement interval for hydraulic oil depends on the type of oil being used. New machines are shipped from the factory with the Takeuchi genuine hydraulic oil 46. This manual describes when to replace the hydraulic oil assuming that this Takeuchi oil is used. When a conventional anti-wear hydraulic oil is used, replace it every 2000 hours.

API Standards: American Petroleum Institute

ACEA Standards: European Automobile Manufacturers' Association

SAE Standard: SAE International® (Society of Automotive Engineers)

JASO Standards: Japanese Automotive Standards Organization

Diesel fuel standards

Use a diesel fuel that is compliant with any of the standards listed below. The table below shows standards from various countries/regions.

Diesel fuel standards	Country/Region
ASTM D975 No. 1-D, S15 No. 2-D, S15	USA Canada
EN590: 2009	EU
ISO 8217 DMX	International standard
BS 2869-A1 (or A2)	UK
JIS K2204 Grade, 2-go	Japan
KSM-2610	Korea
GB252	China

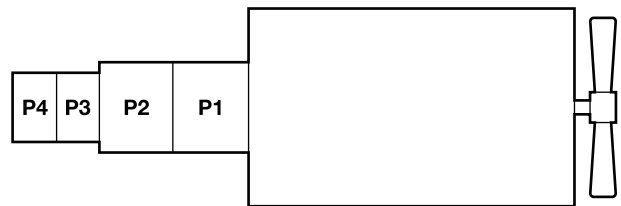
Part	Type		Capacity
Fuel tank	Diesel fuel	To maintain the performance and service life of the engine, always use clean and high-quality fuel. • To avoid freezing in cold climates, use a light oil that still functions when the temperature is at least 12°C (54°F) below the lowest expected ambient temperature. • Use a light oil with a cetane number of 45 or higher. When operating at a very low temperature or at a high altitude, a higher cetane number fuel will be required. • Use fuel with an overall sulfur content below 0.5%. Be sure to use fuel with an ultra-low sulfur content for applications in the U.S. or Canada, in particular. • The use of fuel containing a high sulfur content may cause sulfuric acid corrosion to occur inside the cylinder. • Do not mix fuel with any kerosene, used engine oil, or left-over fuel. • Poor quality fuel can degrade engine performance. It can also damage the engine. • Refrain from adding additives to the fuel. Some fuel additives can degrade engine performance.	22 L (5.8 US gal.)

PERFORMANCE CRITERIA

Standard values table

Item				Standard value	Allowable value
Engine speed	Idling		min ⁻¹ (rpm)	1060 ⁺¹⁰⁰ ₋₁₀₀ (1060 ⁺¹⁰⁰ ₋₁₀₀)	
	Maximum R.P.M.		min ⁻¹ (rpm)	2560 ⁺⁵⁰ ₋₅₀ (2560 ⁺⁵⁰ ₋₅₀)	
Hydraulic oil pres- sure	Boom		MPa (psi)	21.0 ^{+1.2} _{-0.3} (3046 ⁺¹⁴⁵ ₋₄₄)	
	Arm		MPa (psi)	21.0 ^{+1.2} _{-0.3} (3046 ⁺¹⁴⁵ ₋₄₄)	
	Dozer blade		MPa (psi)	20.0 ^{+1.2} _{-0.3} (2901 ⁺¹⁴⁵ ₋₄₄)	
	Slew		MPa (psi)	13.4 ^{+3.1} _{-1.0} (1943 ⁺²⁹⁰ ₋₁₄₅)	
	Pilot pressure		MPa (psi)	3.4 ^{+0.4} _{-0.3} (493 ⁺⁵⁸ ₋₄₄)	
Cylinder speed	Boom cylinder	Retracted	s	2.1 ^{+0.4} _{-0.4}	2.7
		Extended	s	2.2 ^{+0.4} _{-0.4}	2.8
		Retracted	s		
		Extended	s		
	Arm cylinder	Retracted	s	2.7 ^{+0.4} _{-0.4}	3.4
		Extended	s	2.9 ^{+0.4} _{-0.4}	3.6
	Bucket cylin- der	Retracted	s	1.8 ^{+0.4} _{-0.4}	2.4
		Extended	s	2.5 ^{+0.4} _{-0.4}	3.2
	Swing cylinder	Retracted	s	5.3 ^{+0.7} _{-0.7}	6.5
		Extended	s	5.0 ^{+0.7} _{-0.7}	6.2
		Retracted	s		
		Extended	s		
	Dozer blade cylinder	Retracted	s	2.3 ^{+0.4} _{-0.4}	2.9
		Extended	s	2.4 ^{+0.4} _{-0.4}	3.0
	Spanner cylin- der	Retracted	s	3.8 ^{+0.7} _{-0.7}	4.9
		Extended	s	3.8 ^{+0.7} _{-0.7}	4.9
Slew time		Normal speed	s	12.7 ^{+0.8} _{-0.8}	14.8
		Low speed	s		
Overrun when slewing stops			mm (in.)	33 ⁺²⁰ ₋₂₀ (1.3 ^{+0.8} _{-0.8})	67 (2.6)
Natural travel drop			mm (in.)	0.0 (0.0)	
Natural slew drop	Slew bearing		mm (in.)	0.0 (0.0)	
	Swing cylinder		mm (in.)	5.0 ^{+0.0} _{-5.0} (0.2 ^{+0.0} _{-0.2})	10.0 (0.4)
Travel speed 10 m (32.8 ft.)	1st	Rubber	s	16.0 ^{+1.2} _{-1.2}	18.8
		Steel	s		
	2nd	Rubber	s	9.0 ^{+1.0} _{-1.0}	11.3
		Steel	s		
Travel speed (5 revs.)	1st	Rubber	s	26.1 ^{+1.2} _{-1.2}	29.9
		Steel	s		
	2nd	Rubber	s	14.3 ^{+0.8} _{-0.8}	17.1
		Steel	s		
Straight-ahead traveling			mm (in.)	0 ⁺¹²⁵ ₀ (0 ^{+4.9} ₀)	

Straight travel function check	Bucket		To be moved forward using simultaneous operation		
	Arm				
	Boom				
	Dozer blade				
Bucket cylinder speed		Retracted	s	2.9 ^{+0.8} _{-0.8}	4.0
Natural cylinder drop	Boom cylinder		mm (in.)	5 ⁰ ₋₅ (0.2 ^{0.0} _{-0.2})	10 (0.4)
	Arm cylinder		mm (in.)	5 ⁰ ₋₅ (0.2 ^{0.0} _{-0.2})	10 (0.4)
	Bucket cylinder		mm (in.)	3 ⁰ ₋₃ (0.1 ^{0.0} _{-0.1})	6 (0.2)
	Dozer blade cylinder		mm (in.)	2 ⁰ ₋₂ (0.1 ^{0.0} _{-0.1})	4 (0.2)
	Bucket tip		mm (in.)	70 ⁰ ₋₇₀ (2.8 ^{0.0} _{-2.8})	140 (5.5)
Backlash			mm (in.)	20 ⁺¹⁵ ₋₁₅ (0.8 ^{+0.6} _{-0.6})	40 (1.6)
Lever play	Right control lever		mm (in.)	4 ⁰ ₋₄ (0.2 ^{0.0} _{-0.2})	
	Left control lever		mm (in.)	4 ⁰ ₋₄ (0.2 ^{0.0} _{-0.2})	
	Travel lever		mm (in.)	22 ⁰ ₋₂₂ (0.9 ^{0.0} _{-0.9})	
	Dozer blade lever		mm (in.)	35 ⁰ ₋₃₅ (1.4 ^{0.0} _{-1.4})	
Lever control force	Swing lever		N (lbf)	75 ⁺¹⁵ ₋₁₅ (16.9 ^{+3.4} _{-3.4})	
	Travel lever		N (lbf)	15 ⁺⁴ ₋₄ (3.4 ^{+0.9} _{-0.9})	
	Dozer blade lever		N (lbf)	30 ⁺¹⁰ ₋₁₀ (6.7 ^{+2.2} _{-2.2})	
Slew bearing play			mm (in.)	0.5 ^{+0.4} _{-0.4} (0.02 ^{+0.02} _{-0.02})	1.5 (0.1)
Track tension	Rubber		mm (in.)	59 to 64 (2.3 to 2.5)	
	Rubber pads		mm (in.)		
	Steel		mm (in.)		

Hydraulic pump assignment table

2DAA01Z

P1	Boom swing, 1st auxiliary line piping, right travel, boom, bucket	16.8 L/min. (4.4 US gal/min.)
P2	Boom swing, 1st auxiliary line piping, arm, left travel	16.8 L/min. (4.4 US gal/min.)
P3	Slew, blade, 2nd auxiliary line piping, 3rd auxiliary line piping (right)	10.8 L/min. (2.9 US gal/min.)
P4	Pilot pressure, travel speed switching, 3rd auxiliary line piping (left)	6.5 L/min. (1.7 US gal/min.)

Pump P1

Boom swing	Pressure: 21.0 MPa (3045 PSI)	Test port A1
1st auxiliary line piping	Pressure: 21.0 MPa (3045 PSI)	Test port A1
Right travel	Pressure: 21.0 MPa (3045 PSI)	Test port A1
Boom	Pressure: 21.0 MPa (3045 PSI)	Test port A1
Bucket	Pressure: 21.0 MPa (3045 PSI)	Test port A1

Pump P2

Boom swing	Pressure: 21.0 MPa (3045 PSI)	Test port A2
1st auxiliary line piping	Pressure: 21.0 MPa (3045 PSI)	Test port A2
Arm	Pressure: 21.0 MPa (3045 PSI)	Test port A2
Left travel	Pressure: 21.0 MPa (3045 PSI)	Test port A2

Pump P3

Slew	Pressure: 13.4 MPa (1943 PSI)	Test port A3
Dozer blade	Pressure: 20.0 MPa (2900 PSI)	Test port A3
2nd auxiliary line piping	Pressure: 20.0 MPa (2900 PSI)	Test port A3
3rd auxiliary line piping (right)	Pressure: 20.0 MPa (2900 PSI)	Test port A3

Pump P4

Pilot pressure	Pressure: 3.4 MPa (493 PSI)	Test port P4
3rd auxiliary line piping (left)	Pressure: 3.4 MPa (493 PSI)	Test port P4
Travel speed switching	Pressure: 3.4 MPa (493 PSI)	Test port P4

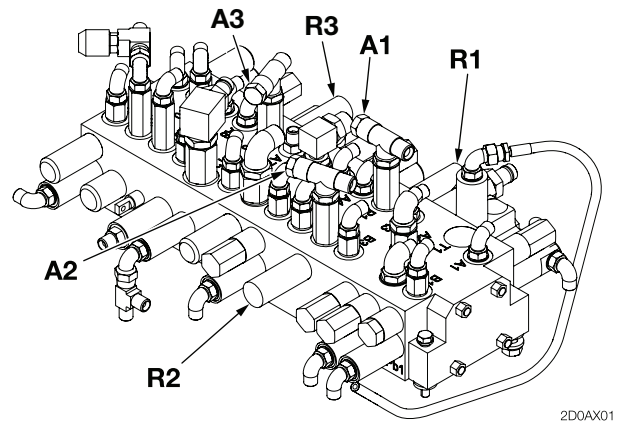
Methods for inspecting performance

Hydraulic oil pressure (Boom, arm, dozer blade)

Measurement method

- Engine: Maximum R.P.M.
- Hydraulic oil temp.: 50°C to 60°C (122°F to 140°F)
- Install a pressure gauge on the pressure detection port. Operate the hydraulic circuit to be tested, and measure the relief pressure.

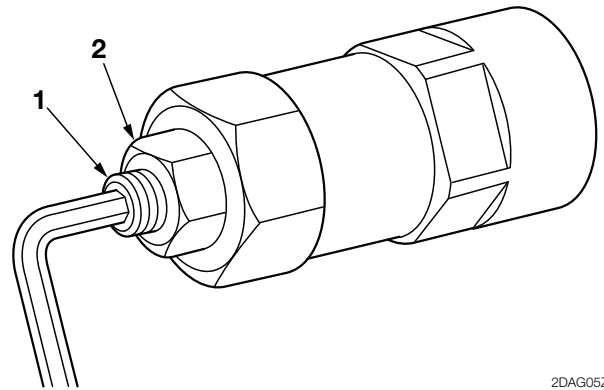
Circuit	Relief valve	Pressure detection port	
		Port	Size
Boom	R1	A1	G1/4
Arm	R2	A2	
Dozer blade	R3	A3	



2D0AX01

Adjustment method

1. Loosen the locknut (2), and turn the setscrew (1) to adjust the set pressure.
 - Turn the setscrew clockwise to increase the set pressure.
 - Turn the setscrew counterclockwise to decrease the set pressure.
2. In order to keep the setscrew (1) from turning after the pressure has been adjusted, tighten the locknut (2) while holding the setscrew (1) firmly in place.
 - 🔑 Lock nut: 30 ± 2 N·m (22.1 ± 1.5 ft.-lb)
3. Operate the relief valve once more to confirm that the pressure that has been set is stabilized.

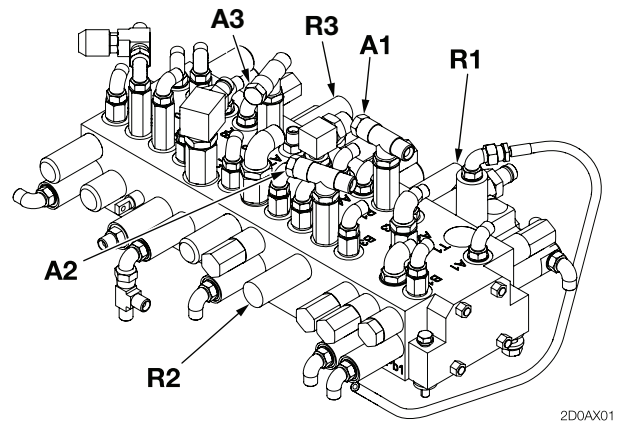


2DAG05Z

Hydraulic oil pressure (Slew)**Measurement method**

- Engine: Maximum R.P.M.
- Hydraulic oil temp.: 50°C to 60°C (122°F to 140°F)
- Install a pressure gauge on the pressure detection port. Operate the hydraulic circuit to be tested, and measure the relief pressure. (Secure the upper structure so that it cannot slew in the direction to be measured.)

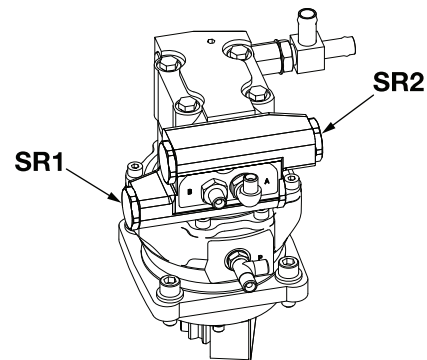
Circuit	Relief valve	Pressure detection port	
		Port	Size
Right slew	SR1	A3	G1/4
Left slew	SR2		



2D0AX01

Adjustment method

The set pressure cannot be adjusted while the relief valve is attached to the slew motor. If adjustments need to be made, replace the relief valve assembly.

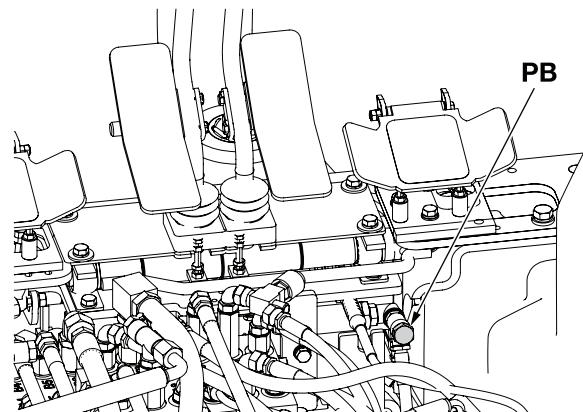


2D0AX02

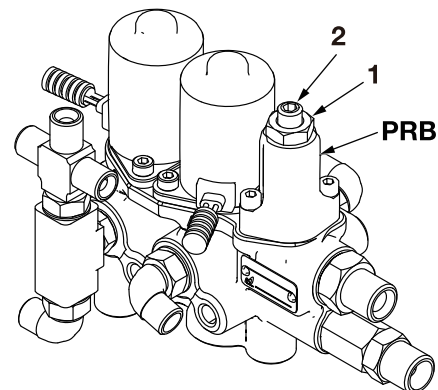
Hydraulic oil pressure (Pilot pressure)**Measurement method**

- Engine: Maximum R.P.M.
- Hydraulic oil temp.: 50°C to 60°C (122°F to 140°F)
- Install a pressure gauge on the pressure detection port to measure the relief pressure.

Relief valve	Pressure detection port	
	Port	Size
PRB	PB	G1/4

**Adjustment method**

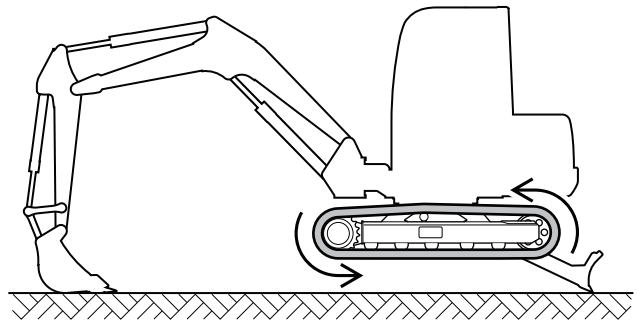
- Loosen the locknut (1), and turn the setscrew (2) to adjust the set pressure.
 - Turn the setscrew clockwise to increase the set pressure.
 - Turn the setscrew counterclockwise to decrease the set pressure.
- In order to keep the setscrew (2) from turning after the pressure has been adjusted, tighten the locknut (1) while holding the setscrew (2) firmly in place.
 - ⚙ Locknut: 15.7 N·m (11.6 ft.-lb)
- Operate the relief valve once more to confirm that the pressure that has been set is stabilized.



2D0AX04

Travel speed (5 revs.)

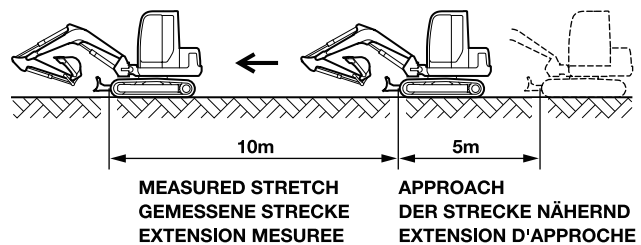
- Engine: Maximum R.P.M.
- Hydraulic oil temp.: 50°C to 60°C (122°F to 140°F)
- Measuring attitude: Excavator body to be raised using both the hoe attachment and the dozer blade
- Set crawler belts in motion. Starting after one full revolution, measure the time required for five revolutions. (To measure speed after it has stabilized.)



2DAF06Z

Travel speed (10 m)

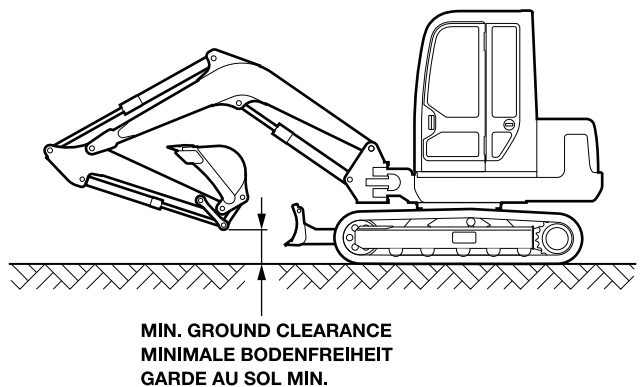
- Engine: Maximum R.P.M.
- Hydraulic oil temp.: 50°C to 60°C (122°F to 140°F)
- Measuring attitude: Traveling
- Drive 5 meters (16.4 ft.) first and then start measuring the time required for the machine to travel another 10 meters (32.8 ft.). Do this on level ground.



2DAF07Z

■ Traveling attitude

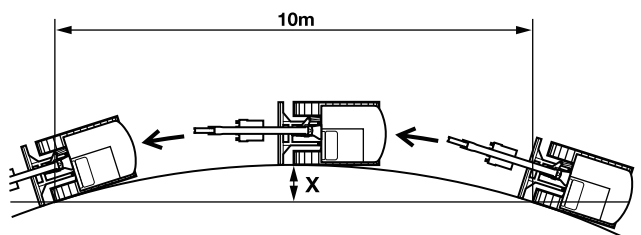
With the bucket in a no-load state and the boom raised, fully extend the arm and bucket cylinders and adjust the hoe attachment so that its lowest part is even with the excavator's minimum ground clearance level. The dozer blade should not be touching the ground.



2DAF08Z

Straight-ahead traveling

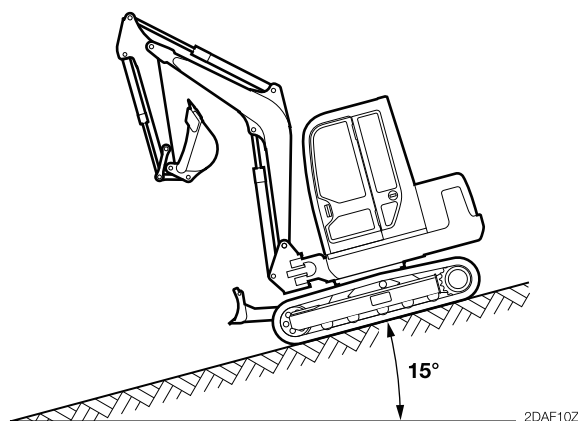
- Engine: Maximum R.P.M.
- Hydraulic oil temp.: 50°C to 60°C (122°F to 140°F)
- Measuring attitude: Traveling
- Starting from an approach of 5 meters (16.4 ft.), drive the excavator in a turn for 10 meters (32.8 ft.), and then measure the distance, X (from the 5-m point). Do this on level ground.



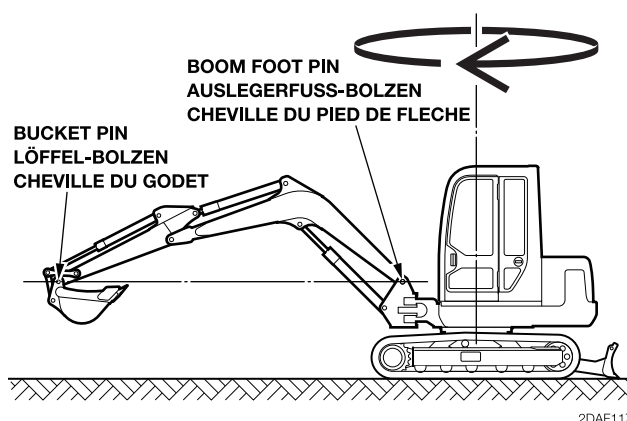
2DAF09Z

Natural travel drop

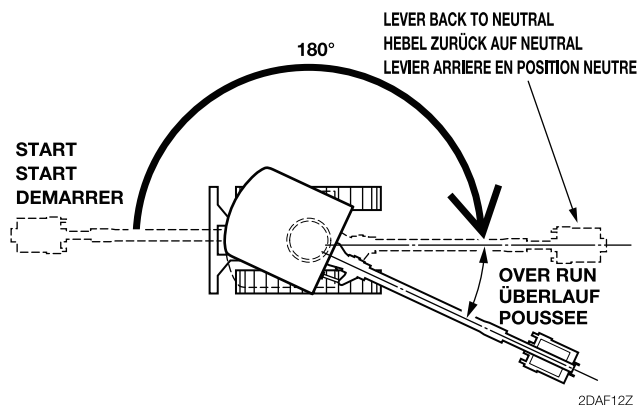
- Engine: Stopped
- Hydraulic oil temp.: 50°C to 60°C (122°F to 140°F)
- Inclination angle: 15°
- Measuring attitude: Fully extend the boom, arm, and bucket cylinders. Completely retract the dozer blade cylinder.
- Leave the excavator parked at an angle for 5 minutes and then measure the amount of natural drop.

**Slew time**

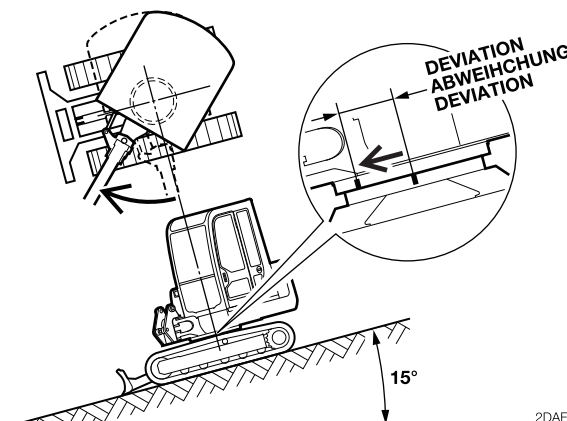
- Engine: Maximum R.P.M.
- Hydraulic oil temp.: 50°C to 60°C (122°F to 140°F)
- Measuring attitude: With the bucket in a no-load state, completely retract the arm cylinders, and then fully extend the bucket cylinder and make adjustments so that the boom foot pin and bucket pin are at the same height.
- Set the upper structure in motion, wait 1 rotation, and then measure the time required for the next 2 rotations.

**Overrun when slewing stops**

- Engine: Maximum R.P.M.
- Hydraulic oil temp.: 50°C to 60°C (122°F to 140°F)
- Measuring attitude: Same as that for measuring slew time
- Draw matching marks on the outer race of the slew bearing and the lower frame at points rotated exactly 180° from the starting point. With the hoe attachment in a no-load state, slew another 180 degrees, at which point the operation lever should return back to neutral. Measure the difference between the position marks and the point at which the hoe attachment was stopped.

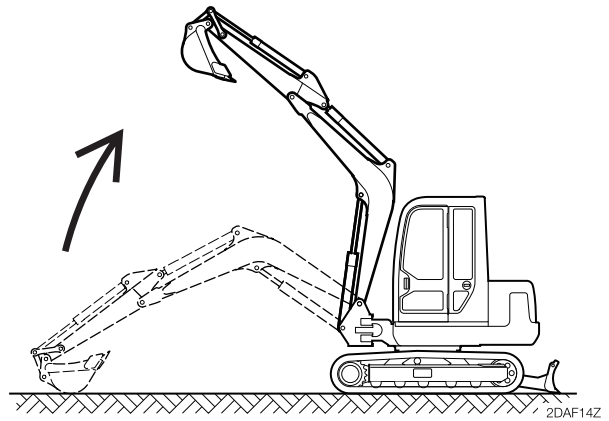
**Natural slew drop**

- Engine: Stopped
- Hydraulic oil temp.: 50°C to 60°C (122°F to 140°F)
- Inclination angle: 15°
- Measuring attitude: Same as that for measuring slew time
- Rotate the upper structure so that it is directly abeam of the grade. Next, draw positional marks on the outer race of the slew bearing and on the lower frame. Measure the amount of distance that opens up between the marks after 5 minutes have passed.

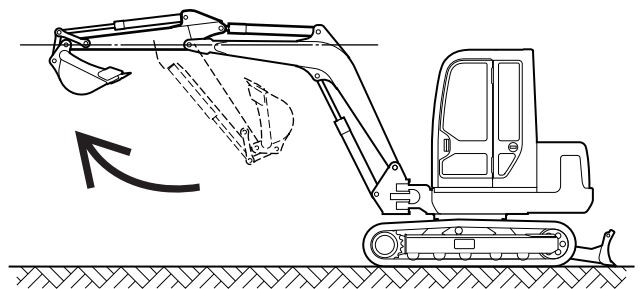


Boom cylinder speed

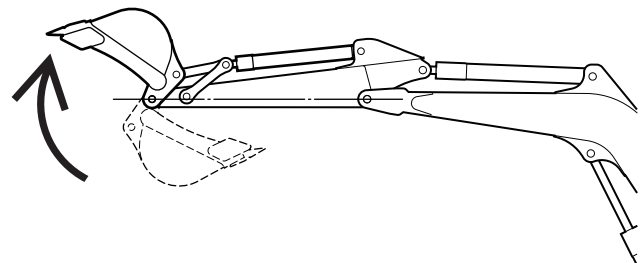
- Engine: Maximum R.P.M.
- Hydraulic oil temp.: 50°C to 60°C (122°F to 140°F)
- Measuring attitude: Completely retract the arm cylinder, and fully extend the bucket cylinder.
- Next, measure the time required for the bucket to reach its highest elevation point (lowest point) from its lowest point (highest point) at rest on the ground. (exclusive of cushion operating time).

**Arm cylinder speed**

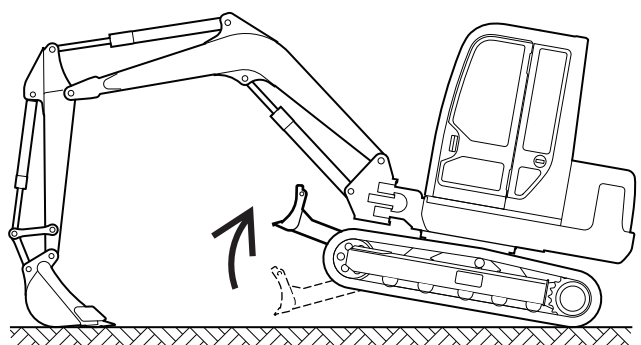
- Engine: Maximum R.P.M.
- Hydraulic oil temp.: 50°C to 60°C (122°F to 140°F)
- Measuring attitude: With the bucket in a no-load state, completely retract the arm cylinder, fully extend the bucket cylinder, position the arm horizontally, and rest the dozer blade on the ground.
- Measure the time required for the arm cylinder to move from the fully retracted position to the fully extended position, and vice versa.

**Bucket cylinder speed**

- Engine: Maximum R.P.M.
- Hydraulic oil temp.: 50°C to 60°C (122°F to 140°F)
- Measuring attitude: With the bucket in a no-load state, completely retract the arm cylinder, position the arm horizontally, and rest the dozer blade on the ground.
- Measure the time required for the bucket cylinder to move from the fully retracted position to the fully extended position, and vice versa.

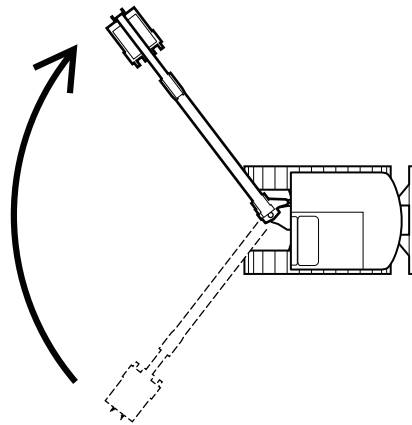
**Dozer blade cylinder speed**

- Engine: Maximum R.P.M.
- Hydraulic oil temp.: 50°C to 60°C (122°F to 140°F)
- Measuring attitude: Using the hoe attachment, lift up the dozer blade end of the excavator.
- After raising and lowering the dozer blade one full stroke each, measure the time required per stroke in each direction.



Swing cylinder speed

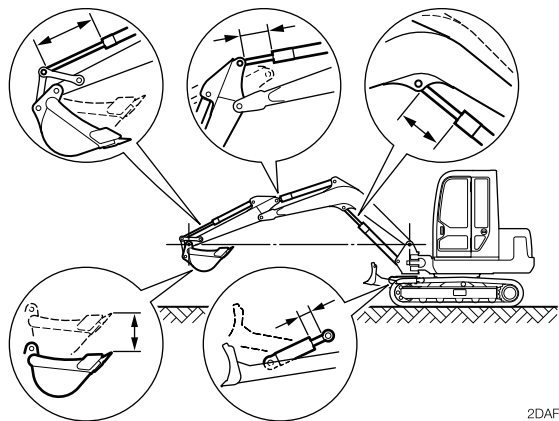
- Engine: Maximum R.P.M.
- Hydraulic oil temp.: 50°C to 60°C (122°F to 140°F)
- Measuring attitude: Same as that for measuring slew time
- While swinging the boom from left (right) to right (left), measure the time required for a full stroke in each direction. (exclusive of cushion operating time).



2DAF18Z

Natural cylinder drop**Boom, arm bucket, dozer blade, bucket tip**

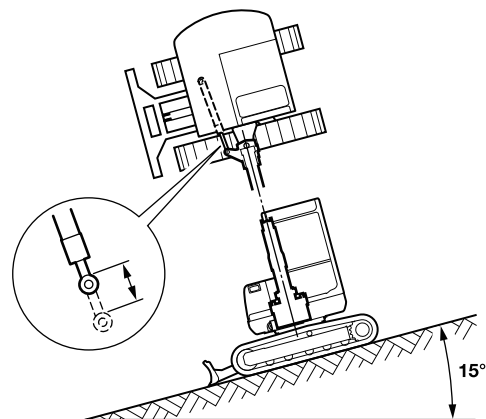
- Engine: Stopped
- Hydraulic oil temp.: 50°C to 60°C (122°F to 140°F)
- Measuring attitude: With the bucket in a no-load state, completely retract the dozer blade and arm cylinders, and then fully extend the bucket cylinder and make adjustments so that the boom foot pin and bucket pin are at the same height.
- Maintain this attitude for 5 minutes and then measure the change in rod length and the distance that the bucket tip moved.



2DAF19Z

Swing

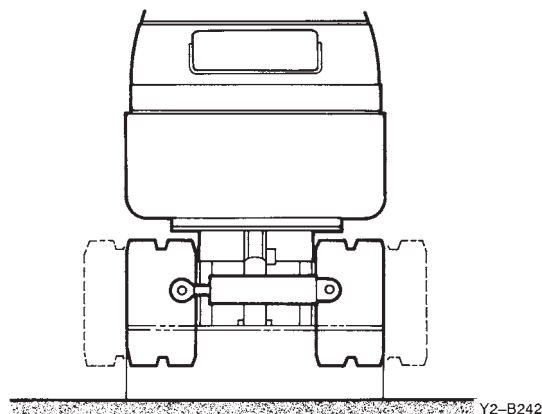
- Engine: Stopped
- Hydraulic oil temp.: 50°C to 60°C (122°F to 140°F)
- Inclination angle: 15°
- Measuring attitude: Same as that for measuring slew time
- Rotate the upper structure so that it is directly abeam of the grade, and then measure the change in rod length after 5 minutes has passed.



2DAF20Z

Spanner cylinder speed

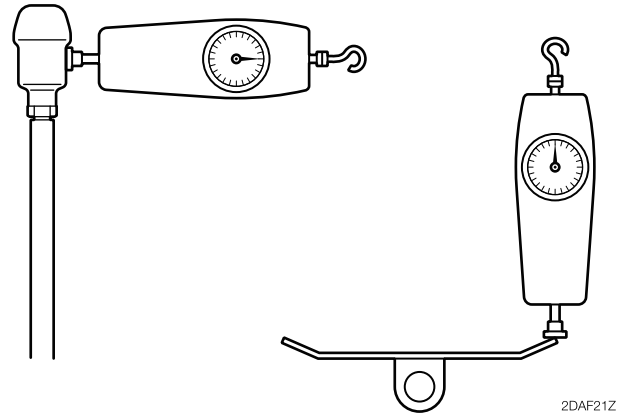
- Engine: Maximum R.P.M.
- Hydraulic oil temp.: 50°C to 60°C (122°F to 140°F)
- Measuring attitude: Excavator body to be raised using both the hoe attachment and the dozer blade.
- Measure the time required for the spanner cylinder to move from the fully retracted position to the fully extended position, and vice versa.



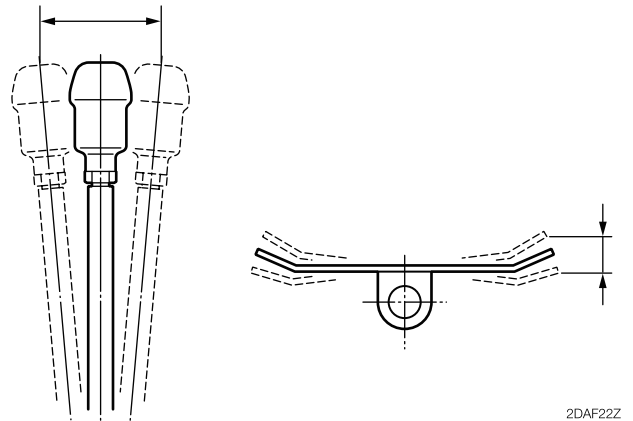
Y2-B242

Lever operating force

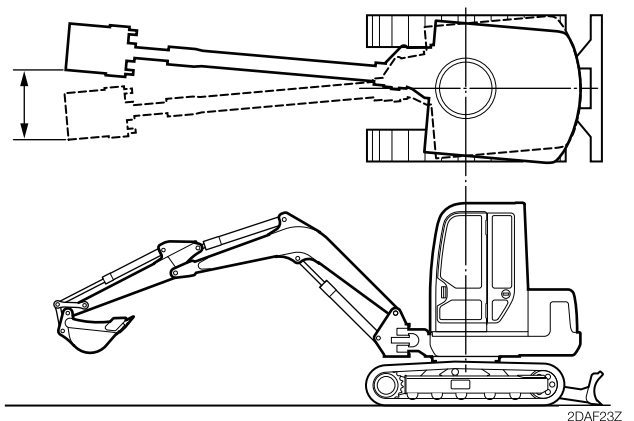
- With the engine turned off, place a push-pull scale on the handle grip center or the pedal edge to measure the force. Record the readings at the point at which the lever/pedal reaches a full stroke.

**Lever play**

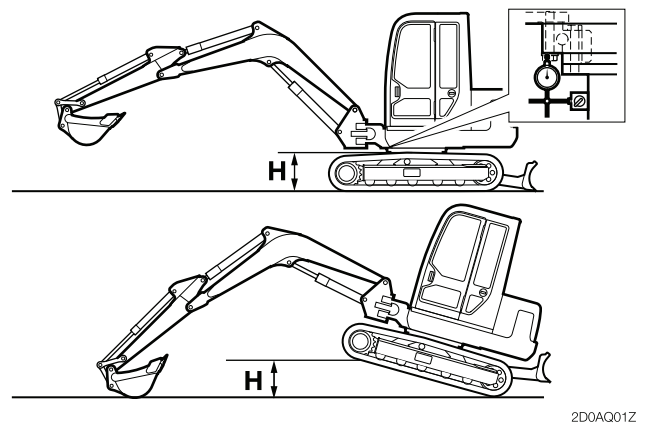
- Measure any discernible play at the tip of the lever or pedal.

**Backlash**

- Measuring attitude: Completely retract the arm cylinder, and fully extend the bucket cylinder.
- Move the tips of the bucket teeth from side to side (left and right), and measure the amount of play.

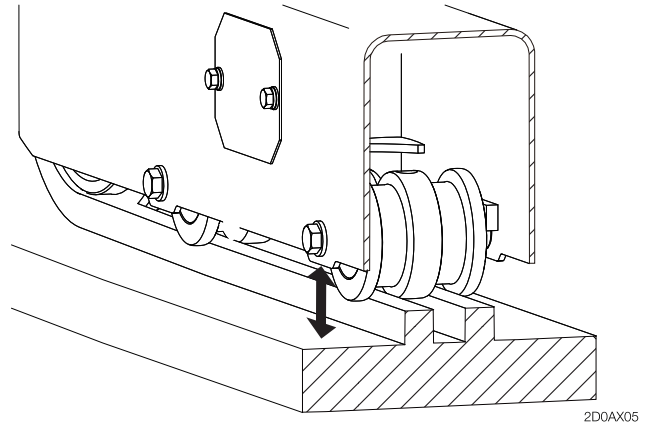
**Slew bearing play**

- With the bucket in a no-load state, completely retract the arm cylinder, fully extend the bucket cylinder, move the dozer blade back, and make adjustments so that the boom foot pin and bucket pin are at the same height.
- Attach a dial gauge to the bottom face of the slew bearing's outer race located near the front of the excavator, and set the dial gauge to 0.
- Lower the boom, raise the crawler to the height, H, and then read the dial gauge to get the measurement.



Track tension

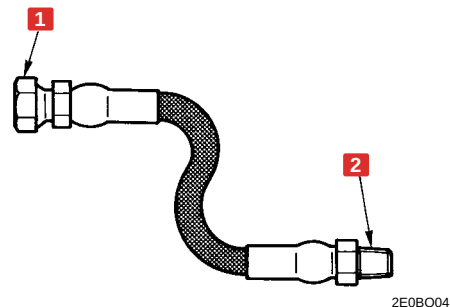
- Measuring attitude: Excavator body to be raised using both the hoe attachment and the dozer blade. For models with rubber crawlers, line up the crawler seam joint (marked with an M or ∞ symbol) with the upper center of the upper structure.
- Measure the width of the gap between the bottom surface of the frame and the top surface of the track shoe at the center of the crawler frame.



TIGHTENING TORQUE

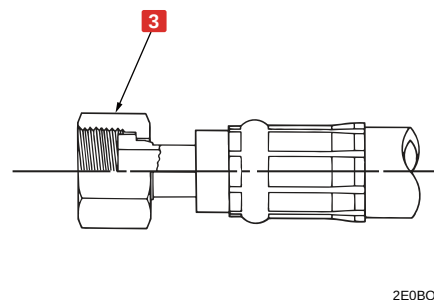
Hydraulic hose

Nominal thread diameter	Tightening torque			
	Parallel internal-thread external-seat union joint for piping		Tapered external-thread joint for piping	
	N·m	ft-lb	N·m	ft-lb
G(R)1/8	15 ^{+4.9} ₀	11 ^{+3.6} ₀	11.8 ± 1.2	8.7 ± 0.8
G(R)1/4	25 ^{+4.9} ₀	18 ^{+3.6} ₀	29.4 ± 2.9	21.7 ± 2.1
G(R)3/8	49 ^{+4.9} ₀	36 ^{+3.6} ₀	53.9 ± 5.4	39.8 ± 3.9
G(R)1/2	64 ^{+4.9} ₀	47 ^{+3.6} ₀	88.3 ± 8.8	65.1 ± 6.4
G(R)3/4	132 ^{+4.9} ₀	97 ^{+3.6} ₀	147.1 ± 14.7	108.5 ± 10.7
G(R)1	196 ^{+4.9} ₀	145 ^{+3.6} ₀	196.1 ± 19.6	144.7 ± 14.3
G(R)1 1/4	225 ^{+4.9} ₀	166 ^{+3.6} ₀	—	—
G(R)1 1/2	255 ^{+4.9} ₀	188 ^{+3.6} ₀	—	—



- 1** Parallel internal-thread external-seat union joint for piping
- 2** Tapered external-thread joint for piping

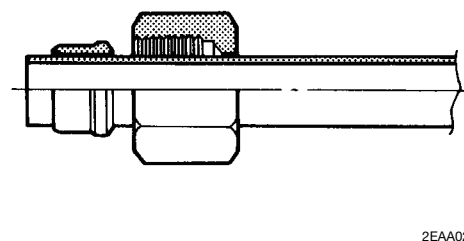
Nominal thread diameter	Tightening torque	
	UNF internal-thread flat-face sealing union joint	
	N·m	ft-lb
9/16-18 UNF	25 ^{+4.9} ₀	18 ^{+3.6} ₀
11/16-16 UN	37 ^{+4.9} ₀	27 ^{+3.6} ₀
13/16-16 UN	75 ^{+4.9} ₀	55 ^{+3.6} ₀
1-14 UNS	110 ^{+4.9} ₀	81 ^{+3.6} ₀
1 3/16-12 UN	150 ^{+4.9} ₀	110 ^{+3.6} ₀
1 7/16-12 UN	190 ^{+4.9} ₀	140 ^{+3.6} ₀



- 3** UNF internal-thread flat-face sealing union joint

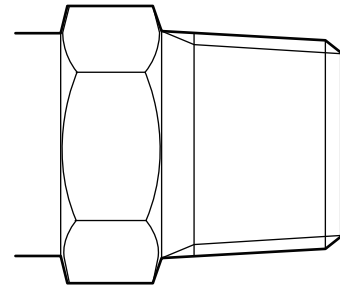
Bite-type pipe fitting for steel pipe

Outer diameter of pipe (mm)	Tightening torque	
	N·m	ft-lb
8	34.3 ± 4.9	23.5 ± 3.5
10	41.7 ± 2.5	30.7 ± 1.7
12	58.8 ± 4.9	43.4 ± 3.5
15	88.3 ± 4.9	65.1 ± 3.5
16	93.2 ± 4.9	68.7 ± 3.5
18	132.4 ± 4.9	97.6 ± 3.5
22	205.9 ± 9.8	151.8 ± 7.2
27.2	245.2 ± 9.8	181.0 ± 7.2
28	313.8 ± 19.6	231.4 ± 14.3
32	313.8 ± 19.6	231.4 ± 14.3
35	411.9 ± 19.6	303.7 ± 14.3



Joint for piping

Nominal thread diameter	Tightening torque			
	Port material: Steel		Port material: Cast steel	
	N·m	ft-lb	N·m	ft-lb
R1/8	11.8 ± 1.2	8.7 ± 0.8	10.8 ± 1.1	8.0 ± 0.7
R1/4	29.4 ± 2.9	21.7 ± 2.1	24.5 ± 2.5	18.1 ± 1.7
R3/8	53.9 ± 5.4	39.8 ± 3.9	49.0 ± 4.9	36.2 ± 3.5
R1/2	88.3 ± 8.8	65.1 ± 6.4	73.5 ± 7.4	54.3 ± 5.3
R3/4	147.1 ± 14.7	108.5 ± 10.7	127.5 ± 12.7	94.1 ± 9.3
R1	196.1 ± 19.2	144.7 ± 14.3	171.6 ± 17.2	126.6 ± 12.5

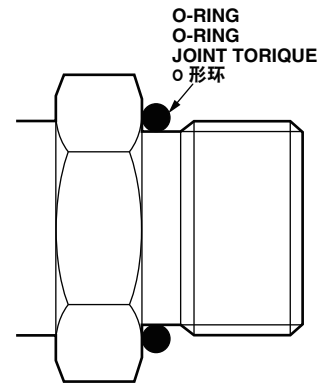


2EAA03Z

Joint for piping (O-ring seal type)

Bring a magnet close to the port to check the port material.
If the port is made of steel, the magnet sticks to the port. If the port is made of aluminum, the magnet does not stick to the port.

Nominal thread diameter	Tightening torque			
	Port material: Steel		Port material: Aluminum	
	N·m	ft-lb	N·m	ft-lb
G1/8	19.6 ± 2.0	14.5 ± 1.5	19.6 ± 2.0	14.5 ± 1.45
G1/4	34.3 ± 4.9	25.3 ± 3.6	26.5 ± 4.9	19.6 ± 3.6
G3/8	53.9 ± 4.9	39.8 ± 3.6	41.6 ± 4.9	30.7 ± 3.6
G1/2	64 ± 4.9	47 ± 3.6	64 ± 4.9	47.0 ± 3.6
G3/4	132 ± 4.9	97 ± 3.6	88.2 ± 4.9	65.0 ± 3.6
G1	196 ± 9.8	145 ± 7.2	107.9 ± 9.8	79.6 ± 7.2
G1-1/4	225 ± 9.8	166 ± 7.2	117.7 ± 9.8	86.8 ± 7.2
G1-1/2	255 ± 9.8	188 ± 7.2	137.3 ± 9.8	101.2 ± 7.2



2E0B002

Nominal thread diameter	Tightening torque	
	N·m	ft-lb
7/16-20 UNF	16.7 ± 2.0	12.3 ± 1.4
1/2-20 UNF	22.6 ± 2.0	16.6 ± 1.4
9/16-18 UNF	31.4 ± 2.9	23.1 ± 2.1
3/4-16 UNF	53.9 ± 4.9	39.8 ± 3.6
7/8-14 UNF	64 ± 4.9	47 ± 3.6
1 1/16-12 UNF	102.0 ± 5.9	75.2 ± 4.4
1 3/16-12 UNF	132 ± 7.8	97 ± 5.8
1 5/16-12 UNF	135.3 ± 7.8	99.8 ± 5.8
1 5/8-20 UNF	181.4 ± 9.8	133.8 ± 7.2

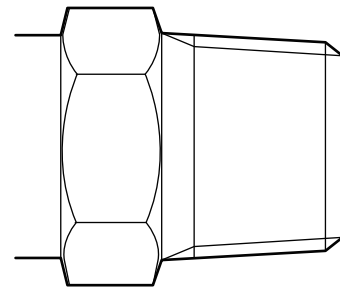
Bolts and nuts (JIS strength category 10.9)

Thread	Size × pitch	Tightening torque			
		General tightening points		Special tightening points	
		N·m	ft-lb	N·m	ft-lb
Coarse	M6 × 1.0	9.8 ± 0.8	7.2 ± 0.6	12 ± 1.0	9.0 ± 0.7
	M8 × 1.25	23 ± 1.8	17 ± 1.4	26 ± 2.1	20 ± 1.6
	M10 × 1.5	47 ± 3.8	35 ± 2.8	55 ± 4.4	41 ± 3.3
	M12 × 1.75	83 ± 6.6	62 ± 5	97 ± 7.8	72 ± 5.8
	M14 × 2.0	134 ± 10.7	99 ± 7.9	156 ± 12.5	115 ± 9.2
	M16 × 2.0	208 ± 16.6	153 ± 12.2	241 ± 19.3	178 ± 14.2
	M20 × 2.5	411 ± 32.9	303 ± 24.2	476 ± 38.1	351 ± 28.1
Fine	M8 × 1.0	25 ± 2.0	18 ± 1.4	28 ± 2.2	21 ± 1.7
	M10 × 1.25	50 ± 4.0	37 ± 3	59 ± 4.7	43 ± 3.4
	M12 × 1.5	87 ± 7.0	64 ± 5.1	102 ± 8.2	75 ± 6
	M14 × 1.5	135 ± 10.8	100 ± 8	158 ± 12.6	117 ± 9.4
	M16 × 1.5	221 ± 17.7	163 ± 13	256 ± 20.5	189 ± 15.1
	M20 × 1.5	452 ± 36.2	333 ± 26.6	523 ± 41.8	386 ± 30.9

1. General tightening points (non-lubricated)
All securing points that have no special tightening torque specified in this manual and that are not special tightening points.
2. Special tightening points (grease with molybdenum disulfide applied)
Points where a specific tightening torque is specified in this manual.
3. Points where thread-locking compound should be applied (ThreeBond #1324).
4. If a tightening torque value is specified in this manual for a point not listed in the table above, follow the specification in the manual.
5. To tighten multiple bolts and nuts evenly, tighten opposite bolts/nuts alternately as a pair.

Joint for piping

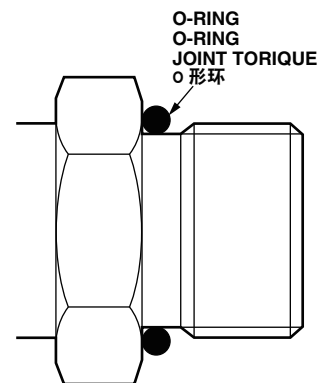
Nominal thread diameter (R)	Tightening torque			
	Steel		Cast steel	
	N·m	ft.-lb	N·m	ft.-lb
1/8	11.8 ± 1.2	8.7 ± 0.8	10.8 ± 1.1	8.0 ± 0.7
1/4	29.4 ± 2.9	21.7 ± 2.1	24.5 ± 2.5	18.1 ± 1.7
3/8	53.9 ± 5.4	39.8 ± 3.9	49.0 ± 4.9	36.2 ± 3.5
1/2	88.3 ± 8.8	65.1 ± 6.4	73.5 ± 7.4	54.3 ± 5.3
3/4	147.1 ± 14.7	108.5 ± 10.7	127.5 ± 12.7	94.1 ± 9.3
1	196.1 ± 19.2	144.7 ± 14.3	171.6 ± 17.2	126.6 ± 12.5



2EAA03Z

Joint for piping (O-ring seal type)

Nominal thread diameter (G)	Tightening torque	
	N·m	ft.-lb
1/8	19.6 ± 2.0	14.5 ± 1.4
1/4	34.3 ± 4.9	25.3 ± 3.5
3/8	53.9 ± 4.9	39.8 ± 3.5
1/2	63.7 ± 4.9	47.0 ± 3.5
3/4	93.2 ± 4.9	68.7 ± 3.5
1	107.9 ± 9.8	79.5 ± 7.2
1-1/4	117.7 ± 9.8	86.8 ± 7.2
1-1/2	137.3 ± 9.8	101.2 ± 7.2



2E0B002

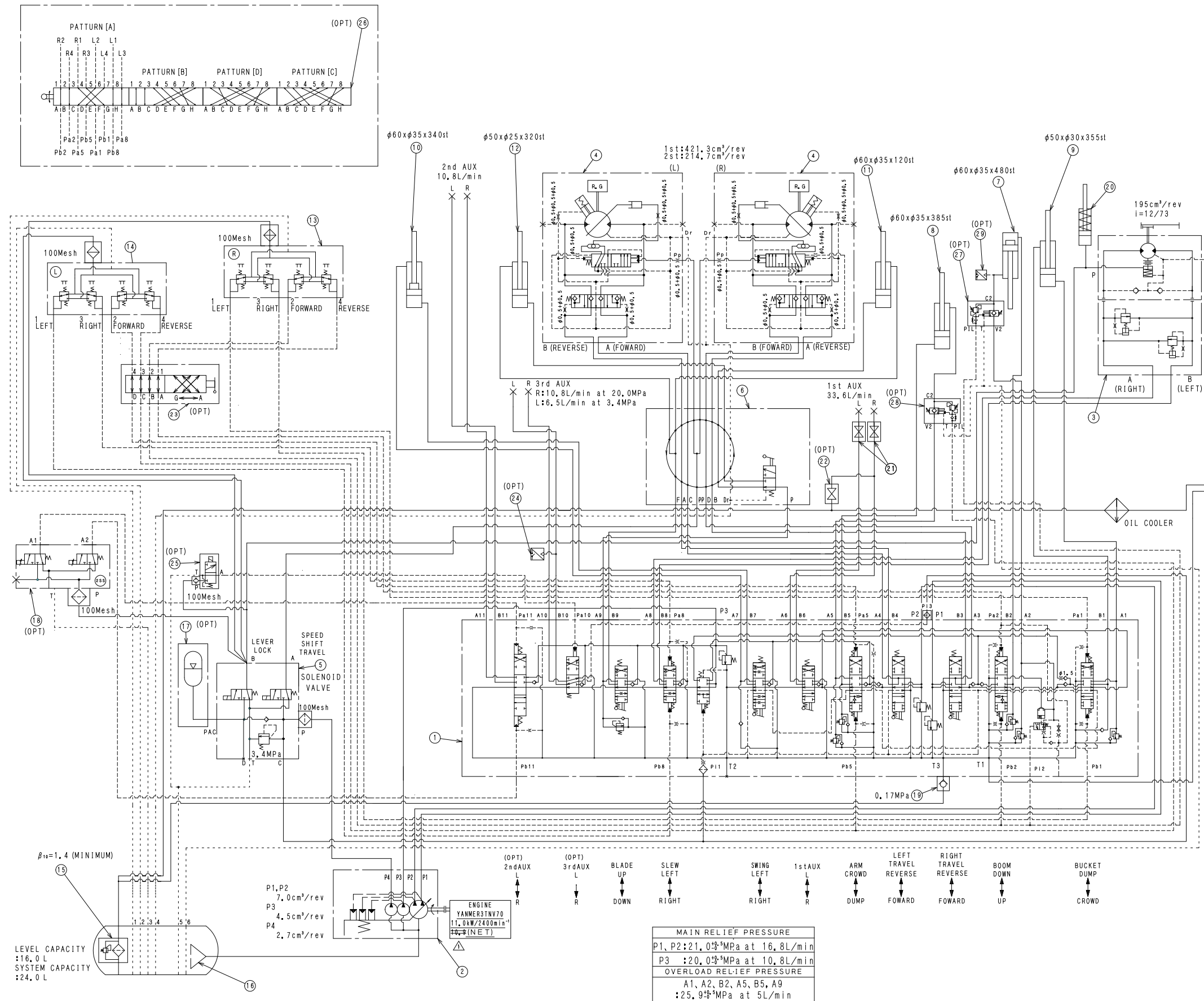
Nominal thread diameter (UNF)	Tightening torque	
	N·m	ft.-lb
7/19-20	16.7 ± 2.0	12.3 ± 1.4
1/2-20	22.6 ± 2.0	16.6 ± 1.4
9/16-18	31.4 ± 2.9	23.1 ± 2.1
3/4-16	59.8 ± 4.9	44.1 ± 3.5
1-1/16-12	102.0 ± 5.9	75.2 ± 4.4
1-5/16-12	135.3 ± 7.8	99.8 ± 5.8
1-5/8-20	181.4 ± 9.8	133.8 ± 7.2

Bolts and nuts (JIS strength category 10.9)

Thread	Size × pitch	Tightening torque			
		General tightening points		Special tightening points	
		N·m	ft.-lb	N·m	ft.-lb
Coarse	M6 × 1.0	9.8 ± 0.8	7.2 ± 0.6	12 ± 1.0	9.0 ± 0.7
	M8 × 1.25	23 ± 1.8	17 ± 1.4	26 ± 2.1	20 ± 1.6
	M10 × 1.5	47 ± 3.8	35 ± 2.8	55 ± 4.4	41 ± 3.3
	M12 × 1.75	83 ± 6.6	62 ± 5	97 ± 7.8	72 ± 5.8
	M14 × 2.0	134 ± 10.7	99 ± 7.9	156 ± 12.5	115 ± 9.2
	M16 × 2.0	208 ± 16.6	153 ± 12.2	241 ± 19.3	178 ± 14.2
	M20 × 2.5	411 ± 32.9	303 ± 24.2	476 ± 38.1	351 ± 28.1
Fine	M8 × 1.0	25 ± 2.0	18 ± 1.4	28 ± 2.2	21 ± 1.7
	M10 × 1.25	50 ± 4.0	37 ± 3	59 ± 4.7	43 ± 3.4
	M12 × 1.5	87 ± 7.0	64 ± 5.1	102 ± 8.2	75 ± 6
	M14 × 1.5	135 ± 10.8	100 ± 8	158 ± 12.6	117 ± 9.4
	M16 × 1.5	221 ± 17.7	163 ± 13	256 ± 20.5	189 ± 15.1
	M20 × 1.5	452 ± 36.2	333 ± 26.6	523 ± 41.8	386 ± 30.9

1. General tightening points (non-lubricated)
All securing points that have no special tightening torque specified in this manual and that are not special tightening points.
2. Special tightening points (grease with molybdenum disulfide applied)
Points where a specific tightening torque is specified in this manual.
3. Points where thread-locking compound should be applied (ThreeBond #1324).
4. If a tightening torque value is specified in this manual for a point not listed in the table above, follow the specification in the manual.
5. To tighten multiple bolts and nuts evenly, tighten opposite bolts/nuts alternately as a pair.

HYDRAULIC CIRCUIT DIAGRAM



2-9	PRESSURE SWITCH
2-8	LOAD HOLDING VALVE
2-7	LOAD HOLDING VALVE
2-6	MULTI SELECTOR VALVE
2-5	SOLENOID VALVE
2-4	PRESSURE SWITCH
2-3	SELECTOR VALVE
2-2	STOP VALVE
2-1	STOP VALVE
2-0	TRAVEL LEVER LOCK CYLINDER
1-9	CHECK VALVE
1-8	SOLENOID VALVE
1-7	ACCUMULATOR
1-6	SUCTION FILTER
1-5	RETURN FILTER
1-4	REMOTE C, V
1-3	REMOTE C, V
1-2	SPAN CYLINDER
1-1	BLADE CYLINDER
1-0	SWING CYLINDER
9	BUCKET CYLINDER
8	ARM CYLINDER
7	BOOM CYLINDER
6	SWIVEL JOINT
5	SOLENOID VALVE
4	TRAVEL MOTOR
3	SLEW MOTOR
2	HYDRAULIC PUMP
1	CONTROL VALVE
0	NAME OF PART

Drawing No.	1
03301-00004-1	1

Control valve

Part number			19010-50900 19010-51000* 19010-51100**
Type			KVSE-36B-2
Set main relief valve pressure	P1, P2	MPa at L/min. (psi at US gal./min.)	21.0 at 16.8 (3045 at 4.4)
	P3	MPa at L/min. (psi at US gal./min.)	20.0 at 10.8 (2900 at 2.9)
Set overload relief valve pressure	A1, A2, B2, A5, B5, A9	MPa at L/min. (psi at US gal./min.)	25.9 at 5.0 (3756 at 1.3)

* 2nd auxiliary line piping attached
** 2nd, 3rd auxiliary line piping attached

Main pump

Part number			19020-28700
Type			PVD00B-14D-5G3
Engine RPM		min ⁻¹ (rpm)	2400 (2400)
Displacement	P1, P2	cm ³ /rev (cu. in./rev)	7.0 (0.4)
	P3	cm ³ /rev (cu. in./rev)	4.5 (0.3)
	P4	cm ³ /rev (cu. in./rev)	2.7 (0.2)
Delivery	P1, P2	L/min. (US gal./min.)	16.8 (4.4)
	P3	L/min. (US gal./min.)	10.8 (2.9)
	P4	L/min. (US gal./min.)	6.5 (1.7)

Slew motor

Part number		19031-30600
Type		2PC20C3233-C
Total displacement	cm ³ /rev (cu. in./rev)	195 (11.9)
Motor displacement	cm ³ /rev (cu. in./rev)	32.1 (2.0)
Reduction gear ratio		12/73
Set relief valve pressure	MPa at L/min. (psi at US gal./min.)	13.4 at 10.8 (1943 at 2.9)
Parking brake torque	N·m (ft.-lb.)	441 (325)
Parking brake release pressure	MPa (psi)	2 (290)

Travel motor

Part number			19031-30300
Type			PHV-1B-12B-PT
Total displacement	1st	cm ³ /rev (cu. in./rev)	421.3 (25.7)
	2nd	cm ³ /rev (cu. in./rev)	232 (14.2)
Motor displacement	1st	cm ³ /rev (cu. in./rev)	11.4 (0.7)
	2nd	cm ³ /rev (cu. in./rev)	5.8 (0.3)
Reduction gear ratio			1/36.96
2nd-speed switching speed		MPa (psi)	3.4 (493)
Parking brake torque		N·m (ft.-lb.)	22.6 (16.7)
Parking brake release pressure		MPa (psi)	1.9 (116)
Amount of reduction gear lubricant used		L (US gal.)	0.33 (0.35)

Solenoid valve (Lever lock and travel speed switching)

Part number			19017-62800
Type			AGCH-16826
Power supply voltage	V		12

Swivel joint

Part number			19040-07600
Type			YV-7151A

Boom cylinder

Part number			19001-16100
Type			–
Bore diameter × rod diameter	mm (in.)		60×35 (2.4×1.4)
Stroke	mm (in.)		480 (18.9)
Maximum retraction length*	mm (in.)		–

* Length from the center of the pinhole on the tube side to the center of the pinhole on the rod side

Arm cylinder

Part number			19001-16200
Type			–
Bore diameter × rod diameter	mm (in.)		60×35 (2.4×1.4)
Stroke	mm (in.)		385 (15.2)
Maximum retraction length*	mm (in.)		–

* Length from the center of the pinhole on the tube side to the center of the pinhole on the rod side

Bucket cylinder

Part number			19001-13700
Type			–
Bore diameter × rod diameter	mm (in.)		50×30 (2.0×1.2)
Stroke	mm (in.)		355 (14.0)
Maximum retraction length*	mm (in.)		–

* Length from the center of the pinhole on the tube side to the center of the pinhole on the rod side

Swing cylinder

Part number		19001-16000
Type		–
Bore diameter × rod diameter	mm (in.)	60×35 (2.4×1.4)
Stroke	mm (in.)	340 (13.4)
Maximum retraction length*	mm (in.)	–

* Length from the center of the pinhole on the tube side to the center of the pinhole on the rod side

Dozer blade cylinder

Part number		19001-13900
Type		–
Bore diameter × rod diameter	mm (in.)	60×35 (2.4×1.4)
Stroke	mm (in.)	120 (4.7)
Maximum retraction length*	mm (in.)	–

* Length from the center of the pinhole on the tube side to the center of the pinhole on the rod side

Spanner cylinder

Part number		19001-14000
Type		–
Bore diameter × rod diameter	mm (in.)	50×25 (2.0×1.0)
Stroke	mm (in.)	320 (12.6)
Maximum retraction length*	mm (in.)	–

* Length from the center of the pinhole on the tube side to the center of the pinhole on the rod side

Pilot valve (R)

Part number			19017-63200
Type			PV48M2213
Secondary pressure (proportional range)	Port 1, 3	MPa (psi)	0.54 to 1.96 (78 to 248)
	Port 2, 4	MPa (psi)	0.54 to 1.96 (78 to 248)
Push rod stroke (proportional range)	Port 1, 3	mm (in.)	1.1 to 6.5 (0.04 to 0.26)
	Port 2, 4	mm (in.)	1.1 to 8.5 (0.04 to 0.33)

Pilot valve (L)

Part number			19017-63100 19017-64400*
Type			PV48M2212
Secondary pressure (proportional range)	Port 1, 3	MPa (psi)	0.54 to 1.96 (78 to 248)
	Port 2, 4	MPa (psi)	0.54 to 1.96 (78 to 248)
Push rod stroke (proportional range)	Port 1, 3	mm (in.)	1.1 to 6.5 (0.04 to 0.26)
	Port 2, 4	mm (in.)	1.1 to 8.5 (0.04 to 0.33)

*Equipped with trigger button

Solenoid valve (2nd auxiliary line piping)

Part number		19017-52100
Type		2KWE5A-30/G12R-269
Power supply voltage	V	12

Travel lever lock cylinder

Part number		19000-74800
Type		–
Stroke	mm (in.)	320 (12.6)
Maximum retraction length*	mm (in.)	–

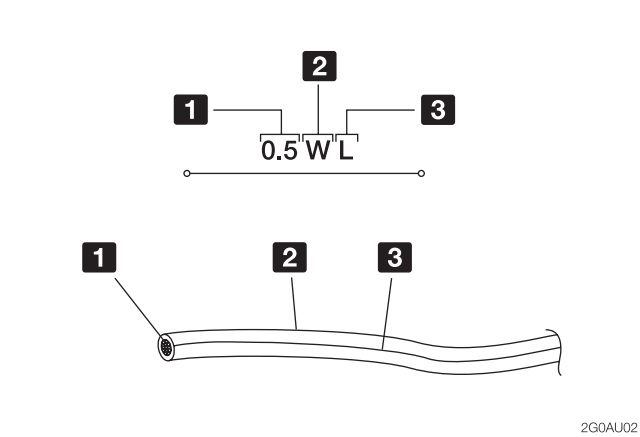
* Overall length

Solenoid valve (3rd auxiliary line piping)

Part number		19017-56100
Type		AGCD-16587
Power supply voltage	V	12

ELECTRICAL CIRCUIT DIAGRAM

Wire/cable color symbols



- 1

Cross-sectional area (mm²)
- 2

Base color
- 3

Stripe color*
- * There may be wires of solid color with no stripe.

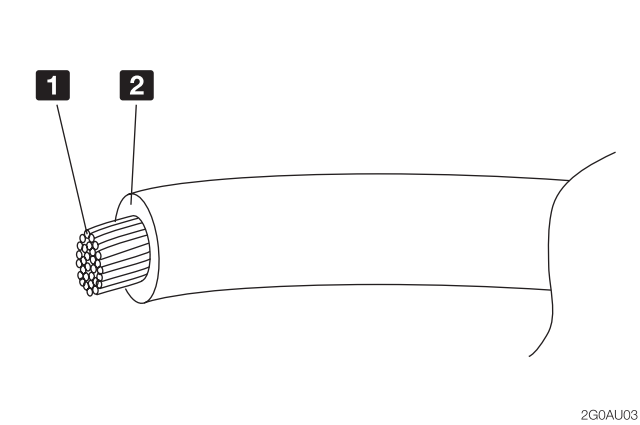
Wiring/cable Colors

Symbol	Color	Symbol	Color	Symbol	Color
B	Black	W	White	V	Violet
G	Green	Y	Yellow	Dg	Dark green
L	Blue	P	Pink	Ch	Chocolate
R	Red	O	Orange		

Types of wire to use

- Use AVSS wire for cross-sectional areas of 2 mm² or less.
- Use AV or AVS wire for cross-sectional areas exceeding 2 mm². (AVX wire can be used for wires of solid color.)

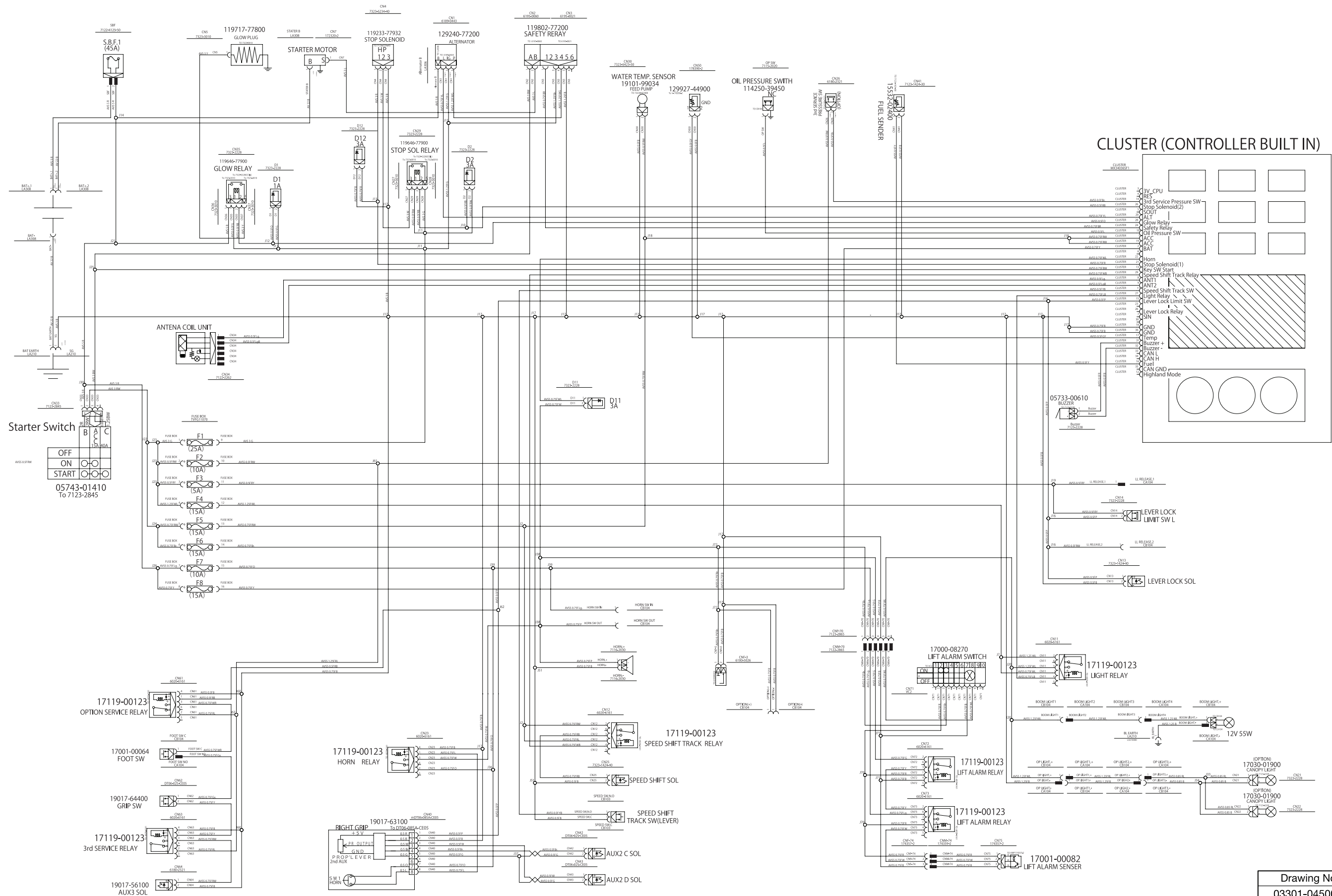
Symbol	Overview	Characteristics	Temperature limit
AV	Low-voltage cables for automobiles	• Wire used in low-voltage circuits.	80°C (176°F)
AVX	Heat-resistant, cross-linked, vinyl-insulated low-voltage cables	• A wire with dramatically improved heat resistance over that of AV wire, enabling it to provide high reliability while responding to rises in temperature in automotive wiring environments.	100°C (212°F)
AVS	Thin-insulation low-voltage cables for automobiles	• A thinner wire than the AV wire with equivalent electrical characteristics.	80°C (176°F)
AVSS	Thin-insulation low-voltage cables for automobiles	• A wire with an even thinner insulator than AVS wire that has equivalent electrical characteristics.	80°C (176°F)



- 1

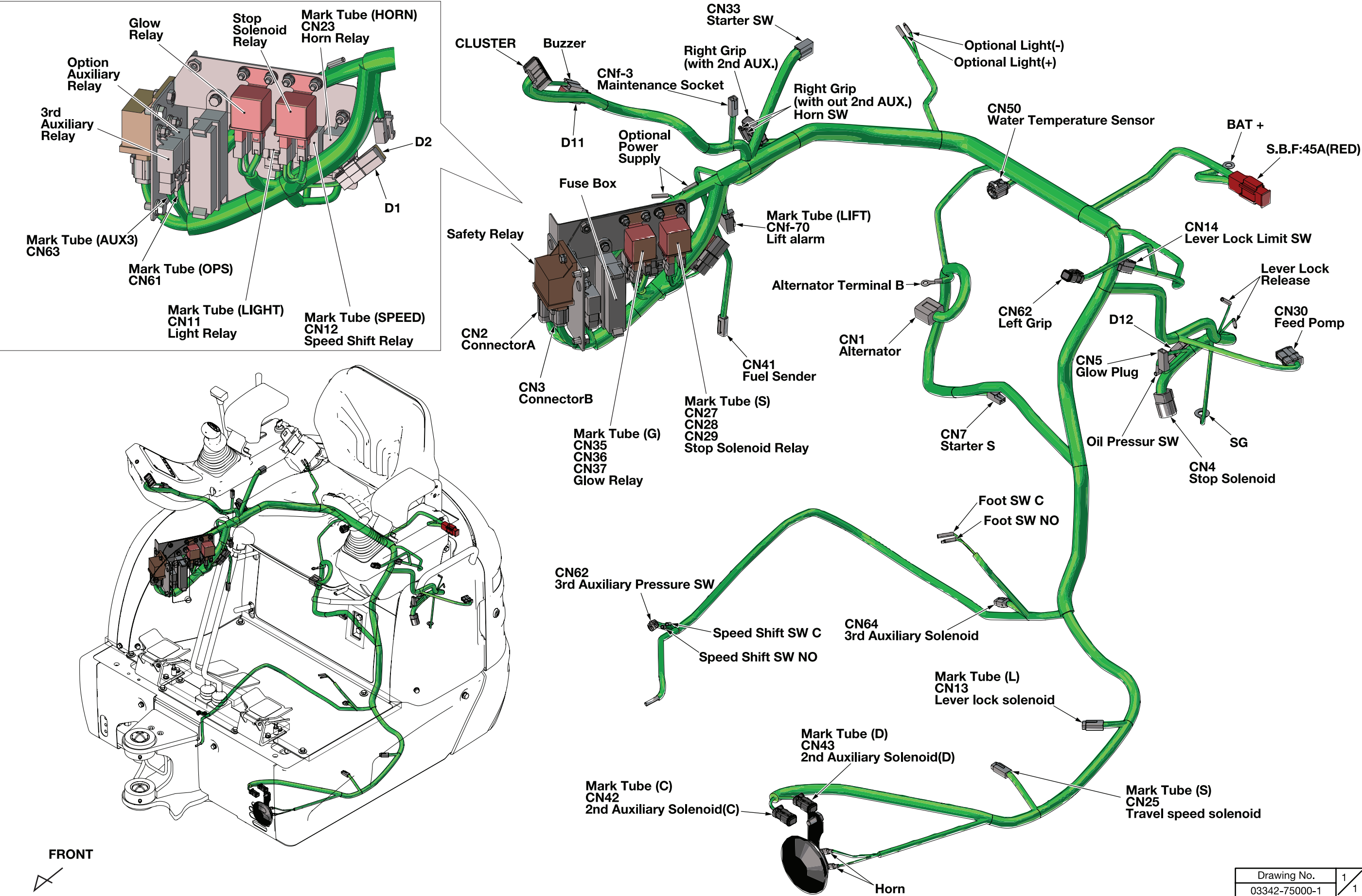
Conductor: Annealed copper
- 2

Insulator: Vinyl

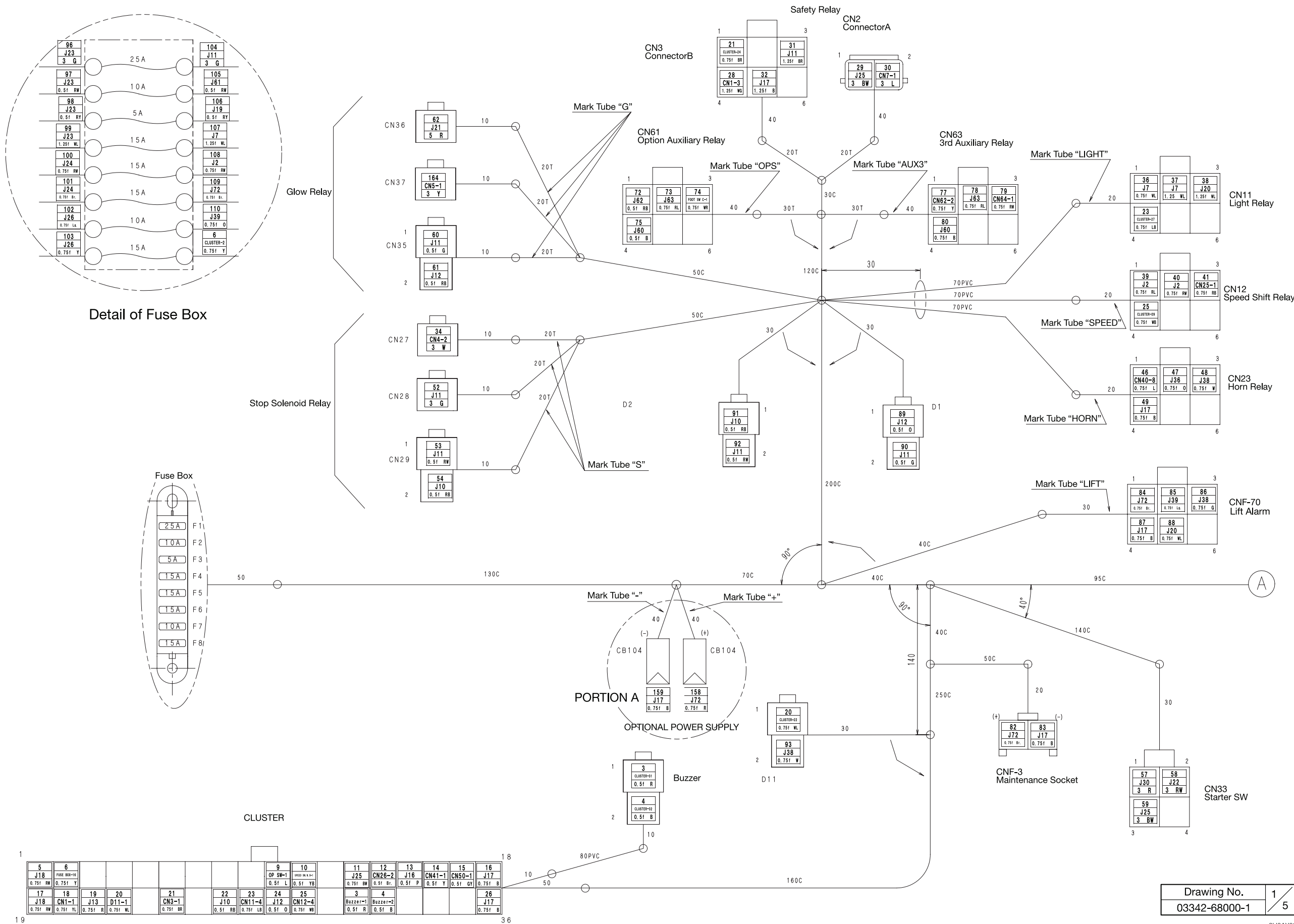


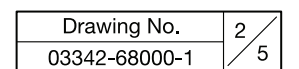
WIRE HARNESS DIAGRAM

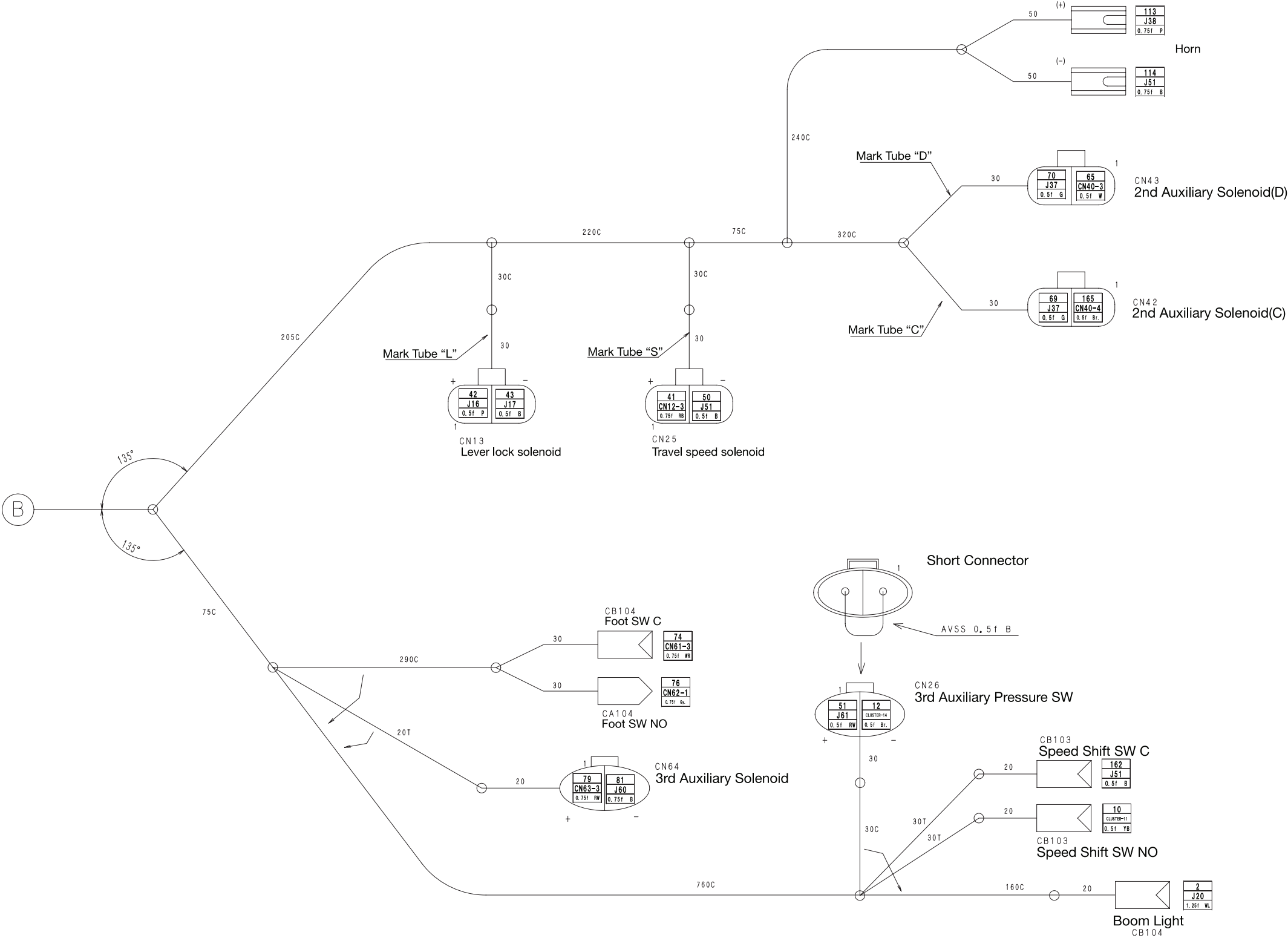
Wiring diagram



Body harness: 03342-68000







J 2	39 CN12-1 0.75f RL 40 CN12-2 0.75f RW 108 FUSE BOX-13 0.75f RW 116 J18 0.75f RW
J 7	36 CN11-1 0.75f WL 37 CN11-2 1.25 WL 107 FUSE BOX-12 1.25f WL
J 1 0	22 CLUSTER-25 0.5f RB 54 CN29-2 0.5f RB 91 D2-1 0.5f RB
J 1 1	27 CN1-2 1.25f G 31 CN3-3 1.25f BR 52 CN28-1 3 G 53 CN29-1 0.5f RW 60 CN35-1 0.5f G 90 D1-2 0.5f G 92 D2-2 0.5f RW 104 FUSE BOX-9 3 G
J 1 2	24 CLUSTER-28 0.5f O 61 CN35-2 0.5f RB 89 D1-1 0.5f O
J 1 3	33 CN4-1 3 R 95 D12-2 0.75f R 19 CLUSTER-21 0.75f R
J 1 4	120 J21 5 R 163 #99-9-B-1 5 R 160 SBF-2 5 R
J 1 6	42 CN13-1 0.5f P 123 J62 0.5f P 13 CLUSTER-15 0.5f P 45 CN14-2 0.5f P 155 LL RELEASE 2-1 0.5f RW
J 1 7	16 CLUSTER-18 0.75f B 26 CLUSTER-36 0.75f B 32 CN3-5 1.25f B 35 CN4-3 3 B 43 CN13-2 0.5f B 49 CN23-4 0.75f B 55 CN30-1 0.5f B 64 CN40-2 0.5f B 68 CN41-2 0.5f B 71 CN50-2 0.5f B 83 CNF-3-2 0.75f B 87 CNF-70-4 0.75f B 94 D12-1 0.75f B 137 J51 1.25f B 138 J60 0.75f B 157 OP LIGHT ---1 1.25f B 161 J17 3-5 B 159 OPTION (-)-1 0.75f B
J 1 8	5 CLUSTER-1 0.75f RW 17 CLUSTER-19 0.75f RW 116 J2 0.75f RW 56 CN30-2 0.5f RW
J 1 9	44 CN14-1 0.5f RY 106 FUSE BOX-11 0.5f RY 154 LL RELEASE 1-1 0.5f RY
J 2 0	2 BORN LIGHT-1 1.25f WL 38 CN11-3 1.25f WL 88 CNF-70-5 0.75f WL 156 OP LIGHT ---1 1.25 WL
J 2 1	62 CN36-1 5 R 120 J14 5 R 141 J30 5 R
J 2 2	58 CN33-2 3 RW 142 J23 3 RW 143 J24 3 W
J 2 3	96 FUSE BOX-1 3 G 99 FUSE BOX-4 1.25f WL 98 FUSE BOX-3 0.5f RY 97 FUSE BOX-2 0.5f RW 142 J22 3 RW
J 2 4	101 FUSE BOX-6 0.75f BL 100 FUSE BOX-5 0.75f RW 143 J22 3 W

J 2 5	29 CN2-1 3 BW 59 CN33-3 3 BW 11 CLUSTER-15 0.75f BW
J 2 6	103 FUSE BOX-8 0.75f Y 102 FUSE BOX-7 0.75f Lg 146 J30 3 R
J 3 0	57 CN33-1 3 R 141 J21 5 R 146 J26 3 R
J 3 6	47 CN23-2 0.75f O 67 CN40-7 0.75f O 147 J39 0.75f O
J 3 7	66 CN40-5 0.5f G 69 CN42-2 0.5f G 70 CN43-2 0.5f G
J 3 8	48 CN23-3 0.75f W 86 CNF-70-3 0.75f G 93 D11-2 0.75f W 112 HORN SW OUT-1 0.75f P 113 HORN. +1 0.75f P
J 3 9	85 CNF-70-2 0.75f Lg 110 FUSE BOX-15 0.75f O 111 HORN SW IN-1 0.75f Lg 147 J36 0.75f O
J 5 1	50 CN25-2 0.5f B 114 HORN. ---1 0.75f B 137 J17 1.25f B 162 SPEED SW C-1 0.5f B
J 6 0	75 CN61-4 0.5f B 80 CN63-4 0.75f B 81 CN64-2 0.75f B 138 J17 0.75f B
J 6 1	51 CN26-1 0.5f RW 105 FUSE BOX-10 0.5f RW 152 J63 1.25f RL
J 6 2	63 CN40-1 0.5f P 72 CN61-1 0.5f RB 123 J16 0.5f P
J 6 3	73 CN61-2 0.75f RL 78 CN63-2 0.75f RL 152 J61 1.25f RL
J 7 2	82 CNF-3-1 0.75f Br 84 CNF-70-1 0.75f Br 109 FUSE BOX-14 0.75f Br 158 OPTION (+)-1 0.75f R

No.	Initial connector	Connector type of initial connector	Pin no.	End connector	Connector type of end connector	Pin no.	Color	Line type	Line diameter	Remarks
1	BAT+1	LA308	1	SBF	7122-4125-50	1	R	AVS	5	
2	BOOM LIGHT1	CB104	1	J20			WL	AVSS	1.25f	
3	Buzzer	7123-2228	1	CLUSTER	MX34036SF1	31	R	AVSS	0.5f	
4	Buzzer	7123-2228	2	CLUSTER	MX34036SF1	32	B	AVSS	0.5f	
5	CLUSTER	MX34036SF1	1	J18			RW	AVSS	0.75f	
6	CLUSTER	MX34036SF1	2	FUSE BOX	TVFG11070	16	Y	AVSS	0.75f	
7										
8										
9	CLUSTER	MX34036SF1	10	OP SW	7115-2020	1	L	AVSS	0.5f	
10	CLUSTER	MX34036SF1	11	SPEED SW.N.O	CB103	1	YB	AVSS	0.5f	
11	CLUSTER	MX34036SF1	13	J25			BW	AVSS	0.75f	
12	CLUSTER	MX34036SF1	14	CN26	6180-2321	2	Br.	AVSS	0.5f	
13	CLUSTER	MX34036SF1	15	J16			P	AVSS	0.5f	
14	CLUSTER	MX34036SF1	16	CN41	7123-1424-30	1	Y	AVSS	0.5f	
15	CLUSTER	MX34036SF1	17	CN50	178390-2	1	GY	AVSS	0.5f	
16	CLUSTER	MX34036SF1	18	J17			B	AVSS	0.75f	
17	CLUSTER	MX34036SF1	19	J18			RW	AVSS	0.75f	
18	CLUSTER	MX34036SF1	20	CN1	6189-0443	1	YL	AVSS	0.75f	
19	CLUSTER	MX34036SF1	21	J13			R	AVSS	0.75f	
20	CLUSTER	MX34036SF1	22	D11	7323-2228	1	WL	AVSS	0.75f	
21	CLUSTER	MX34036SF1	24	CN3	6195-0021	1	BR	AVSS	0.75f	
22	CLUSTER	MX34036SF1	△ 25-26	J10			RB	AVSS	0.5f	
23	CLUSTER	MX34036SF1	27	CN11	6020-6161	4	LB	AVSS	0.75f	
24	CLUSTER	MX34036SF1	28	J12			O	AVSS	0.5f	
25	CLUSTER	MX34036SF1	29	CN12	6020-6161	4	WB	AVSS	0.75f	
26	CLUSTER	MX34036SF1	36	J17			B	AVSS	0.75f	
27	CN1	6189-0443	2	J11			G	AVSS	1.25f	
28	CN1	6189-0443	3	CN3	6195-0021	4	WG	AVSS	1.25f	
29	CN2	6195-0060	1	J25			BW	AVS	3	
30	CN2	6195-0060	2	CN7	172320-2	1	L	AVS	3	
31	CN3	6195-0021	3	J11			BR	AVSS	1.25f	
32	CN3	6195-0021	5	J17			B	AVSS	1.25f	
33	CN4	7323-6234-40	1	J13			R	AVS	3	
34	CN4	7323-6234-40	2	CN27	7323-3010	1	W	AVS	3	
35	CN4	7323-6234-40	3	J17			B	AVS	3	
36	CN11	6020-6161	1	J7			WL	AVSS	0.75f	
37	CN11	6020-6161	2	J7			WL	AVSS	1.25	
38	CN11	6020-6161	3	J20			WL	AVSS	1.25f	
39	CN12	6020-6161	1	J2			RL	AVSS	0.75f	
40	CN12	6020-6161	2	J2			RW	AVSS	0.75f	
41	CN12	6020-6161	3	CN25	7323-1424-40	1	RB	AVSS	0.75f	
42	CN13	7323-1424-40	1	J16			P	AVSS	0.5f	
43	CN13	7323-1424-40	2	J17			B	AVSS	0.5f	
44	CN14	7323-2228	1	J19			RY	AVSS	0.5f	
45	CN14	7323-2228	2	J16			P	AVSS	0.5f	
46	CN23	6020-6161	1	CN40	mDT06-08SA-CE05	8	L	AVSS	0.75f	
47	CN23	6020-6161	2	J36			O	AVSS	0.75f	
48	CN23	6020-6161	3	J38			W	AVSS	0.75f	
49	CN23	6020-6161	4	J17			B	AVSS	0.75f	
50	CN25	7323-1424-40	2	J51			B	AVSS	0.5f	
51	CN26	6180-2321	1	J61			RW	AVSS	0.5f	
52	CN28	7323-3010	1	J11			G	AVS	3	
53	CN29	7323-2228	1	J11			RW	AVSS	0.5f	
54	CN29	7323-2228	2	J10			RB	AVSS	0.5f	
55	CN30	7323-6423-30	1	J17			B	AVSS	0.5f	
56	CN30	7323-6423-30	2	J18			RW	AVSS	0.5f	
57	CN33	7123-2845	1	J30			R	AVS	3	
58	CN33	7123-2845	2	J22			RW	AVS	3	
59	CN33	7123-2845	3	J25			BW	AVS	3	
60	CN35	7323-2228	1	J11			G	AVSS	0.5f	
61	CN35	7323-2228	2	J12			RB	AVSS	0.5f	
62	CN36	7323-3010	1	J21			R	AVS	5	
63	CN40	mDT06-08SA-CE05	1	J62			P	AVSS	0.5f	
64	CN40	mDT06-08SA-CE05	2	J17			B	AVSS	0.5f	
65	CN40	mDT06-08SA-CE05	3	CN43	DT06-02S-CE05	1	W	AVSS	0.5f	Twisted B
66	CN40	mDT06-08SA-CE05	5	J37			G	AVSS	0.5f	
67	CN40	mDT06-08SA-CE05	7	J36			O	AVSS	0.75f	
68	CN41	7123-1424-30	2	J17			B	AVSS	0.5f	
69	CN42	DT06-02S-CE05	2	J37			G	AVSS	0.5f	Twisted A
70	CN43	DT06-02S-CE05	2	J37			G	AVSS	0.5f	Twisted B
71	CN50	178390-2	2	J17			B	AVSS	0.5f	
72	CN61	6020-6161	1	J62			RB	AVSS	0.5f	
73	CN61	6020-6161	2	J63			RL	AVSS	0.75f	
74	CN61	6020-6161	3	FOOT SW C	CB104	1	WR	AVSS	0.75f	
75	CN61	6020-6161	4	J60			B	AVSS	0.5f	
76	CN62	DT06-02S-CE05	1	FOOT SW NO	CA104	1	Gy.	AVSS	0.75f	
77	CN62	DT06-02S-CE05	2	CN63	6020-6161	1	Y	AVSS	0.75f	
78	CN63	6020-6161	2	J63			RL	AVSS	0.75f	
79	CN63	6020-6161	3	CN64	6180-2321	1	RW	AVSS	0.75f	
80	CN63	6020-6161	4	J60			B	AVSS	0.75f	
81	CN64	6180-2321	2	J60			B	AVSS	0.75f	
82	CNF-3	6100-5026	1	J72			Br.	AVSS	0.75f	
83	CNF-3	6100-5026	2	J17			B	AVSS	0.75f	

No.	Initial connector	Connector type of initial connector	Pin no.	End connector	Connector type of end connector	Pin no.	Color	Line type	Line diameter	Remarks
84	CNF-70	7123-2865	1	J72			Br.	AVSS	0.75f	
85	CNF-70	7123-2865	2	J39			Lg.	AVSS	0.75f	
86	CNF-70	7123-2865	3	J38			G	AVSS	0.75f	
87	CNF-70	7123-2865	4	J17			B	AVSS	0.75f	
88	CNF-70	7123-2865	5	J20			WL	AVSS	0.75f	
89	D1	7323-2228	1	J12			O	AVSS	0.5f	
90	D1	7323-2228	2	J11			G	AVSS	0.5f	
91	D2	7323-2228	1	J10			RB	AVSS	0.5f	
92	D2	7323-2228	2	J11			RW	AVSS	0.5f	
93	D11	7323-2228	2	J38			W	AVSS	0.75f	
94	D12	7323-2228	1	J17			B	AVSS	0.75f	
95	D12	7323-2228	2	J13			R	AVSS	0.75f	
96	FUSE BOX	TVFG11070	1	J23			G	AVS	3	
97	FUSE BOX	TVFG11070	2	J23			RW	AVSS	0.5f	
98	FUSE BOX	TVFG11070	3	J23			RY	AVSS	0.5f	
99	FUSE BOX	TVFG11070	4	J23			WL	AVSS	1.25f	
100	FUSE BOX	TVFG11070	5	J24			RW	AVSS	0.75f	
101	FUSE BOX	TVFG11070	6	J24			Br.	AVSS	0.75f	
102	FUSE BOX	TVFG11070	7	J26			Lg.	AVSS	0.75f	
103	FUSE BOX	TVFG11070	8	J26			Y	AVSS	0.75f	
104	FUSE BOX	TVFG11070	9	J11			G	AVS	3	
105	FUSE BOX	TVFG11070	10	J61			RW	AVSS	0.5f	
106	FUSE BOX	TVFG11070	11	J19			RY	AVSS	0.5f	
107	FUSE BOX	TVFG11070	12	J7			WL	AVSS	1.25f	
108	FUSE BOX	TVFG11070	13	J2			RW	AVSS	0.75f	
109	FUSE BOX	TVFG11070	14	J72			Br.	AVSS	0.75f	
110	FUSE BOX	TVFG11070	15	J39			O	AVSS	0.75f	
111	HORN SW IN	CB104	1	J39			Lg.	AVSS	0.75f	
112	HORN SW OUT	CB104	1	J38			P	AVSS	0.75f	
113	HORN,+	7116-2030	1	J38			P	AVSS	0.75f	
114	HORN,-	7116-2030	1	J51			B	AVSS	0.75f	
115										
116	J2			J18			RW	AVSS	0.75f	
117										
118										
119										
120	J14			J21			R	AVS	5	
121										
122										
123	J16			J62			P	AVSS	0.5f	
124										
125										
126										
127										
128										
129										
130										
131										
132										
133										
134										
135										
136										
137	J17			J51			B	AVSS	1.25f	
138	J17			J60			B	AVSS	0.75f	
139										
140										
141	J21			J30			R	AVS	5	
142	J22			J23			RW	AVS	3	
143	J22			J24			W	AVS	3	
144										
145										
146	J26			J30			R	AVS	3	
147	J36			J39			O	AVSS	0.75f	
148										
149										
150										
151										
152	J61			J63			RL	AVSS	1.25f	
153										
154	LL RELEASE,1	CA104	1	J19			RY	AVSS	0.5f	
155	LL RELEASE,2	CB104	1	J16			RW	AVSS	0.5f	
156	OP LIGHT,+	CB104	1	J20			WL	AVSS	1.25	
157	OP LIGHT,-	CA104	1	J17			B	AVSS	1.25f	
158	OPTION(+)	CB104	1	J72			R	AVSS	0.75f	
159	OPTION(-)	CB104	1	J17			B	AVSS	0.75f	
160	SBF	7122-4125-50	2	J14			R	AVS	5	
161	SG	LA210	1	J17			B	AVS	3 5 Δ	
162	SPEED SW,C	CB103	1	J51			B	AVSS	0.5f	
163	オルタネーターB	LA306	1	J14			R	AVS	5	
164	CN5	7323-3010	1	CN37	7323-3010	1	Y	AVS	3	
165	CN40	mDT06-08SA-CE05	4	CN42	DT06-02S-CE05	1	Br.	AVSS	0.5f	Twisted A

FUNCTION **3**

HYDRAULIC PUMP (PISTON)

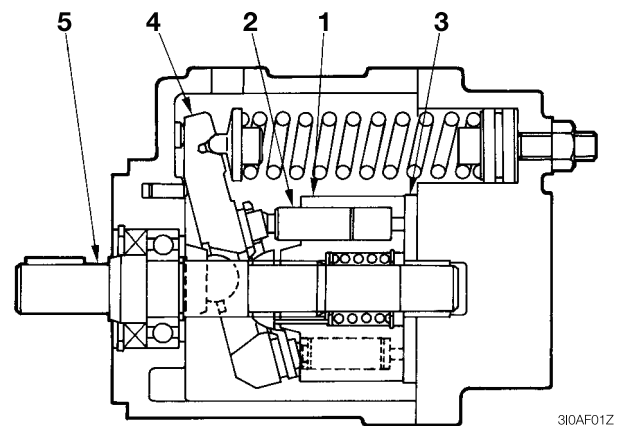
This pump is a variable displacement piston pump with a single cylinder block that discharges two separate but equal volumes of fluid.

The pistons (2) are installed in the cylinder block (1), and the end surface of which is in contact with the valve plate (3). The discharge port A of the pump P1 along with the discharge port B and the suction port C of the pump P2 are located in the valve plate (3). The swash plate (4), on the other hand, is fixed at an angle to the housing, and the pistons (2) are designed to rotate along with the swash plate (4).

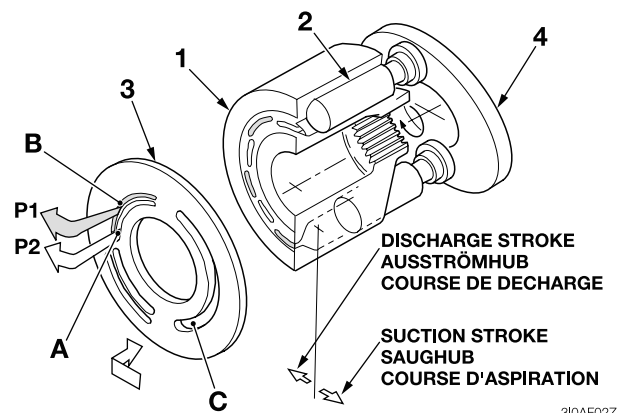
Here, the cylinder block (1) rotates as the shaft (5) is rotated, and the pistons (2) mounted in the cylinder block (1) follow and move back and forth with the motion of the swash plate (4), which activates the suction and discharge pumps. At this time, the piston in contact with the discharge port A in the valve plate (3) operates as the pump P1, while the piston in contact with the discharge port B operates as the pump P2.

As thus described, the pistons (2) complete one stroke of intake and exhaust for every stroke of the cylinder block (1). The continuous rotation of the shaft (5) allows the pistons to continue the intake and exhaust process.

The displacement of the pistons (2) can be varied through modification of the angle of inclination of the swash plate (4) as the degree of displacement depends on the inclination of the swash plate (4).



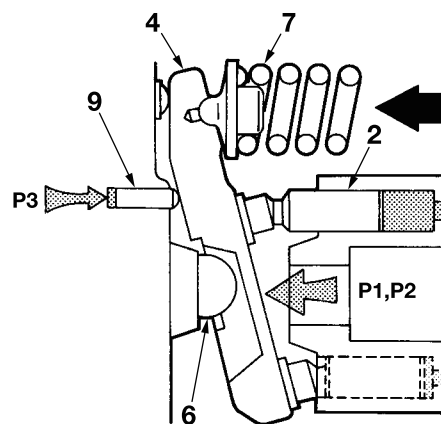
310AF01Z



310AF02Z

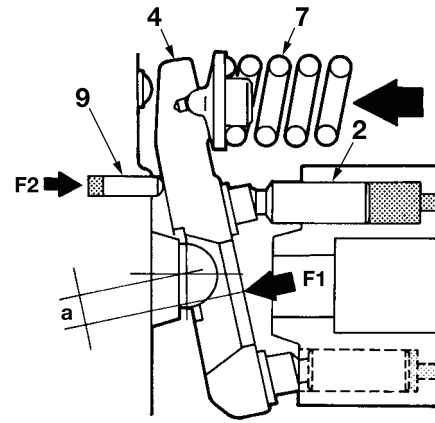
Discharge volume control mechanism

The swash plate (4) is equipped with the swing pins (6) and is mounted on the housing at an angle of inclination that can be changed. The swash plate (4) has arranged on it the pistons (2) of the cylinder block and the piston (9), which lie in opposition to the spring (7). The discharge pressures from the pumps P1 and P2 work on the pistons (2), and the discharge pressure from the pump P3 works on the piston (9). If the discharge pressure falls below the preset value for the spring (7), the angle of inclination of the swash plate (4) will be set to its maximum value by the spring (7).



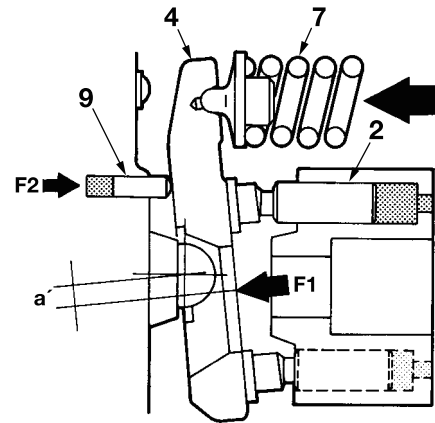
310AF03Z

If the discharge pressure becomes higher than the pre-set value for the spring (7), the angle of inclination of the swash plate (4) becomes smaller due to the net force on the piston, $F_1 \times a$, and the force, F_2 , of the piston (9), which allows the plate to be retained at the position at which the discharge pressure and the spring force are balanced.



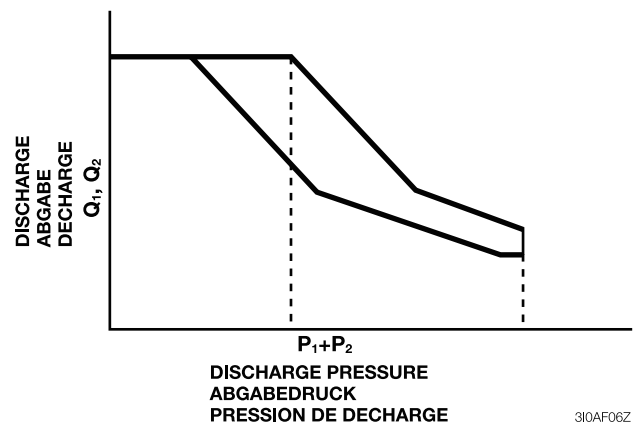
310AF04Z

If the discharge pressure increases further, the angle of inclination of the swash plate (4) decreases further. At this time, the arm length, a , which is determined by the action of the net force on the piston, F_1 , becomes smaller, represented by a' , resulting in a larger force F_1 being needed to act against the inclination of the swash plate.



310AF05Z

In this way, the angle of inclination of the swash plate (4) is changed and the discharge volume is controlled. This allows the pump to supply only the pressure and flow required for the load so as to minimize pressure losses. The angle of inclination of the swash plate (4) changes according to the operating pressure of the pump P3 as well as the operating pressure of the pumps P1 and P2. The P-Q curve of the piston pump consequently becomes the curve that effectively uses the engine horsepower (total horsepower control).



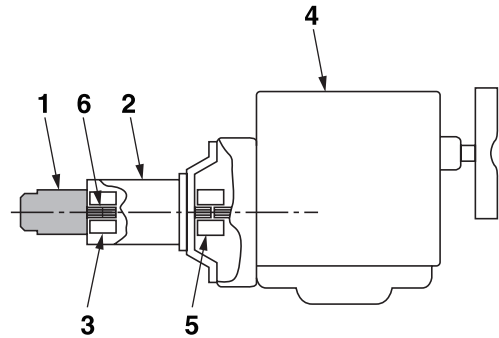
310AF06Z

GEAR PUMP

The gear pump (1) is a constant-volume pump with double-gear pumps (P3, P4) that discharges a constant volume of discharge material over a constant speed.

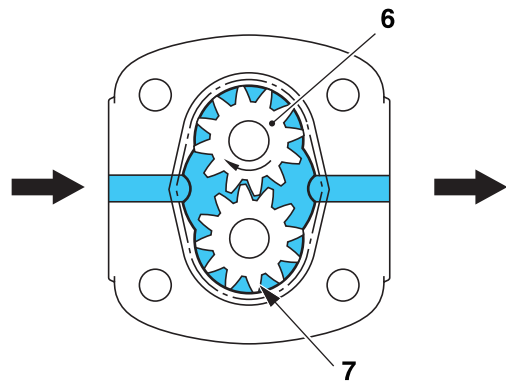
The pump P3 is used for the 2nd and 3rd auxiliary line piping, blade, and slew motor, and the pump P4 is used to discharge the pilot pressure oil.

The gear pump (1) is connected by the hydraulic pump (piston) (2) and coupling (3), and the hydraulic pump (2) is connected by the engine (4) and coupling (5), with the drive gear (6) of the gear pump (1) being rotated with the rotation of the engine.



311AQ01Z

The gear pump is located inside one of the gear cases and is interlocked with the drive gear (6) and driven gear (7). When the drive gear (6) is rotated, the space between the case and the gears is filled with that oil flowing from the inlet to the outlet.

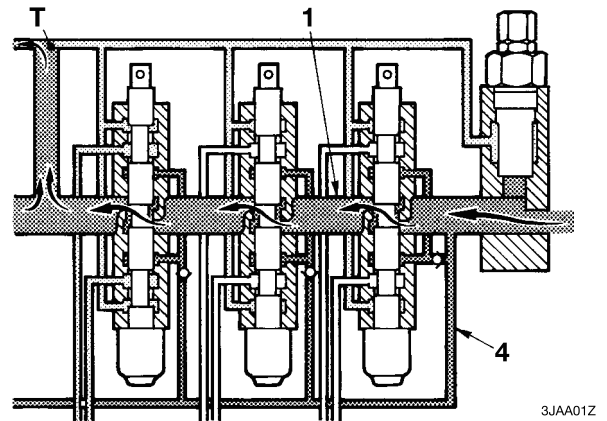


311AQ02Z

CONTROL VALVE

When the spools are in the neutral position:

When the control valve spools are not moved, the oil flows through the center bypass passage (1) and the tank passage T to return to the tank, as shown by the arrow.

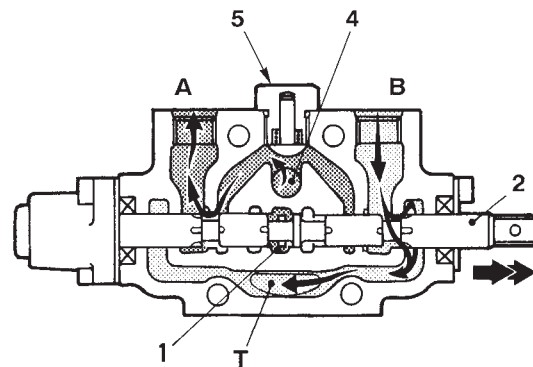


When the spool is being operated:

The description given here uses an example in which the spool (2) is moved to the right.

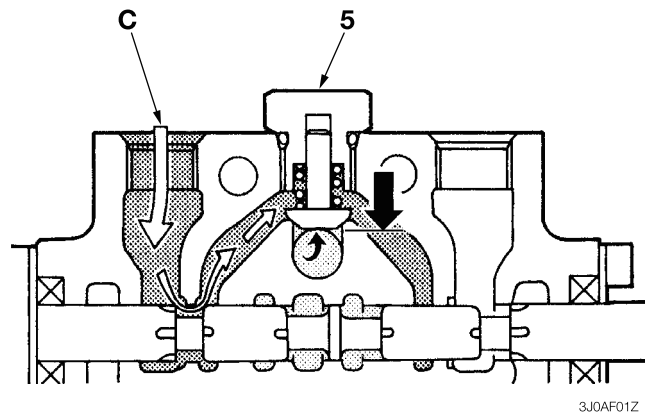
When the spool (2) is moved to the right, the center bypass passage (1) is closed and the oil that has flowed into the valve from the pump passes through the parallel passage (4), the load check valve (5), and port A into the actuator.

Meanwhile, oil returning from port B returns to the tank through the tank passage T.



Load check valve

This valve prevents oil from flowing backward while the spool switching operation is being performed due to the load pressure C coming from the actuator port.



Main relief valves

A main relief valve is mounted between the pump circuit and tank circuit of each inlet housing and works to maintain the circuit pressure at the set value.

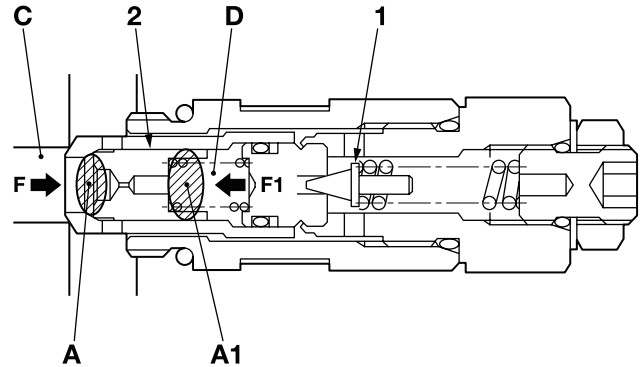
The relief valve remains turned off:

As long as the pressure in the circuit is lower than the set pressure, the relief valve will maintain the pressure equilibrium and remain shut off. The hydraulic pressure from the pump passes from the chamber C into the orifice of the main poppet (2) and then on until it reaches the chamber D and needle valve (1). Meanwhile, the forces F and F1 act on the sides of the main poppet (2), as indicated by the arrows.

$$F = P \times A$$

$$F1 = P \times A1 \quad (P: \text{Pressure, } A \text{ and } A1: \text{Cross-sectional areas})$$

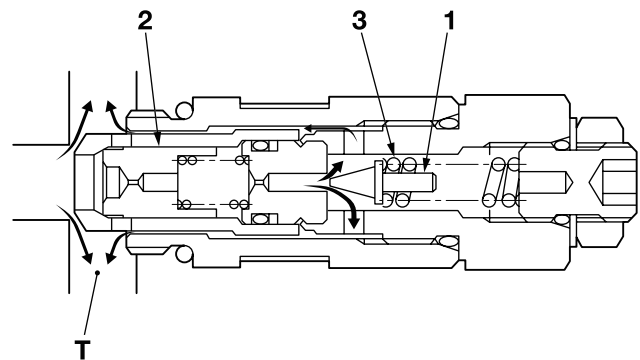
The cross-sectional area A1 is larger than the cross-sectional area A, which causes the main poppet (2) to be pushed to the left seat surface by the force of F1 - F.



3J0AF02Z

The relief valve is activated:

If the pressure in the circuit becomes higher than the set pressure of the spring (3), the needle valve (1) will be pushed to the right by hydraulic pressure, which will cause the oil to flow into the tank passage T. When this happens, a pressure differential is generated between the two ends of the orifice of the main poppet (2), which causes the main poppet to be pushed to the right by the hydraulic pressure. As a result, the pressure oil in the circuit flows into the tank passage as shown by the arrows. This operation works to maintain the pressure in the circuit at the set value.



3JAA05Z

Port relief valve

The port relief valve is located between the actuator and the tank circuit T. It protects the actuator from pressure shocks caused by the sudden blocking of the actuator port or by overloading, or absorbs abnormal pressure generated by an external force.

The relief valve is subjected to the relief operation:

As long as the pressure in the circuit is lower than the set pressure, the relief valve will maintain the pressure equilibrium and remain shut off. The hydraulic pressure from the pump passes from the chamber B through the orifice of the piston (4) and on until it reaches the chamber C and the needle valve (5).

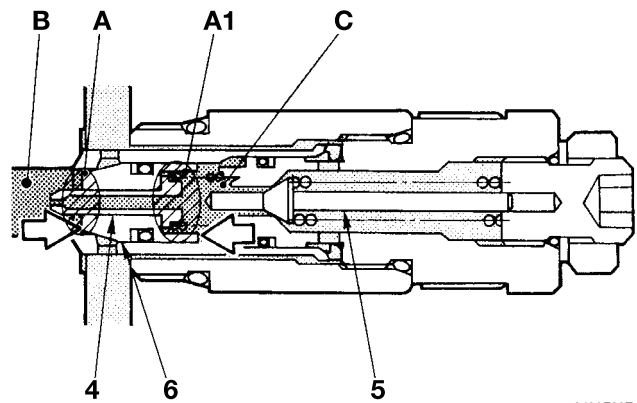
Meanwhile, the forces F and F_1 act on the sides of the main poppet (6) as indicated by the arrows.

$$F = P \times A$$

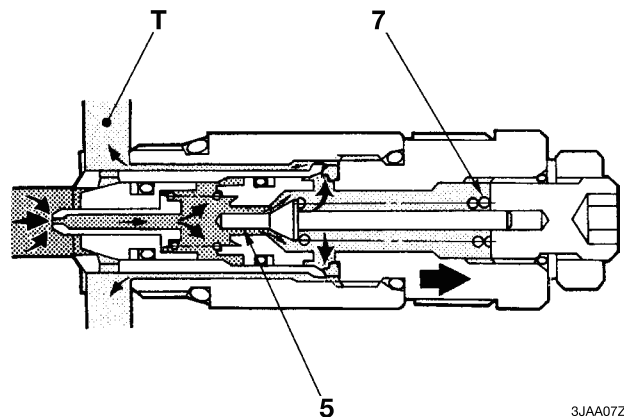
$$F_1 = P \times A_1 \quad (P: \text{Pressure, } A \text{ and } A_1: \text{Cross-sectional areas})$$

The cross-sectional area A_1 is larger than the cross-sectional area A , which causes the main poppet (2) to be pushed to the left seat surface by the force of $F_1 - F$.

If the pressure in the circuit becomes higher than the force of the spring (7), the needle valve (5) is pushed to the right by hydraulic pressure, connecting the high-pressure area with the tank passage T. The oil then flows around the circumference of the needle valve (5) and passes through the slits, flowing into the tank passage T.

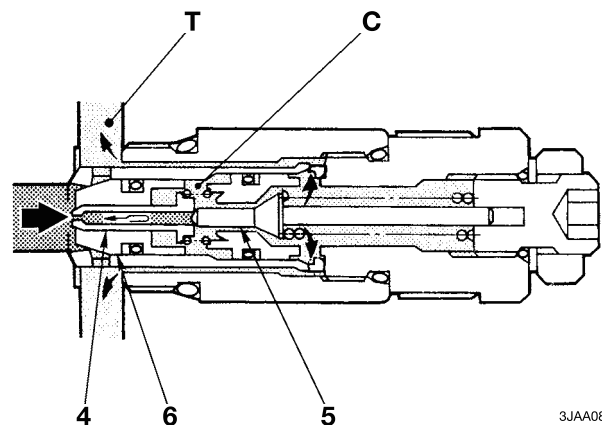


3J0AF03Z



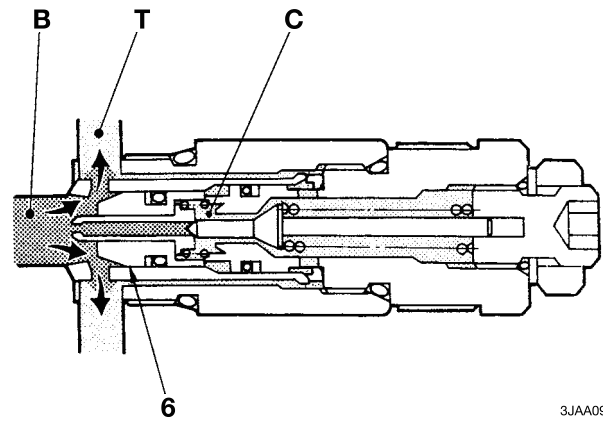
3JAA07Z

When the needle valve (5) is pushed to the right, which connects the high-pressure area with the tank passage T, the pressure behind the piston (4) drops; consequently, the piston (4) is pushed to the right and up against the needle valve (5). As a result, the flow of oil from chamber B to chamber C is cut-off, and the pressure in chamber C drops.



3JAA08Z

The pressure in chamber C drops below that in chamber B, causing the pressure to become unequal. This causes the main poppet (6) to open up, which allows the pressure oil to flow to the tank passage T.

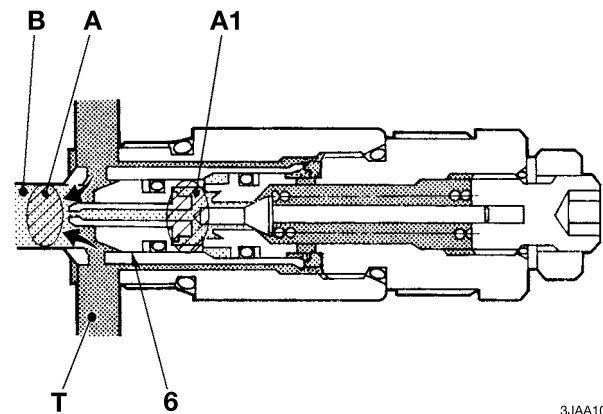


3JAA09Z

When the valve is engaged in valve suction operation:

If the cylinder is operated at a speed too fast for the oil supply to keep up, and thus the pressure of the chamber B becomes almost negative, oil is supplied from the tank to prevent cavitation.

When the pressure in chamber B is lower than the pressure in the tank passage T, the difference in cross-sectional areas between A and A1 causes the main poppet (6) to open. This, in turn, causes oil to enter from the tank passage T to fill in the empty space in the chamber B.

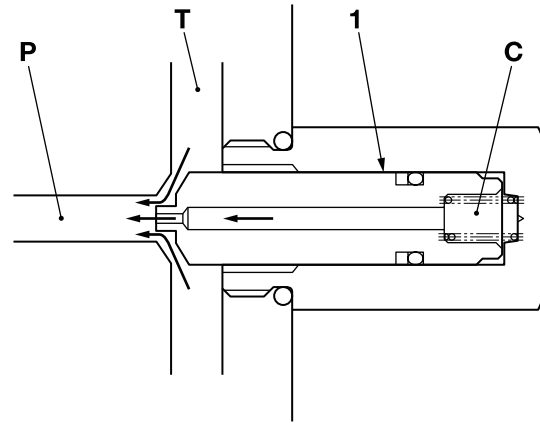


3JAA10Z

Anti-cavitation valve

This valve is inserted between the cylinder port and the tank passage. It works to supply oil from the tank to prevent cavitation when the cylinder is operated at a speed that is too fast for the oil supply to keep up, which would cause the pressure of the cylinder port to become almost negative.

Under normal conditions, a pressure is applied to the cylinder port (P), which causes the poppet (1) to remain closed. A negative pressure arises in the cylinder port (P). When the pressure drops below that in the tank passage (T), the poppet (1) is pushed open, allowing oil to flow from the tank passage (T) and into the cylinder port (P).



3J0AF04Z

Anti-drift valve

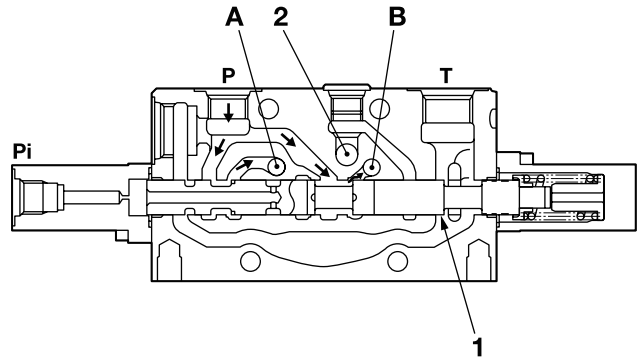
This valve is installed in the head side of the cylinder circuit of the boom section. It is designed to prevent oil from leaking into the cylinder head circuit when the spools are in the neutral position and to decrease the natural drop of the boom.

Switch valve

This valve switches among the circuits of the bucket, arm, boom, swing, and auxiliary line hydraulics when any of them is activated during travel operation. The oil supplied by the pump P3 is directed to a section other than the travel section, which enables straight travel together with other operations under combined control.

When the switch valve is activated:

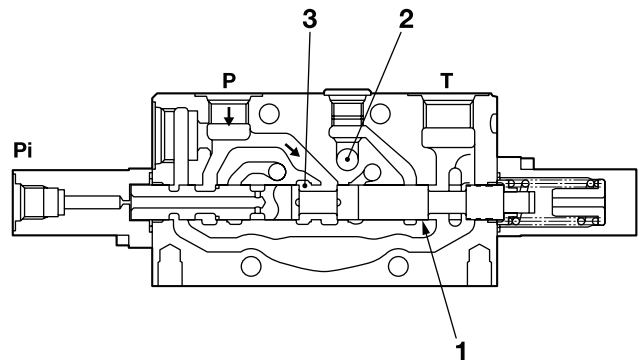
When travel operation and other operations are performed at the same time, the pilot pressure is directed to the port P1, which causes the spool (1) to be pushed up. This allows the oil that entered the port P to flow through the parallel passage (2) as well as the spool head and the second parallel passages A and B. The second parallel passage A is connected to the boom and bucket sections while the second parallel passage B is connected to the arm and swing sections, allowing combined operation involving travel and other operation.



3J0AF08Z

When the switch valve is not activated:

The spool (1) does not get switched because the pilot passage is open to the tank passage and thus the pressure in the port Pi is equal to the pressure in the tank. As a result, the oil that entered the port P flows into the center bypass passage (3). In addition, part of the oil flows through the connected parallel passage (2) and the dozer blade and slew sections.



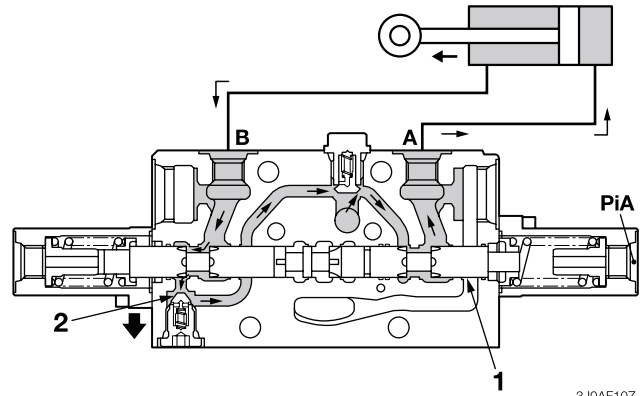
3J0AF09Z

Arm In regeneration

The speed at which the arm cylinder is extended (Arm In operation speed) can be increased by directing part of the oil returned from the arm cylinder to the supply side again to increase the supply flow.

When the Arm In operation is performed, the pilot pressure is directed to the port PiA, which causes the spool (1) to be pushed up. This results in the oil from the pump being supplied to the head side of the arm cylinder through the port A.

Meanwhile, the return oil from the rod side of the arm cylinder flows from the port B through the spool head and the tank passage to be returned to the tank. At the same time, it pushes the regenerative poppet (2) downward, allowing it to be joined with the flow from the pump. This combined flow is then supplied back to the head side of the arm cylinder again via the port A.



PILOT VALVE (CONTROL LEVER)

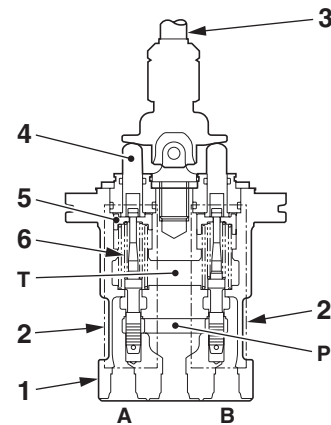
The pilot valve is a remote-controlled valve with a reducing valve system used to operate the spool in the control valve. The pilot valve comes with right and left control levers.

The pilot valve casing (1) contains a vertical shaft hole that incorporates a reducing valve (2). When the lever (3) is tilted, the push rod (4) and spring seat (5) are pushed down, which changes the pressure of the secondary pressure spring (6).

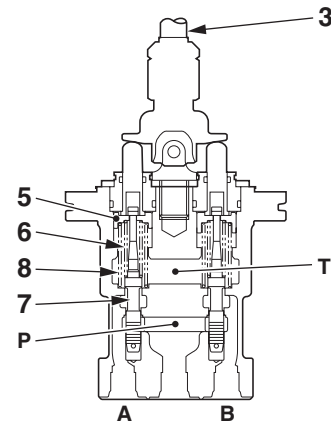
The casing (1) contains the oil inlet port P (primary pressure) and the tank port T. The secondary pressure which corresponds to changes in operating angle produced using the lever (3) can be provided through the output ports A and B located below the vertical shaft hole. The secondary pressure functions as the pilot pressure to activate the spool of the control valve.

When the lever (3) is in the neutral position:

The force of the spring (6) that determines the output pressure (secondary pressure) of the pilot valve is not conveyed to the spool (7). This causes the spool (7) to be pushed up by the return spring (8) and spring sheet (5), and the output ports A and B are connected to the tank port T, which makes the pressures in the ports A and B be equal to the pressure in the tank port T.



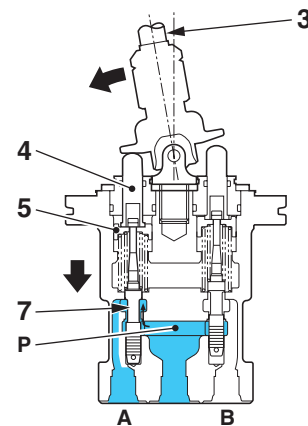
3K2AQ01Z



3K2AQ02Z

When the lever (3) is tilted:

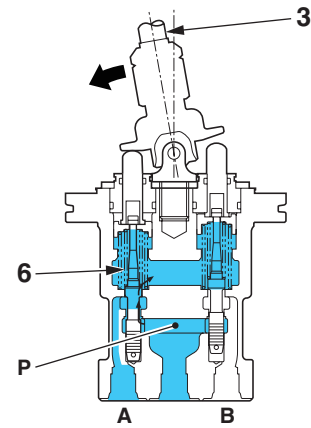
When the lever (3) is tilted and the push rod (4) is pushed, the spring sheet (5) and spool (7) move downward, and the input port P is connected to the output port A. The oil from the pilot pump then flows into the output port A to generate a pressure.



3K2AQ03Z

When the lever (3) is kept at a certain position:

When the pressure in the output port A increases to a level equivalent to the force of the spring (6) set by the inclination of the lever (3), the hydraulic pressure is balanced with the spring force. When the pressure in the output port A becomes higher than the set spring force, the output port A is disconnected from the input port P and then becomes connected to the tank port T. When the pressure in the output port A drops below than the set spring force, the output port A becomes connected to the input port P and it is then disconnected from the tank port T. The secondary pressure is thus always kept constant.



3K2AQ04Z

PROPORTIONAL CONTROL SOLENOID VALVE (2ND AUXILIARY LINE PIPING)

The proportional lever (2) and proportional amplifier (3) of the pilot valve (1) control the driving current that flows to the proportional control solenoid valve (4), which controls the pilot pressure of the control valve (5) (auxiliary section) whereby the flow rate of the auxiliary line piping changes.

The proportional control solenoid valve controls the secondary pressure using the built-in proportional pressure-reducing valve. The secondary pressure generated corresponds to the changes in current because of the force used to generate the secondary pressure being applied to the solenoid in accordance with the amount of current flowing through the coil.

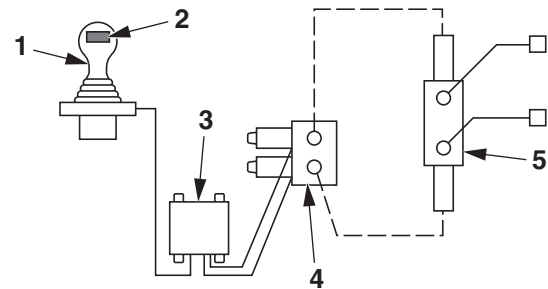
When current flows through the solenoid, a thrust force proportional to the current is generated and moves the spool (6) so that the oil supplied from the port P is introduced into the port A on the secondary pressure side, which increases the pressure P_a of the port A.

The pressure P_a acts on the differential area S between the cross section $A1$ and cross section $B1$ of the spool (6), and the spool (6) is pushed to the solenoid side by the oil pressure, $P_a \times s$. The spool (6) stops at the position where the sum of the oil pressure, $P_a \times s$, and the force, F_k , exerted by the springs (7) is balanced with the thrust force, F_s , generated by the solenoid. The weight, F_{ks} , of the spring (8) used for fine adjustment of the secondary pressure acts in the direction (left) of assistance of the thrust force from the solenoid.

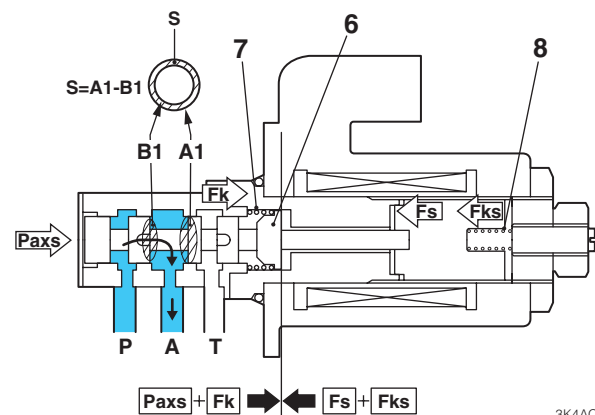
When the thrust force is greater than a set value, the spool (6) is moved to the left, which connects the port P (supply side) and the port A (secondary side) together through the notch (9).

When the thrust force is lower than a set value, the spool (6) is moved to the right, which connects the port A (secondary side) and the port T (tank side) together through the notch (10).

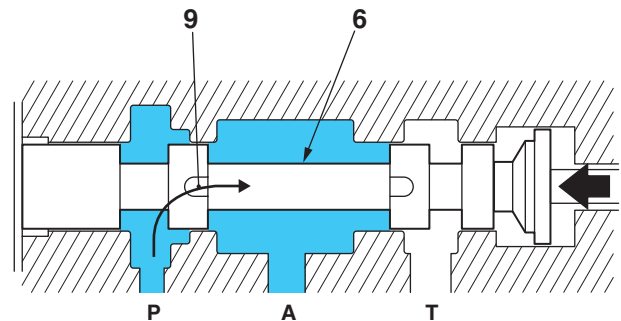
The opening areas of the notch (9) on the supply side and the notch (10) on the discharge side are thus controlled by the movement of the spool (6), and a secondary (pilot) pressure can be provided that corresponds to the thrust force generated by the solenoid.



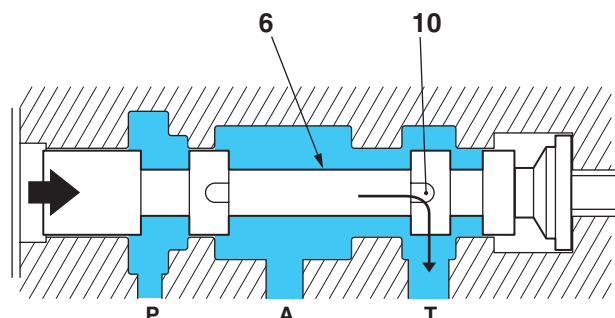
3K4AQ01Z



3K4AQ02Z



3K4AQ03Z



3K4AQ04Z

SOLENOID VALVE(3RD AUXILIARY LINE PIPING)

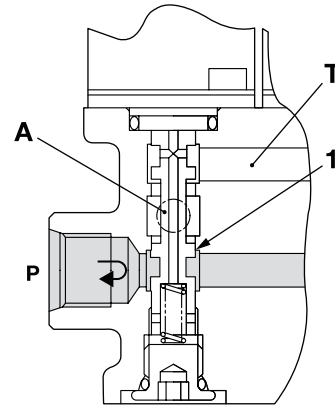
This valve switches circuit connections by moving the spool using magnets and supplies the pilot pressure to the 3rd auxiliary section.

Solenoid valve

When the solenoid is not energized:

The oil in the port P (pump side) is blocked by the spool (1).

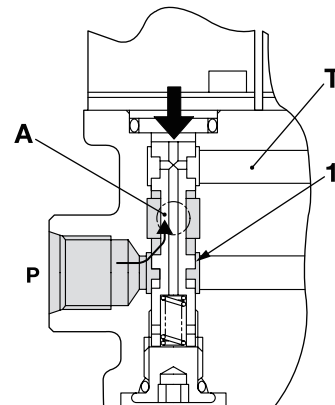
The oil flows through the port A (on the pilot circuit side of the 3rd auxiliary section) and port T (on the tank side), which means that the pressure of the downstream pilot circuit is the same as the tank pressure.



3K0AI01Z

When the solenoid is energized:

A magnetic field is generated around the coil that causes the push rod to be pulled downward and the spool (1) to be pushed down. This causes the oil in the port P to flow to the port A, and the pressure is transmitted to the lower pilot circuit.



3K0AI02Z

SOLENOID VALVE (LEVER LOCK)

This valve switches circuit connections by moving the spool using magnets and supplies the pilot pressure to the pilot valve and 2nd-speed travel switch.

The pilot pressure is kept constant with the relief valve.

Solenoid switching and relief function

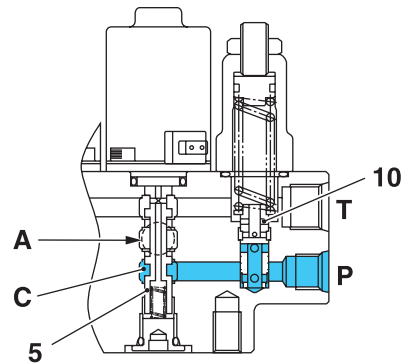
For simplification purposes, only port A will be used in the descriptions below as port A and port B in the valve operate in the same way.

When the solenoid is not energized:

The pressure oil from port P is blocked from entering the circuit to port A by the spool (5) and plunger (10).

The oil flows through the port A (on the pilot circuit side of the pilot valve or 2nd-speed travel switch) and port T (on the tank side), which means that the pressure of the downstream pilot circuit is the same as the tank pressure.

In addition, the pressure in port C is the same as that in port P under normal conditions as port C is connected to port P.

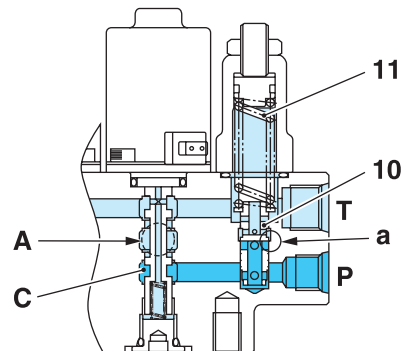


3K6AX01

When the pressure of port P increases and exceeds the set value for the spring (11), the plunger (10) is pushed upward, and the oil from port P flows into port T from the "a" section.

When the pressure of the port P drops and falls below a set value for the spring (11), the plunger (10) is moved down by the spring (11), which blocks the circuit to the port P and port T.

This enables the pressure inside the circuit to be maintained at a constant level.

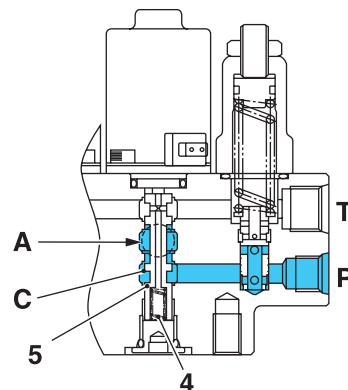


3K6AX02

When the solenoid is energized:

A magnetic field is generated around the coil that causes the push rod to be pulled downward and the spool (5) to be pushed down. This causes the oil in the port P to flow to the port A, and the pressure is transmitted to the lower pilot circuit.

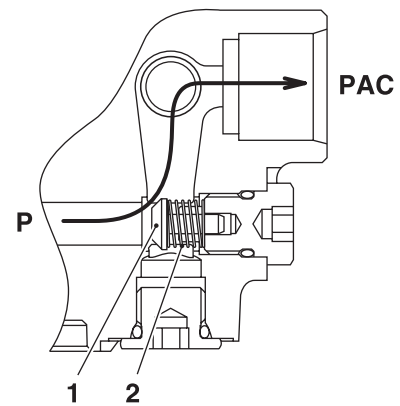
When the power to the coil is turned OFF, the spool (5) is pushed upward by the spring (4).



3K6AX03

Check function**Port P → Port PAC and Port B**

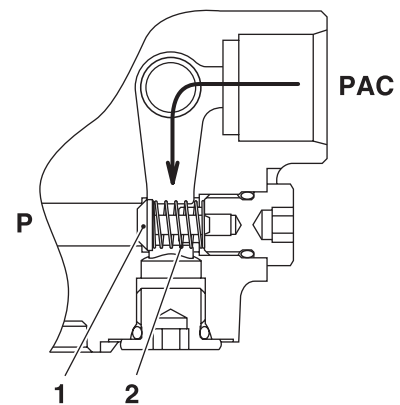
When the pressure in port P exceeds the force applied by the spring (2), the plunger (1) moves to the right, allowing the pressure oil to flow from port P to port PAC.



3K6AX04

Port PAC → Port P

The plunger (1) is returned to the left by the spring (2), and the port PAC and port P are blocked off to prevent backflow into either port.

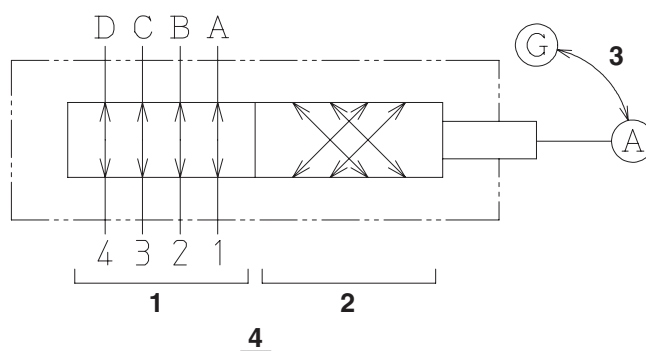
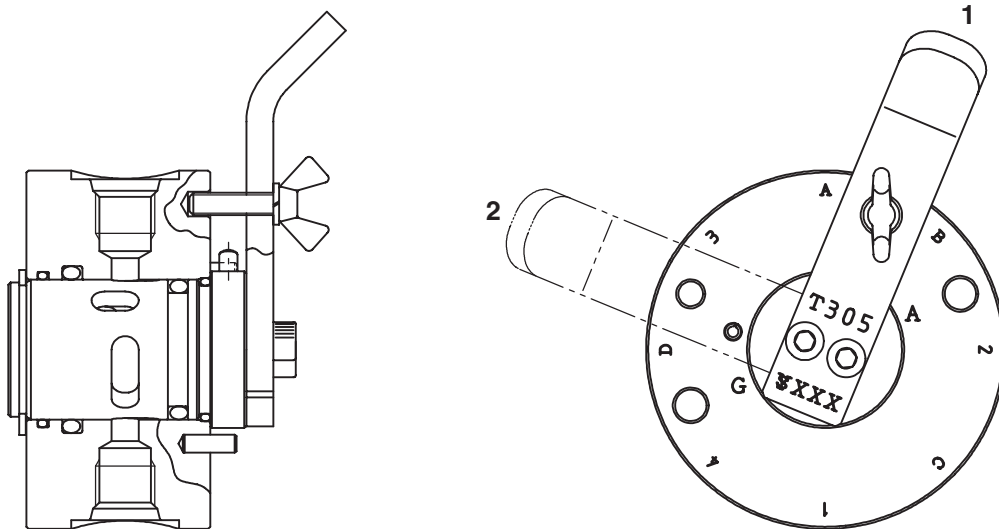


3K6AX05

SELECTOR VALVE

The selector valve is connected between the control valve and the pilot valve (control lever).

Turn the selector valve lever to switch the connection port to switch the control lever pattern.



3K8AQ00Z

1. Position A (ISO)
2. Position G (JCB)
3. Rotation of 90°
4. Circuit schematic

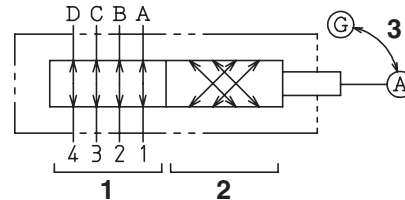
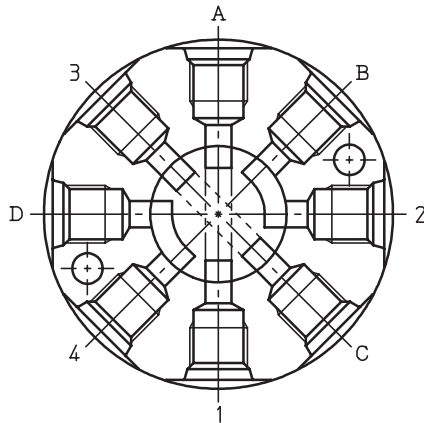
Position A (ISO)

Port A ⇔ Port 1

Port B ⇔ Port 2

Port C ⇔ Port 3

Port D ⇔ Port 4



3K8AQ01Z

1. Position A (ISO)
2. Position G (JCB)
3. Rotation of 90°

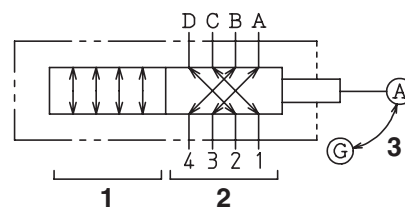
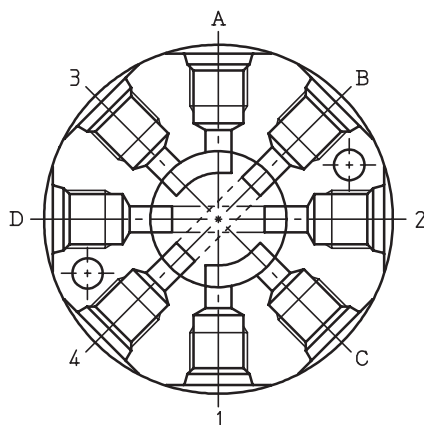
Position G (JCB)

Port A ⇔ Port 3

Port B ⇔ Port 4

Port C ⇔ Port 1

Port D ⇔ Port 2

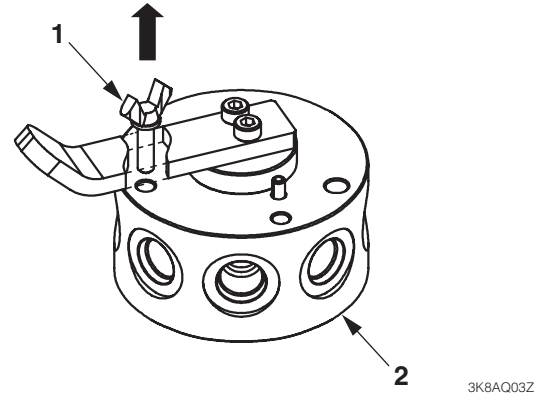


3K8AQ02Z

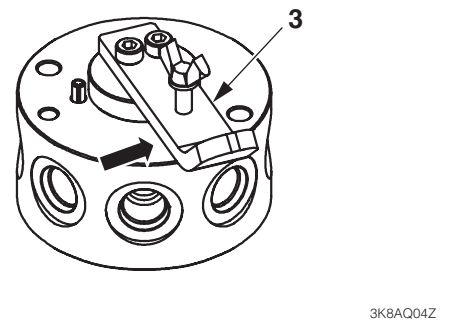
1. Position A (ISO)
2. Position G (JCB)
3. Rotation of 90°

Switching from Position A (ISO) to Position G (JCB)

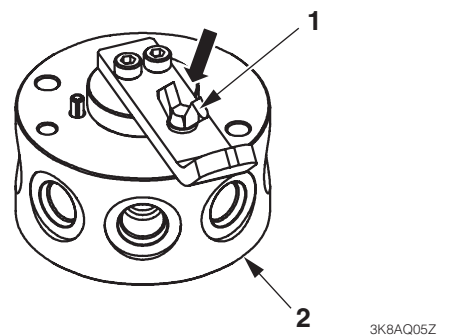
1. Loosen the wing bolt (1) enough for its end to emerge from the hole in the body (2).



2. Turn the lever (3) counterclockwise 90°.

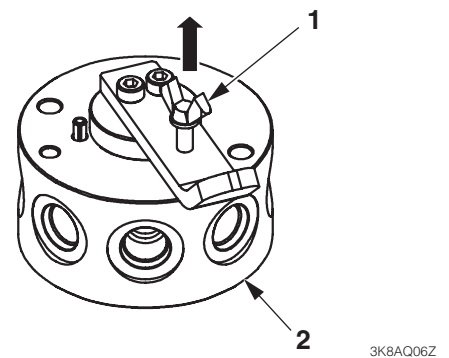


3. Tighten the wing bolt (1) by hand.
 - The end of the wing bolt (1) should go into the anti-rotation hole in the body (2).

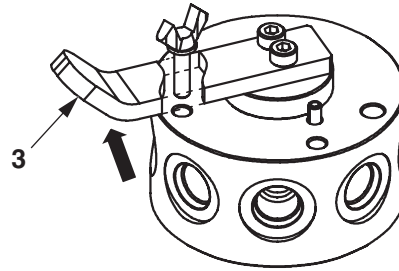


Switching from Position G (JCB) to Position A (ISO)

1. Loosen the wing bolt (1) enough for its end to emerge from the hole in the body (2).



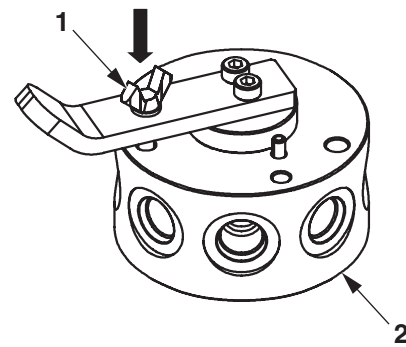
2. Turn the lever (3) clockwise 90°.



3K8AQ07Z

3. Tighten the wing bolt (1) by hand.

- The end of the wing bolt (1) should go into the anti-rotation hole in the body (2).



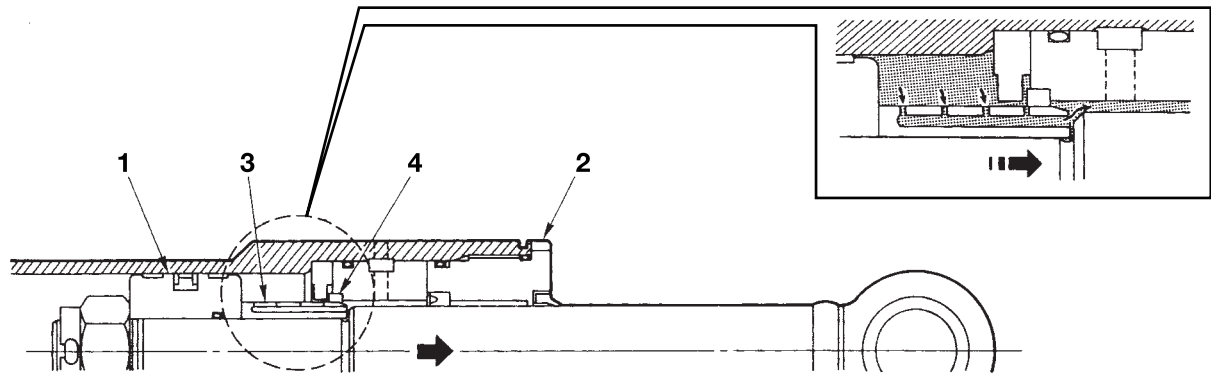
3K8AQ08Z

CYLINDERS

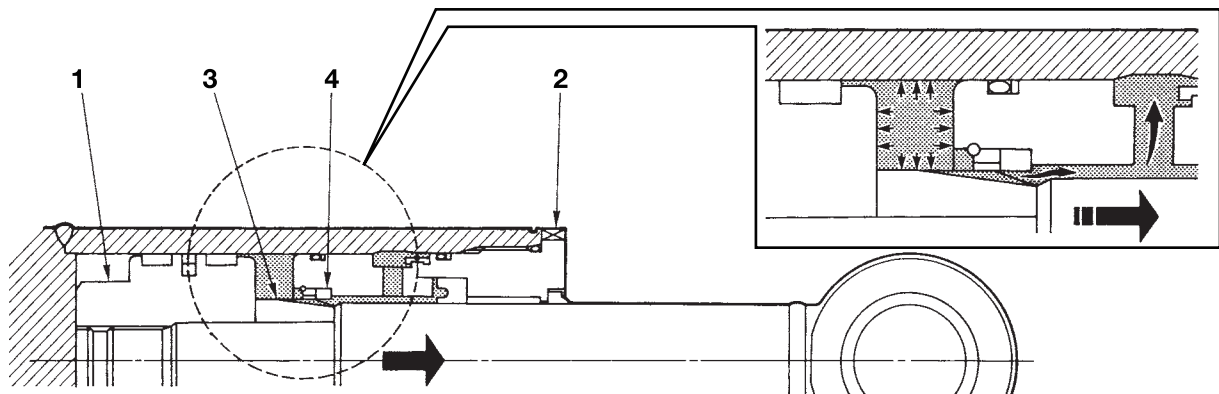
The pressure oil flowing alternately in through the outlet and inlet on both sides (head and rod sides) of the piston acts on the piston and its force causes the piston to move back and forth.

For those cylinders with a cushion mechanism, the shock resulting from the piston colliding with the cover at the stroke end is dampened by the mechanism.

Cushion mechanism



3LAA01Z



3LAA02Z

When the piston (1) approaches the stroke end and appears likely to bump into the cover (2), the cushion bearing (3) that is moving ahead of the piston enters the cushion seal (4). Since this shuts off the return channel for the hydraulic oil on the back of the piston, the oil is expelled only from the throttle hole or the groove provided in the cushion bearing (3). This causes the piston (1) backpressure to increase, slowing the piston speed.

TRAVEL MOTOR

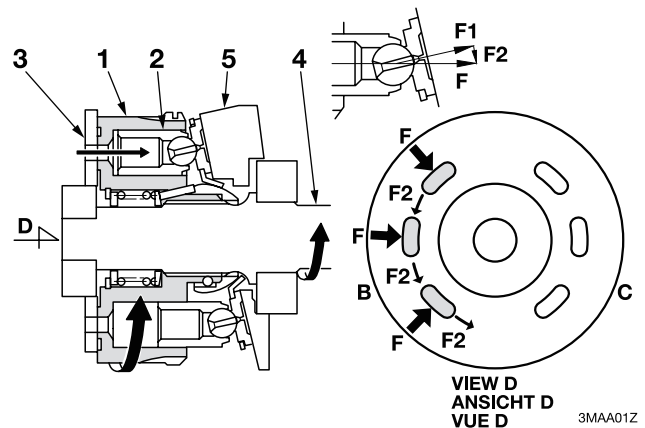
Hydraulic motor

The cylinder block (1) is formed of the pistons (2), and its end surface comes in contact with the valve plate (3) that contains the two half-moon-shaped ports B and C. The cylinder block (1) rotates freely and is connected to the drive shaft (4) via the splines. Meanwhile, the swash plate (5) is secured to the housing.

When the high-pressure oil is directed to the port B, the pistons (2) push against the swash plate (5) with a force F per piston.

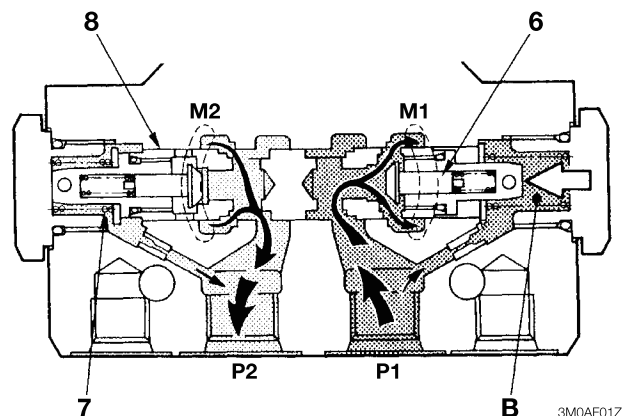
$F = P \times A$, where P : Pressure, A : Cross-sectional area of piston

The pushing force F applied against the swash plate (5) by the pistons (2) has two components: a force F_1 component that pushes against the swash plate and a force F_2 component that rotates the cylinder block (1). The total sum of the components in the direction of rotation of the piston on the high-pressure side generates a rotational force in the cylinder block (1), resulting in the torque being transmitted to the shaft (4) via the splines, causing it to turn. Conversely, if high-pressure oil is instead introduced into the port C, rotation will occur in the reverse direction of that described above.

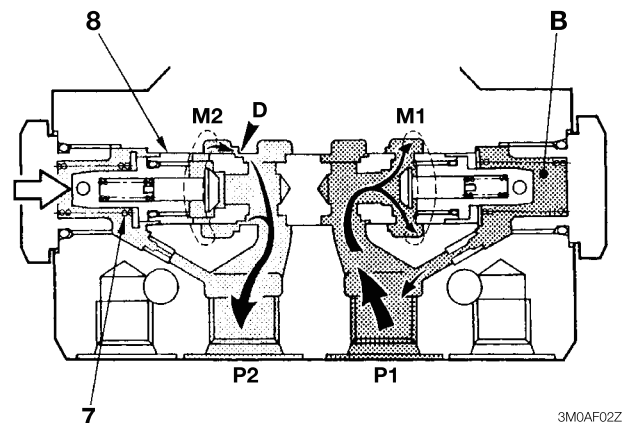


Counterbalance valve

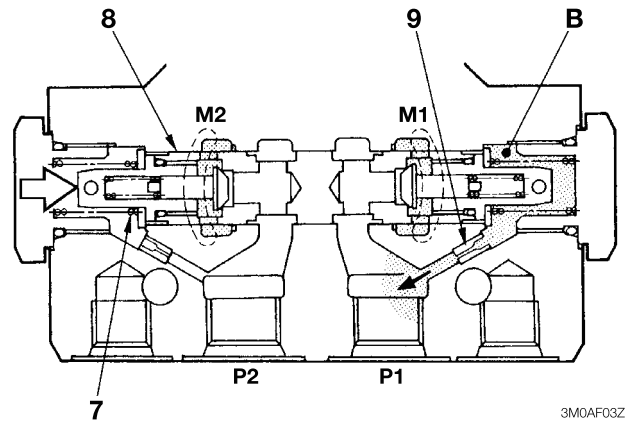
When the high-pressure oil is directed into the port P1, the oil pushes the check valve (6) upward and then flows into both the motor port M1 and the chamber B in the pilot section. The pressure oil flows into the motor from the motor port M1. By contrast, the return oil from the motor does not flow into the port P2 because the passage between the motor port M2 and the port P2 is blocked by the check valve (6), which causes the pressure in the port P1 and chamber B to rise. When the pressure in the chamber B rises to exceed that of the set value for the spring (7), the spool (8) is moved to the left to connect the motor port M2 with the port P2. This causes the motor to start running.



If the motor speed becomes too fast and the volume of oil flowing out of the motor port M2 becomes greater than that flowing into the motor port M1, the pressure in the port P1 and chamber B will drop. When the pressure in the chamber B drops to a value lower than the set pressure value of the spring (7), the spool (8) attempts to move back to the right. As a result, the flow of the return oil is narrowed down at the section D to generate a back pressure in the motor port M2 and slow down the motor speed. If the motor speed decreases, the pressure in the port P1 and the chamber B again rises, causing the spool (8) to move to the left. The back pressure generated in the motor port M2 is then eliminated. As thus described, the motor is controlled to run at a speed proportional to the volume of the oil flowing into it.



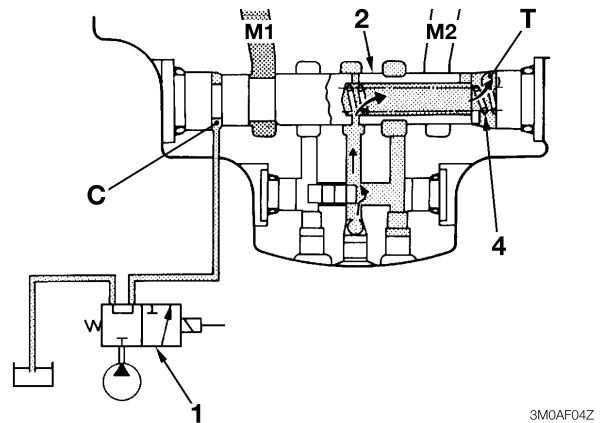
When the high-pressure oil that is directed to the port P1 is shut off, the pressure in the port P1 becomes equal to that in the port P2 and the spool (8) attempts to return to the neutral position using the force of the spring. This pushes the oil in the chamber B out to the port P1 side. At this time, the oil flow is narrowed down at the orifice (9), resulting in the spool (8) being slowly returned to the neutral position. In this way, the motor can thus be shut down without being affected by shocks as they are absorbed.



2-speed mechanism

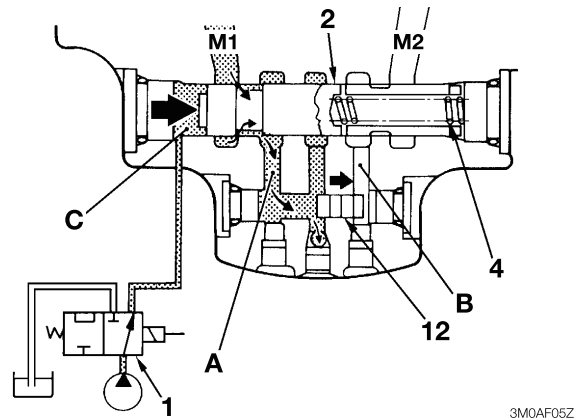
2-speed control valve

The pressure in the chamber C is low when the high-pressure oil is directed to the motor port M1 and the travel 2-speed solenoid valve (1) is at the 1st speed side position because the chamber C is connected to the tank passage via the 2-speed solenoid valve (1). This causes the spool (2) to be pushed to the left by the spring (4) and the piston chamber (3) that controls the swash plate to become connected to the tank port (T). There is no force pushing the swash plate (5) upward at this time.



When the 2-speed travel solenoid valve (1) is switched to the 2nd-speed position, the pressure oil from the 2-speed travel solenoid valve (1) flows into the chamber C, which causes the spool (2) to move to the right. Once the spool (2) is moved to the right, the motor port M1 is connected to the port A and the motor port M2 to the port B. This causes the pressure oil from the motor port M1 to move the shuttle spool (12) to the right and to flow into the piston chamber (3) of the piston that controls the swash plate. The control piston (11) then operates to push the swash plate (5) upward.

Since there is no pressure oil supplied while the engine is stopped, the spool (2) is then returned to the 1st-speed position by the spring (4).



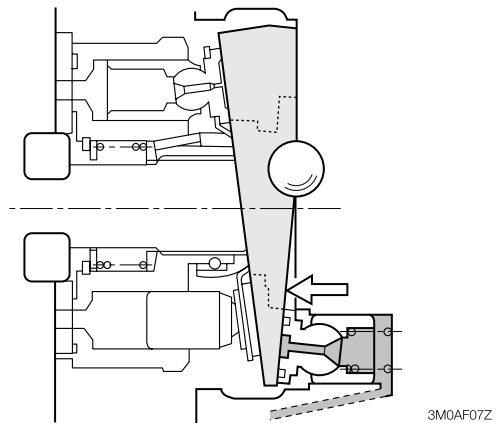
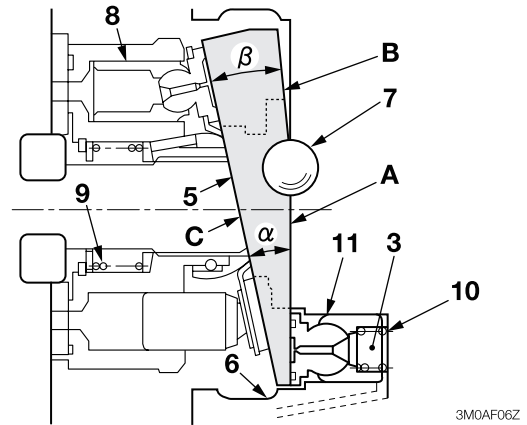
Swash plate

As shown in the figure, the swash plate (5) has three planes, A, B and C, and is mounted to the flange holder (6) such that its angle of inclination with respect to the flange holder (6) can be changed using the two steel balls (7).

The swash plate control piston chamber (3) is connected to the tank port when the 2-speed control valve is switched to the 1st-speed side. In addition, the swash plate (5) is stabilized at surface "A" by the forces of the piston assembly (8) and the springs (9) and (10), resulting in the swash plate being oriented at an angle, α , which enables the motor to run in 1st-speed (low speed).

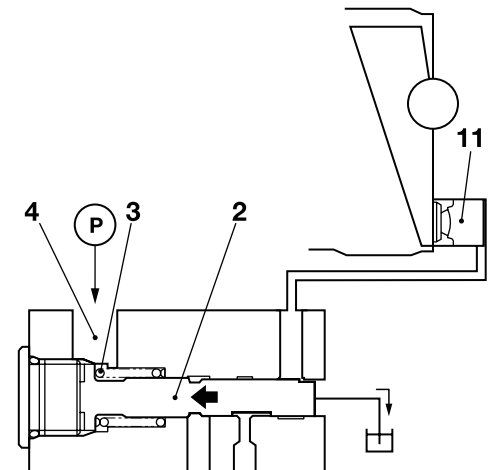
The swash plate control piston chamber (3) is connected to the motor drive pressure port when the 2-speed control valve is switched to the 2nd-speed side. In addition, the swash plate (5) is stabilized at surface "B" due to the equilibrium between the force of the springs (9), (10) and the force of the 2-speed control piston (11), resulting in the swash plate being oriented at an angle, β , which enables the motor to run in 2nd speed (high speed).

When the engine is stopped, the pilot pressure of the 2-speed control valve is cut off, which causes the swash plate (5) to be stabilized at surface A at an angle of inclination, α , resulting in the control valve being moved to the 1st-speed side by the force of the springs (9) and (10). Because of this, the motor is always set to the 1st-speed setting when the engine is started.



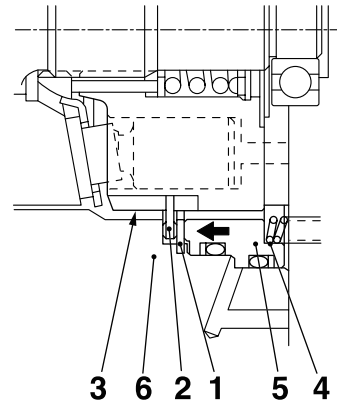
Automatic 2-speed switching

When the size of the load applied to the travel motor during travel operation in 2nd (high) speed increases, the hydraulic pressure passing through the passage (1) from the counterbalance and working on the valve (2) increases. This causes the valve (2) to move to the left. Once the valve (2) is moved to the left, the pressure oil that has been flowing through the shuttle valve (12) and the valve (2) to work on the piston (11) then flows into the tank passage. The piston (11) returns to its prior position, and the motor is switched to 1st (low) speed.



Parking brake

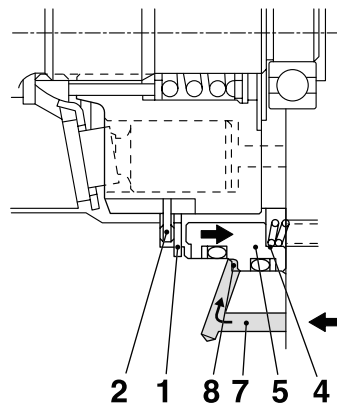
The friction disc (2) and the disc (1) are connected via the spline. The friction disc (2) and the disc (1) are pressed against the flange holder (6) by the springs (4) via the brake piston (5). The friction force between these discs generates a braking torque that works to prevent the cylinder block (3) from rotating.



B5D503

When the pressure oil is introduced into the motor, the oil flows from the parking brake release port (7) into the brake piston chamber (8). The oil pressure overpowers the spring force and moves the brake piston (5) to the right. This generates a clearance between the friction disc (2) and the disc (1) that works to release the parking brake function.

Once the motor stops, no pressure oil flows into the parking brake release port (7), and the parking brake force is operated by the spring (4).



B5D504

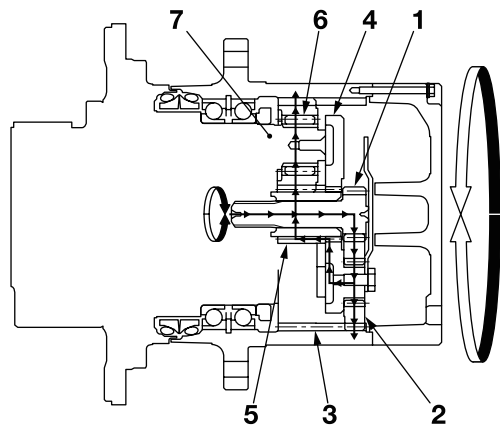
Reduction gears

The reduction gears consist of simple two-stage planetary gear assemblies connected in series. Each planetary gear assembly consists of a sun (input) gear, an internal ring gear with teeth that point inward, and planet gears mounted on a carrier. The sun gear “floats” within the planet gears so as to attain a uniform load distribution over multiple gear mesh points.

The motor drives the 1st-stage sun gear (1), which in turn drives the 1st-stage planet gears (2). Since these planet gears (2) are engaged with the ring gear (3), their rotation is transmitted to the 1st-stage carrier (4).

The 1st-stage carrier (4) is coupled directly to the 2nd-stage sun gear (5), which drives the 2nd-stage planet gears (6).

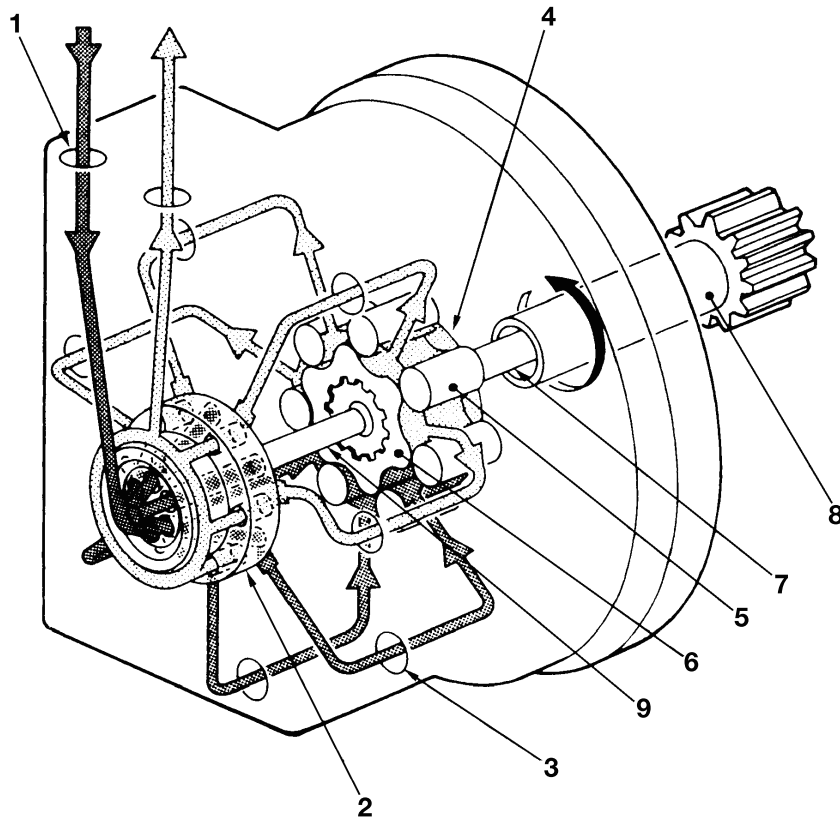
The 2nd-stage carrier (7) is a part of the motor housing and thus non-rotating, which means that the main torque is output to the ring gear (3). The output flange rotates in the direction opposite that of the input rotation.



3MAA08Z

SLEW MOTOR

Hydraulic motor 1



3N0A101Z

The high-pressure oil that flows from the main port (1) passes through the valve (2) and valve plate (3) and into the gerol (4). The gerol (4) is formed of a stator (5), which is installed in the housing and has seven rollers on its inner side, and a roller (6). The inner rotor has six external teeth. These teeth divide the gerol into seven internal chambers. The rotor (6) is designed to orbit around the inside of the stator (5).

Meanwhile, the valve (2) has twelve oil holes, six of which are provided for high-pressure oil to flow into and another six for the return oil to flow into. The valve plate (3) also has seven oil holes, which are connected to the seven chambers in the gerol (4). The circuit to the gerol (4) is then opened when the seven oil holes in the valve plate (3) are connected to some of the twelve oil holes in the valve.

As thus described, the planetary motion of the rotor (6) in the gerol (4) is initiated by the hydraulic pressure. Of the planetary motion present in the system, only the rotating motion of the rotor itself is extracted from the drive shaft (7) and transmitted to the shaft (8).

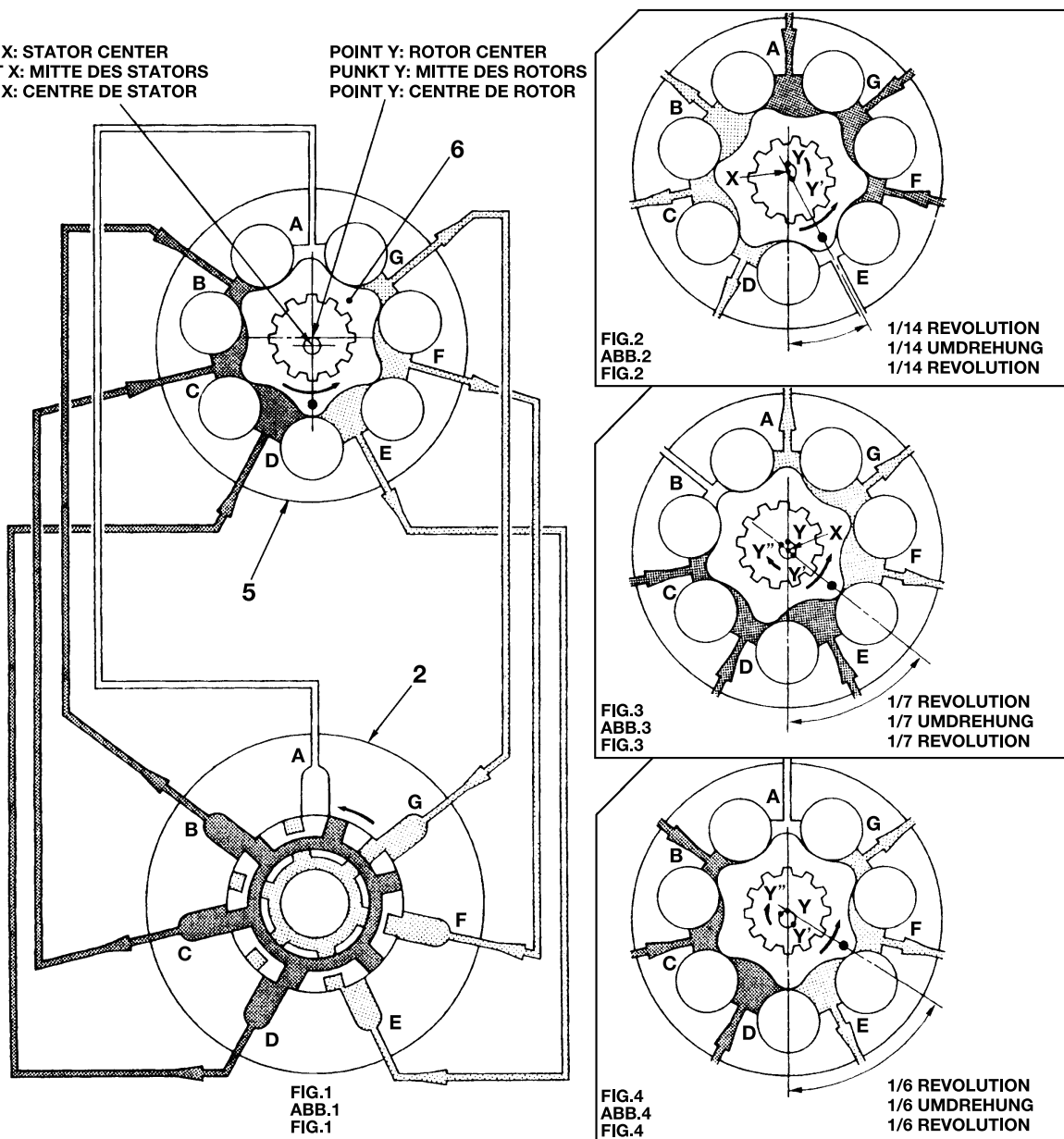
The rotating motion of the rotor (6) is transmitted to the valve through the valve drive shaft (9).

In this way, the oil holes in the valve (2) connected to the oil holes in the valve plate (3) are shifted in turns whenever the valve (2) rotates. This allows the high-pressure oil that entered the gerol (4) to flow into the different chambers in turns. As a result, the motor is able to continuously rotate.

Hydraulic motor 2

POINT X: STATOR CENTER
PUNKT X: MITTE DES STATORS
POINT X: CENTRE DE STATOR

POINT Y: ROTOR CENTER
PUNKT Y: MITTE DES ROTORS
POINT Y: CENTRE DE ROTOR



3N0A102Z

Figure 1 shows that the rotor (6) rotates in the direction of the arrow while making contact with the inside of the stator (5) when the high-pressure oil is directed into the chambers B, C and D. This in turn causes the valve (2) to rotate, which causes the chambers into which the high-pressure oil is directed to be successively shifted in the direction opposite the direction of the arrow. Figure 2 shows that the rotor (6) has turned 1/14 of a revolution, resulting in the chambers into which the high-pressure is to be directed to be shifted to the chambers A, G and F. At this time, the center point Y of the rotor (6) is shifted to the point Y' around the point X. This point Y' is further shifted to Y'' as shown in Figure 3. In other words, the center of the rotor (6) rotates 6/7 of a revolution around the point X, changing its position from Y to Y' and then to Y''. Figure 4 shows that the center of the rotor is returned to point Y from point Y'' to complete one cycle of the shifting of the chambers into which the high-pressure oil is to be directed.

At this time, the "•" mark on the rotor (6) rotates 1/6 of a revolution in the direction opposite that of the motion of point Y. As a result, the output shaft is made to rotate one complete rotation by the high-pressure oil, which is directed into 42 chambers, which is 7 chambers $\times$ 6 cycles = 42 chambers.

Brake valve

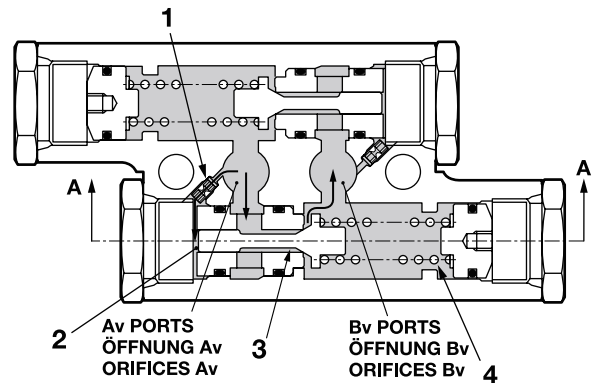
This valve is equipped with a shockless function.

When the high-pressure oil enters the port Av, it flows through the orifice (1) and into the damper chamber (2) where it attempts to move the plunger (3) to the right. At this time, the spring (4) remains in its set position.

When the pressure in the pressure oil increases to where it overpowers the spring force of the spring (4), the plunger (3) is moved to the right. This causes the pressure in the pressure oil to be released into the Bv port through a relief operation.

At the same time, the pressure oil flows through the orifice (6) and enters the piston chamber (B), where it works in the direction of spring compression to compress the spring (4). At this time, the spring force increases in proportion to the distance traveled by the piston (5), which causes the relief pressure to increase.

The spring (4) is compressed the most when the piston (5) is moved left to the stroke end. At this time, the pressure becomes the set relief pressure.

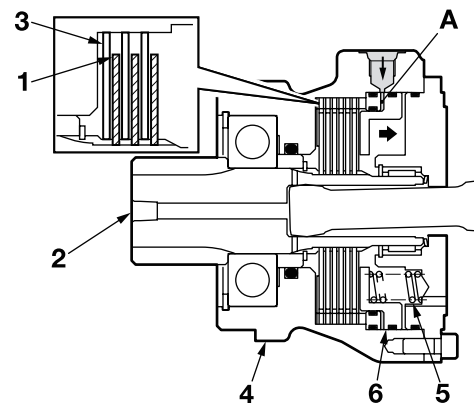


3N0A103Z

Parking brake

The friction discs (1) are each connected to the pinion gear (2) via the spline, and the center discs (3) are also each connected to the bearing housing (4) via the spline. The friction discs (1) and the center discs (3) are each pressed against the bearing housing (4) by the springs (5) via the brake piston (6). The friction force between these discs generates a braking torque that prevents the pinion gear (3) from rotating.

When the oil is directed from the parking brake release port to the piston chamber (A), the oil pressure overpowers the spring force and acts to move the brake piston (6). This creates a clearance between the friction discs (1) and the center discs (3), which works to release the parking brake function.

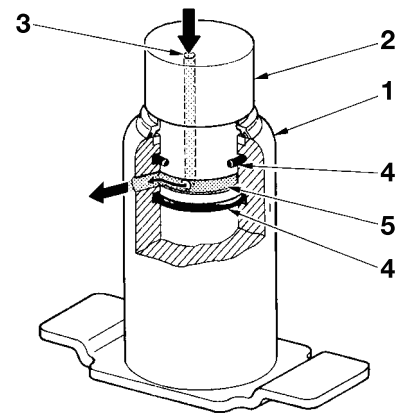


3N0A105Z

SWIVEL JOINT

The swivel joint is located at the slew center of the machine and has the role of continuing to connect the oil circuit regardless of the slew angle of the upper frame.

A number of ports (3) equal to the number of fluid circuits is provided on a hub (1) and shaft (2) that are mutually rotatable. Grooves used as oil channels are processed into the inner periphery of the hub (1) and the outer periphery of the shaft (2). A seal (4) is applied to the top and bottom of the peripheral grooves. The oil flowing from the port (3) continues to flow through the oil pressure channel (5) between the hub (1) and shaft (2) to enable continued connection of the circuit located between the slew assemblies without being blocked due to rotation.

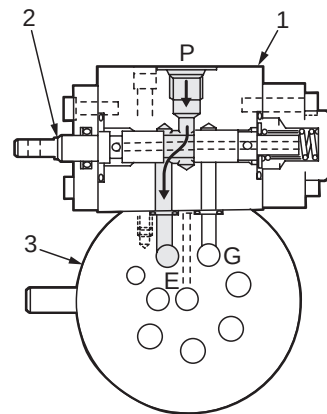


300AF01Z

Selector

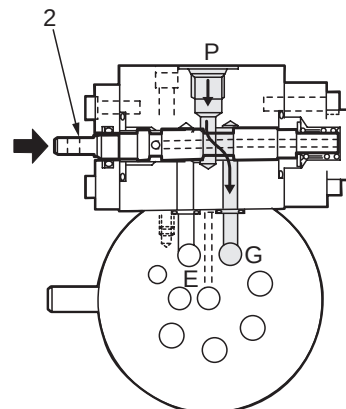
The swivel joint is equipped with a selector valve that can be used to switch between separate circuits. The selector valve switches between the blade cylinder and the spanner cylinder.

When the spool (2) of the selector (1) is set to the left, port P of the selector (1) is connected to port E of the swivel joint (3). This allows the oil from the control valve to flow into the dozer blade cylinder.



C4D703

When the spool (2) of the selector (1) is moved to the right, port P of the selector (1) is connected to port G of the swivel joint (3). This allows the oil from the control valve to flow into the spanner cylinder.



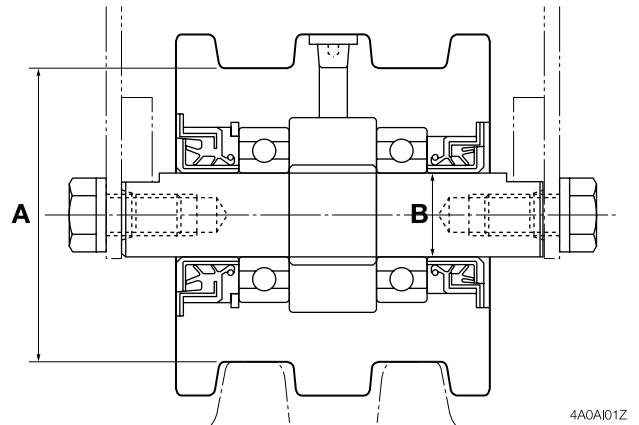
C4D704

DISASSEMBLY AND ASSEMBLY 4

SERVICE STANDARDS

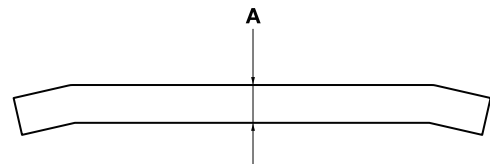
Track roller

Code	Criteria, mm (in.)	
	Standard dimension	Allowable value
A	75 (3.0)	69 (2.7)
B	25 (1.0)	—



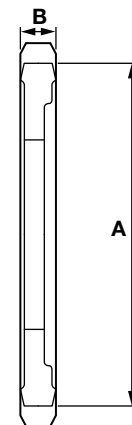
Shoe slider

Code	Criteria, mm (in.)	
	Standard dimension	Allowable value
A	9 (0.4)	4.5 (0.2)



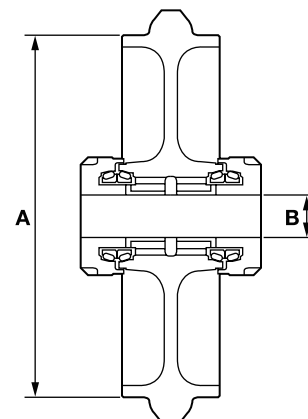
Sprocket

Code	Criteria, mm (in.)	
	Standard dimension	Allowable value
A	251.6 (9.9)	241.6 (9.5)
B	24 (0.9)	—

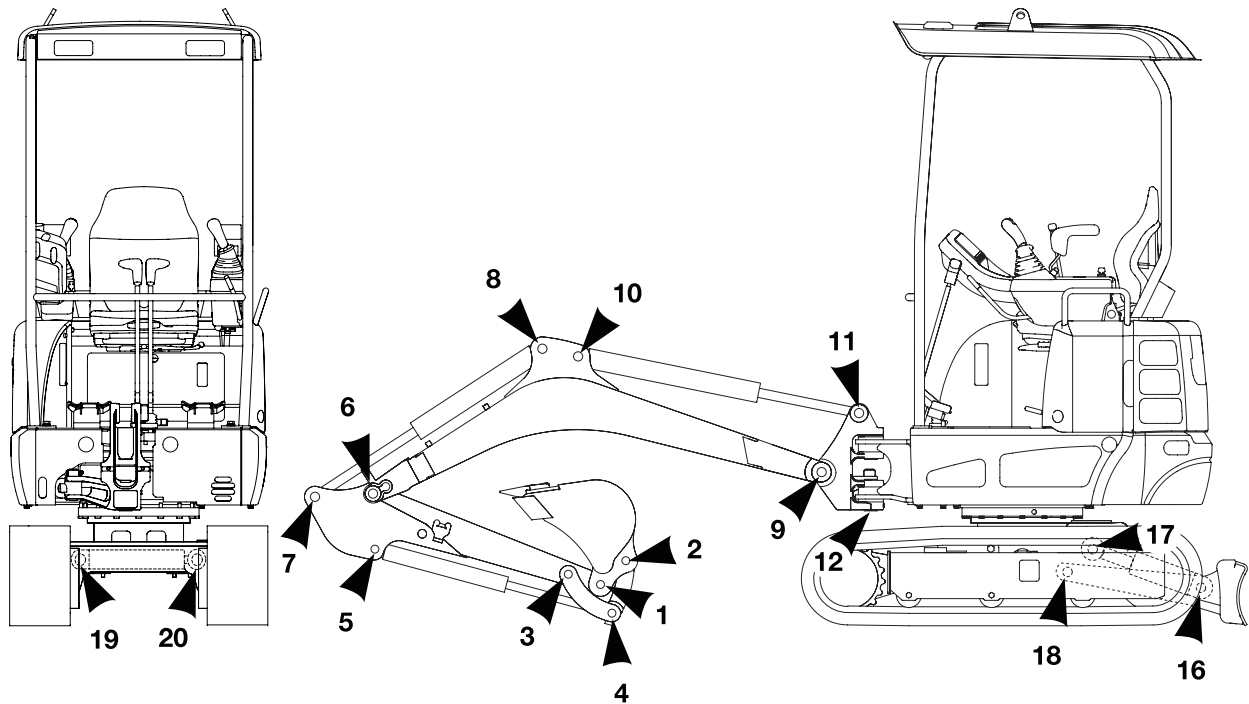
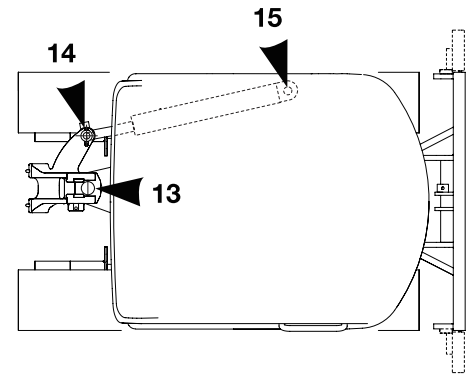


Idler

Code	Criteria, mm (in.)	
	Standard dimension	Allowable value
A	232 (9.1)	226 (8.9)
B	30 (1.2)	—



Clearance for pin and bushing



4A0AX01

Unit: mm (in.)

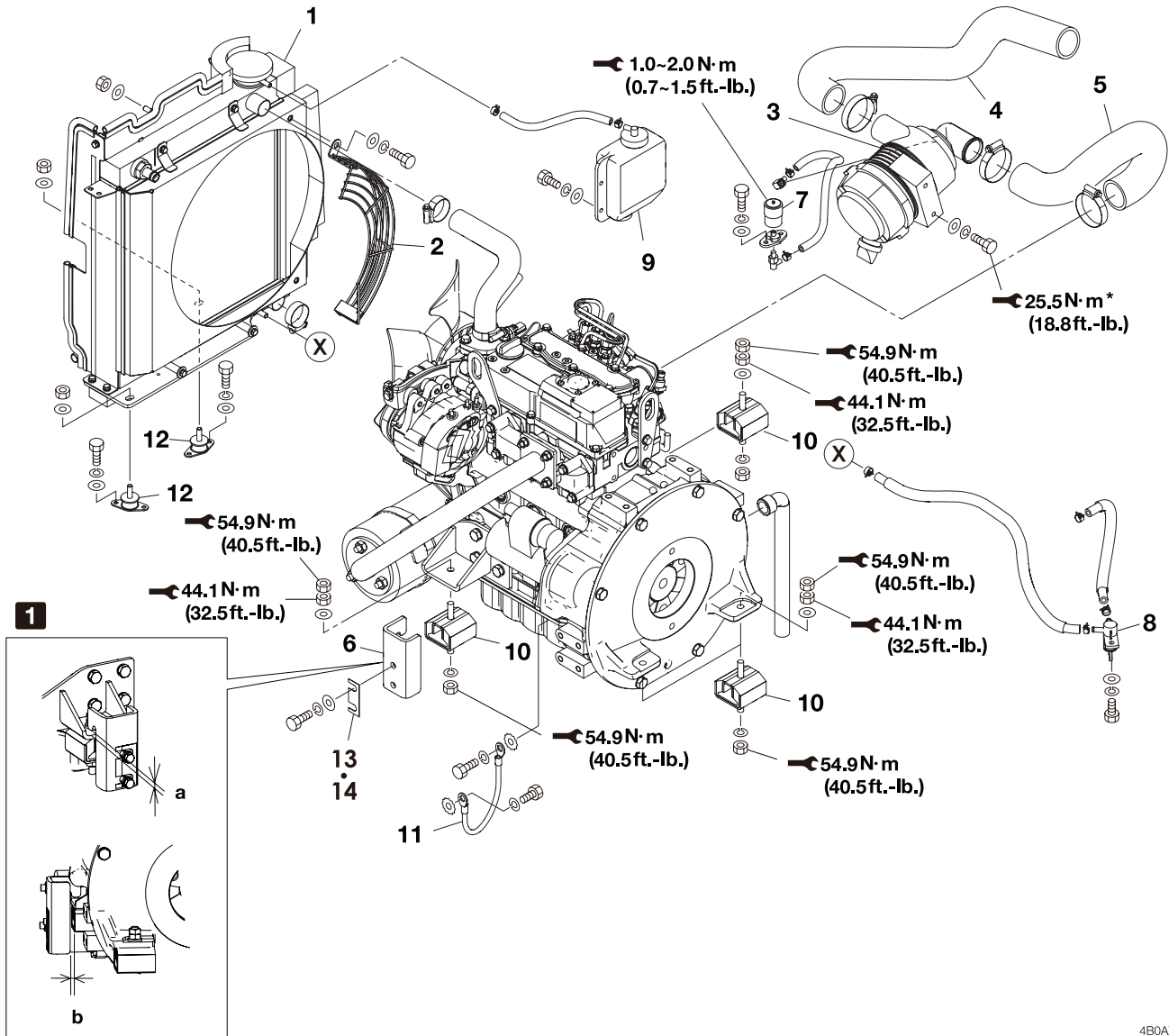
Code	Item	Standard dimension
1	Bucket and arm	30 (1.18)
2	Bucket and link	30 (1.18)
3	Arm and link	30 (1.18)
4	Bucket cylinder and link	30 (1.18)
5	Bucket cylinder and arm	30 (1.18)
6	Arm and boom	35 (1.38)
7	Arm cylinder and arm	35 (1.38)
8	Arm cylinder and boom	35 (1.38)
9	Boom and swing bracket	35 (1.38)
10	Boom cylinder and boom	35 (1.38)
11	Boom cylinder and swing bracket	35 (1.38)
12	Swing bracket and turntable	50 (1.97)
13	Swing bracket and turntable	50 (1.97)
14	Swing cylinder and swing bracket	30 (1.18)
15	Swing cylinder and turntable	30 (1.18)
16	Blade cylinder and blade	30 (1.18)
17	Blade cylinder and lower frame	30 (1.18)
18	Blade and lower frame	30 (1.18)
19	Spanner cylinder and frame R	30 (1.18)
20	Spanner cylinder and frame L	30 (1.18)

Replacing the pin and bushing

Replace the pin or the bushing if there is looseness of 1 mm (0.04 in.) or more.

DRIVE SYSTEM

Engine



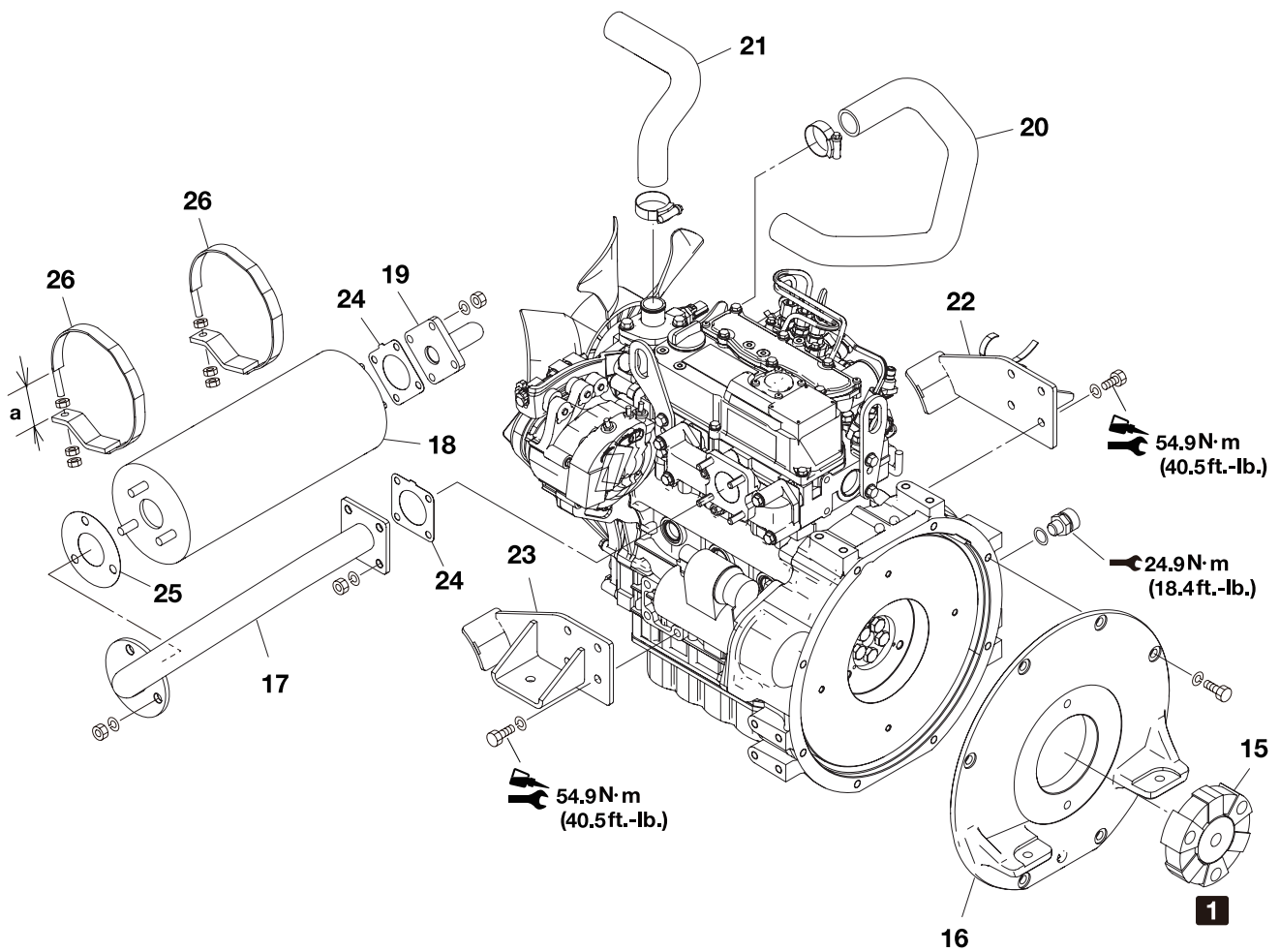
4B0AX01

* 25.4 N·m (18.8 ft.-lb.) or below

1 Use a shim to adjust the clearance between the engine hood and stopper.

- Clearance "a": 5 mm (0.2 in.)
- Clearance "b": 6 mm (0.24 in.)

- | | |
|-------------------------|------------------------|
| 1. Radiator assembly | 8. Drain valve |
| 2. Fan guard | 9. Tank |
| 3. Air cleaner assembly | 10. Cushion rubber |
| 4. Hose | 11. Earth ground cable |
| 5. Hose | 12. Cushion rubber |
| 6. Stopper | 13. Shim |
| 7. Indicator | 14. Shim |



4B0AX02

ThreeBond #1324

1 Use the included bolts which have been coated to prevent them from becoming loose.

54.9 N·m (40.5 ft.-lb.)

Press-fit the three included spring pins into the assembly to insert them.

2 Clearance "a": 19 mm (0.75 in.)

15. Coupling

16. Housing

17. Pipe

18. Silencer

19. Pipe

20. Hose

21. Hose

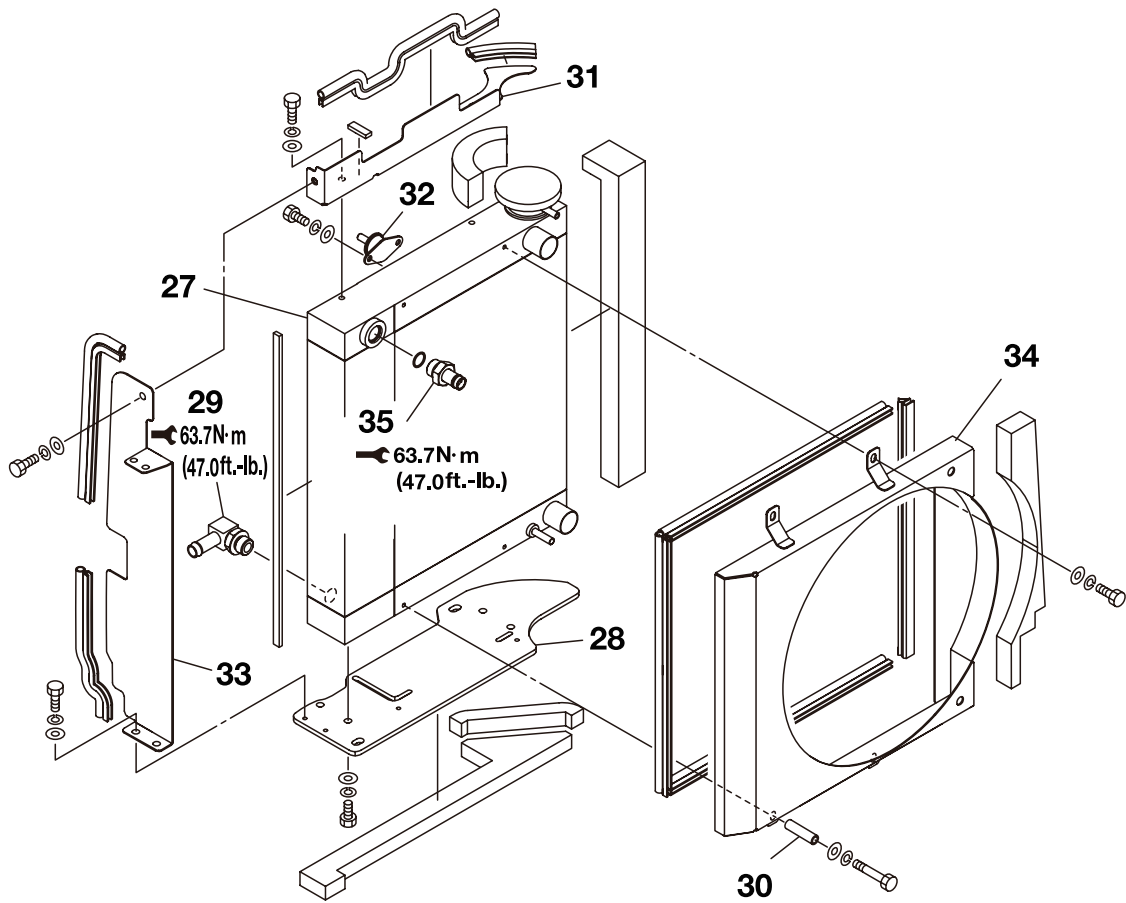
22. Engine hood FR

23. Engine hood FL

24. Gasket

25. Gasket

26. Band



4B0AX03

- | | |
|-------------|---------------------|
| 27. RAD/HOC | 32. Cushion rubber |
| 28. Plate | 33. Plate |
| 29. Elbow | 34. Shroud assembly |
| 30. Pipe | 35. Nipple |
| 31. Plate | |

Removing the engine

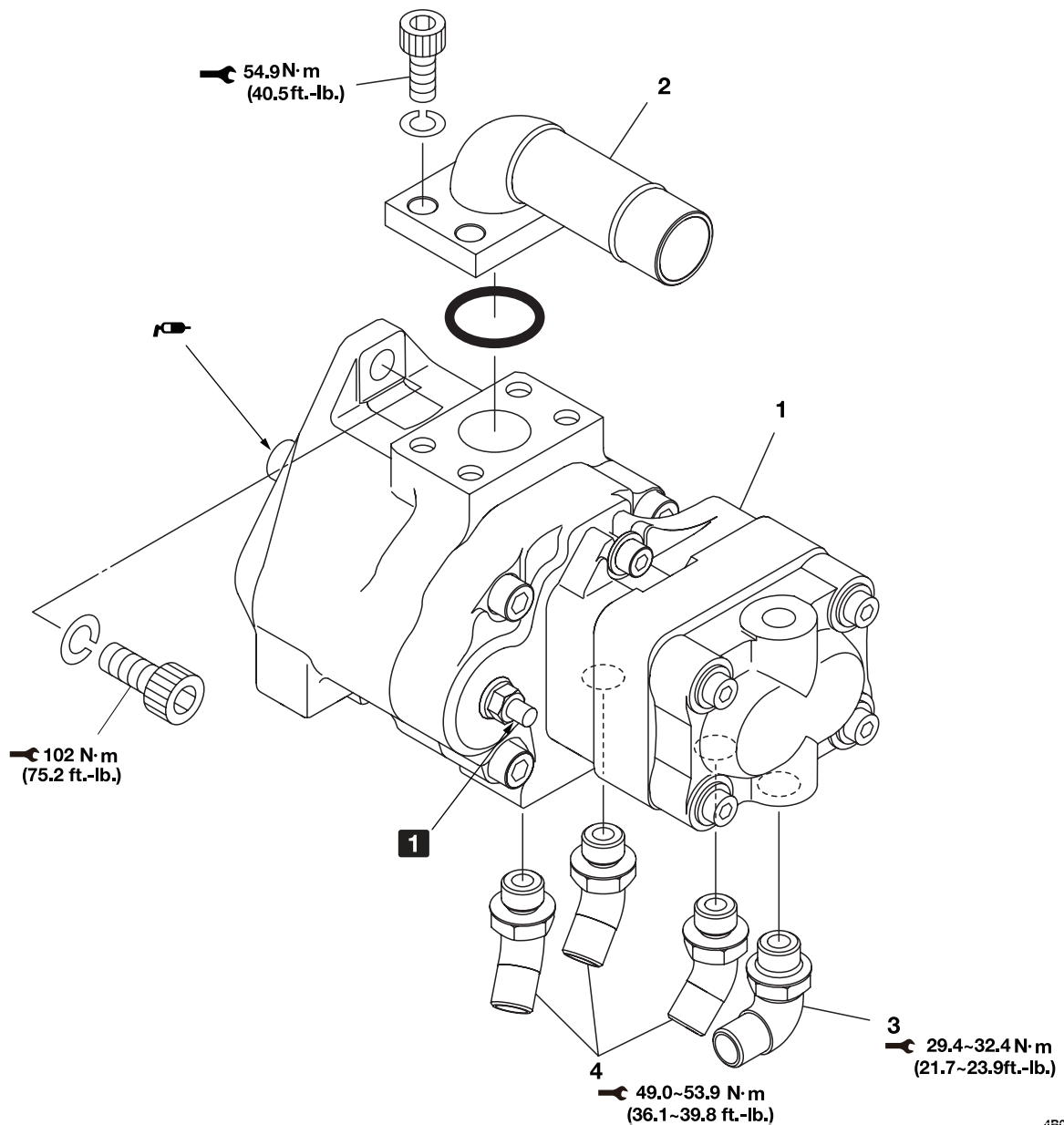
1. Remove the battery ground cable from the battery terminal.
2. Remove the covers.
 "Removing the covers"
3. Disconnect the hoses, and take out the air cleaner assembly (3).
4. Loosen the radiator cap, and bleed out the engine coolant from the drain valve (8).
 - Engine coolant volume: 3.9 L (4.1 USLqt)
5. Disconnect the hoses (21) and (22) from the radiator assembly (1).
6. Disconnect the hose from the drain valve (8).
7. Disconnect the hose from the sub-tank (9), and remove the sub-tank.
8. Drain the hydraulic oil from the tank.
 "Removing the hydraulic tank"
9. Disconnect the hydraulic hoses (20) and (21) from the radiator assembly (1).
10. Remove the fan guard (2).
11. Take out the fixing nuts holding the cushion rubber in place, and remove the radiator assembly (1).
 - Slowly hoist up the radiator assembly while slowly pulling it forward so that the shroud does not strike the cooling fan. : 13 kg (28 lbs)
12. Remove the hydraulic pump.
 "Removing the hydraulic pump"
13. Disconnect the fuel hoses on the engine side.
 "Removing the hydraulic tank"
14. Disconnect the battery cable and the engine electrical wiring on the engine side.
 - Attach an identification label to each wiring. "2. Wire harness diagram"
 "Removing the battery"
15. Disconnect the engine ground cable (11).
16. Take out the nuts, and suspend the engine.
 - Use a shim to adjust the clearance between the engine hood and the stopper (6). Upper side of the nut: 54.9 N·m (40.5 ft-lb)
 Lower side of the nut: 44.1 N·m (32.5 ft-lb)
 Refer to the construction diagram
 : 103 kg (227 lb)

Installing the engine

For installation of the engine, follow the same procedures as for removal but in the reverse order.

The radiator must be mounted at a right angle to the frame and parallel to the cooling fan.

Hydraulic pump



4B0AV04

- Apply molybdenum disulfide grease on the spline.
- Applying a large amount of grease on the spline hole in the coupling assembly may cause the grease to drip down onto rubber parts and cause the rubber to deteriorate.

1 Not adjustable. Do not loosen the lock nut.

- 1. Hydraulic pump
- 2. Pipe
- 3. Elbow
- 4. Elbow

Removing the hydraulic pump

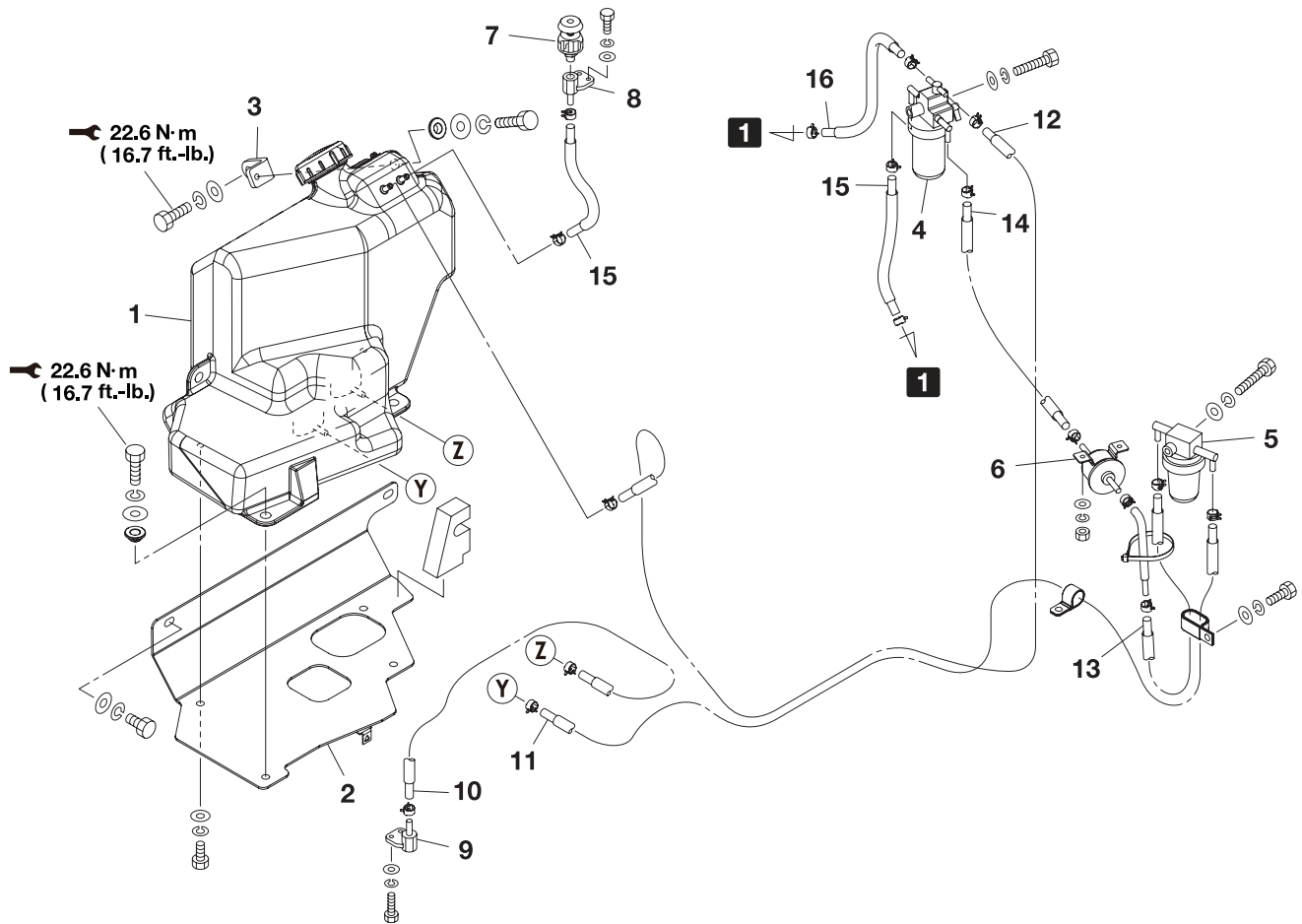
1. Remove the battery ground cable from the battery terminal.
2. Remove the covers.
 "Removing the covers"
3. Drain the hydraulic oil from the tank.
 "Removing the hydraulic tank"
4. Disconnect the suction hose from the hydraulic pump.
5. Disconnect the discharge hose from the hydraulic pump.
6. Take out the bolts, and remove the hydraulic pump assembly.
 Apply molybdenum disulfide grease on the spline.
 Bolt: 102 N·m (75.2 ft.-lb)
 Pump: 13 kg (29 lb.)

Installing the hydraulic pump

For installation, follow the same procedures as for removal but in the reverse order.

Cautions on starting the hydraulic pump

- a. Start the engine, let it run at a low idling speed for ten minutes, and then extend and retract each cylinder 4 or 5 times, without letting them reach the stroke end.
- b. Run the engine at high speed, and then extend and retract each cylinder 4 or 5 times, without letting them reach the stroke end.
- c. Return the engine speed to low idle, and then extend and retract each cylinder 4 or 5 times, without letting them reach the stroke end.

Fuel tank

4B0AX05

1 To engine

- | | |
|-----------------|---------------|
| 1. Fuel tank | 9. Drain plug |
| 2. Plate | 10. Fuel hose |
| 3. Plate | 11. Fuel hose |
| 4. Fuel sender | 12. Fuel hose |
| 5. Sedimenter | 13. Fuel hose |
| 6. Feed pump | 14. Fuel hose |
| 7. Air breather | 15. Fuel hose |
| 8. Plug | 16. Fuel hose |

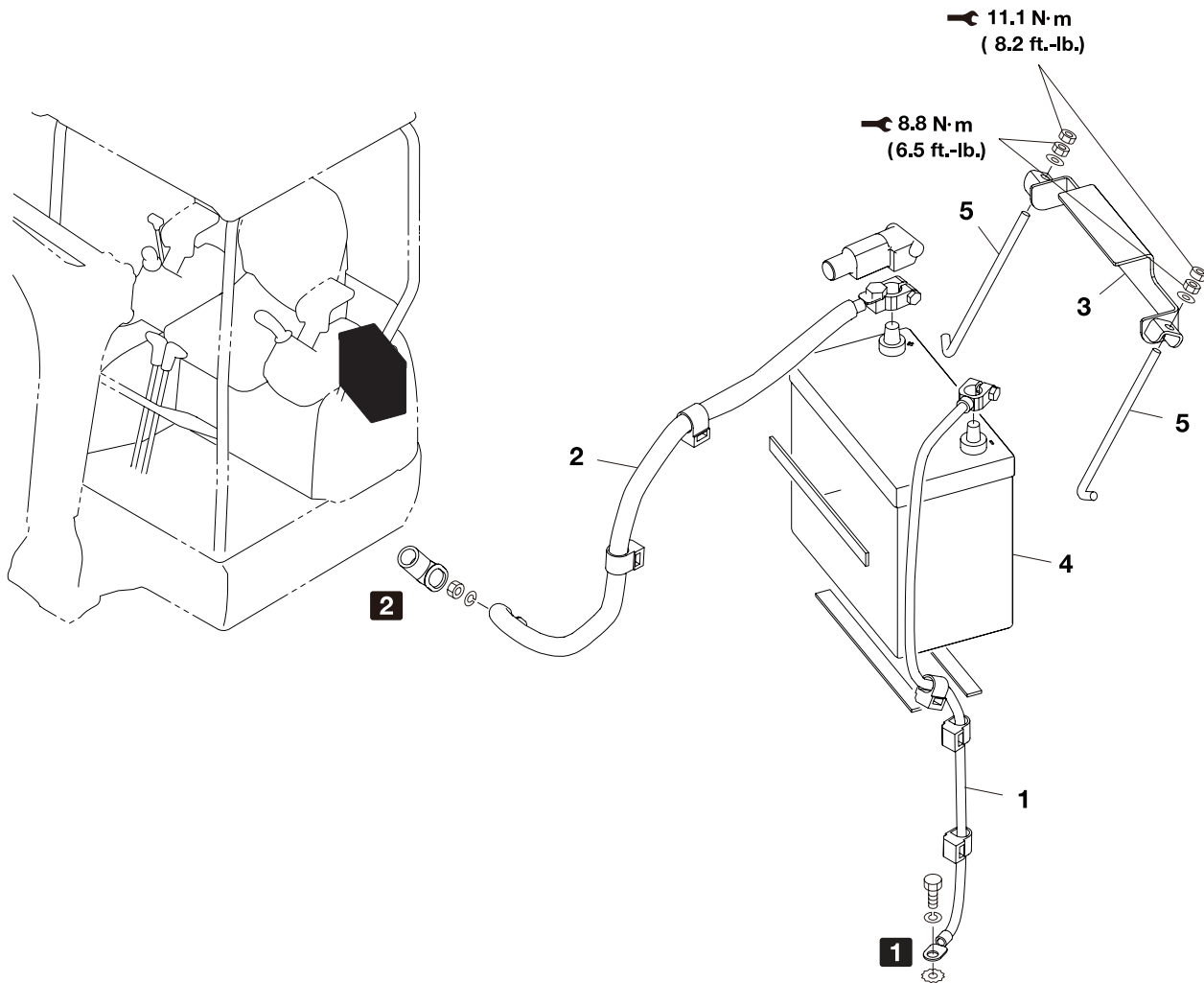
Removing the fuel tank

1. Remove the canopy.
2. Remove the covers from the perimeter around the tank.
3. Loosen the drain plug (9), and let the fuel drain out.
 - Fuel tank capacity: 22 L (5.8 US·gal)
4. Disconnect the fuel hoses from the fuel tank, sedimenter, and fuel pump.
5. Take out the bolts holding the fuel tank (1) in place, and remove the fuel tank (1).
 Bolt: 22.6 N·m (16.7 ft-lb)

Installing the fuel tank

For installation, follow the same procedures as for removal but in the reverse order.

Battery



4B0AX06

- 1** Body earth point
- 2** Connection to the starter

- 1. Earth ground cable
- 2. Battery cable
- 3. Battery clamp
- 4. Battery
- 5. Hook bolt

Removing the battery



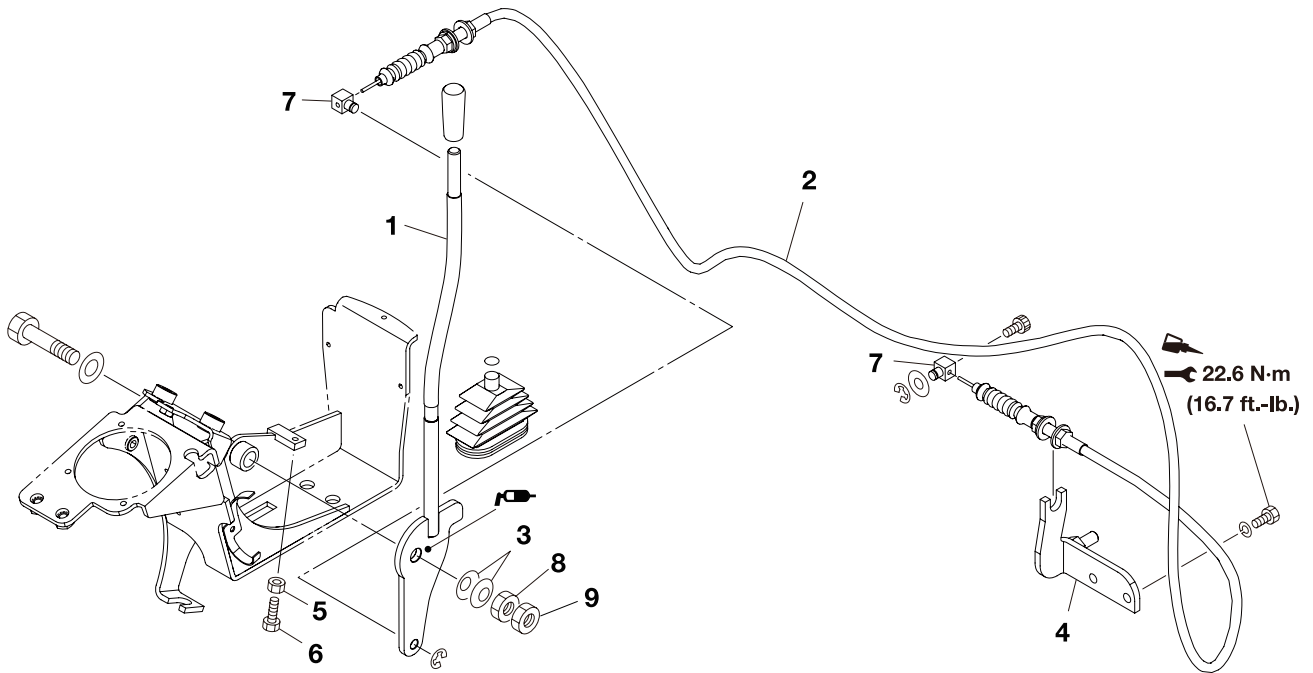
WARNING

- Wear protective glasses and gloves when working with batteries.
- Batteries generate flammable hydrogen gas which may explode. Keep away from flames and sparks.
- Be sure to stop the engine by turning off the starter switch before inspecting or handling the battery.
- Be careful not to let metal tools (or any metal objects) such as a hammer or wrench come into contact with the battery terminals.
- When disconnecting the battery wiring, always disconnect it from the earth side (-). When connecting, connect the earth side last.
- Loose battery terminals may cause sparks. Be sure to fasten terminals tightly.

1. Disconnect the battery ground cable (1) from the battery terminal.
2. Remove the battery cables (2).
3. Remove the nuts.
 - 🔧 Upper nut: 11.1 N·m (8.2 ft-lb.)
 - 🔧 Lower nut: 8.8 N·m (6.5 ft-lb.)
 - During assembly, tighten down the top nut while keeping the bottom nut fixed in place so that it does not turn.
4. Remove the battery (4).

Installing the battery

For installation, follow the same procedures as for removal but in the reverse order.

Throttle lever

4B0AX10

Apply molybdenum disulfide grease to both surfaces of the lever.

- Line up the conical washers (3) so that the indented sides are all on the same side.

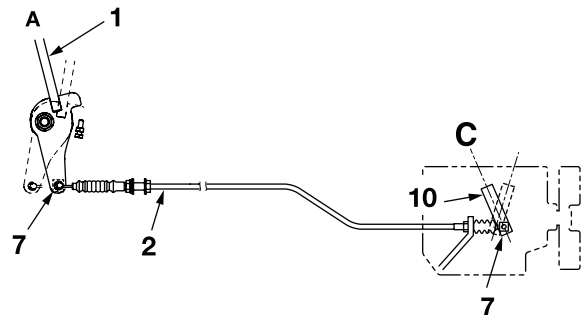
ThreeBond #1324

- | | |
|-------------------|------------------|
| 1. Lever | 6. Stopper |
| 2. Wire | 7. Wire lock pin |
| 3. Conical washer | 8. Lock nut |
| 4. Bracket | 9. Nut |
| 5. Lock nut | |

Adjusting the throttle lever

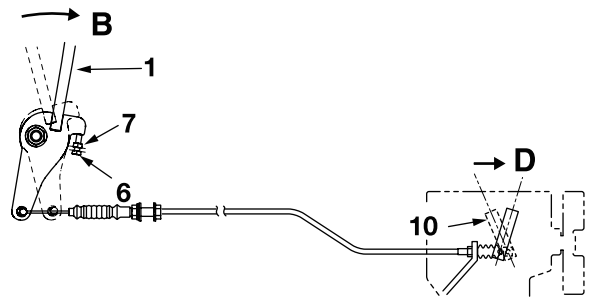
Engine speed

1. Secure the wire (2) to the throttle lever (1) using the wire lock pin (7).
2. Push the throttle lever (1) down to the low-idling side A, and position the governor (10) to the idling position C.
 - Keep pushing the throttle lever (1) over until it makes contact with the notch in the bracket.
3. Fasten the wire (2) in place with the wire lock pin (7).



4B0AX07

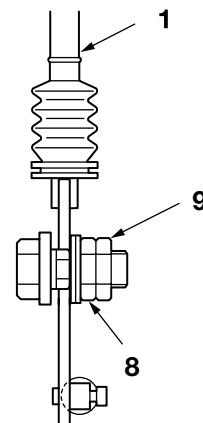
4. Pull the throttle lever (1) out to the full-throttle side B, and position the governor (10) to the full-throttle position D.
 - Adjust the stopper (6) so that the throttle lever (1) makes contact with the stopper (6), and secure it in place using the lock nut (7).



4B0AX08

Control force

1. Loosen the lock nut (9), and turn the nut (8) to adjust the control force.
Control force: 24.5 N (5.5 lbf)
 "2. Service data, Performance criteria, Lever operating force"
2. After completing the adjustment, tighten the lock nut (9) by fixing the nut (8) in place so that it does not turn.
3. Operate the throttle lever (1) again, and check to make sure that the control force is stable.



4B0AX09

TRAVEL SYSTEM

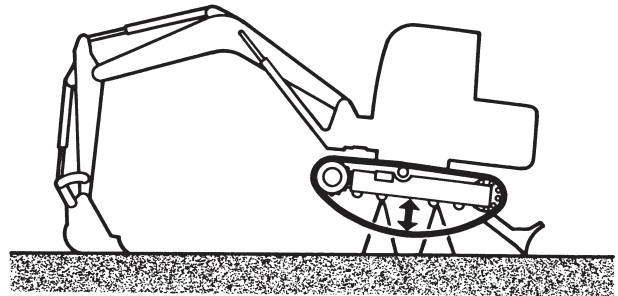
Removing the crawler

WARNING

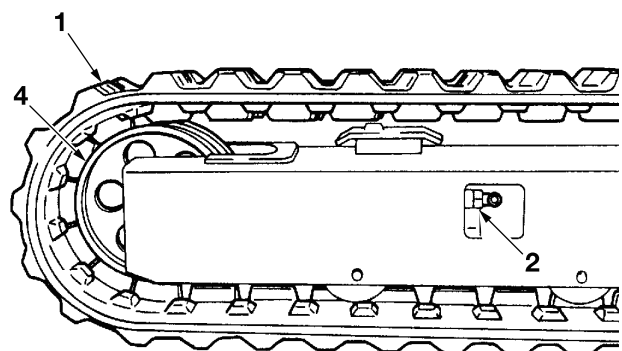
When working under the machine while it is raised up, be sure to use a stand to support the machine.

Important: When replacing crawlers, replace both the right and left ones at the same time.

1. Lift up the machine.
 - Use the blade and hoe attachment to raise the machine.
2. Loosen the crawler tension for the crawler (1).
 - When loosening the check valve (2), do it slowly. Stop loosening the check valve once grease starts to come out. If no grease comes out, slightly move the machine forward and backward.
 -  Check valve: 177 N·m (130.5 ft.-lb)
3. Insert the iron pipe (3) into the crawler and then rotate the sprocket in the reverse direction.
4. Stop rotating the sprocket once the pipe reaches the side of the idler.
5. Slide the crawler over to the side and remove it.
 -  Rubber crawler (One side): 55 kg (120 lb)



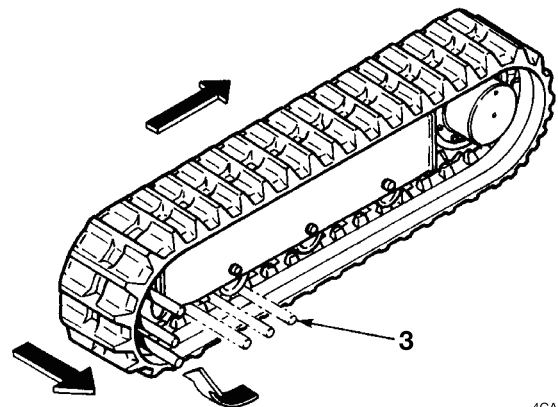
4C0AQ01Z



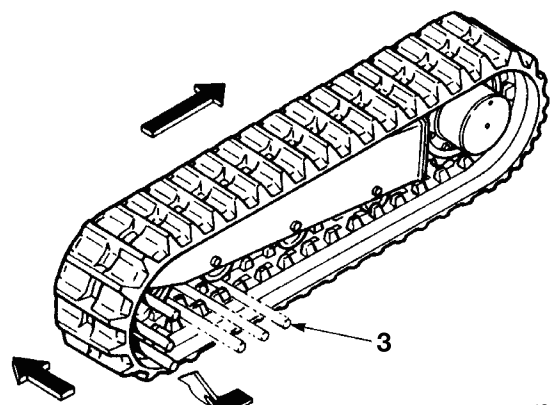
4C0AX01

Installing the crawler

1. Lift up the machine, and insert the crawler into the frame.
 - Set the crawler so that it is engaged with the sprocket.
2. Insert the iron pipe (3) into the crawler and then rotate the sprocket in the reverse direction.
3. Stop rotating the sprocket once the pipe (3) reaches the side of the sprocket.
4. Slide the crawler into a position where it can be properly fitted to engage with the idler.
5. Position the crawler so as to ensure that it is securely engaged with the sprocket and idler and then adjust the crawler tension.
 -  "2. Service data, Performance criteria"



4CAA02Z



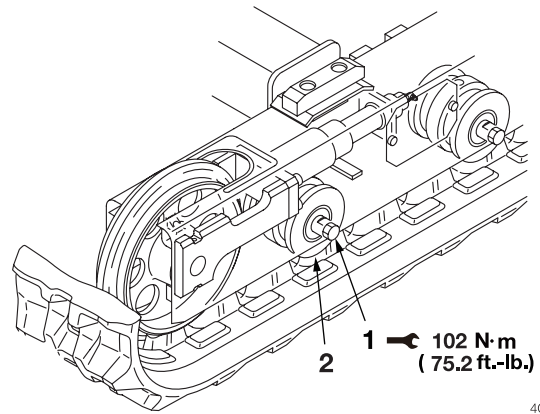
4CAA03Z

Removing the track roller

1. Loosen the crawler tension.
2. Loosen the roller bolt (1) slightly (about one turn).
3. Lift up the machine, take out the bolt (1), and remove the roller (2).

Installing the track roller

1. Temporarily secure the roller (2) in place by tightening down the bolt (1).
2. Tighten the bolt (1) to the stipulated torque.
 -  Bolt: ThreeBond #1324
 -  Bolt: 102 N·m (75.2 ft.-lb.)
3. Lift up the machine, and adjust the crawler tension.



4C0AX02

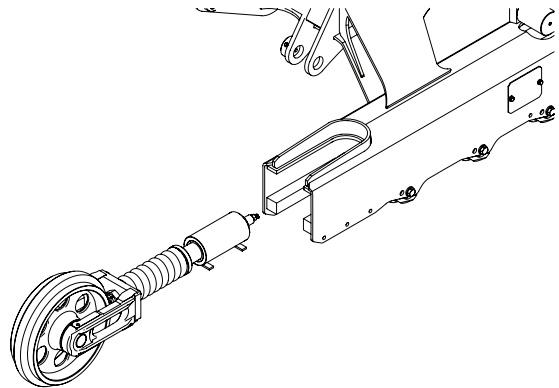
Removing the idler and track adjuster

1. Remove the crawler.
 -  "Removing the crawler"
2. Pull out the idler and the track adjuster.
 -  Idler and track adjuster: 21 kg (46.3 lb)

Installing the idler and track adjuster

To install, follow the same procedures as for removal but in the reverse order.

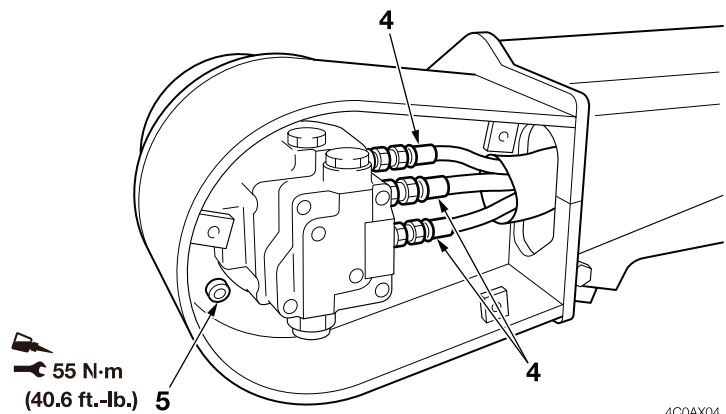
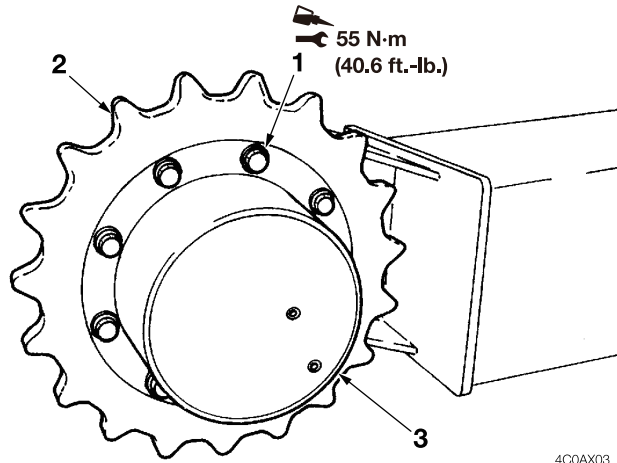
-  Apply on the sliding surfaces of the track adjuster piston and cylinder.



4C0AV05

Removing the travel motor

1. Remove the crawler.
☞ "Removing the crawler"
2. Take out the bolts (1), and remove the sprocket (2).
☞ Bolt: ThreeBond #1324
☞ Bolt: 55 N·m (40.6 ft.-lb.)
3. Remove the cover, and disconnect the hydraulic hoses (4).
 - Make sure to attach identification labels to each of the hoses and the joints before disconnecting the hoses.
4. Hoist up the travel motor (3) temporarily, and remove the bolts (5).
☞ Bolt: ThreeBond #1324
☞ Bolt: 55 N·m (40.6 ft.-lb.)
5. Raise the travel motor (3), and remove it.
☞ Travel motor: 18 kg (40 lb)



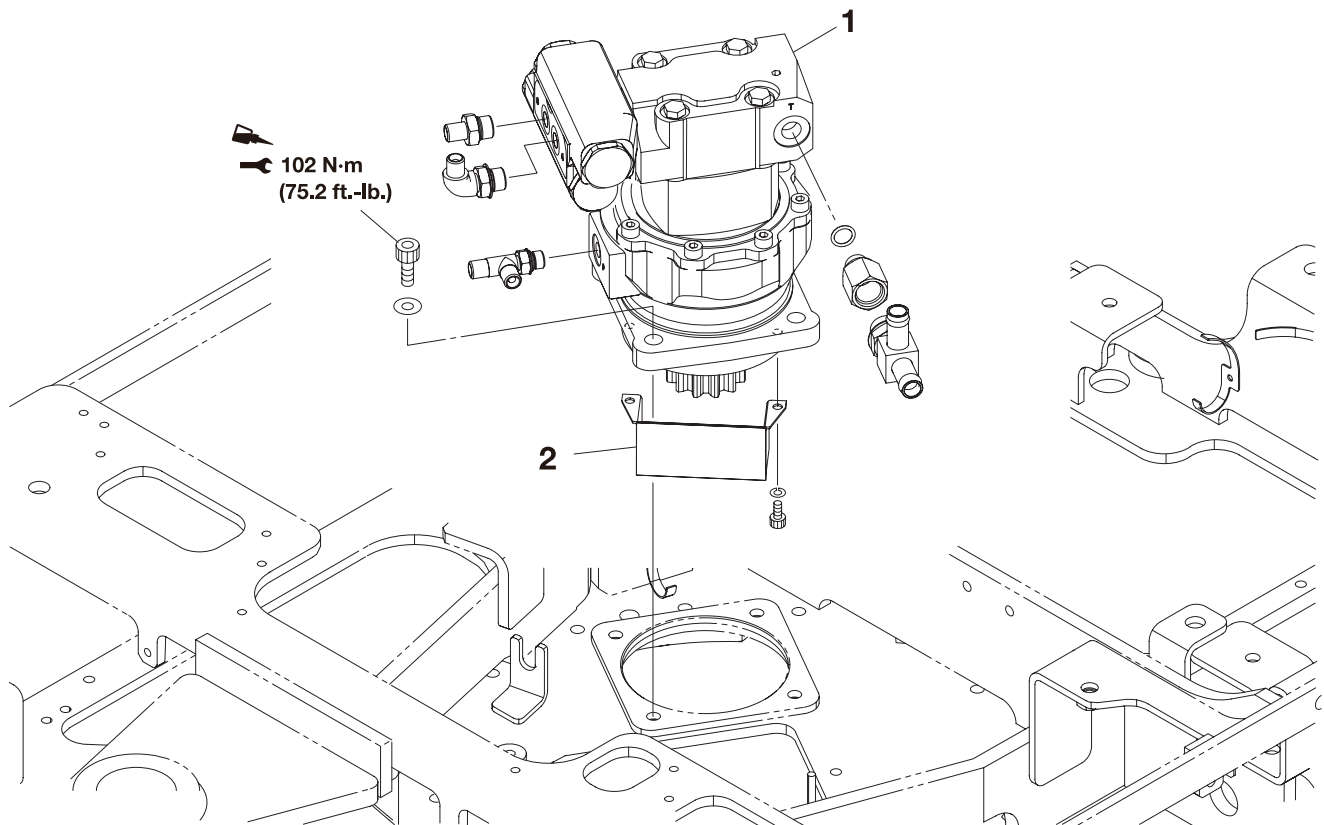
Installing the travel motor

To install, follow the same procedures as for removal but in the reverse order.

SLEW EQUIPMENT

Slew motor

Construction



4D0AX01

ThreeBond #1324

- 1. Slew motor
- 2. Cover

Removing the slew motor

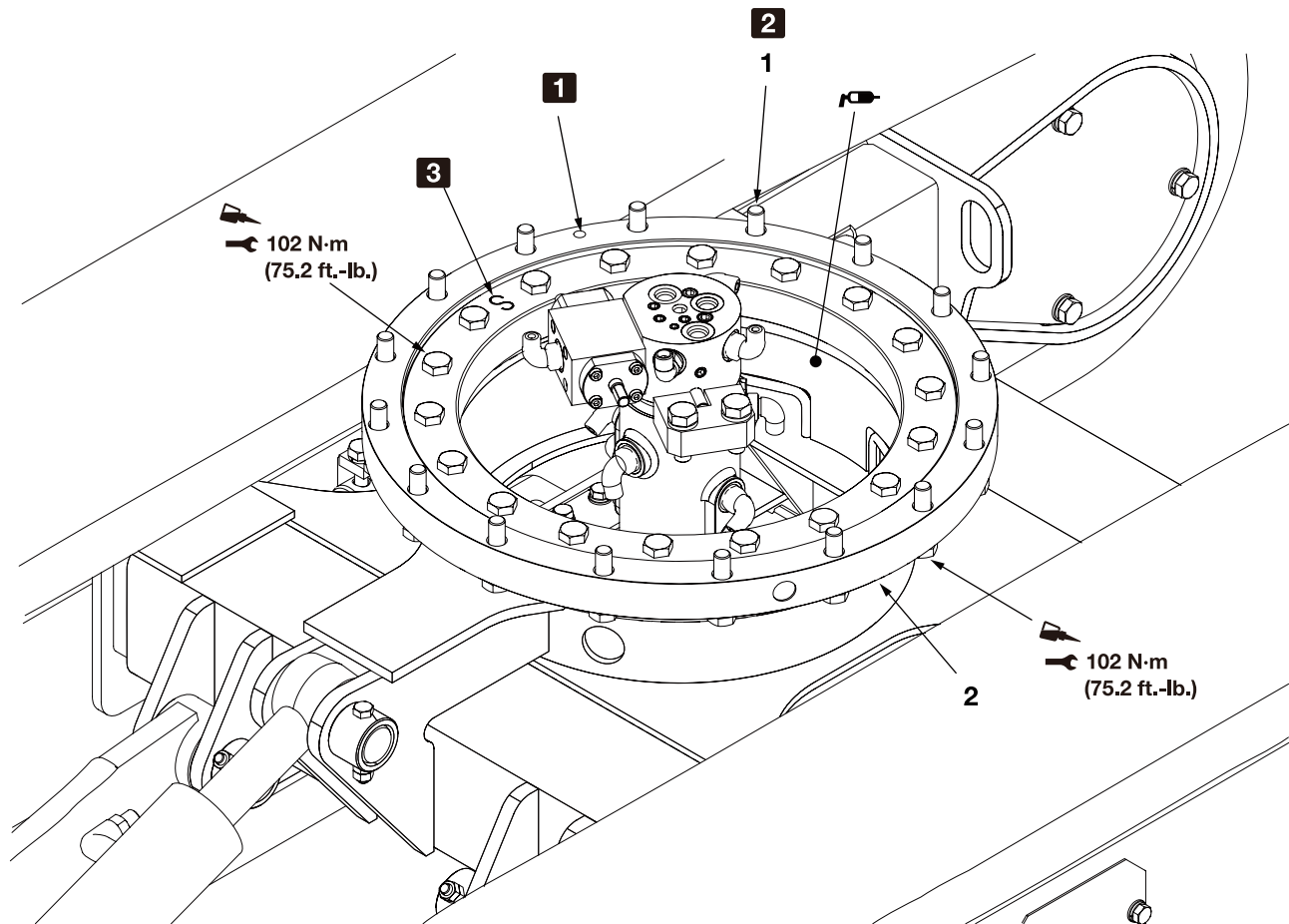
1. Disconnect the hydraulic hoses from the slew motor (1).
2. Remove the bolts from the slew motor.
 -  Bolt: ThreeBond #1324
 -  Bolt: 102 N·m (75.2 ft.-lb)
3. Raise the slew motor (1), and remove it.
 -  Slew motor: 22 kg (49 lb)

Installing the slew motor

To install, follow the same procedures as for removal but in the reverse order.

Slew bearing

Construction



4D0AX02

 ThreeBond #1324 Grease the tooth surfaces and grease bus with lithium grease EP-2.

- 1** Supply port hole
- 2** Use a reamer bolt at this position only
- 3** "S" die stamp

- 1. Reamer bolt
- 2. Slew bearing

Removing the slew bearing

1. Remove the hoe attachment.
 "Removing the hoe attachment"
2. Remove the upper frame.
3. Remove the fixing bolts for the inner race.
 Bolt: ThreeBond #1324
 Bolt: 102 N·m (75.2 ft.-lb)
4. Raise the slew bearing (2), and remove it.
 Slew bearing: 18 kg (40 lb)

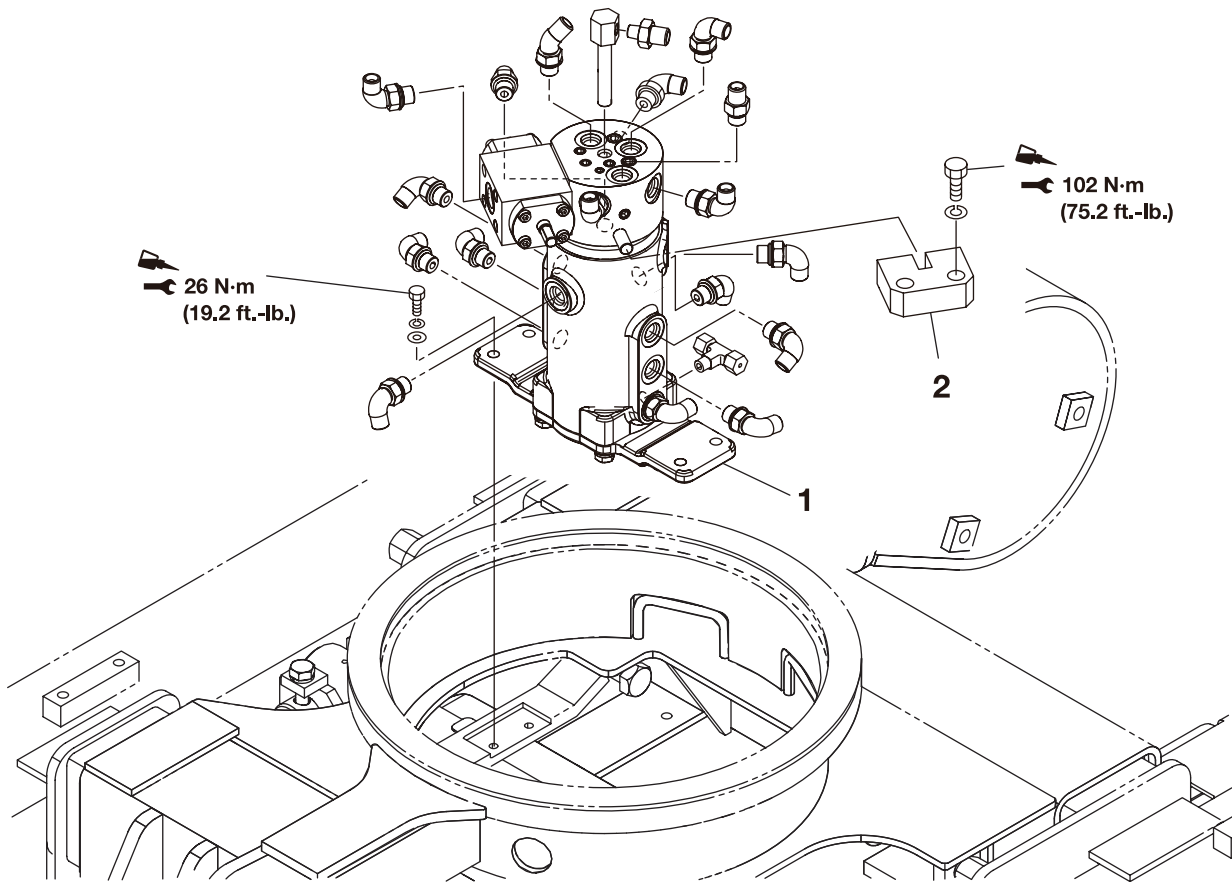
Installing the slew bearing

To install, follow the same procedures as for removal but in the reverse order.

- Refer to the construction diagram for the positions of the reamer bolts and the grease supply port.
- Grease the tooth surfaces and grease bus with lithium grease EP-2.

Swivel joint

Construction



4D0AX03

ThreeBond #1324

- 1. Swivel joint
- 2. Stopper

Removing the swivel joint

1. Remove the upper frame.
 "Removing the upper frame"
2. Disconnect the hydraulic hoses from the swivel joint (1).
3. Take out the bolt holding the stopper in place, and remove the stopper (2).
 Bolt: ThreeBond #1324
 Bolt: 102 N·m (75.2 ft.-lb)
4. Take out the bolts holding the swivel joint (1) in place, and remove the swivel joint (1).
 Bolt: ThreeBond #1324
 Bolt: 26 N·m (19.2 ft.-lb)
5. Raise the swivel joint (1), and remove it.
 Swivel joint: 12 kg (27 lb)

Installing the swivel joint

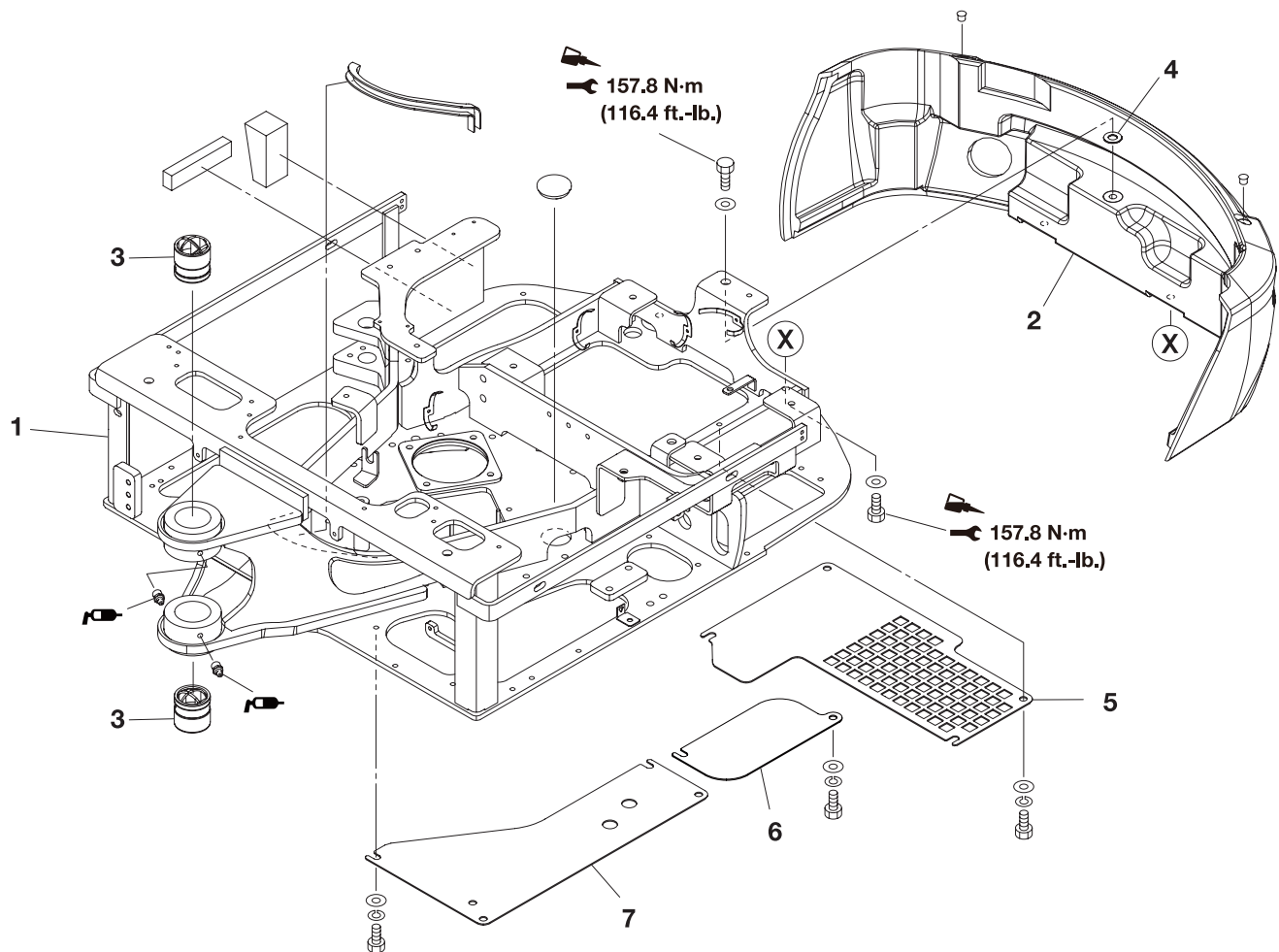
For installation, follow the same procedures as for removal but in the reverse order.

- When installing the swivel joint, secure it in place temporarily using bolts, and position the center using a dial gauge.
- Adjust the position so that the center offset is 1 mm (0.0394 in.) or less.

UPPER FRAME

Upper frame

Construction

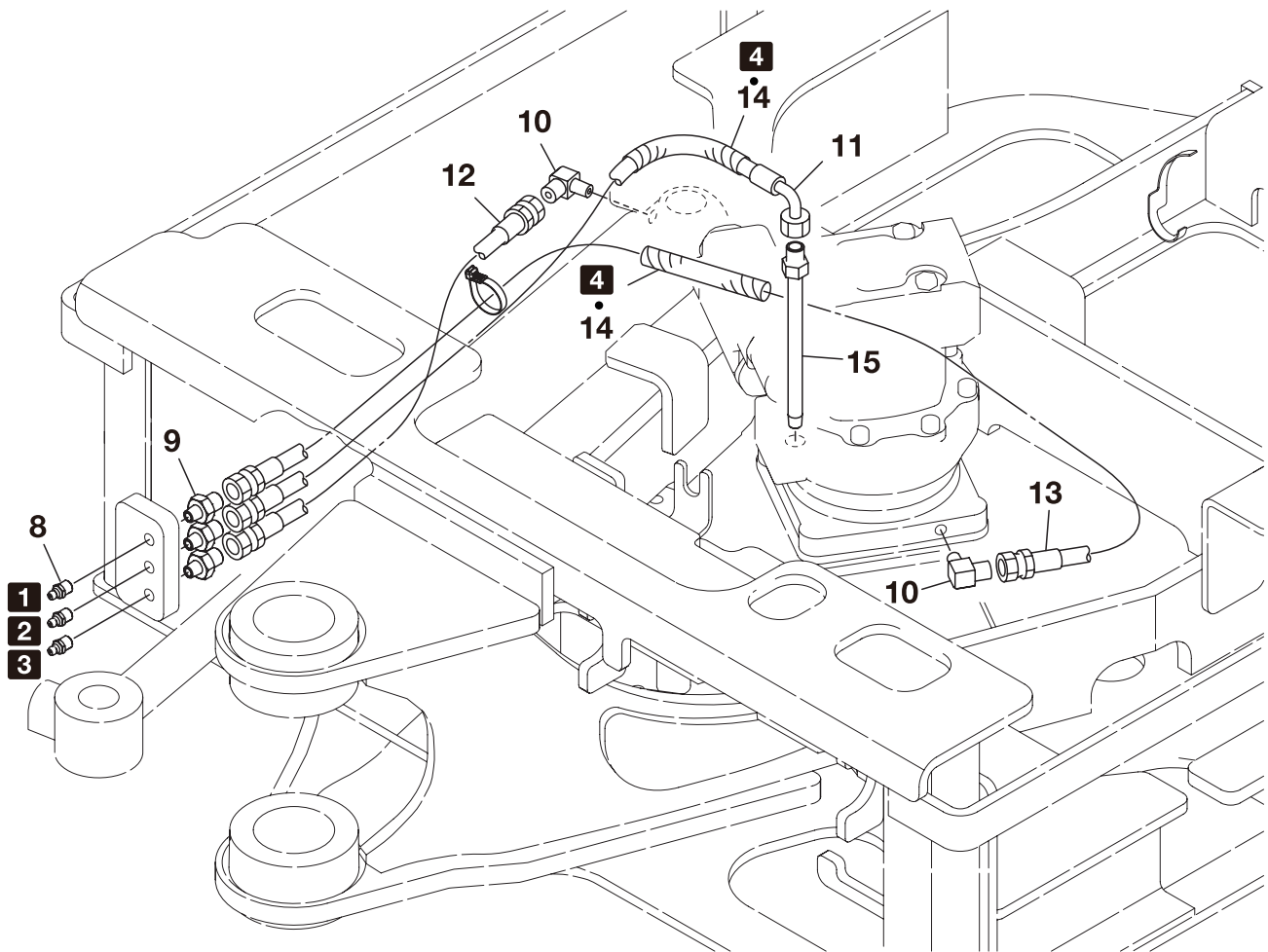


4E0AX01

Apply molybdenum disulfide grease.

ThreeBond #1324

- | | |
|--------------------------|----------|
| 1. Upper frame | 5. Cover |
| 2. Counterweight | 6. Cover |
| 3. Bushing | 7. Cover |
| 4. Shim (Selected usage) | |



4E0AX02

- 1** To the slew motor
- 2** To the slew bearing
- 3** To the swing cylinder
- 4** Use the spiral tube to keep the hoses and machine body from coming into contact with each other.

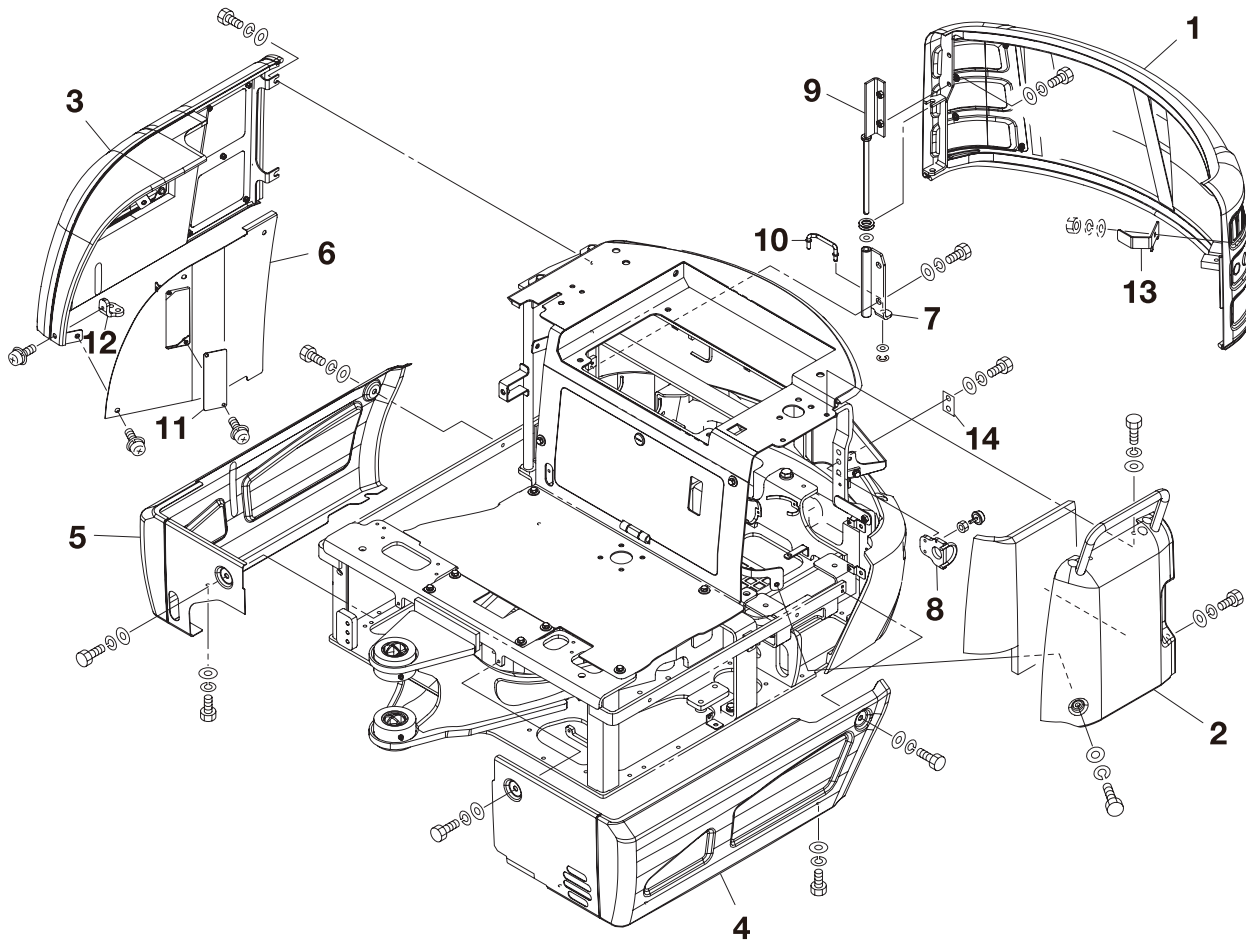
- 8. Grease fitting
- 9. Adapter
- 10. Elbow
- 11. Hose
- 12. Hose
- 13. Hose
- 14. Spiral tube
- 15. Adapter

Removing the upper frame

1. Remove the hoe attachment.
 "Removing the hoe attachment"
2. Take out the canopy.
 "Removing the canopy"
3. Remove the covers.
 "Removing the covers"
4. Disconnect the hydraulic hoses from the swivel joint.
 "Removing the swivel joint"
5. Take out the bolts holding the swivel joint stopper in place, and remove the stopper.
 "Removing the swivel joint"
 Bolt: 102 N·m (75.2 ft.-lb)
 ThreeBond #1324
6. Disconnect the adapter (15) from the slew bearing.
7. Remove all of the fixing bolts for the outer race of the slew bearing except for two at the front of the machine and two at the rear.
 - When installing the slew bearing, be sure to align it with the positions of the grease supply port and the reamer bolt. "Removing the slew bearing"
 Bolt: ThreeBond #1324
 Bolt: 102 N·m (75.2 ft.-lb)
8. Lift up the upper frame (1) temporarily, and remove the remaining bolts while maintaining the upper frame (1) in balance.
9. Lift up the upper frame, and remove it.

Installing the upper frame

To install, follow the same procedures as for removal but in the reverse order.

Covers**Construction**

4E0AX03

- | | |
|-----------------|------------|
| 1. Engine hood | 8. Bracket |
| 2. Side cover L | 9. Pin |
| 3. Side cover R | 10. Rod |
| 4. Side frame L | 11. Plate |
| 5. Side frame R | 12. Plate |
| 6. Cover | 13. Plate |
| 7. Hinge | 14. Spacer |

Removing the covers

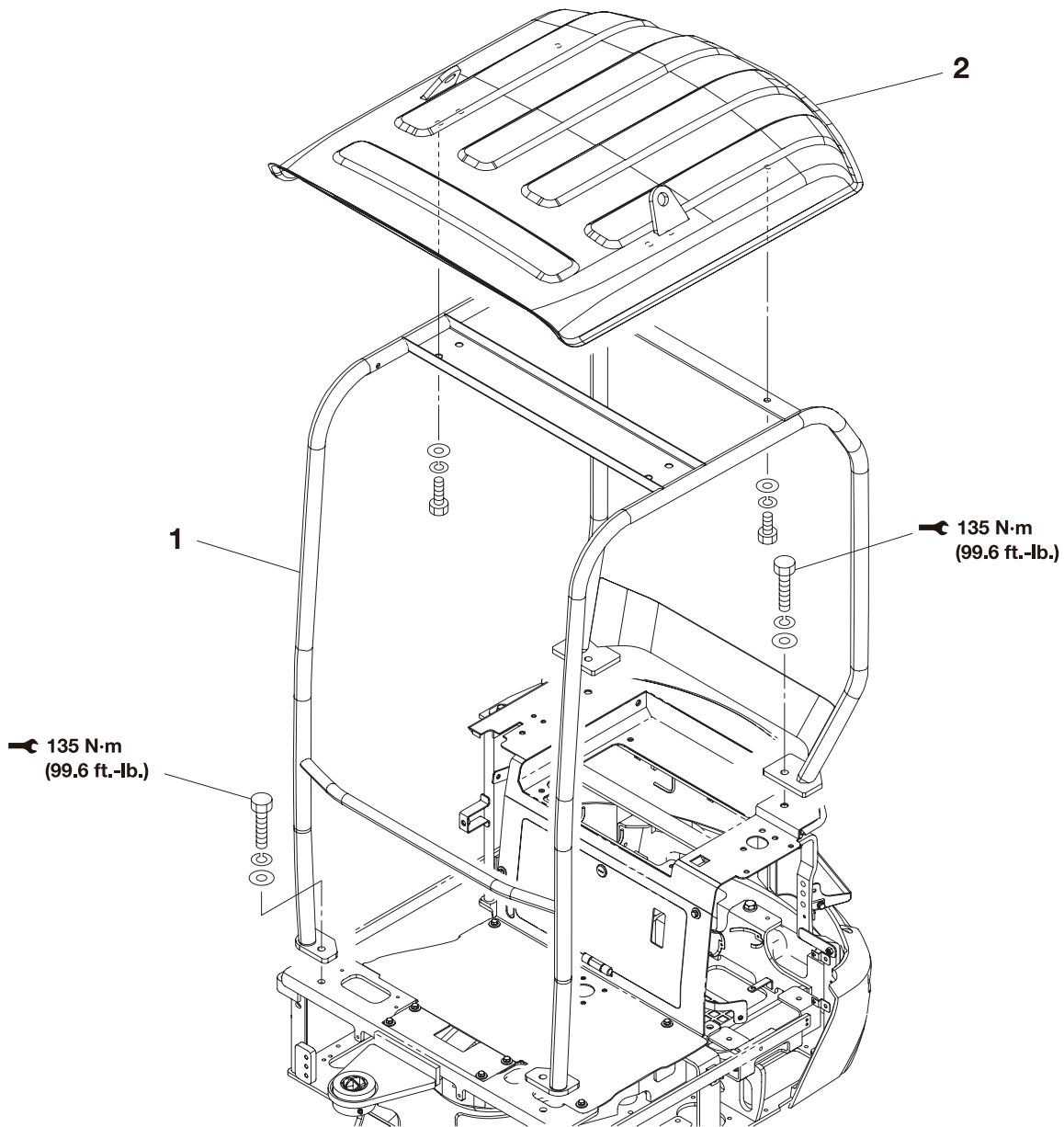
1. Remove the engine hood (1).
 - a. Open the engine hood, and raise it up temporarily.
 - b. Take out the mounting bolts in the hinge, and remove the pins.
 Engine hood: 11 kg (26.5 lb.)
2. Take out the mounting bolts holding the side covers L and R in place, and remove the side covers.
3. Take out the mounting bolts holding the side frames L and R in place, and remove the side frames.

Installing the covers

To install, follow the same procedures as for removal but in the reverse order.

CANOPY

Construction



4E0AX04

- 1. Canopy
- 2. Roof

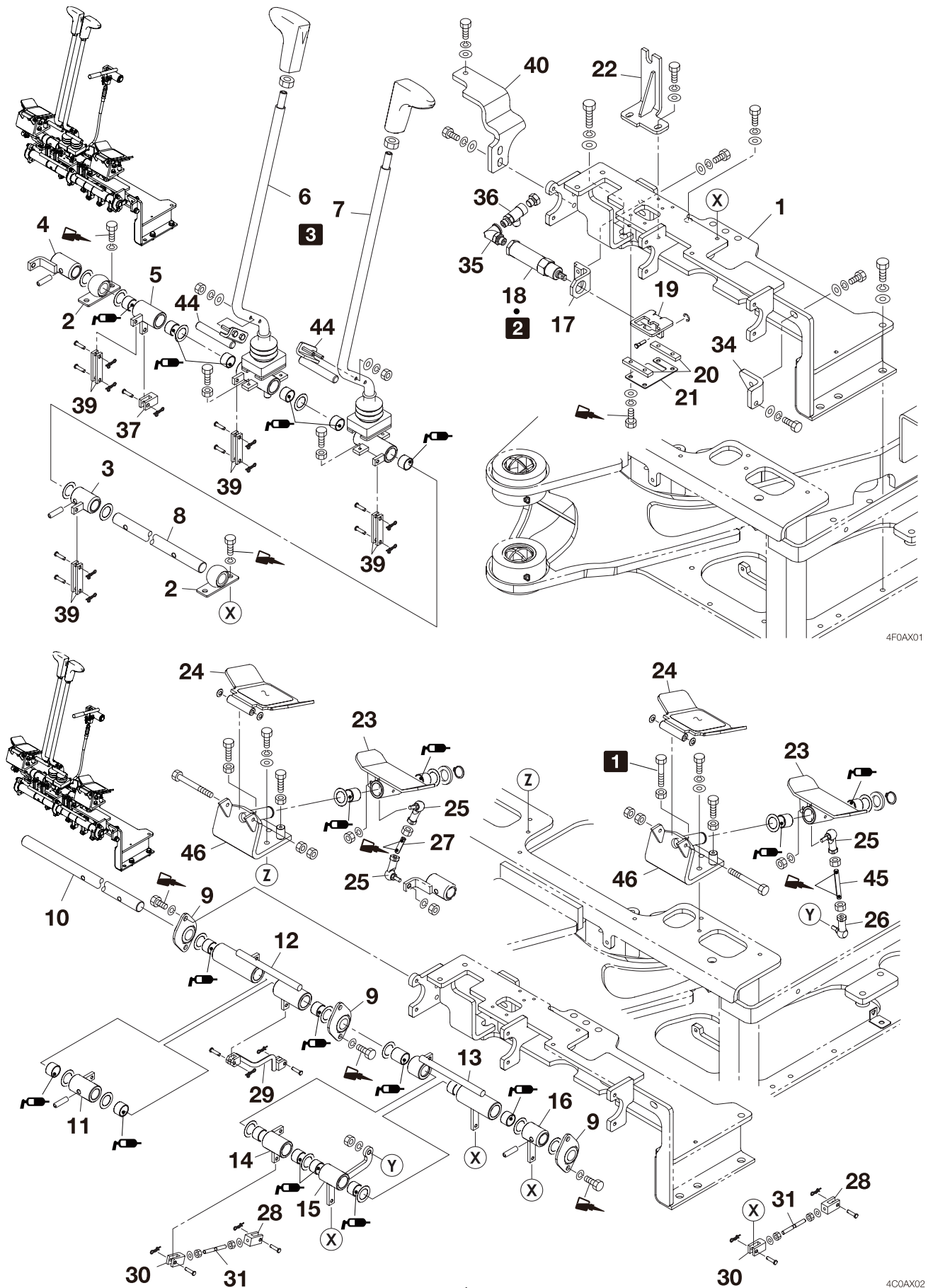
Removing the canopy

1. Remove the battery ground cable from the battery terminal.
2. Disconnect the electrical wiring from the canopy.
3. Take out the mounting bolts.
 Bolt: 135 N·m (99.6 ft-lb)
4. Suspend the canopy and then remove it.
 Canopy: 48 kg (105 lb)

OPERATING DEVICE

Control levers

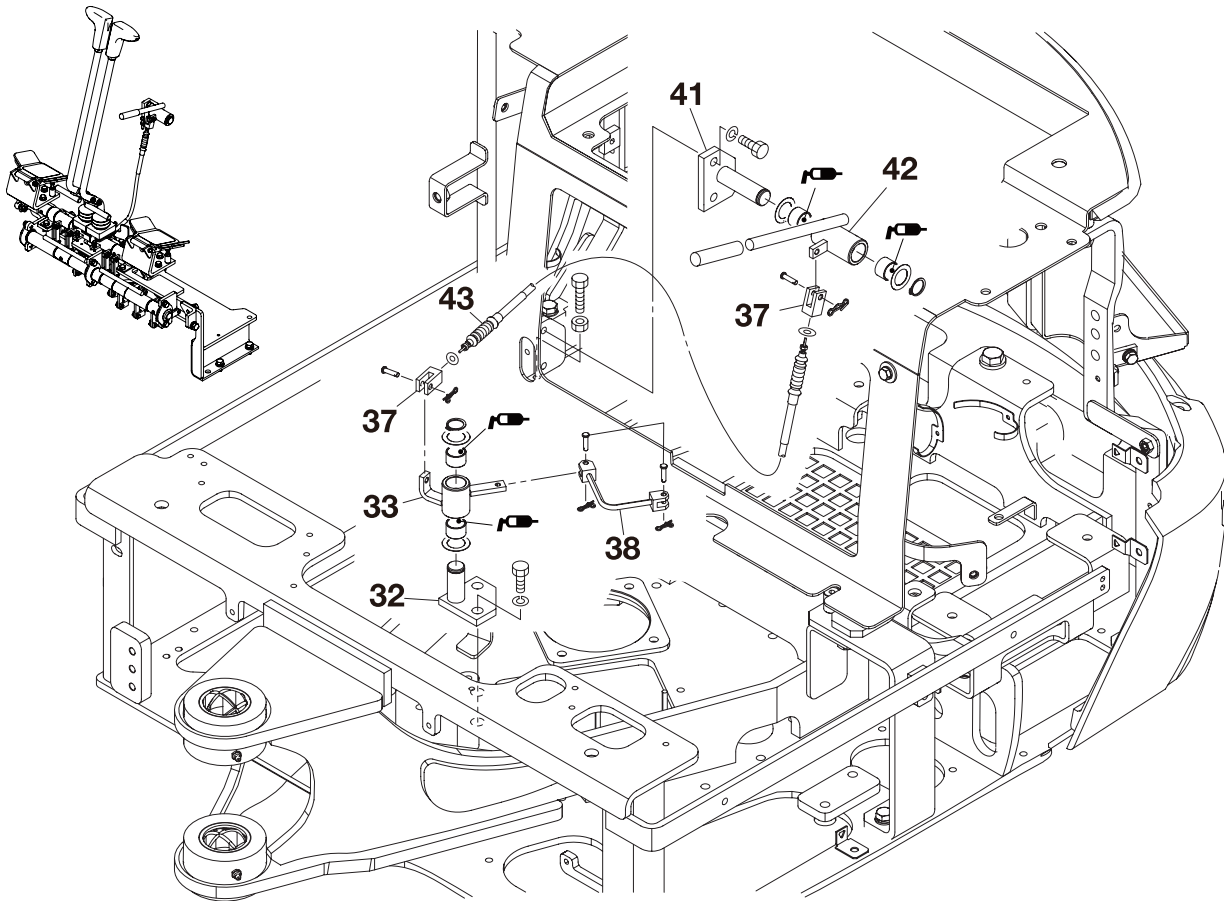
Construction



4F0AX01

4C0AX02

4F0AX00



4F0AX03

 ThreeBond #1324

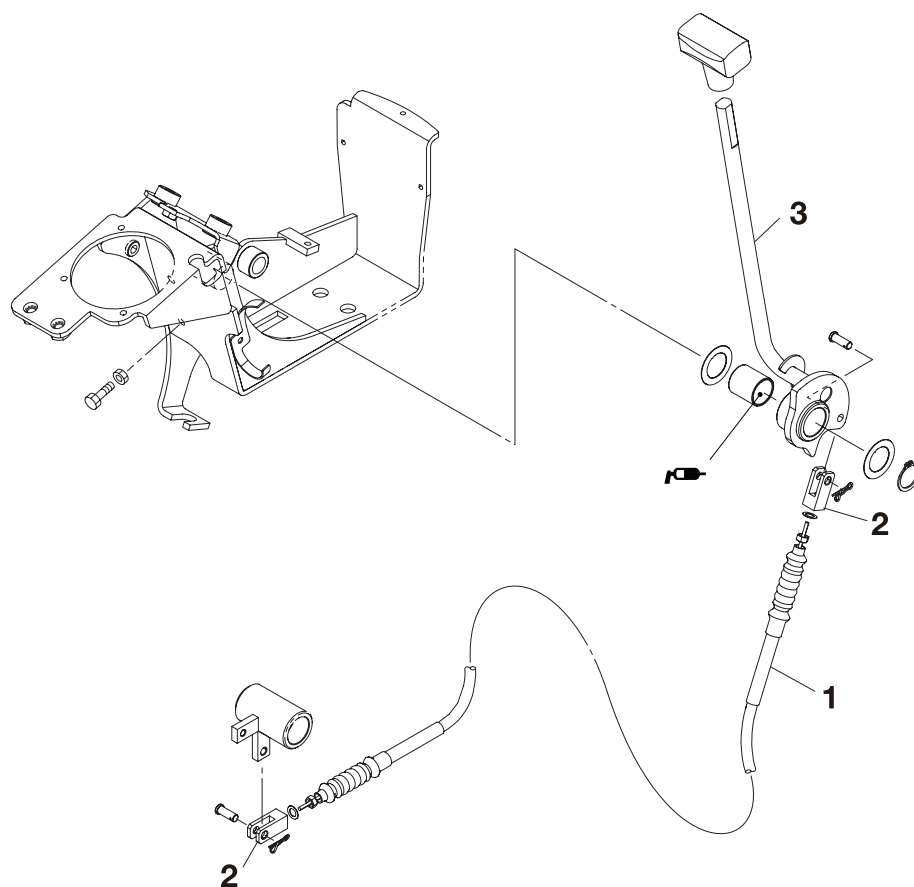
 Apply grease to the inside surfaces of the DU bushing during assembly.

- 1** Adjust the pedal so that it is not depressed at a position away from the center.
- 2** After putting together the machine lever assembly, check the operation of the travel lock section and sliding plate.
- 3** Adjust the lever so that it is oriented at a right angle when set to neutral.

1. Bracket	17. Bracket	33. Lever
2. Mini pillow bearing unit	18. Lock cylinder	34. Bracket
3. Lever	19. Plate	35. Elbow
4. Lever	20. Plate	36. Elbow
5. Lever	21. Plate	37. Yoke
6. Travel lever R	22. Bracket	38. Bracket
7. Travel lever L	23. Pedal	39. Plate
8. Shaft	24. Pedal	40. Bracket
9. Mini pillow bearing unit	25. Rod end	41. Bracket
10. Shaft	26. Rod end	42. Lever
11. Lever	27. Set screw	43. Control cable
12. Lever	28. Yoke R	44. Lever
13. Lever	29. Lever	45. Rod
14. Lever	30. Yoke L	46. Bracket
15. Lever	31. Rod	
16. Lever	32. Bracket	

Dozer blade lever

Construction



4C0AX04

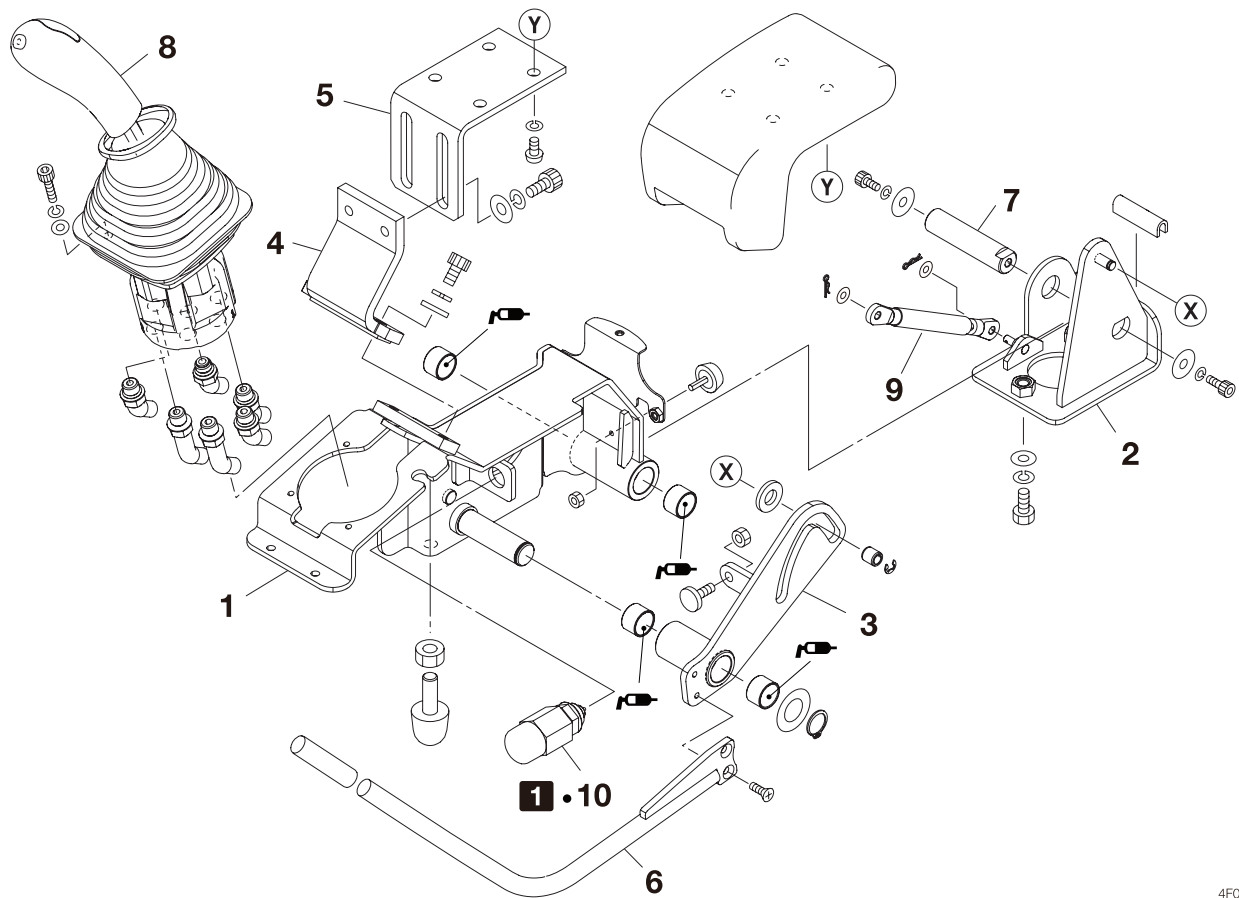
 Apply grease to the inside surfaces of the DU bushing during assembly.

1 Lever control force: 28 N (6.31 lbf)

- 1. Control cable
- 2. Yoke
- 3. Lever

Lever stand**Construction**

Pilot valve (Left)

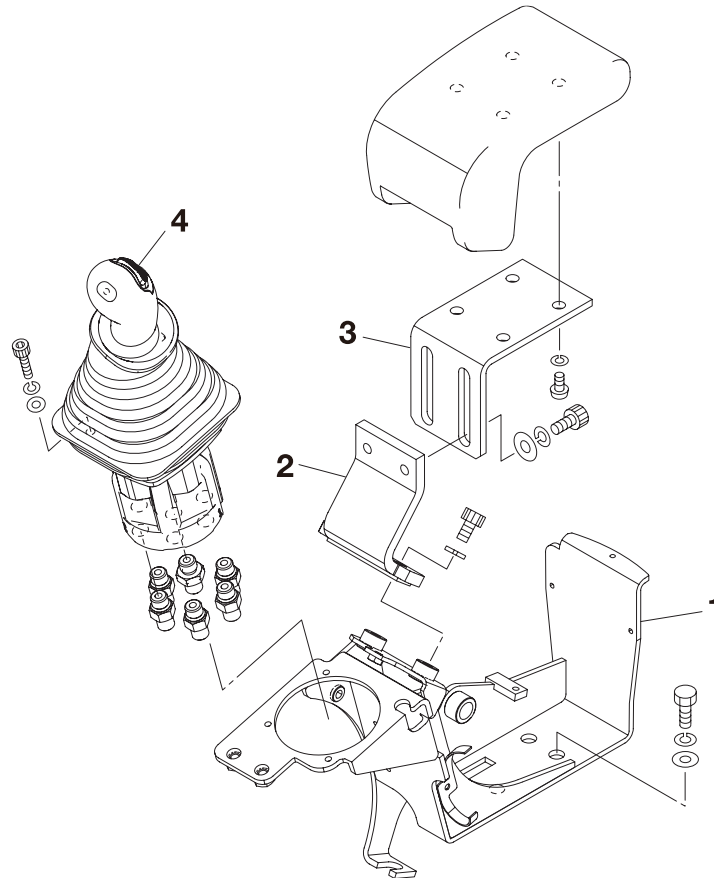


4F0AX05

- 1** Adjusting the limit switch: When the limit switch is in the ON position, the tip of the switch should be visible from the boot.
Apply rubber grease #9106 (for natural rubber).
➡ Apply grease to the inside of the bushing during assembly.

- | | |
|------------------|-----------------------|
| 1. Control box L | 6. Lever |
| 2. Bracket | 7. Shaft |
| 3. Plate | 8. Pilot valve (Left) |
| 4. Bracket | 9. Gas spring |
| 5. Plate | 10. Limit switch |

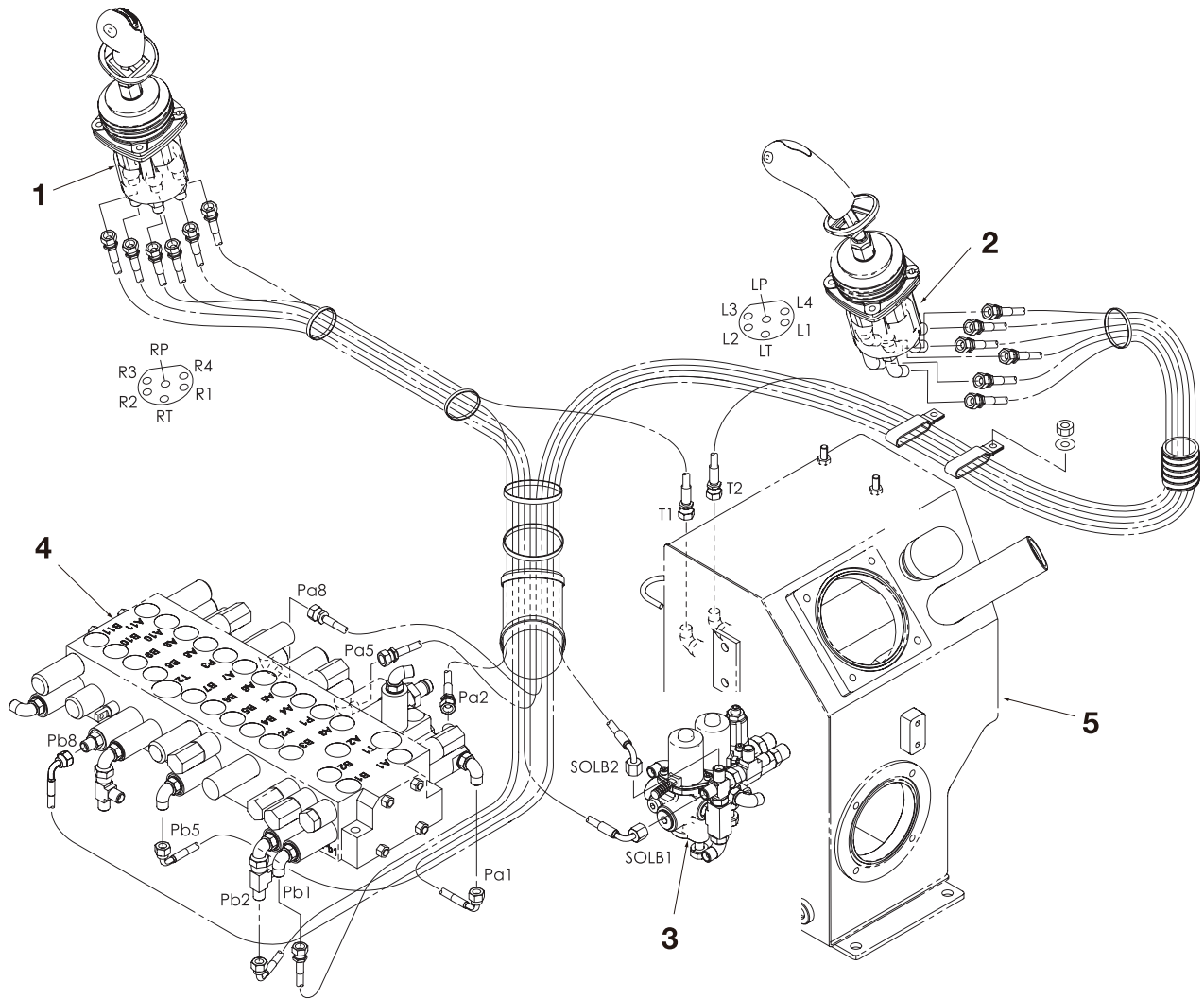
Pilot valve (Right)



4F0AX06

- 1. Control box R
- 2. Bracket
- 3. Plate
- 4. Pilot valve (Right)

Hydraulic piping



4F0AX07

Table of Connections

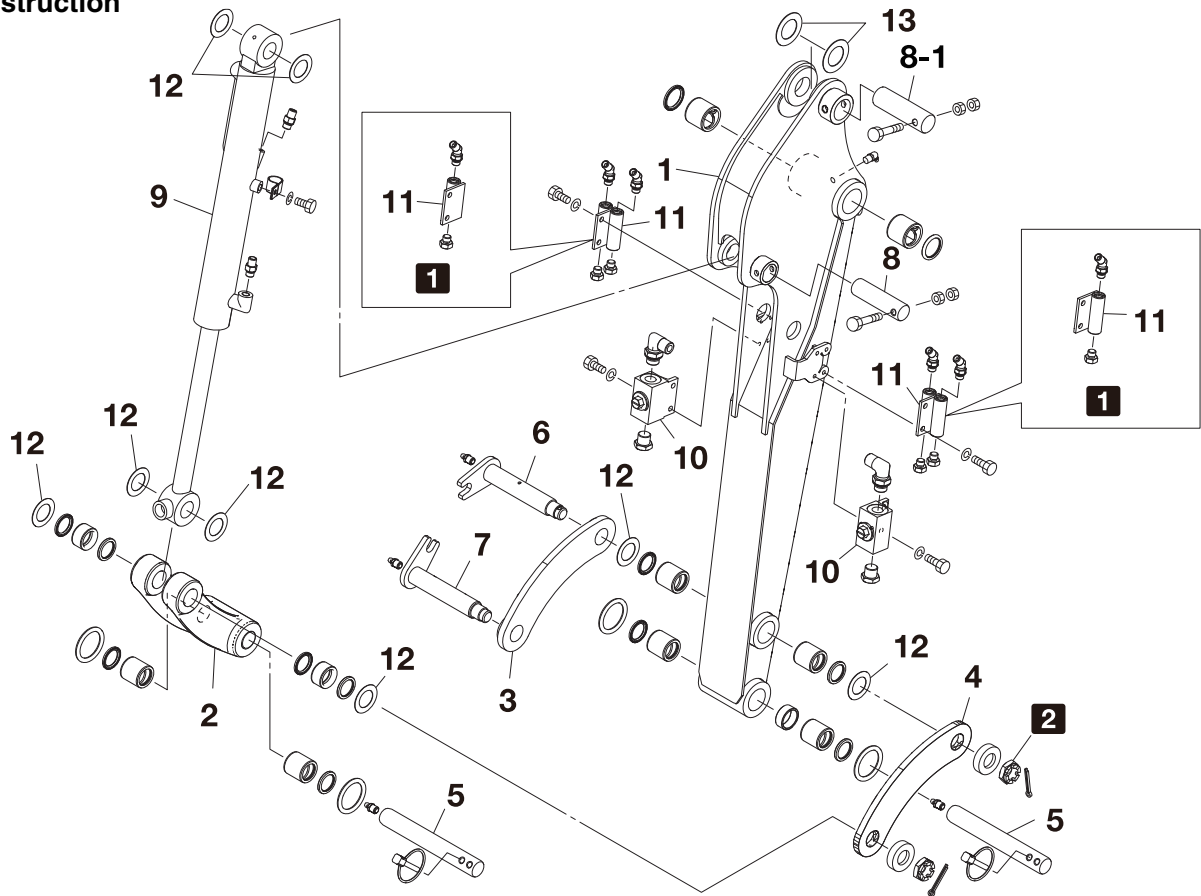
1	R1 ↔ Pa1	4
1	R2 ↔ Pb2	4
1	R3 ↔ Pb1	4
1	R4 ↔ Pa2	4
1	RP ↔ SOL B1	3
1	RT ↔ T1	5
2	L1 ↔ Pb8	4
2	L2 ↔ Pa5	4
2	L3 ↔ Pa8	4
2	L4 ↔ Pb5	4
2	LP ↔ SOL B2	3
2	LT ↔ T2	5
4	Pi2 ↔ Pb2	4

1. Pilot valve (Right)
2. Pilot valve (Left)
3. Solenoid valve (Lever lock)
4. Control valve
5. Hydraulic tank

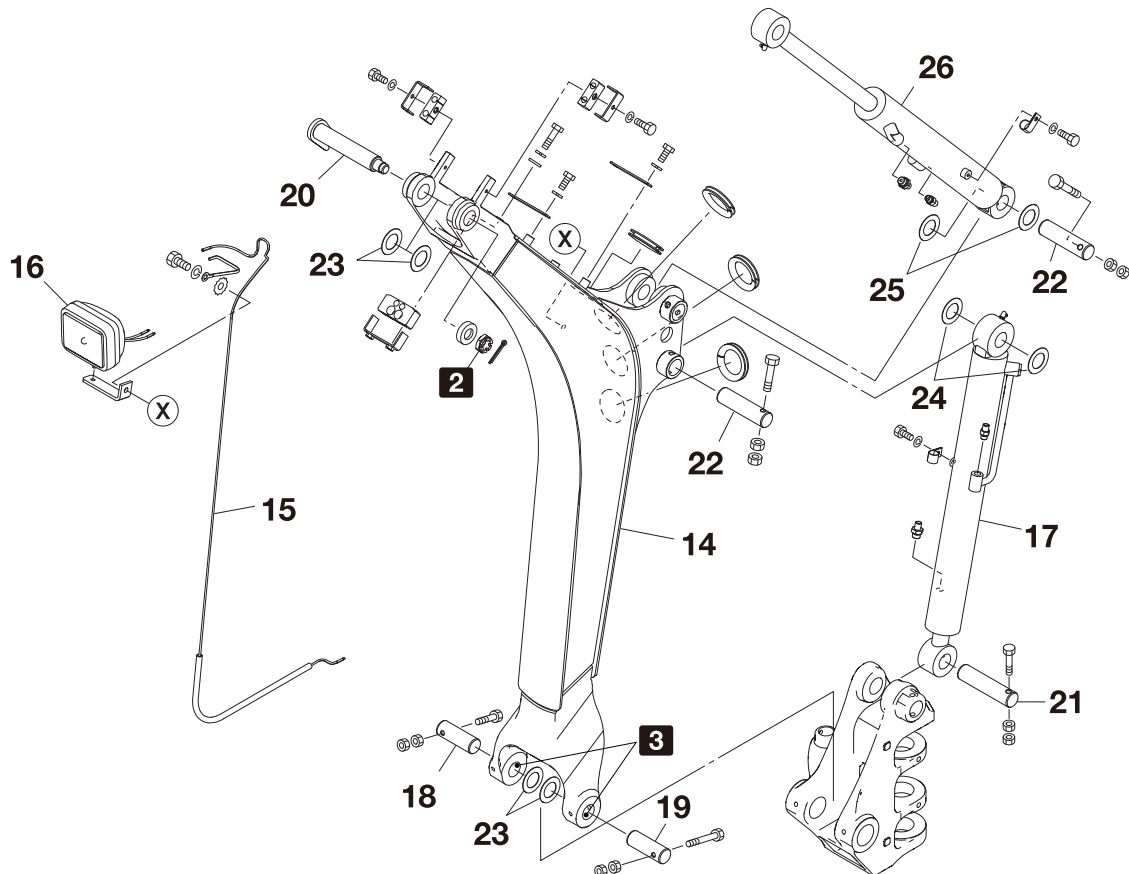
ATTACHMENTS

Hoe attachment

Construction



4G0AX01



4G0AX02

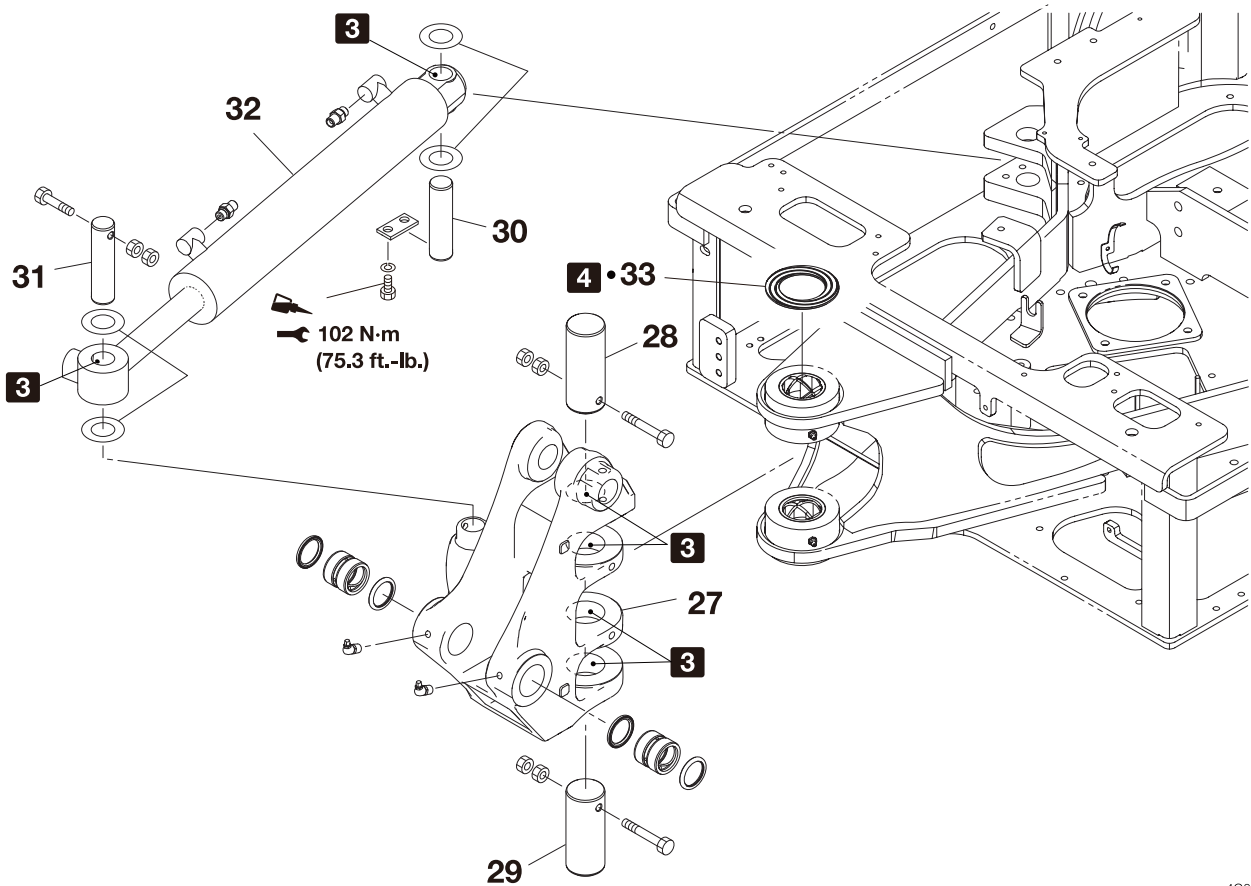
1 2nd auxiliary line piping**2** Do not overtighten the castle nut.

After tightening down the castle nut by hand, firmly tighten it down further until the tightening hole positions line up properly and then secure the castle nut in place with a cotter pin.

3 After applying NEVER-SEEZ NS (Regular grade) or an equivalent anti-seizing lubricant, put the parts together.

- During assembly, grease the pins using lithium grease EP-2 supplied from the grease nipples.

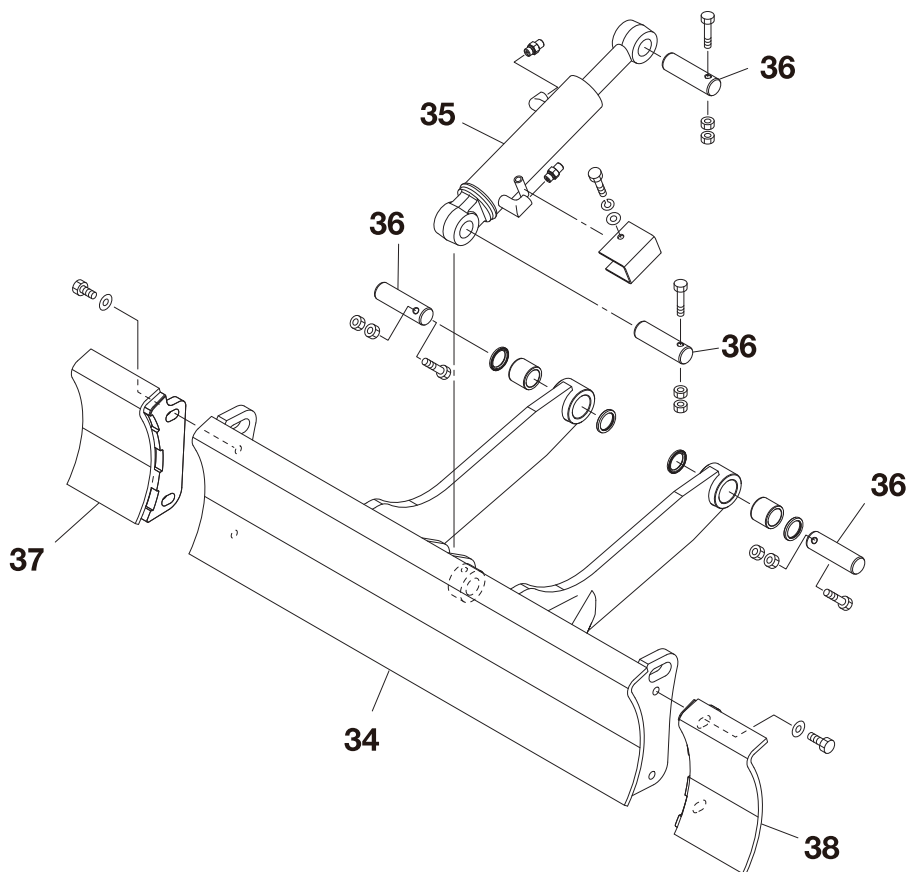
1. Arm	9. Bucket cylinder	18. Pin
2. Link arm	10. Stop valve	19. Pin
3. Guide link R	11. Adapter	20. Pin
4. Guide link L	12. Shim (Selected usage)	21. Pin
5. Pin	13. Shim (Selected usage)	22. Pin
6. Pin	14. Boom	23. Shim (Selected usage)
7. Pin	15. Wire harness	24. Shim (Selected usage)
8. Pin	16. Working lamp	25. Shim (Selected usage)
8-1. Pin	17. Boom cylinder	26. Arm cylinder



4G0AX031

- 3** After applying NEVER-SEEZ NS (Regular grade) or an equivalent anti-seizing lubricant, put the parts together.
- 4** Position with the grooved side facing upward.

- 27. Boom bracket
- 28. Pin
- 29. Pin
- 30. Pin
- 31. Pin
- 32. Swing cylinder
- 33. Washer (Selected usage)



4G0AX04

- 34. Blade
- 35. Blade cylinder
- 36. Pin
- 37. Plate R
- 38. Plate L

Removing the hoe attachment



WARNING

- Be sure to release any residual pressure in the piping before disconnecting the hydraulic hose.
- Do not attempt to insert any fingers into the hole when adjusting the pin hole position.

Important:

- When tightening the lock bolt with a double nut, allow a clearance of 0.5 mm to 1.0 mm (0.0197 in. to 0.0394 in.) between the nut and the lock collar.
- Adjust the clearance for the pin connector to a width of between 0.2 mm to 0.5 mm (0.0079 in. to 0.0197 in.) using a shim.
- Be sure to bleed the air from the cylinder before starting operation for the first time after reassembling hydraulic devices such as the hydraulic cylinder or hydraulic piping.
- Grease the pins using lithium grease EP-2 supplied from the grease nipples.

The numbers in parentheses, (), listed after the names of parts throughout this document are used to refer to the same parts as the numbers listed in the construction diagram and parts lists.

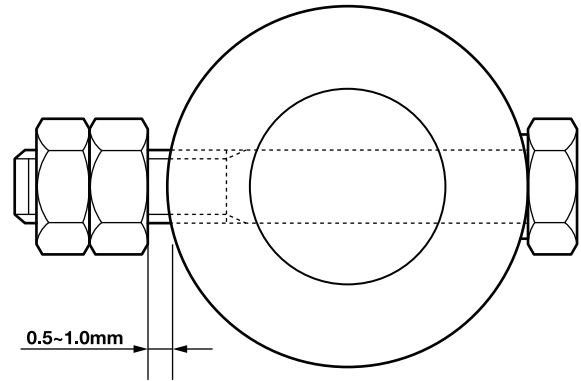
Removing the bucket

1. Orient the back of the bucket downward, and lower the bucket all the way down to the ground.
2. Take out the bolts, and remove the pins.
3. Remove the bucket.

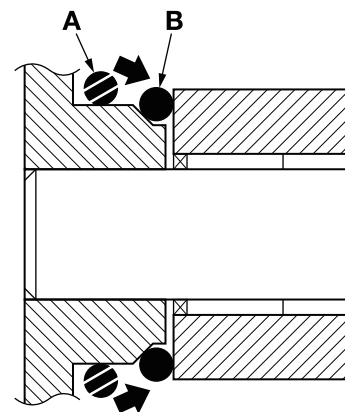
Installing the bucket

To install, follow the same procedures as for removal but in the reverse order.

- Before starting to attach the bucket, place the O-ring in the temporary placement position "A" in the outer circumference of the bucket bushing, and move it to the specified position "B" once attachment is completed.



4G0AK09Z



4G0AK07Z

Removing the link

Completely retract the bucket cylinder, and lower the tip of the arm to the ground.

1. Take out the pin (5), and remove the link arm (2).
 - a. Guide links R (3) and L (4)
.....Exercise caution as they may drop
 - b. Cylinder (9).....Place on a skid
 - c. Link arm (2)Suspend temporarily
2. Take out the pins (6) and (7), and remove the guide links R (3) and L (4).

Installing the link

To install, follow the same procedures as for removal but in the reverse order.

Removing the arm

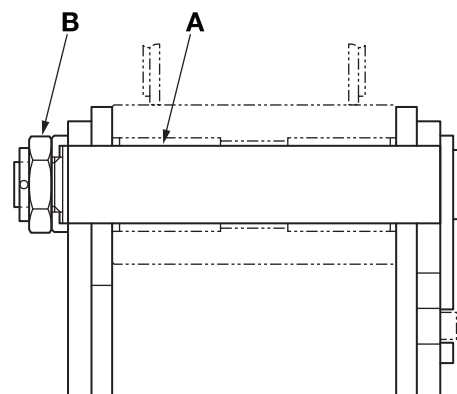
1. Disconnect the hydraulic hoses from the bucket cylinder (9).
Next, disconnect the hydraulic hoses from the auxiliary line ports.
2. Suspend the bucket cylinder (9) temporarily and then pull out the pin and remove the bucket cylinder.
 Bucket cylinder: 9 kg (20 lb)
3. Place a skid under the arm cylinder (26), and remove the pin.
4. Take out the cotter pin, and remove the castle nut.
5. Suspend the arm (1) temporarily and then pull out the pin and remove the arm.
 Arm: 31 kg (68 lb)

Installing the arm

To install, follow the same procedures as for removal but in the reverse order.

Important:

When securing the arm with the fixing pin A and castle nut B, make sure not to tighten the castle nut B too much. After tightening down the castle nut B by hand, firmly tighten it down further until the tightening hole positions for the fixing pin A and cotter pin for the castle nut B line up properly.



4G0AV08

Removing the boom

Lower the tip of the boom all the way to the ground.

1. Disconnect the hydraulic hoses from the arm cylinder (26).
2. Suspend the arm cylinder (26) temporarily and then pull out the pin and remove the arm cylinder.
 Arm cylinder: 17 kg (37 lb)
3. Remove the boom cylinders.
 - a. Disconnect the hydraulic piping from the boom cylinders (17).
 - b. Suspend each boom cylinder (17) temporarily.
 - c. Push in the pin (22), and disconnect the head side of the cylinder and lower the cylinder to the ground.
 - d. Suspend the boom cylinder (17) temporarily, disconnect the rod side from the rod pin (21), and raise the cylinder.
 Boom cylinder: 20 kg (44 lb)
4. Disconnect the electrical wiring (15) to the boom light from the wiring on the machine body side.
5. Disconnect the hydraulic hoses connected from the machine body side from the pipes.
6. Hoist up the boom (14) temporarily and then pull out the pin and remove the boom.
 Boom: 57 kg (125 lb)

Installing the boom

To install, follow the same procedures as for removal but in the reverse order.

During assembly, apply NEVER-SEEZ NS lubricant (an anti-seizing lubricant) to the mounting pin holes for attaching the boom and then insert the pins into the appropriate holes.

Removing the boom bracket

1. Take out the pin (31), and disconnect the swing cylinder (32) from the boom bracket.
2. Suspend the boom bracket (27) temporarily and then pull out the pins and remove the boom bracket.
 - Be careful not to damage the hoses when working with them.

 Boom bracket: 30 kg (65 lb)

Installing the boom bracket

To install, follow the same procedures as for removal but in the reverse order.

- During assembly, apply NEVER-SEEZ NS lubricant (an anti-seizing lubricant) to the fixing pin holes on the boom bracket and then insert the pins into the appropriate holes.
- Attach the washer (33) with the side with the grease groove facing upward (toward the boom bracket side).

Removing the blade

Lower the blade all the way down to the ground.

1. Disconnect the hydraulic hoses from the blade cylinder (35).
2. Suspend the blade cylinder (35) temporarily and then pull out the pins and remove the blade cylinder.

 Blade cylinder: 11 kg (23 lb)

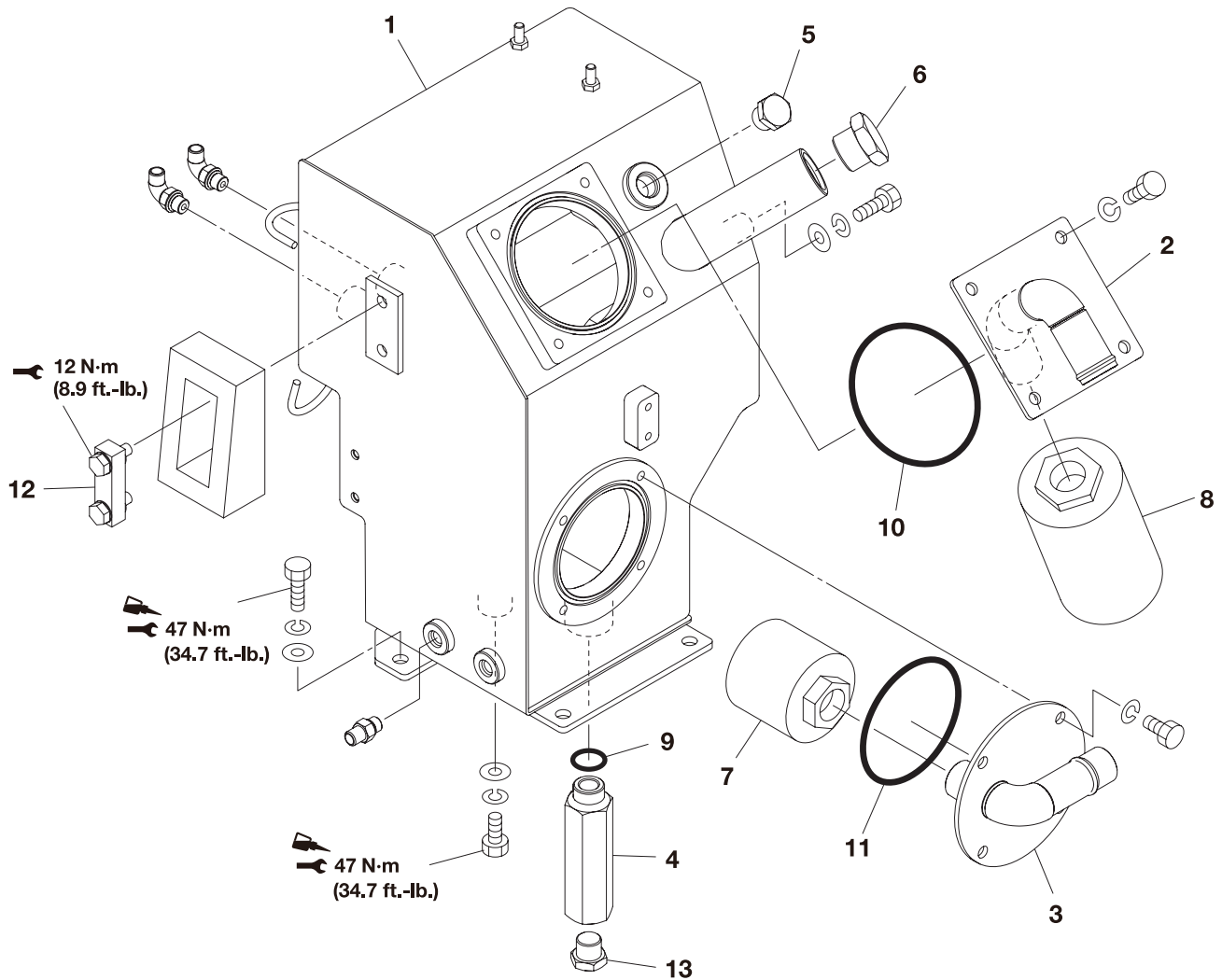
3. Suspend the blade (34) temporarily and then take out the pins and remove the blade (34).

 Blade: 50 kg (111 lb)

Installing the blade

To install, follow the same procedures as for removal but in the reverse order.

HYDRAULIC TANK



4H0AX01

ThreeBond #1324

- | | | |
|-------------------|-------------------|-----------------|
| 1. Hydraulic tank | 6. Oil plug | 11. O-ring |
| 2. Lid | 7. Suction filter | 12. Sight gauge |
| 3. Pipe | 8. Return filter | 13. Drain plug |
| 4. Bushing | 9. O-ring | |
| 5. Plug | 10. O-ring | |

Removing the hydraulic tank

The numbers in parentheses (), listed after the names of parts throughout this document are used to refer to the same parts as the numbers listed in the construction diagram and parts lists.

1. Remove the covers from the perimeter around the hydraulic tank.

 "Removing the covers"

2. Drain the hydraulic oil from the hydraulic tank (1).
 - a. Slowly loosen the oil plug (6) to release the internal pressure in the hydraulic tank.
 - b. Drain out the oil from the drain plug (13).
 - Tank level capacity: 16.1 L (4.3 US gal.)

3. Disconnect the low-pressure hoses from the hydraulic tank.

4. Disconnect the high-pressure hoses from the hydraulic tank.
 - Attach an identification tag on each hoses to avoid mixing them up during reassembly.

5. Take out the bolts holding the hydraulic tank in place, and suspend the hydraulic tank and remove it.

 Bolt: ThreeBond #1324

 Bolt: 47 N·m (34.7 ft.-lb)

 Hydraulic tank: 20 kg (43 lb)

Installing the hydraulic tank

For installation of the hydraulic tank, follow the same procedures as for removal but in the reverse order.

Inspecting and refilling the oil in the hydraulic tank



WARNING

- Oil may spurt out if caps or filters are removed or pipes are disconnected before the pressure in the hydraulic system is released.
- Slowly loosen the oil plug (6) to release the internal pressure in the hydraulic tank.

Inspection

The oil level changes with the oil temperature. Inspect the oil while maintaining the machine at the attitude for inspecting the oil level.

Machine attitude for inspecting the hydraulic oil level

1. Start the engine, and run it at low speed.
2. Fully retract the arm cylinder and the bucket cylinder, and then lower the bucket to the ground.
3. Stop the engine.
4. Inspect the oil level using the sight gauge (12).
When the oil temperature is about 20°C (68°F): The level should be halfway between the upper limit (H) and the lower limit (L). If it is below the lower limit (L), replenish.
When the oil temperature is about 50 to 80°C (122 to 176°F): The level should be near the upper limit (H).

Refilling the oil

Important: Do not refill to above the (H) mark. Doing so may cause damage to the hydraulic circuit or cause oil to spurt out. If the oil level is accidentally filled to above the (H) mark, stop the engine and allow the hydraulic oil to cool down before draining off the excess oil from the drain plug (13).

Important: Failure to pressurize the hydraulic tank may cause the pump to suck in air, which will adversely affect the hydraulic units.

1. Slowly loosen the oil plug (6) to release the internal pressure in the hydraulic tank.
2. Add the specified volume of hydraulic oil through the oil filler port.

Tank pressure

Fully extend each cylinder as far as it will go, and insert the oil plug with the cylinders extended to close off the port. (The dozer blade should be lowered down to the ground.)

- After finishing adding oil, make sure to increase the pressure in the tank.

Bleeding off the air

Important: After replacing the hydraulic oil, bleed the air from the hydraulic circuits and hydraulic devices. Failure to do so may damage the hydraulic devices.

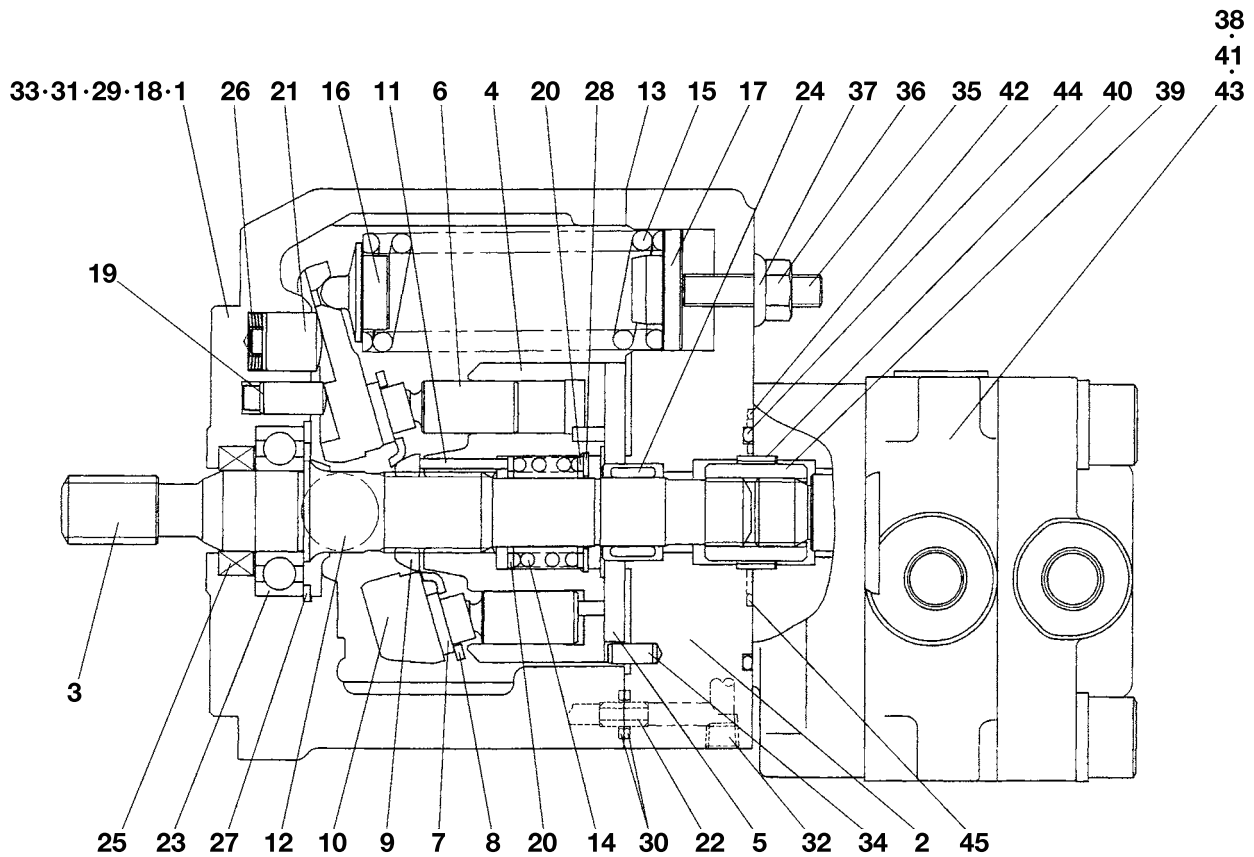
1. Start the engine, and let it idle.
2. Slowly allow each cylinder to start running to release the air in the piping.
 - Continue bleeding off the air from the piping until the cylinders begin running as directed.
3. Release the air in each cylinder.

With the engine running at slow speed, extend and retract the cylinder 4 or 5 times.

 - Move the piston rod to a position 100 mm (3.9 in.) before the end of the stroke, being careful not to allow any air to be released.
4. With the engine running at top speed, complete the operation outlined in “a”, and then, with the engine running at low speed, move the piston rod to the stroke end to bleed off the air in the cylinder.

HYDRAULIC PUMP

Construction



410AY01

- | | | | |
|-------------------|--------------------|-----------------------|-----------------|
| 1. Body S | 13. Packing | 25. Oil seal | 37. Seal washer |
| 2. Body H | 14. Spring C | 26. Belleville spring | 38. Gear pump |
| 3. Shaft | 15. Spring T1 | 27. Snap ring | 39. Coupling |
| 4. Cylinder block | 16. Spring holder | 28. Snap ring | 40. Collar |
| 5. Valve plate | 17. Spring guide | 29. O-ring | 41. Bolt |
| 6. Piston | 18. Pin | 30. O-ring | 42. O-ring |
| 7. Shoe | 19. Piston | 31. Cap screw | 43. Washer |
| 8. Shoe holder | 20. Retainer | 32. Plug | 44. O-ring |
| 9. Guide | 21. Stopper pin A | 33. Plug | 45. O-ring |
| 10. Swash plate | 22. Pin | 34. Spring pin | |
| 11. Pin | 23. Ball bearing | 35. Set screw | |
| 12. Pin | 24. Needle bearing | 36. Nut | |

Disassembly and assembly

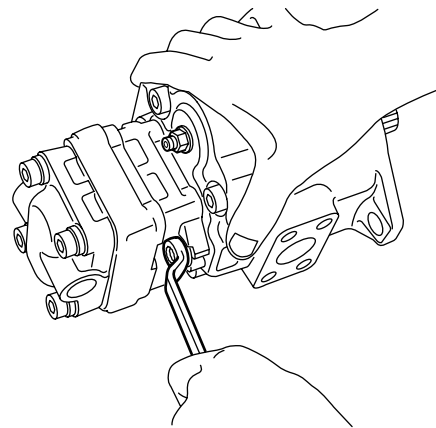
General precautions

The numbers in parentheses, (), listed after the names of parts throughout this document are used to refer to the same parts as the numbers listed in the construction diagram and parts lists.

- Perform disassembly and assembly work in a clean place. Provide clean containers to hold parts during disassembly.
- Before disassembly, clean around the ports and remove coating or thread-locking compound on the joints with a wire brush.
- Clean disassembled parts with dedicated cleaning oil.
- Apply hydraulic oil on the sliding surfaces and thin layer of grease on the seals before assembly.
- Replace seals with new ones after each disassembly.
- Check each part for abnormal wear or seizing. Remove any burrs with sandpaper.

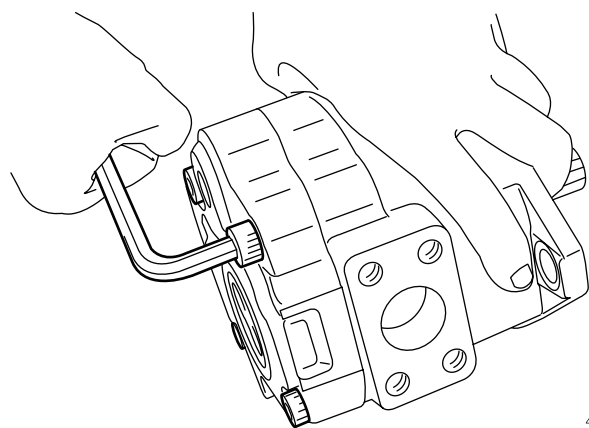
Disassembly

1. Take out the bolt, and remove the gear pump (38).
2. Remove the collar (40) and coupling (39).



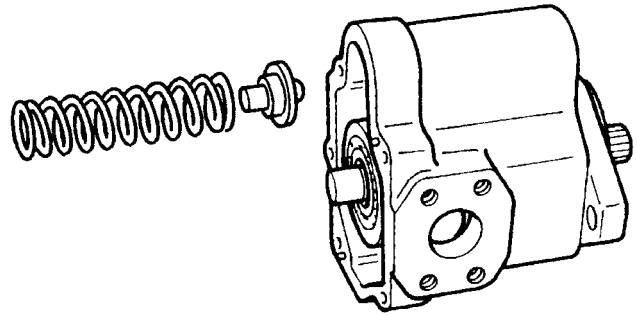
410AY02

3. Disassemble the body S (1) and the body H (2).
 - a. Take out the cap screws.
 - b. Separate the assembly into the body S and body H.
 - Lightly tap the slot where the spring of body H is inserted with a plastic hammer.



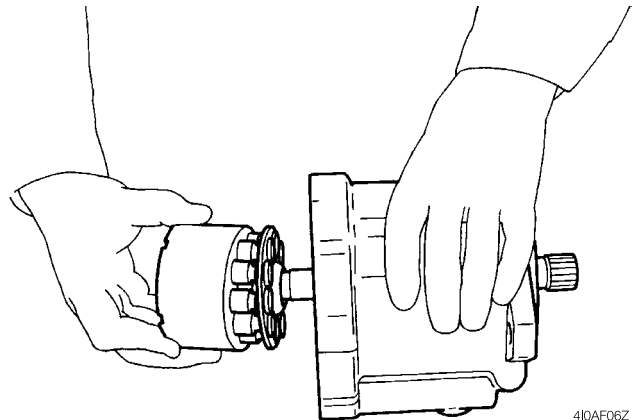
410A103Z

4. Remove the spring (15) and spring holder (16) from the body S (1).



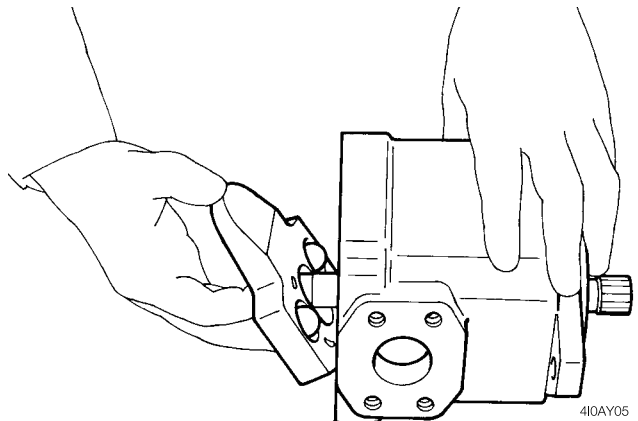
410AY04

5. Remove the cylinder block (4) from the body S (1).



410AF06Z

6. Remove the swash plate (10) and the oscillating pin (12) from the body S (1).

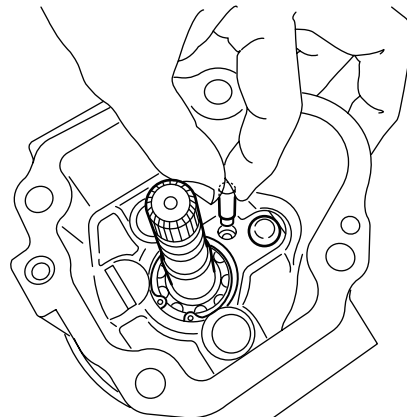


410AY05

7. Remove the stopper pin A (21), belleville spring (26), and piston (19) from the body S (1).

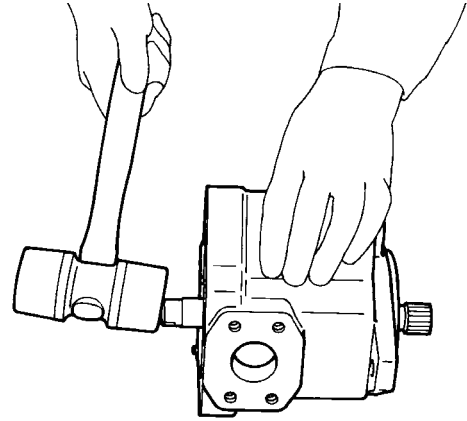
- To avoid errors during reassembly, store these parts in the proper order and arrangement.

8. Remove the snap ring (27) from the shaft end of the body S (1).



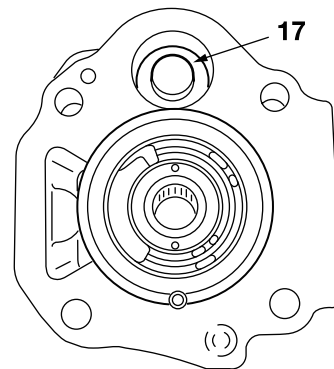
410AY06

9. Remove the shaft (3) and oil seal (25) from the body S (1).
- Tap the shaft (with the bearing attached) with a plastic hammer to remove it.



410AF08Z

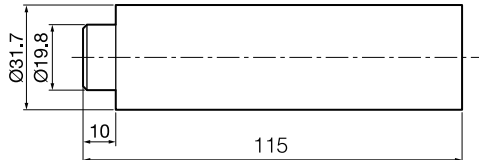
10. Remove the spring guide (17) from the body H (2).



410AY07

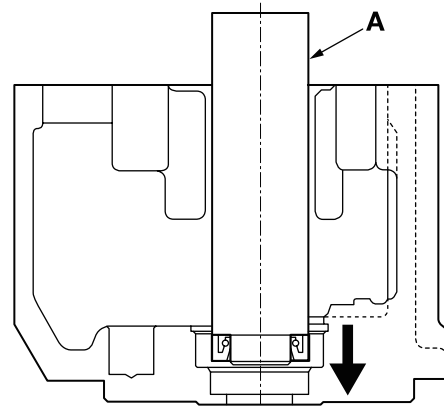
Assembly

1. Insert the oil seal (25) into the body S (1).
 - Make sure to use a new oil seal.
 - Apply a small amount of grease to the lip on the oil seal and around the outer circumference of the oil seal itself.
 - Insert the oil seal using the press-fitting jig A (see the figure below), tapping it lightly with a hammer to make it go in.



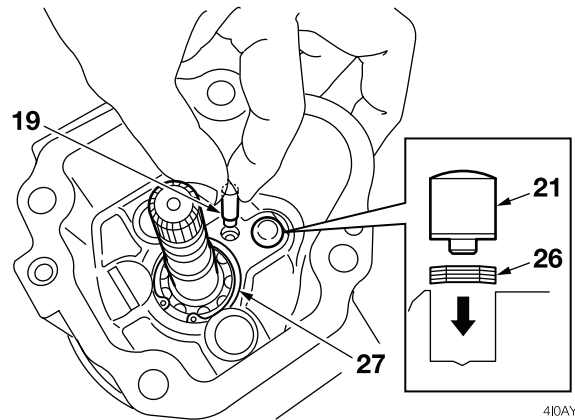
MATERIAL : S35C OR EQUIVALENT
MATERIAL : S35C ODER GLEICHWERTIG
MATERIAU : S35C OU ANALOGUE

410AI051Z



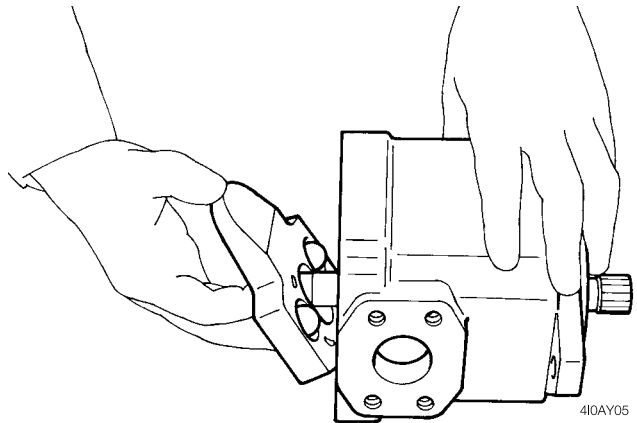
410AY08

2. Insert the shaft (3) into the body S (1), and secure it in place using the snap ring (27).
 - Be careful not to damage the lip on the oil seal while inserting the part.
3. Place the four belleville springs (26) onto the stopper pin A (21), and insert the resulting assembly into the body S (1).
 - Be careful not to attach the belleville springs in the wrong direction.
4. Insert the piston (19) into the body S (1).



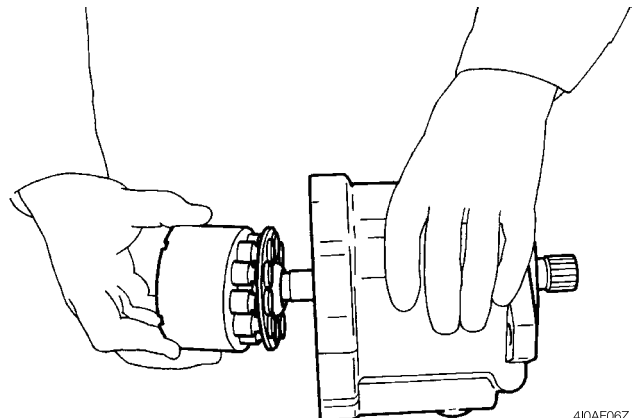
410AY09

5. Attach the oscillating pin (12) to the swash plate (10), and attach the resulting assembly to the spherical hole on the body S (1).
 - Apply grease to the oscillating pin.



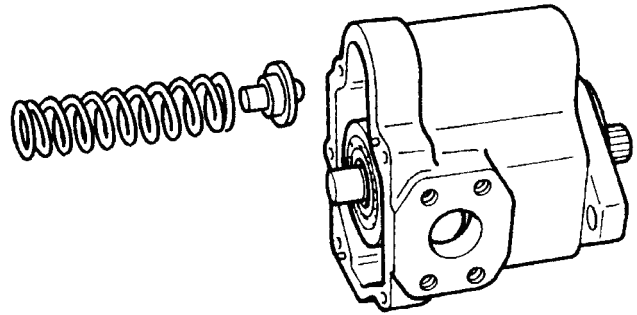
410AY05

6. Insert the cylinder block assembly (4) into the body S (1).



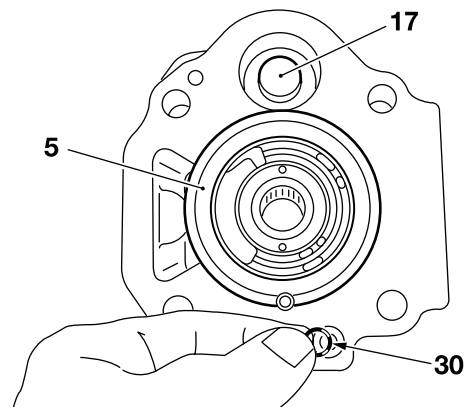
410AF06Z

7. Insert the spring (15) into the spring holder (16). Finally, insert the spherical part of the spring holder into the hole on the swash plate.



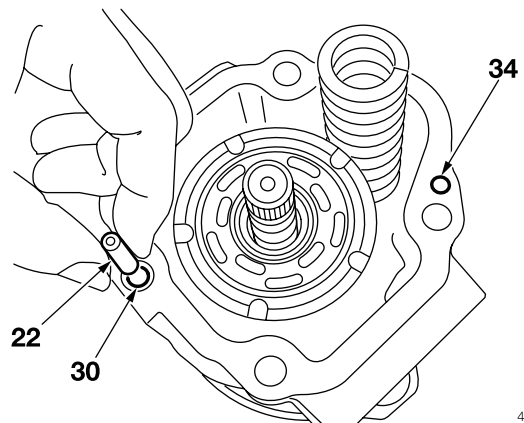
410AY04

8. Insert the spring guide (17) and O-ring (30) into the body H (2).
9. Align the valve plate (5) with the spring pin on the body H and attach it carefully.
- The side of the valve plate with the barbs is the sliding surface that is to make contact with the cylinder block. Make sure not to reverse it.



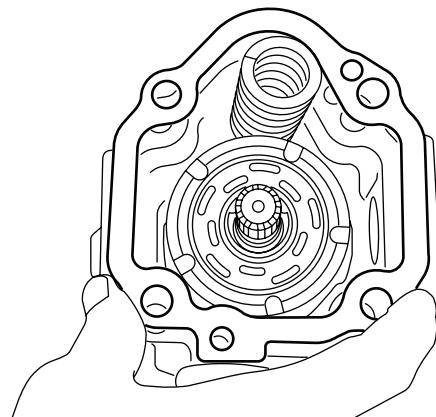
410AY10

10. Insert the O-ring (30) and pins (22) and (34) into the body S (1).



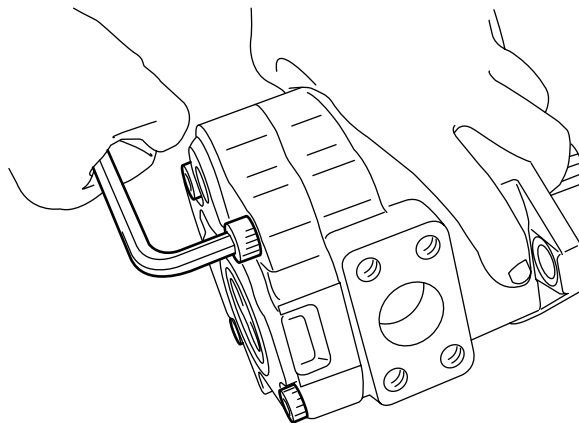
410AY11

11. To attach the packing, line it up with the locator pin on the body S.
- Use a new packing.

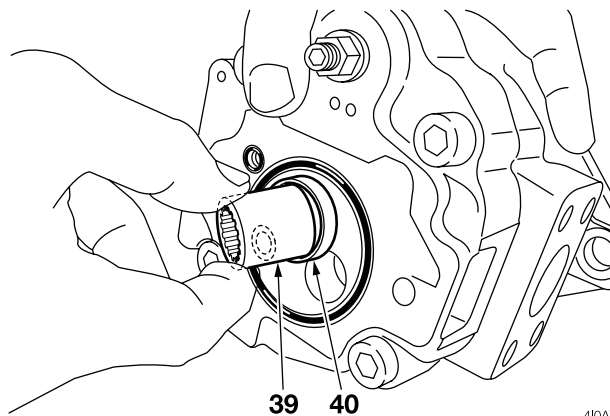


410AY12

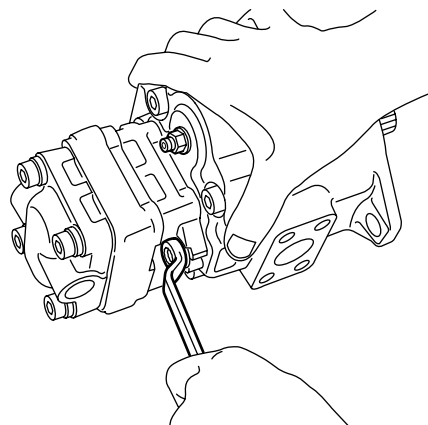
12. Insert the two cap screws (M10×50) for temporary assembly into the proper positions on the top side and loosely tighten them down. Once the gap between the joining surfaces reaches 10 mm (0.39 in.), insert the cap screws (M10×40) into the remaining two screw positions and tighten them down.
13. Take out the cap screws for temporary assembly and replace them with the cap screws (M10×40), and tighten those screws down to secure the parts in place.
- 🔑 Cap screws: 51.0 to 64.7 N·m (37.6 to 47.7 ft.-lb)



14. Attach the collar (40) and the coupling (39) to the gear pump linking section of the piston pump and then attach the O-rings (42) and (44).

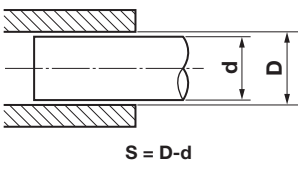
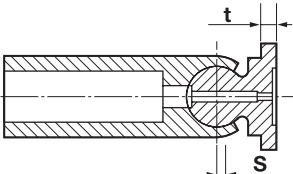
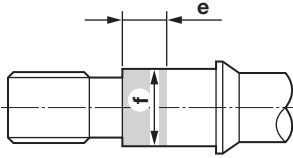


15. Attach the gear pump using the two cap screws (1) and two washers.
- 🔑 Cap screws: 19.6 to 23.5 N·m (14.5 to 15.2 ft.-lb)
16. To check to see if the assembly is in order, turn the pump while holding the shaft in place loosely using a vise. If it does not rotate smoothly, take the assembly apart and try again.



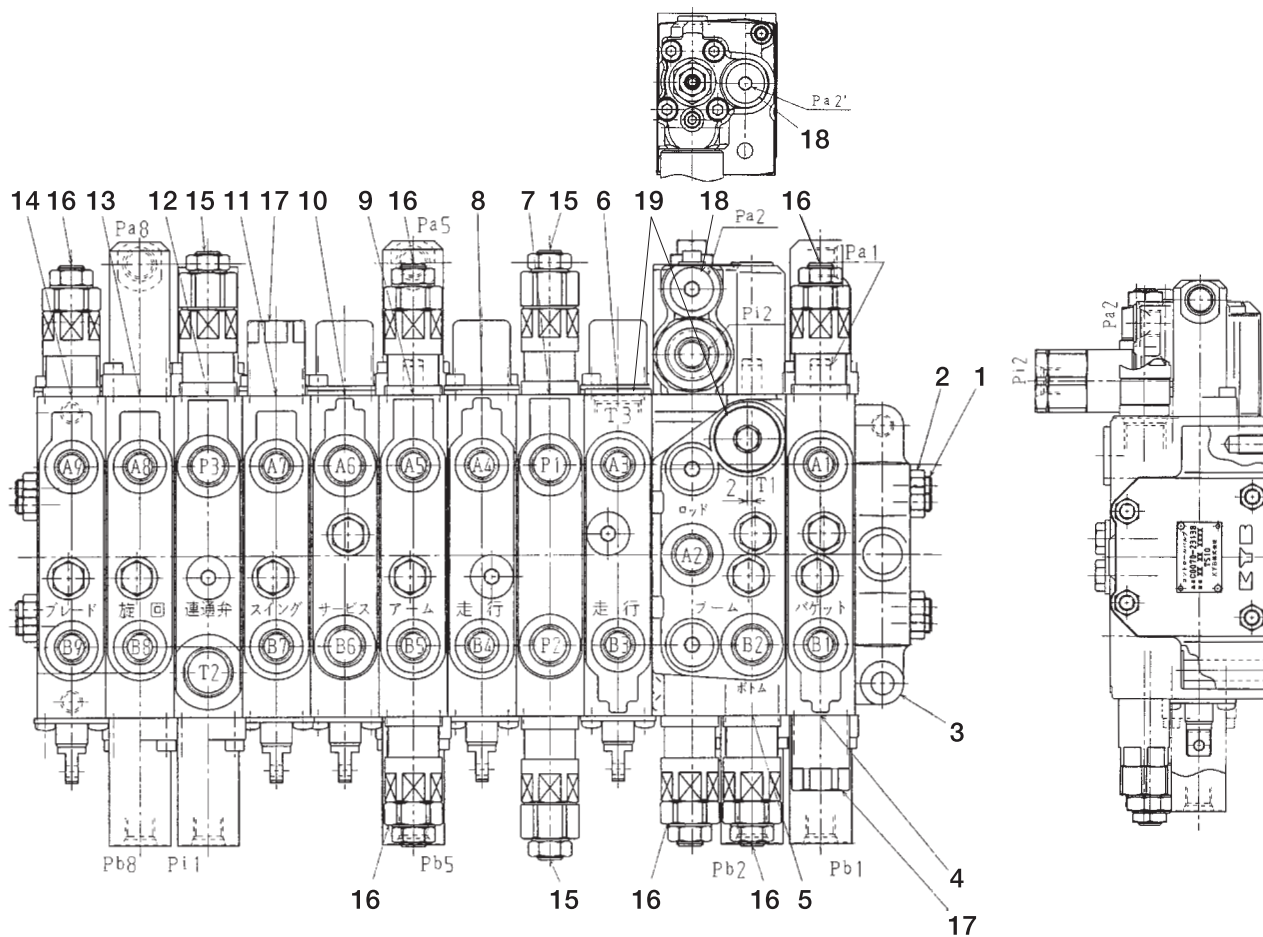
Inspection and adjustments

Checking the parts

Item		Criteria	Action
Piston and cylinder block assembly	 $S = D - d$ 410AF22Z	- When the width of the clearance (S) between the piston and cylinder block assembly is above 0.05 mm (0.0022 in.) - When there is damage, scratches, abnormal wear, or other problems present on the surfaces of sliding parts	- Replace - Replace
Amount of looseness between the piston and shoe	 410AF231Z	When the amount of looseness (S) between the piston and shoe is above 0.2 mm (0.0079 in.) in range	Replace
Shaft and oil seal mount	 410AF24Z	When the amount of wear on the shaft and oil seal mount is 0.025 mm (0.00098 in.) deep or more	Replace
Valve plate		When there are abnormal scratches (measuring more than 0.02 mm (0.00079 in.) in length or width), wear or seizing on the sliding surfaces	Repair or replace
Bushing		When there is abnormal wear or harmful damage on the sliding surfaces	Replace
Seals and O-rings		During reassembly after parts disassembled	Replace
Drive gears and driven gears		When there are abnormal scratches, wear, or flaking on tooth surfaces	Replace
Ball bearings and needle bearings		When there are abnormal scratches, wear, or flaking on the rolling surfaces	Replace together with the shaft assembly

CONTROL VALVE

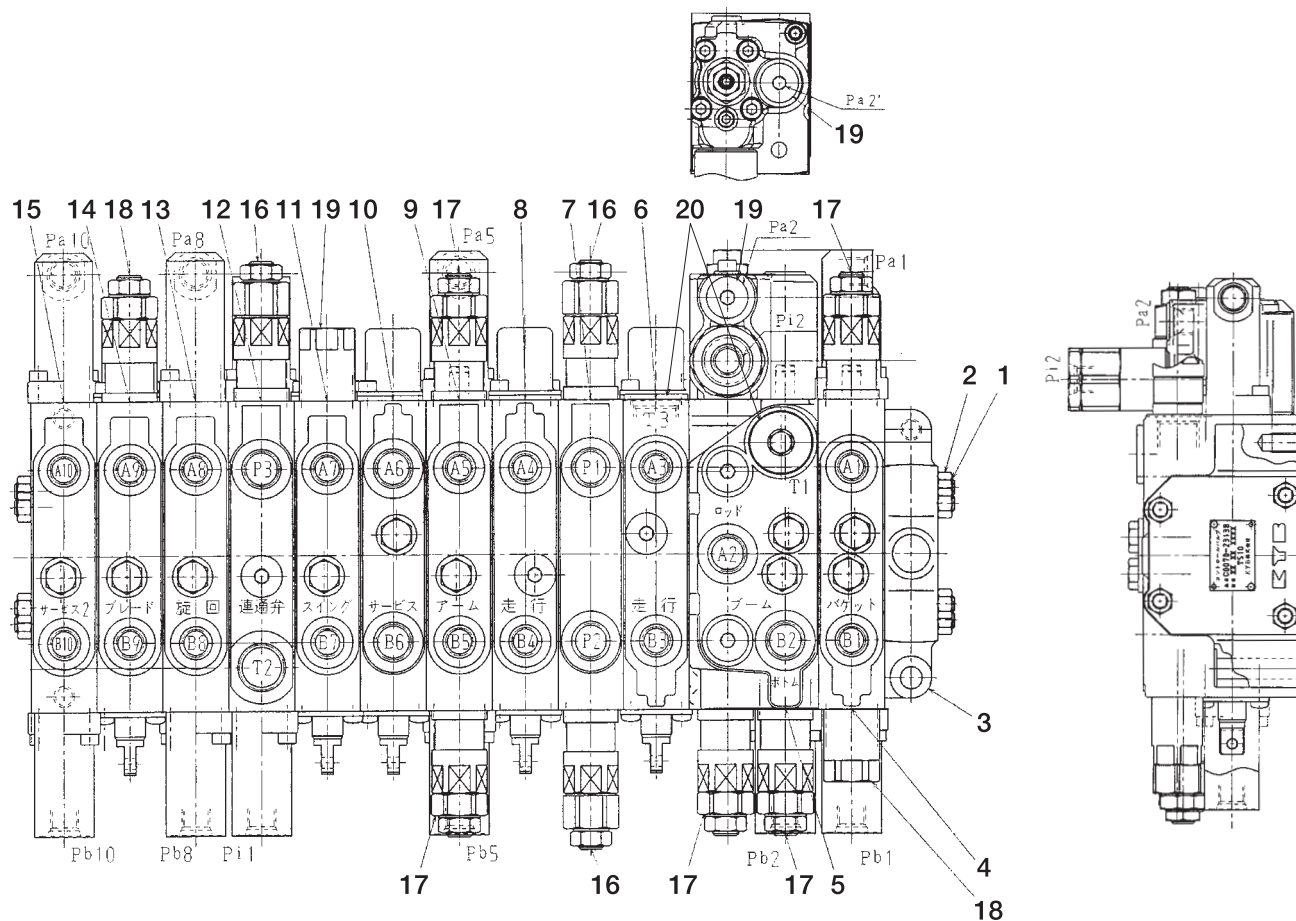
Construction Standard



4J0AX01

- | | |
|-------------------------|---------------------------|
| 1. Tie rod | 11. Swing section |
| 2. Nut | 12. Switch valve |
| 3. Outlet housing | 13. Slew section |
| 4. Bucket section | 14. Dozer blade section |
| 5. Boom section | 15. Main relief valve |
| 6. Right travel section | 16. Port relief valve |
| 7. Inlet housing | 17. Anti-cavitation valve |
| 8. Left travel section | 18. Plug |
| 9. Arm section | 19. Plug |
| 10. Auxiliary section | |

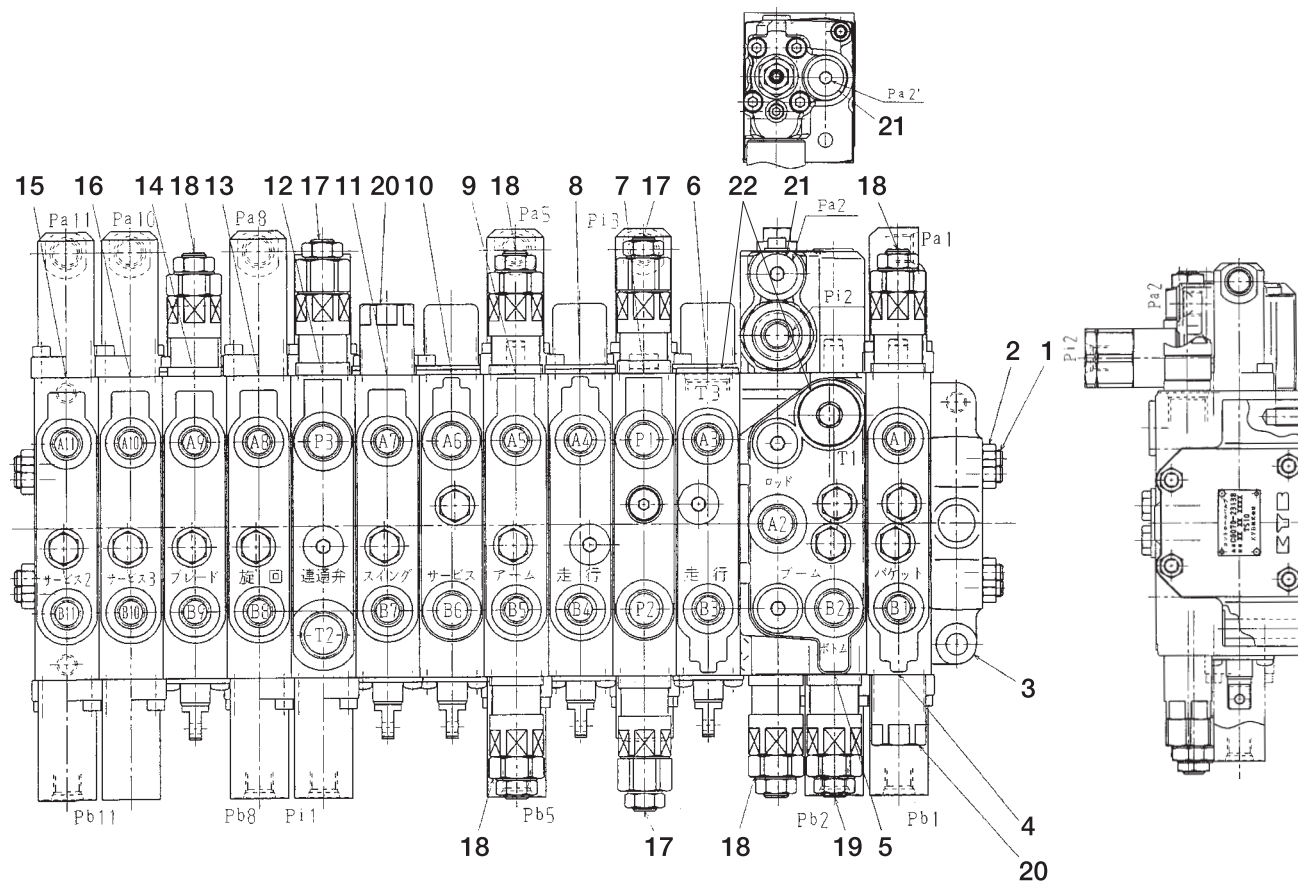
Auxiliary 2



4J0AX02

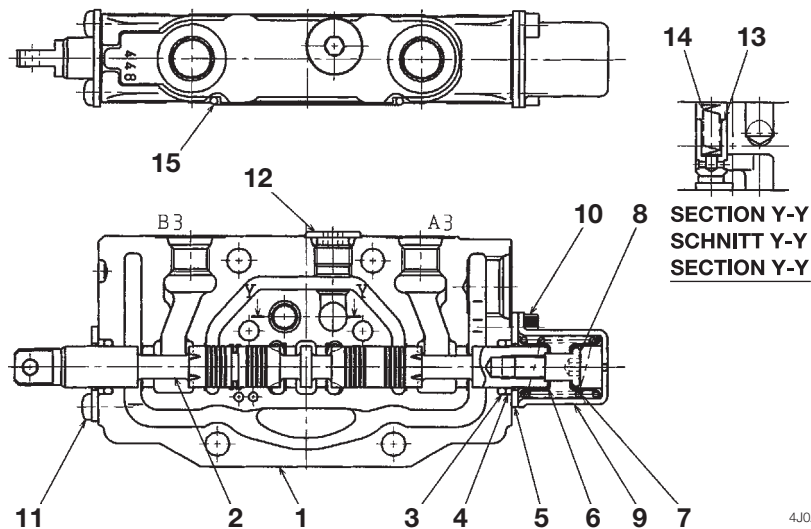
- | | |
|-------------------------|---------------------------|
| 1. Tie rod | 11. Swing section |
| 2. Nut | 12. Switch valve |
| 3. Outlet housing | 13. Slew section |
| 4. Bucket section | 14. Dozer blade section |
| 5. Boom section | 15. 2nd Auxiliary section |
| 6. Right travel section | 16. Main relief valve |
| 7. Inlet housing | 17. Port relief valve |
| 8. Left travel section | 18. Anti-cavitation valve |
| 9. Arm section | 19. Plug |
| 10. Auxiliary section | 20. Plug |

Auxiliary 2 + 3



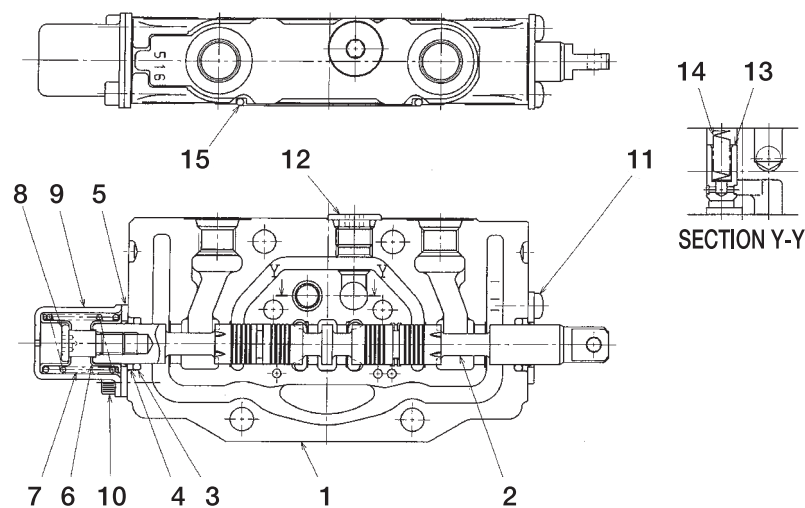
- | | |
|-------------------------|---------------------------|
| 1. Tie rod | 12. Switch valve |
| 2. Nut | 13. Slew section |
| 3. Outlet housing | 14. Dozer blade section |
| 4. Bucket section | 15. 2nd Auxiliary section |
| 5. Boom section | 16. 3rd Auxiliary section |
| 6. Right travel section | 17. Main relief valve |
| 7. Inlet housing | 18. Port relief valve |
| 8. Left travel section | 19. Port relief valve |
| 9. Arm section | 20. Anti-cavitation valve |
| 10. Auxiliary section | 21. Plug |
| 11. Swing section | 22. Plug |

4J0AX03

Right travel section

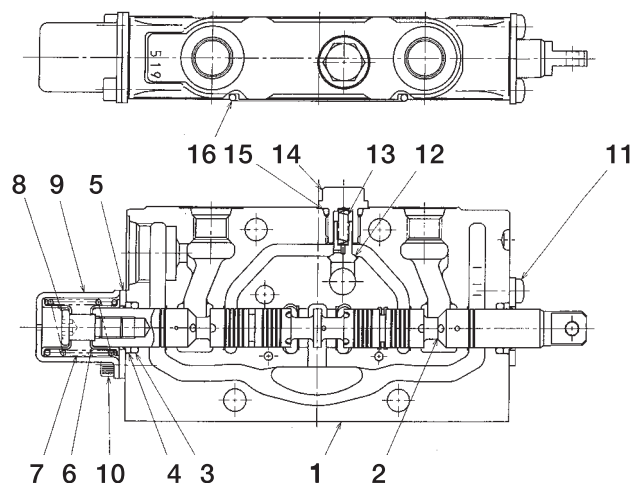
1. Housing
2. Spool
3. O-ring
4. Wiper
5. Seal holder
6. Spring holder
7. Spring
8. Screw
9. Cover
10. Cap screw
11. Screw
12. Plug
13. Poppet
14. Spring
15. O-ring

4J0AI02Z

Left travel section

1. Housing
2. Spool
3. O-ring
4. Wiper
5. Seal holder
6. Spring holder
7. Spring
8. Screw
9. Cover
10. Cap screw
11. Screw
12. Plug
13. Poppet
14. Spring
15. O-ring

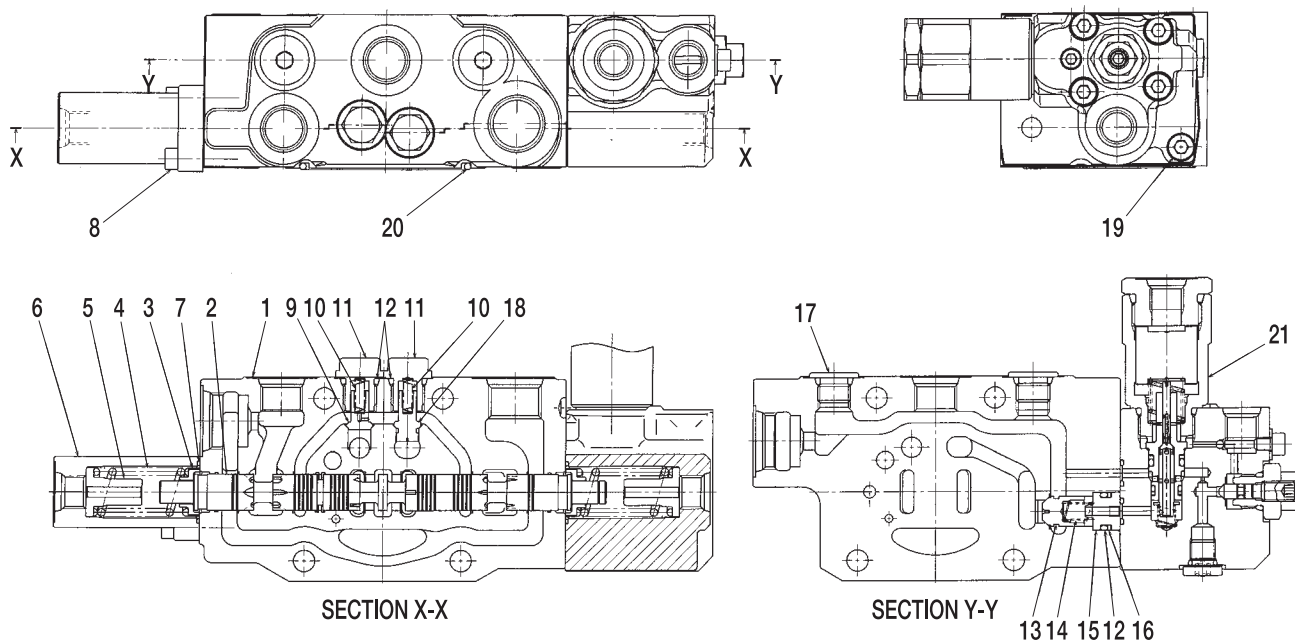
4J0AX04

Swing section

1. Housing
2. Spool
3. O-ring
4. Wiper
5. Seal holder
6. Spring holder
7. Spring
8. Screw
9. Cover
10. Cap screw
11. Screw
12. Poppet
13. Spring
14. Plug
15. O-ring
16. O-ring

4J0AX05

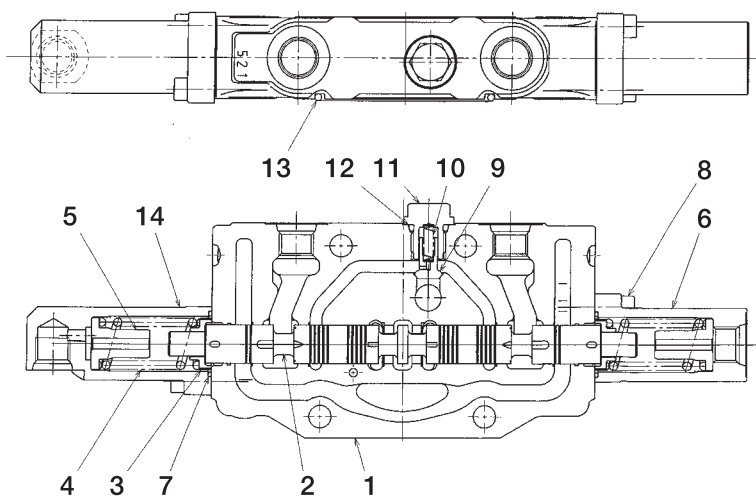
Boom section



4J0AX06

- | | | |
|------------------|--------------|----------------------|
| 1. Housing | 8. Cap screw | 15. Spacer |
| 2. Spool | 9. Poppet | 16. Backup ring |
| 3. Spring holder | 10. Spring | 17. Plug |
| 4. Spring | 11. Plug | 18. Poppet |
| 5. Spring holder | 12. O-ring | 19. Cap screw |
| 6. Cover | 13. Poppet | 20. O-ring |
| 7. O-ring | 14. Spring | 21. Anti drift valve |

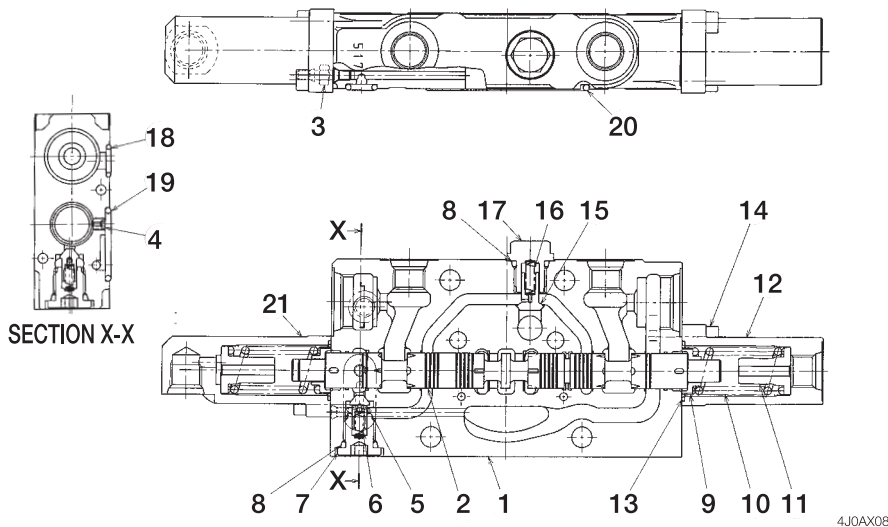
Slew section



4J0AX07

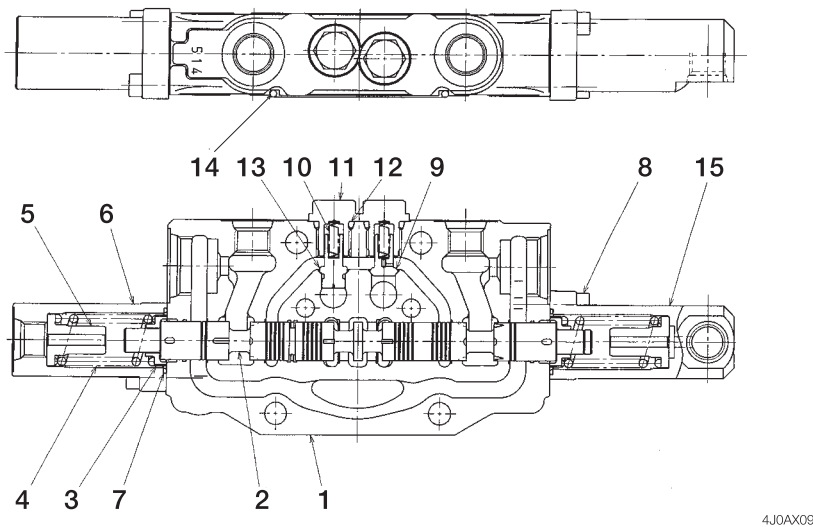
- | |
|------------------|
| 1. Housing |
| 2. Spool |
| 3. Spring holder |
| 4. Spring |
| 5. Spring holder |
| 6. Cover |
| 7. O-ring |
| 8. Cap screw |
| 9. Poppet |
| 10. Spring |
| 11. Plug |
| 12. O-ring |
| 13. O-ring |
| 14. Cover |

Arm section



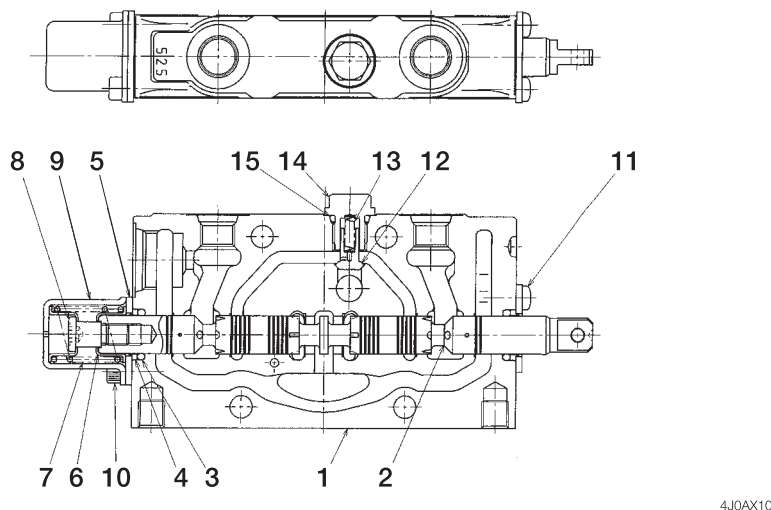
- | | |
|-------------------|------------|
| 1. Housing | 17. Plug |
| 2. Spool | 18. O-ring |
| 3. Plug | 19. O-ring |
| 4. Orifice | 20. O-ring |
| 5. Poppet | 21. Cover |
| 6. Spring | |
| 7. Plug | |
| 8. O-ring | |
| 9. Spring holder | |
| 10. Spring | |
| 11. Spring holder | |
| 12. Cover | |
| 13. O-ring | |
| 14. Cap screw | |
| 15. Poppet | |
| 16. Spring | |

Bucket section



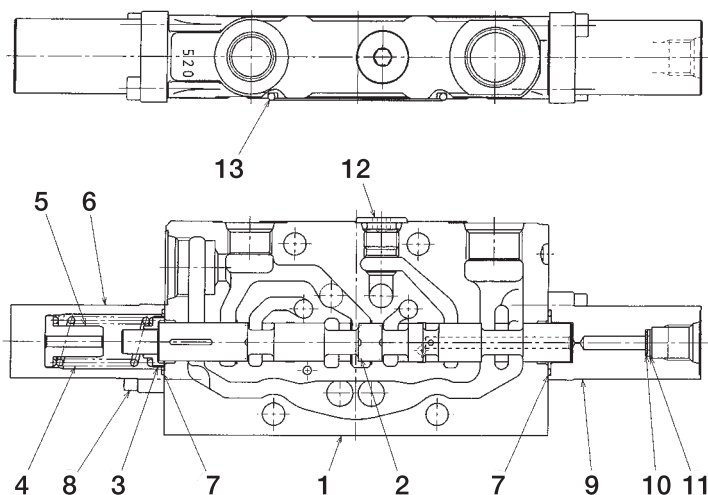
- | |
|------------------|
| 1. Housing |
| 2. Spool |
| 3. Spring holder |
| 4. Spring |
| 5. Spring holder |
| 6. Cover |
| 7. O-ring |
| 8. Cap screw |
| 9. Poppet |
| 10. Spring |
| 11. Plug |
| 12. O-ring |
| 13. Poppet |
| 14. O-ring |
| 15. Cover |

Dozer blade section



- | |
|------------------|
| 1. Housing |
| 2. Spool |
| 3. O-ring |
| 4. Wiper |
| 5. Seal holder |
| 6. Spring holder |
| 7. Spring |
| 8. Screw |
| 9. Cover |
| 10. Cap screw |
| 11. Screw |
| 12. Poppet |
| 13. Spring |
| 14. Plug |
| 15. O-ring |

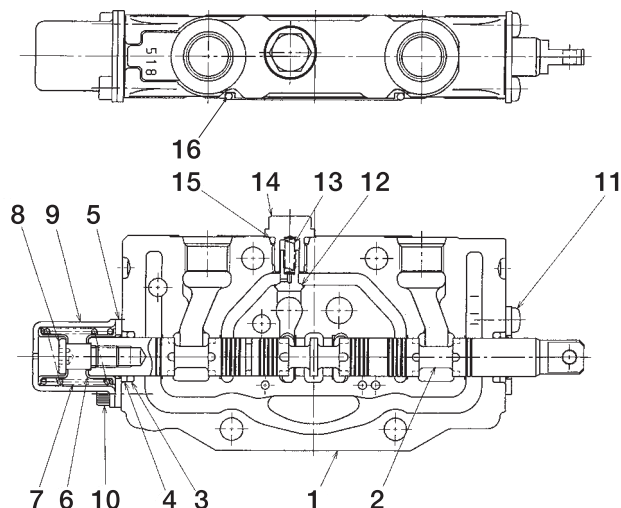
Switch valve



4J0AX11

1. Housing
2. Spool
3. Spring holder
4. Spring
5. Spring holder
6. Cover
7. O-ring
8. Cap screw
9. Cover
10. Filter
11. Washer
12. Plug
13. O-ring

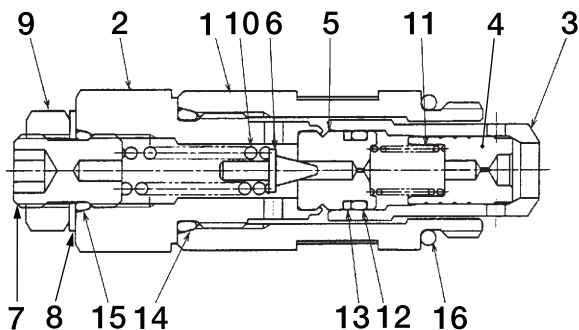
Auxiliary section



4J0AX12

1. Housing
2. Spool
3. O-ring
4. Wiper
5. Seal holder
6. Spring holder
7. Spring
8. Screw
9. Cover
10. Cap screw
11. Screw
12. Poppet
13. Spring
14. Plug
15. O-ring
16. O-ring

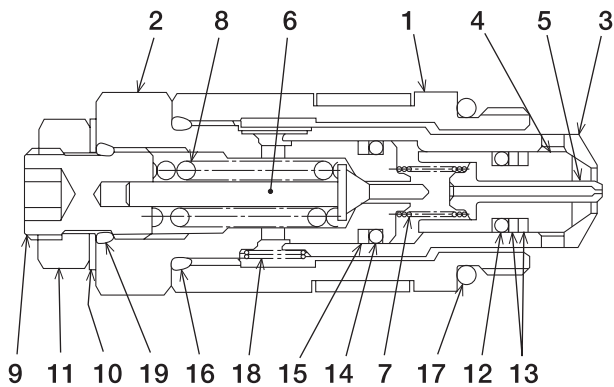
Main relief valve



W2D216

1. Housing
2. Plug
3. Sleeve
4. Main poppet
5. Piston
6. Needle valve
7. Setscrew
8. Washer
9. Lock nut
10. Spring
11. Spring
12. O-ring
13. Backup ring
14. O-ring
15. O-ring
16. O-ring

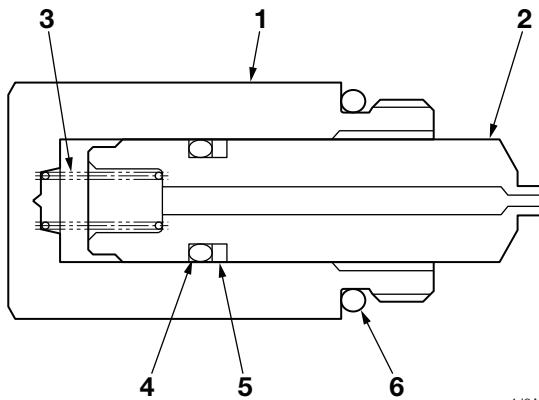
Port relief valve



4J0AX13

- | | |
|-----------------|-----------------|
| 1. Housing | 11. Lock nut |
| 2. Plug | 12. O-ring |
| 3. Sleeve | 13. Backup ring |
| 4. Main poppet | 14. O-ring |
| 5. Piston | 15. Backup ring |
| 6. Needle valve | 16. O-ring |
| 7. Spring | 17. O-ring |
| 8. Spring | 18. Spring |
| 9. Set screw | 19. O-ring |
| 10. Washer | |

Anti-cavitation valve



4J0AF14Z

- | |
|----------------|
| 1. Plug |
| 2. Poppet |
| 3. Spring |
| 4. O-ring |
| 5. Backup ring |
| 6. O-ring |

Disassembly

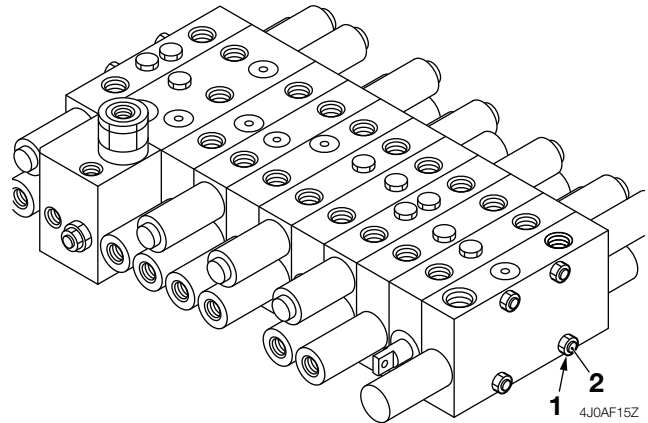
For disassembly of the control valve, follow the procedure below. For assembly of the control valve, follow the same procedure as for disassembly in the reverse order.

Valve assembly

1. Loosen the nuts (1) and remove the tie rods (2), then remove the sections.

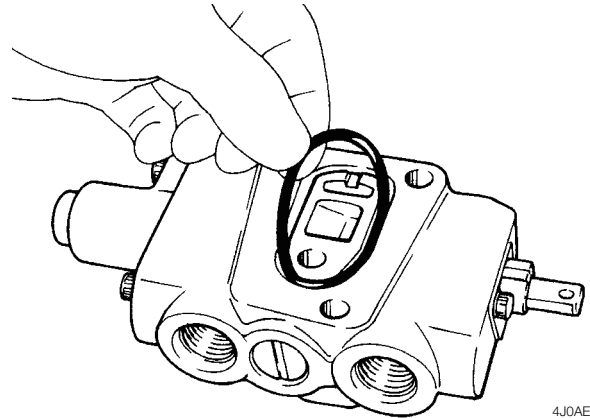
Be sure to apply position marks to each section to avoid mistakes during assembly.

🔑 Nut (1): 26.5 to 29.4 N·m (19.5 to 21.7 ft-lb.)



2. Remove the O-ring.

- The contact surface is of a metal seal. Pay attention not to damage or make a dent on it.

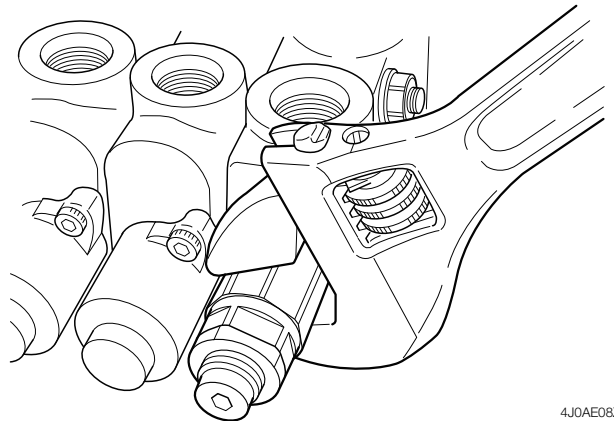


3. Remove the main relief valve and the port relief valve, and then remove the O-ring from the relief valve.

- Do not disassemble unless necessary. The pressure value set in the valve is changed if the lock nut is loosened and the setscrew is turned.
- Do not further disassemble the port relief valve as it is impossible to adjust pressure after reassembly.

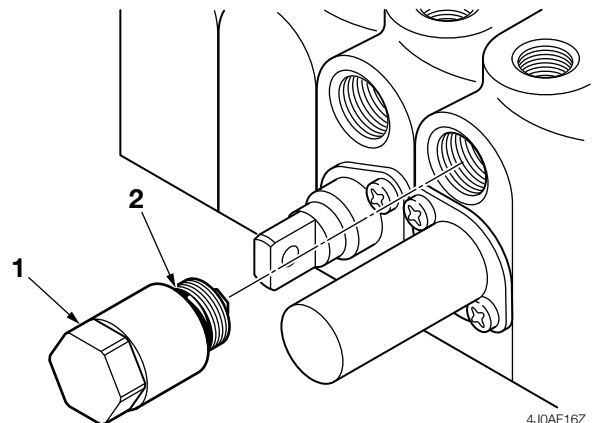
🔑 Main relief valve: 74 ±5 N·m (54.6 ±3.7 ft-lb.)

🔑 Port relief valve: 74 ±5 N·m (54.6 ±3.7 ft-lb.)

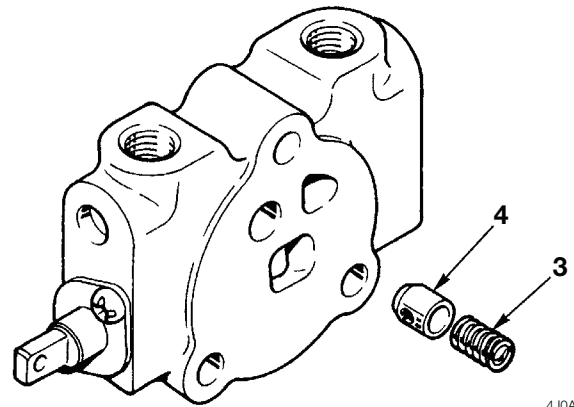


4. Remove the anti-cavitation valve (1), and then remove the O-ring from the anti-cavitation valve.

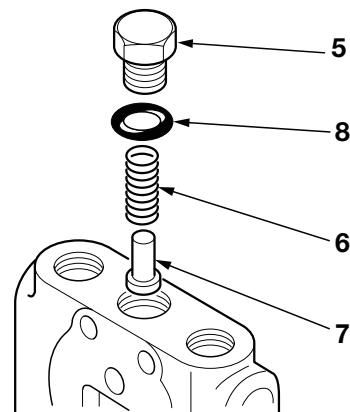
🔑 Anti-cavitation valve: 74 ±5 N·m (54.6 ±3.7 ft-lb.)



5. Remove the load check valve.
 - a. Remove the spring (3) and then the poppet (4).

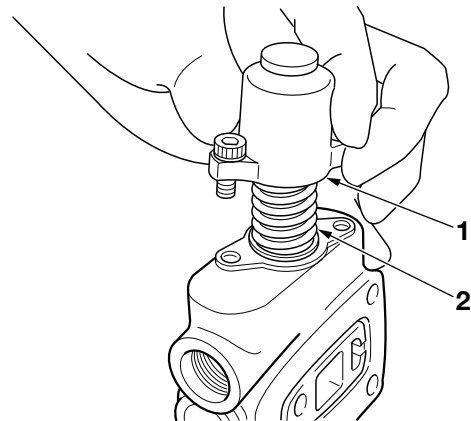


6. Remove the load check valve.
 - a. Take out the plug (5) and spring (6) and remove the poppet (7).
 - ⚙️ Plug: 29.4 N·m (21.7 ft-lb.)
 - b. Remove the O-ring (8) from the plug.

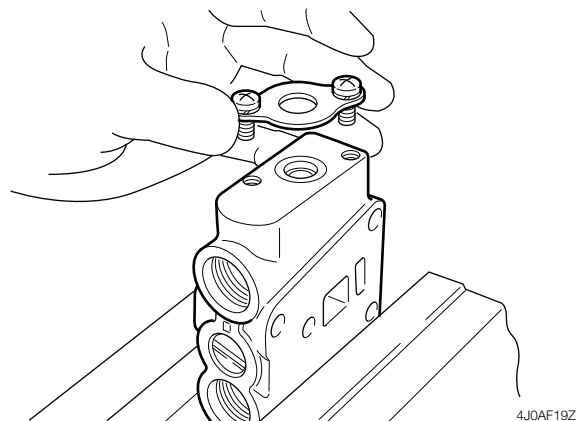


Manually operated section

1. Remove the cap screws, the cover (1) and the spool assembly (2).
- ⚙️ Cap screw: 7.3 N·m (5.4 ft-lb.)
2. Take out the seal holder and remove the wiper and the O-ring.

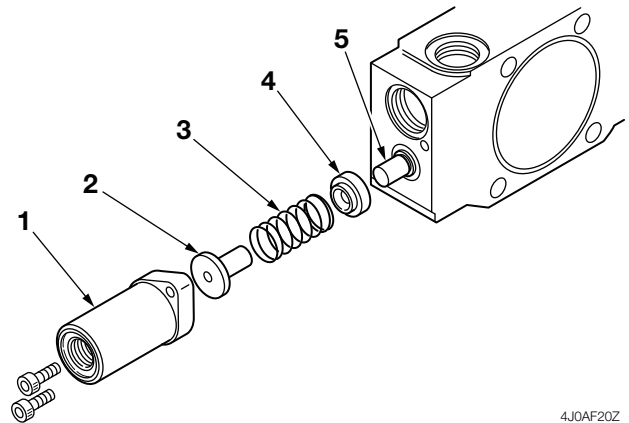


3. Take out the screws on the spool yoke side of the section, and then remove the seal holder, wiper ring and O-ring.
 - When assembling, temporarily fasten the seal holder with the screws and tighten them only after confirming that the spool turns smoothly.



Pilot operated section

1. Remove the cap screws and cover (1), and then remove the O-ring from the cover (1).
 🔑 Cap screw: 7.3 N·m (5.4 ft-lb.)
2. Remove the spring holder (2), spring (3) and spring holder (4).
3. Remove the spool (5) from the housing.
 - Make sure to insert the spool in the correct direction.

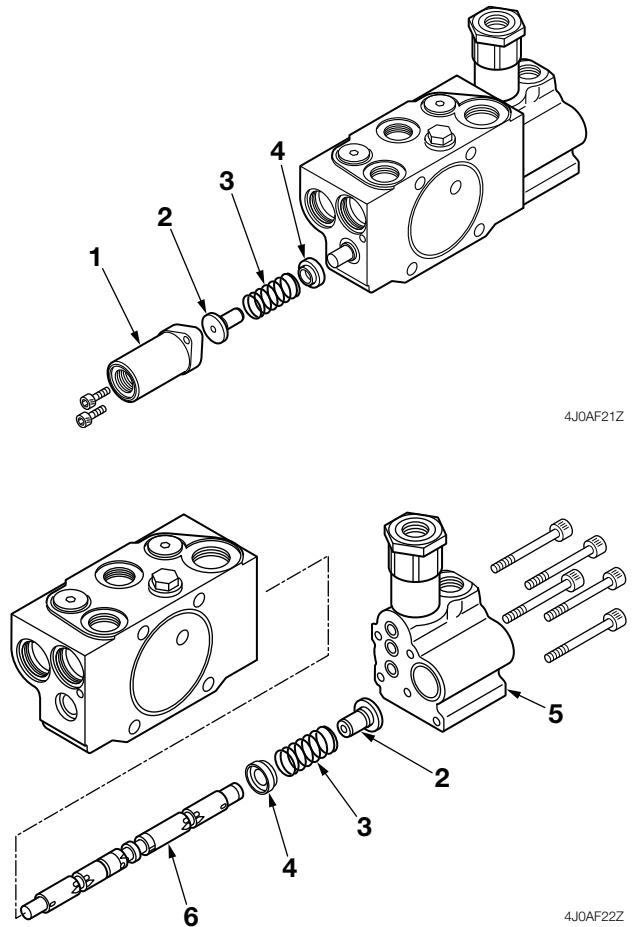


4J0AF20Z

Boom section**⚠ WARNING**

If the anti-drift valve is disassembled with the control valve still installed, parts may be ejected due to the internal pressure. Remove it after relieving the internal pressure by gradually loosening the cap screw.

1. Remove the cap screws and cover (1), and then remove the O-ring from the cover.
 🔑 Cap screw: 7.3 N·m (5.4 ft-lb.)
2. Remove the spring holder (2), spring (3) and spring holder (4).
3. Take out the cap screws and housing (5), and then remove the O-ring from the housing.
 - Do not further disassemble the anti-drift valve.
 🔑 Cap screw: 9.3 N·m (6.9 ft-lb.)
4. Remove the spring holder (2), spring (3) and spring holder (4).
5. Remove the spool assembly (6) from the housing.
 - Make sure to insert the spool in the correct direction.

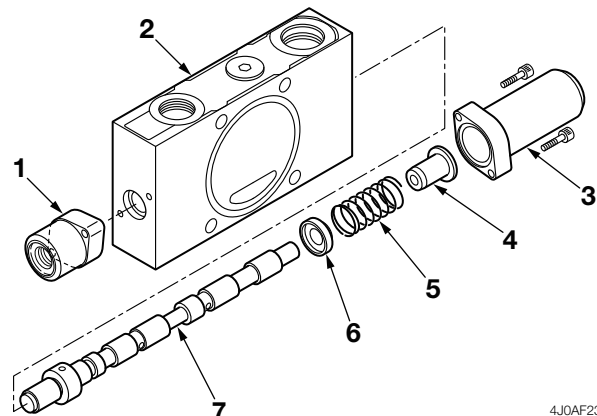


4J0AF21Z

4J0AF22Z

Switch valve

1. Remove the cap screws and cover (1), and then remove the O-ring from the cover (1).
 🔑 Cap screw: 7.3 N·m (5.4 ft-lb.)
2. Remove the cap screws and cover (3), and then remove the O-ring from the cover (3).
 🔑 Cap screw: 7.3 N·m (5.4 ft-lb.)
3. Remove the spring holder (4), spring (5) and spring holder (6).
4. Remove the spool (7) from the housing.
 - Be sure to insert the spool in the correct direction.

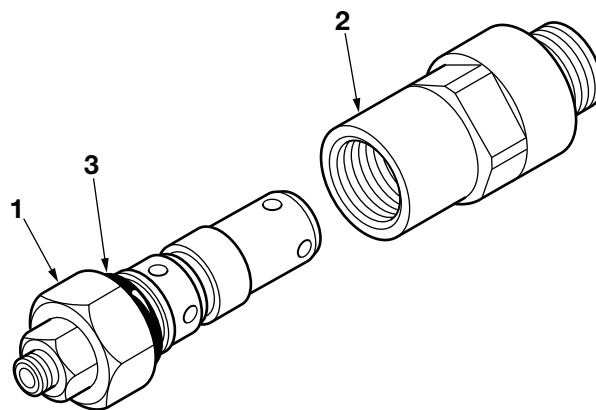


4J0AF23Z

Main relief valve

1. Remove the plug (1) from the housing (2).
 🔑 Plug: 49 to 54 N·m (36.1 to 39.8 ft-lb.)

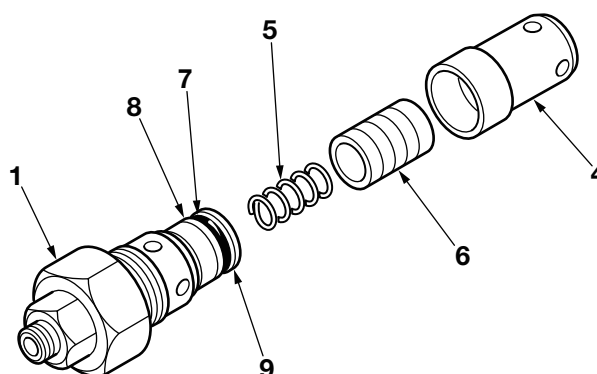
2. Remove the O-ring (3) from the plug (1).



4J0AE13Z

3. Remove the sleeve (4) from the plug (1), and then remove the spring (5) and the main poppet (6) from the sleeve (4).

4. Remove the O-ring (7) and the backup ring (8) from the seat (9).



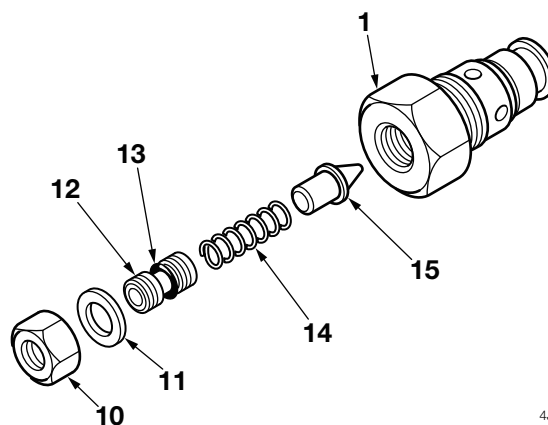
4J0AE14Z

5. Remove the lock nut (10), the washer (11) and the setscrew (12) from the plug (1), and then remove the O-ring (13) from the setscrew (12).

- When assembling, first install the setscrew (12), and then temporarily fasten the lock nut (10) to adjust the pressure before final tightening.

🔑 Lock nut: 27 to 32 N·m (19.9 to 23.6 ft-lb.)

6. Remove the spring (14) and the needle valve (15).



4J0AE15Z

Inspection and adjustment**Checking the parts**

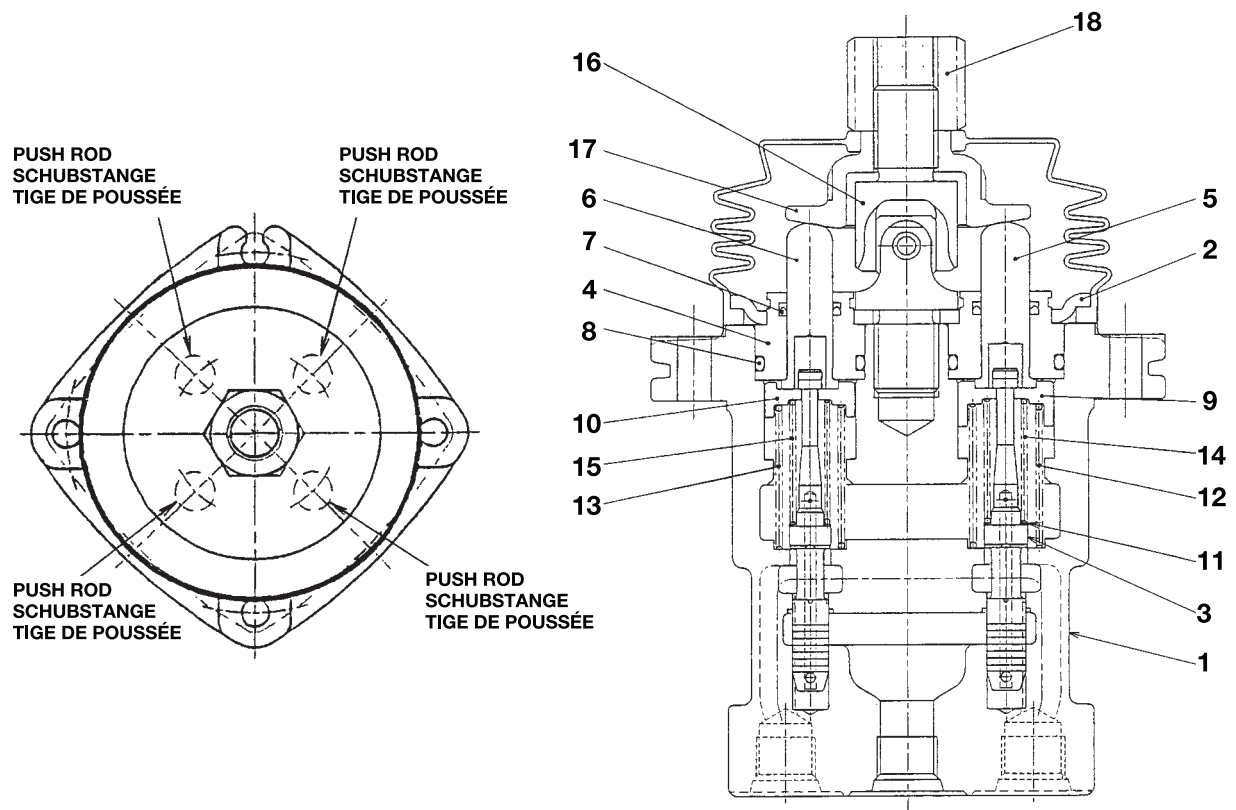
Parts	Judgment criteria	Treatment
Housing, valve body	- Scratches, rust or corrosion on the parts sliding against the spool - Scratches, rust or corrosion on the seal pocket part that the spool enters - Scratches, rust or corrosion on the seal part on the port that is in contact with the O-ring - Scratches, rust or corrosion on the seal part of the relief valve, etc. - Other damage considered to impair normal functions	Replace Replace Replace Replace Replace
Spool	- Scratches on the sliding surface of outer circumference, on which the fingernails get caught - Scratches on parts that slide against the seals at both ends - Spool does not move smoothly	Replace Replace Repair or replace
Load check valve	- Imperfect sealing due to damage to the valve or spring. - Operates smoothly when inserted and operated in the housing	Repair or replace Normal
Around the springs	Rust, corrosion, deformation, breakage or other notable damage to the spring, holder or cover	Replace
Around the spool seal	- Oil leakage to the outside - Rust, corrosion or deformation of the seal holder	Repair or replace Repair or replace
Main relief valve, port relief valve, anti-cavitation valve	- External rust, damage - Damage to valve seat contact surface - Damage to poppet contact surface - Abnormality in the spring - O-rings, backup rings, seals	Replace Replace Replace Replace Replace as a rule

Adjusting the main relief valve pressure

☞ “2. Service data, Performance criteria”

PILOT VALVE

Construction



4K2AQ13Z

- | | | |
|-------------|-----------------|-------------------|
| 1. Casing | 7. Seal | 13. Spring |
| 2. Plate | 8. O-ring | 14. Spring |
| 3. Spool | 9. Spring seat | 15. Spring |
| 4. Plug | 10. Spring seat | 16. Joint |
| 5. Push rod | 11. Washer 2 | 17. Cam |
| 6. Push rod | 12. Spring | 18. Adjusting nut |

Special tools

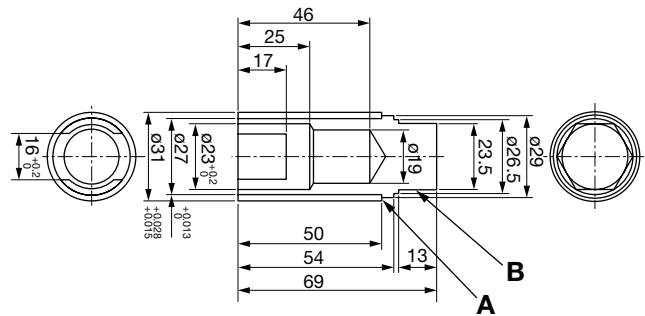
Unit: mm

Installation jig A

Quantity: 1

Material A: S45C

Material B: SCM415N (case hardened)

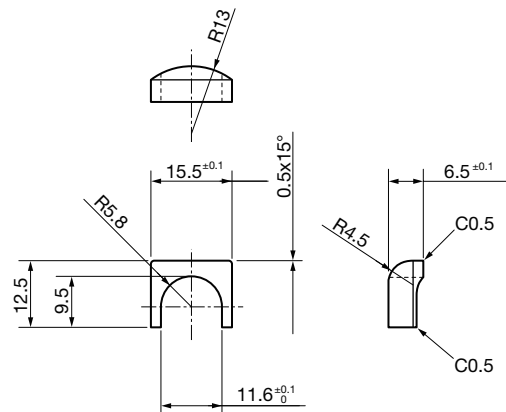


4KAC02Z

Installation jig B

Quantity: 2

Material B: SCM415N (case hardened)



4KAC03Z

Disassembly and Assembly

The numbers in parentheses () listed after the names of parts in this document match the numbers used in the construction diagrams and parts lists.

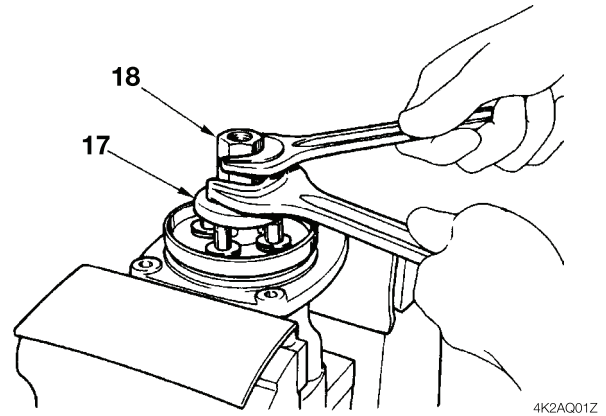
General Precautions

- Perform disassembly and assembly work in a clean place. Provide clean containers to hold parts during disassembly.
- Clean around the ports before disassembly. Remove paint around connectors with a wire brush.
- Clean the disassembled parts with wash oil.
- Put alignment marks on all parts to reassemble them in the same positions.
- After each disassembly, replace all seals and apply a thin layer of grease to them.
- Check each part for abnormal wear or seizing. Remove any burrs with sandpaper.

Disassembly**⚠ WARNING**

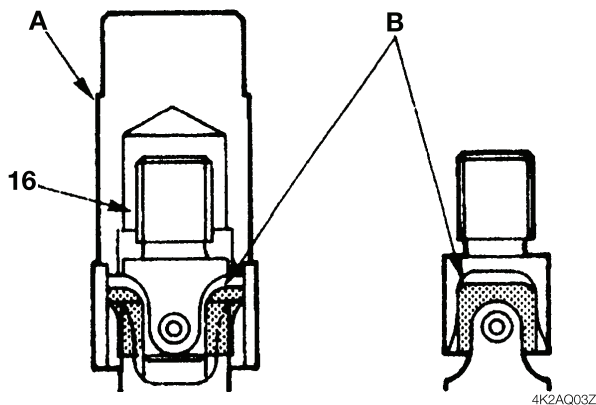
The spring may fly out during disassembly. Refer to the construction diagram and take precautions.

1. Remove the adjusting nut (18) and remove the cam (17) from the joint.
 - Fasten the valve to the vice using copper or lead sheet.

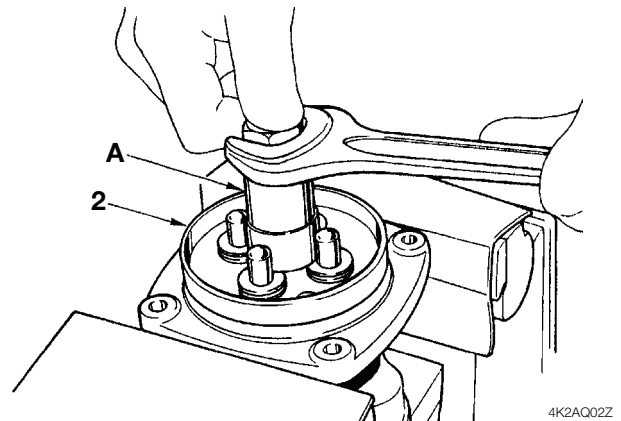


4K2AQ01Z

2. Remove the joint (16), and then remove the plate (2).
 - Use the installation jigs A and B.

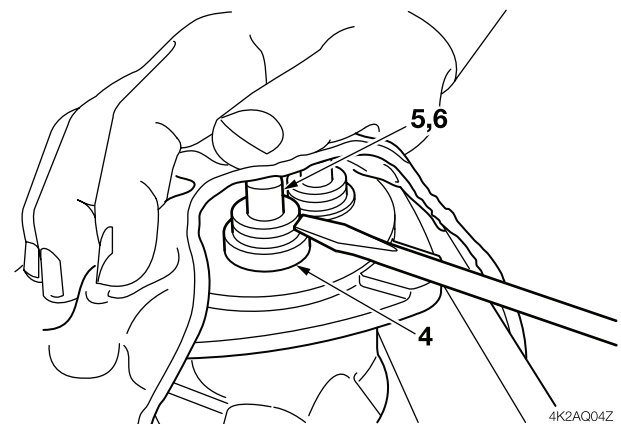


4K2AQ03Z



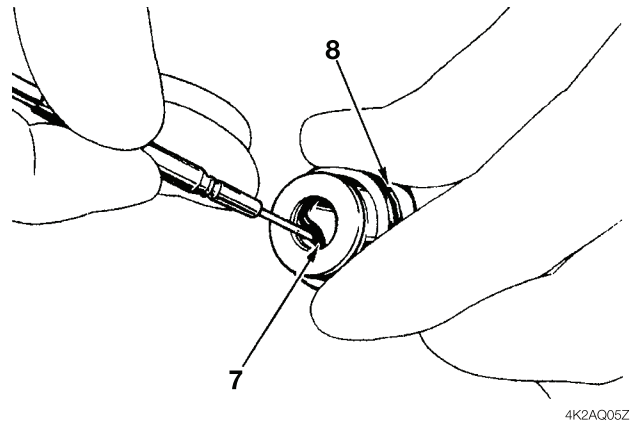
4K2AQ02Z

3. Take out the plugs (4) and remove the push rods (5) (6) from the plugs (4).
 - If it is hard to remove, use a flathead screwdriver.
 - Be aware that the plugs may fly out due to the spring force.



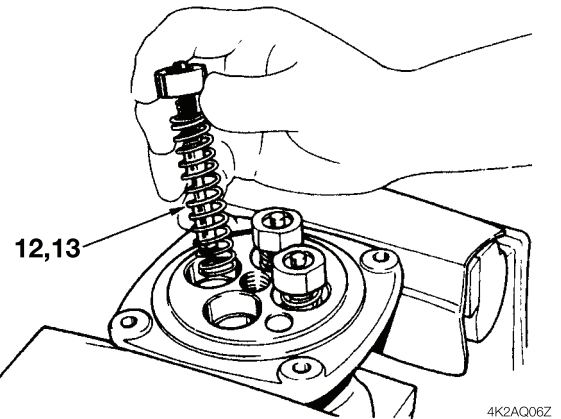
4K2AQ04Z

4. Remove the O-ring (8) and the seal (7) from the plug.



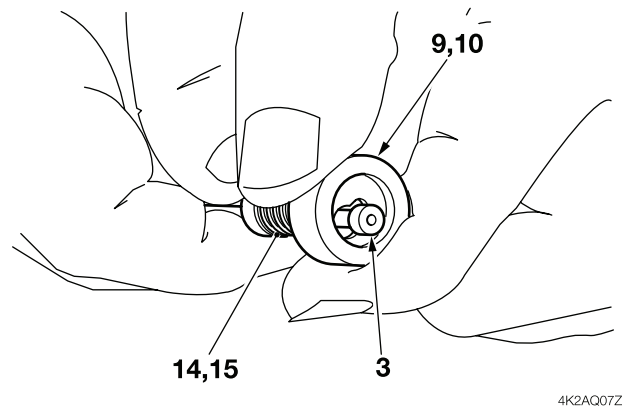
5. Remove the pressure reducing valves and springs (12) (13) from the casing.

- Put alignment marks on the pressure reducing valves and casing holes, to ensure the same position during reassembly.

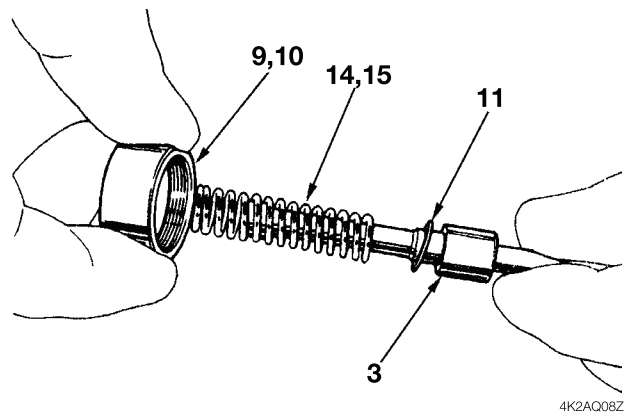


6. Disassemble the pressure reducing valve.

- Push in the spring seats (9) (10) to compress the springs (14) (15). Move the spool (3) from the small hole side to the large hole side of the spring seat (9) (10).
- Do not push down the spring seat more than 6 mm.

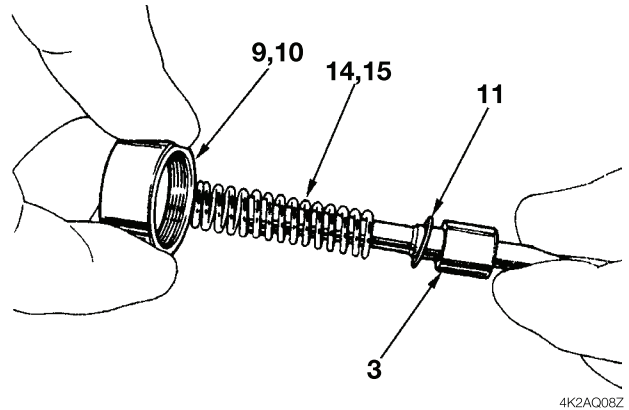


7. Remove the spring seats (9) (10), springs (14) (15), and washer 2 (11) from the spool (3).

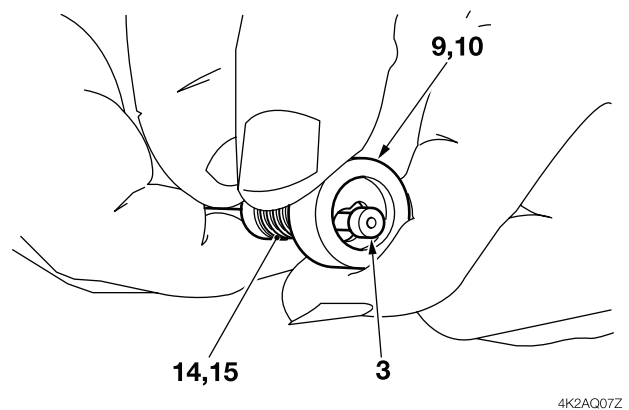


Assembly

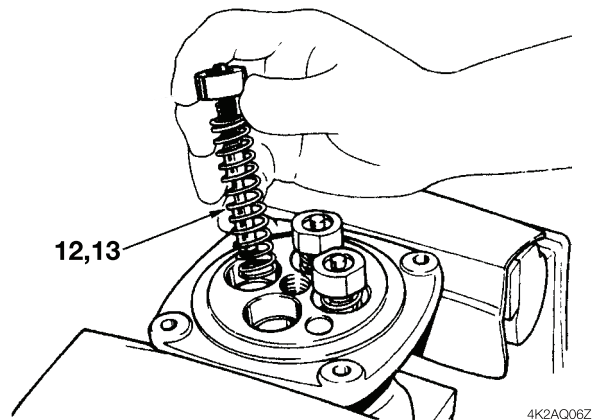
1. Assemble the pressure reducing valve.
 - a. Install washer 2 (11), the springs (14) (15), and the spring seats (9) (10) onto the spool (3).



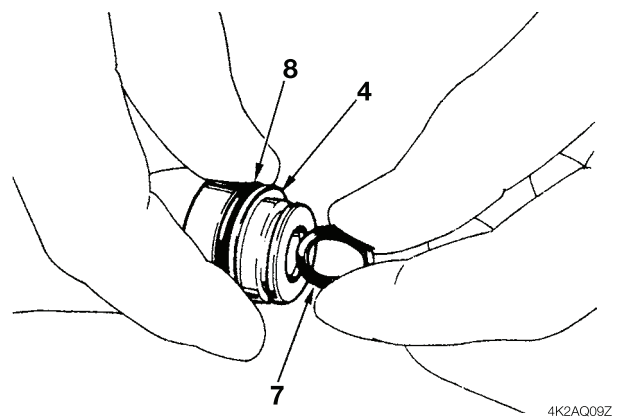
- b. Push in the spring seats (9) (10) to compress the springs (14) (15). Move the spool (3) from the large hole side to the small hole side of the spring seats (9) (10).
- Do not push down the spring seat more than 6 mm.



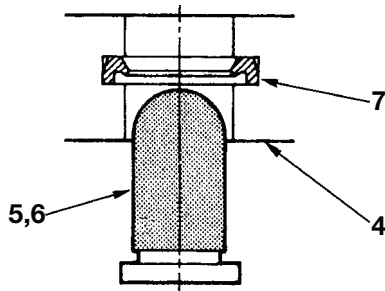
2. Install the springs (12) (13) and the pressure reducing valves.
 - Install them in the locations where they were before disassembly.



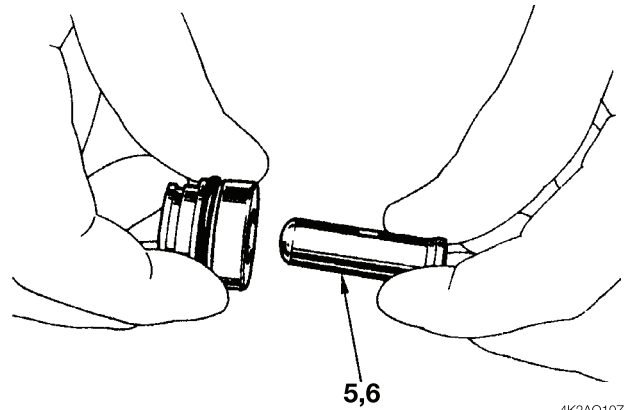
3. Install the O-ring (8) and the seal (7) onto each plug (4).



4. Install the push rod (5) or (6) into the plug (5).
- Apply hydraulic oil to the push rod.



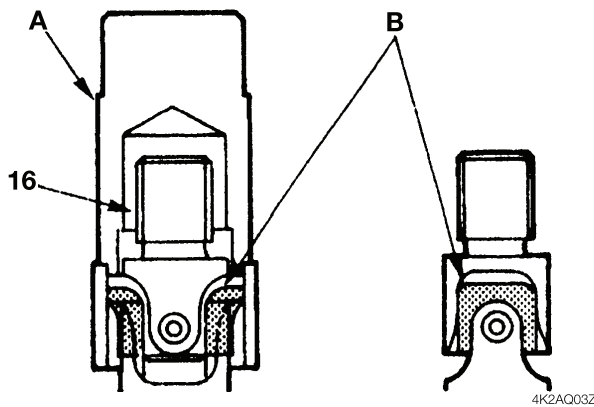
4K2AQ11Z



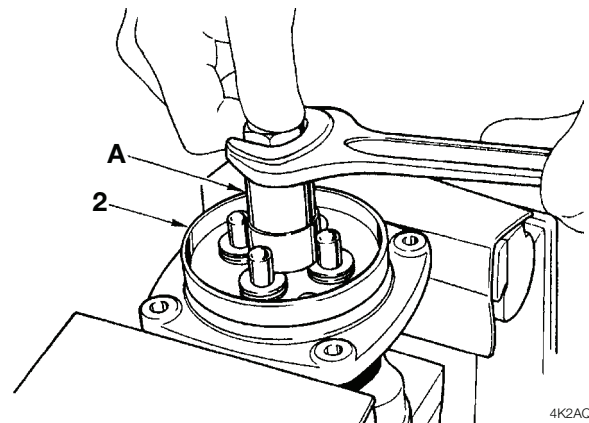
4K2AQ10Z

5. Attach the plugs and plate (2) and install the (16) joint.

- Use the installation jigs A and B to install the joint.
- Joint: 47.1 ± 2.9 N·m



4K2AQ03Z

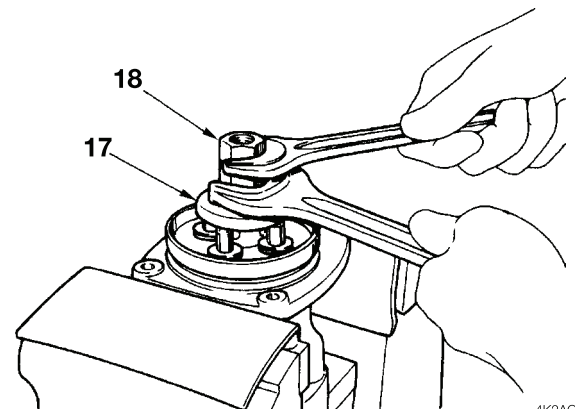


4K2AQ02Z

6. Install the cam (17) and the adjusting nut (18).

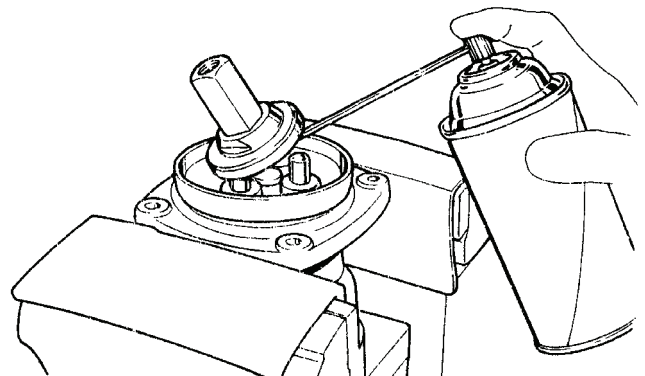
- Tighten the adjusting nut (18) to uniformly contact all four push rods.
- When tightening the adjusting nut, do not move the cam.

Adjusting nut: 68.6 ± 4.9 N·m



4K2AQ01Z

- Grease the contact surfaces on the rotating part of the joint, the disc, and the push rod.



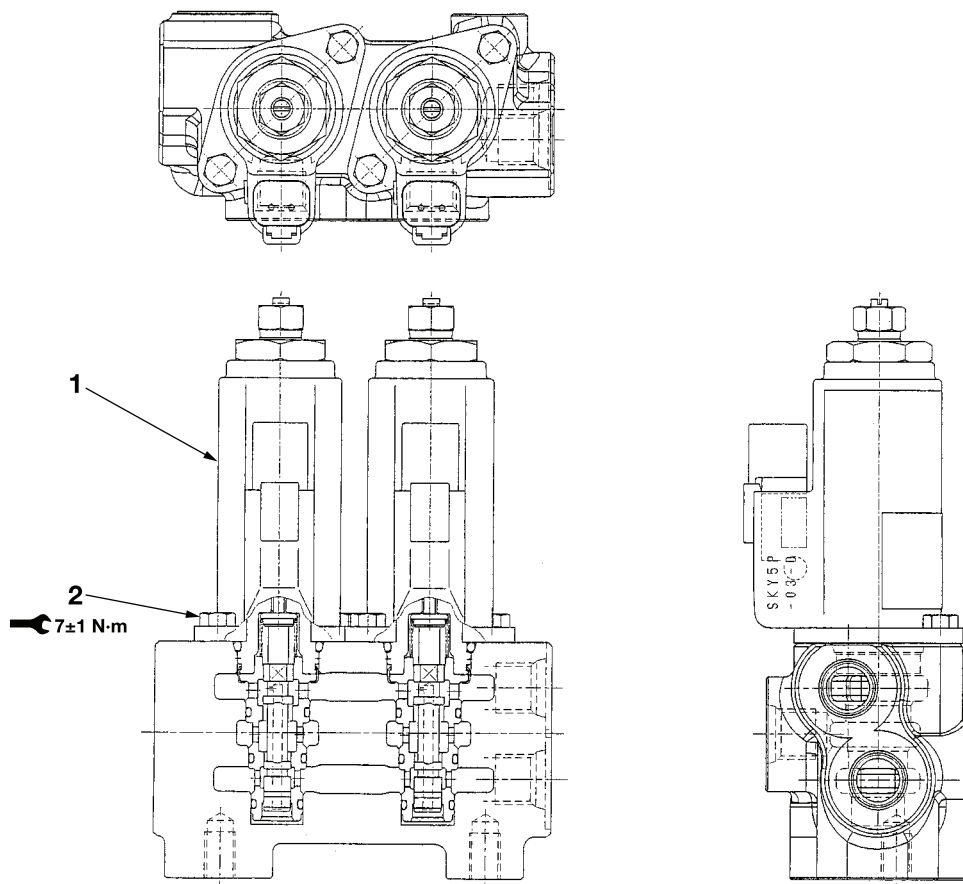
4K2AQ12Z

Inspection and adjustment**Checking the parts**

Part	Criteria	Action
O-ring	—	• Replace
Seal	—	• Replace
Spool	• Wear on the sliding surfaces is 10 µm or more than the non-sliding surfaces. • Scratches on the sliding surfaces. • Spool does not move smoothly.	• Replace • Replace • Replace
Push rod	• Tip is worn 1 mm or more • Scratches on the sliding surfaces	• Replace • Replace
Plug	• Imperfect sealing due to damage	• Repair or replace
Controls	• Looseness in the pin, shaft or joint of the controls results in 2 mm play, or more. • Wear of the pin, shaft or joint of the controls results in 2 mm play, or more.	• Tighten to the specified torque • Replace
Casing, port plate	• Scratches, rust, or corrosion at the parts in sliding contact with the spool. • Scratches, rust, or corrosion of the part of the seal in contact with the O-ring	• Replace • Repair or replace

PROPORTIONAL CONTROL SOLENOID VALVE

Construction



4K4AQ01Z

1. Proportional control solenoid

2. Bolt

Disassembly and Assembly

The numbers in parentheses () listed after the names of parts in this document match the numbers used in the construction diagrams and parts lists.

General Precautions

- Perform disassembly and assembly work in a clean place. Provide clean containers to hold parts during disassembly.
- Clean around the ports before disassembly. Remove paint around connectors with a wire brush.
- Clean the disassembled parts with wash oil.
- Put alignment marks on all parts to reassemble them in the same positions.
- After each disassembly, replace all seals and apply a thin layer of grease to them.
- Check each part for abnormal wear or seizing. Remove any burrs with sandpaper.
- Do not move adjusting screws, unless absolutely necessary.

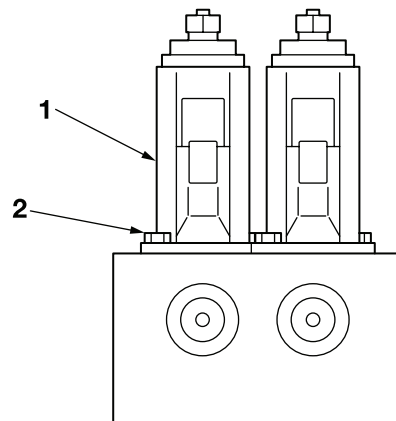
Disassembly

1. Remove the bolts (2) and remove the proportional control solenoid (1).

 Bolt: $6.9 \pm 1 \text{ N}\cdot\text{m}$

Assembly

For assembly, reverse the disassembly procedure.



4K4AQ01Z

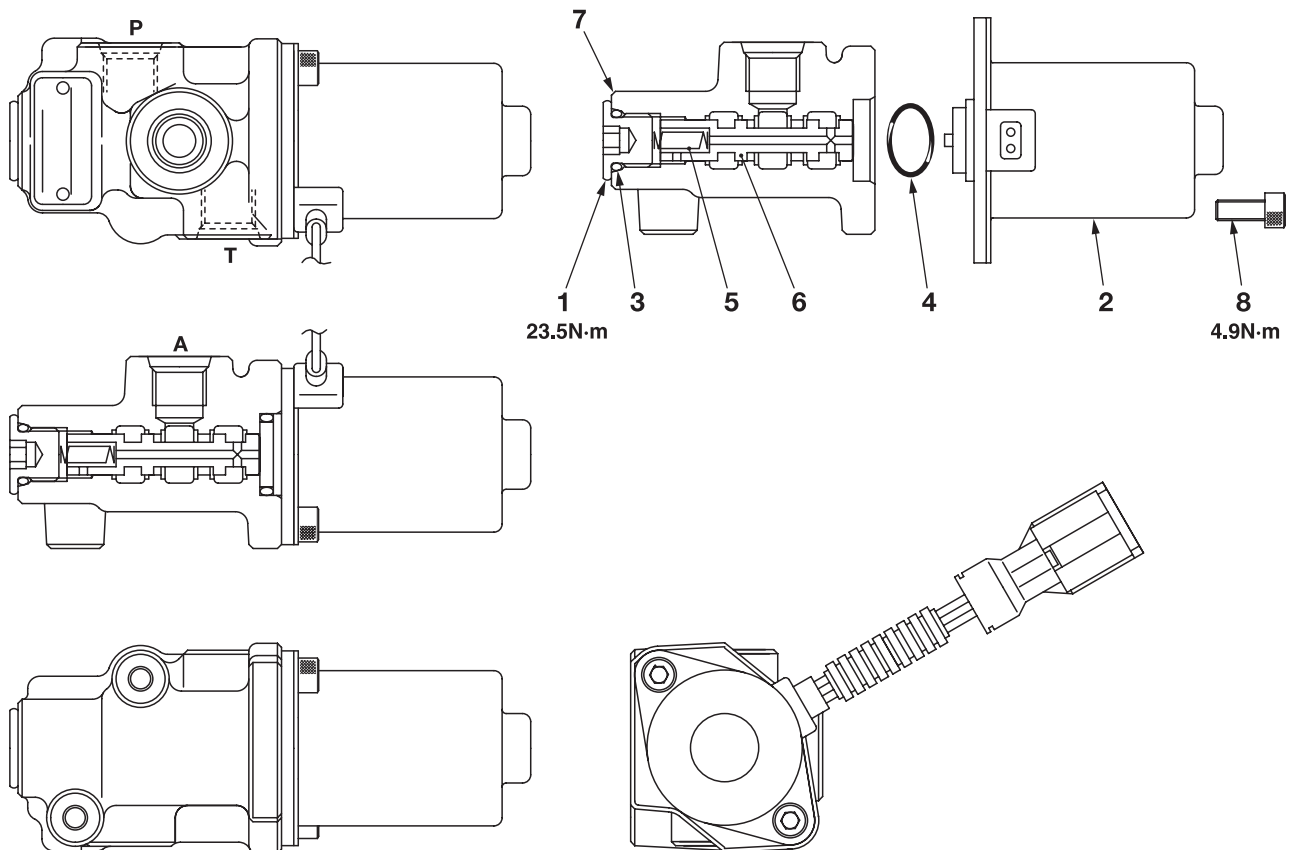
Inspection and adjustment

Checking the parts

Part	Criteria	Action
Coil assembly	• The solenoid is burned-out, short-circuited, or a wire is broken. • Wiring short-circuit or a wire is broken	• Replace • Replace
Body	• Scratches, rust, or corrosion at the parts in sliding contact with the spool. • Scratches, rust, or corrosion of the part of the seal in contact with the O-ring. • Other damage considered to impair the normal functions	• Replace • Replace • Replace
Spool	• Scratches on the outer circumference that easily catch a fingernail • Movement is not smooth	• Replace • Repair or replace
Spring	• Rust, corrosion, deformation, breakage, or other notable damage	• Replace
O-ring	—	• Replace

SOLENOID VALVE (3RD AUXILIARY LINE PIPING)

Construction



4K6AV03

- | | |
|------------------|--------------|
| 1. Plug | 5. Spring |
| 2. Solenoid coil | 6. Spool |
| 3. O-ring | 7. Body |
| 4. O-ring | 8. Cap screw |

Disassembly and Assembly

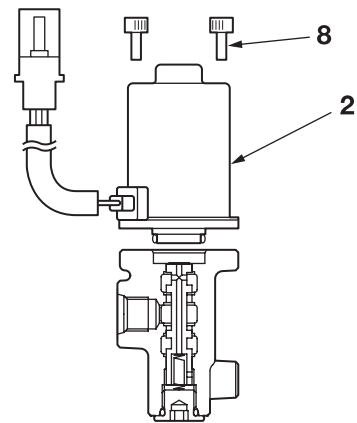
The numbers in parentheses () listed after the names of parts in this document match the numbers used in the construction diagrams and parts lists.

General Precautions

- Perform disassembly and assembly work in a clean place. Provide clean containers to hold parts during disassembly.
- Clean around the ports before disassembly. Remove paint around connectors with a wire brush.
- Clean the disassembled parts with wash oil.
- Put alignment marks on all parts to reassemble them in the same positions.
- After each disassembly, replace all seals and apply a thin layer of grease to them.
- Check each part for abnormal wear or seizing. Remove any burrs with sandpaper.
- Do not move adjusting screws, unless absolutely necessary.

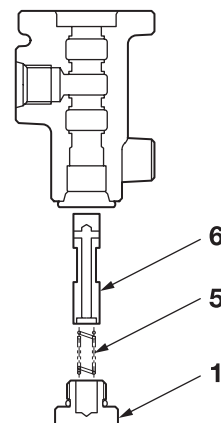
Disassembly

1. Remove the cap screws (8) and remove the solenoid coil (2).
 - Put alignment marks on the solenoids and body, to ensure the same position during reassembly.
 - Take care not to let the push rods fall out.
 - 🔧 Cap screw: 4.9 N·m (3.6 ft.-lb)
2. Remove the O-ring (4) from the solenoid coil (2).



4K6AV04

3. Take out the plug (1) and remove the O-ring (3) from the plug (1).
 - 🔧 Plug: 23.5 N·m (17.3 ft.-lb)
4. Remove the spring (5) and the spool (6) from the body (7).
 - Record the spool and body hole positions to use the same positions during re-assembly.



4K6AV05

Assembly

For assembly, refer to the construction diagram and reverse the disassembly procedure.

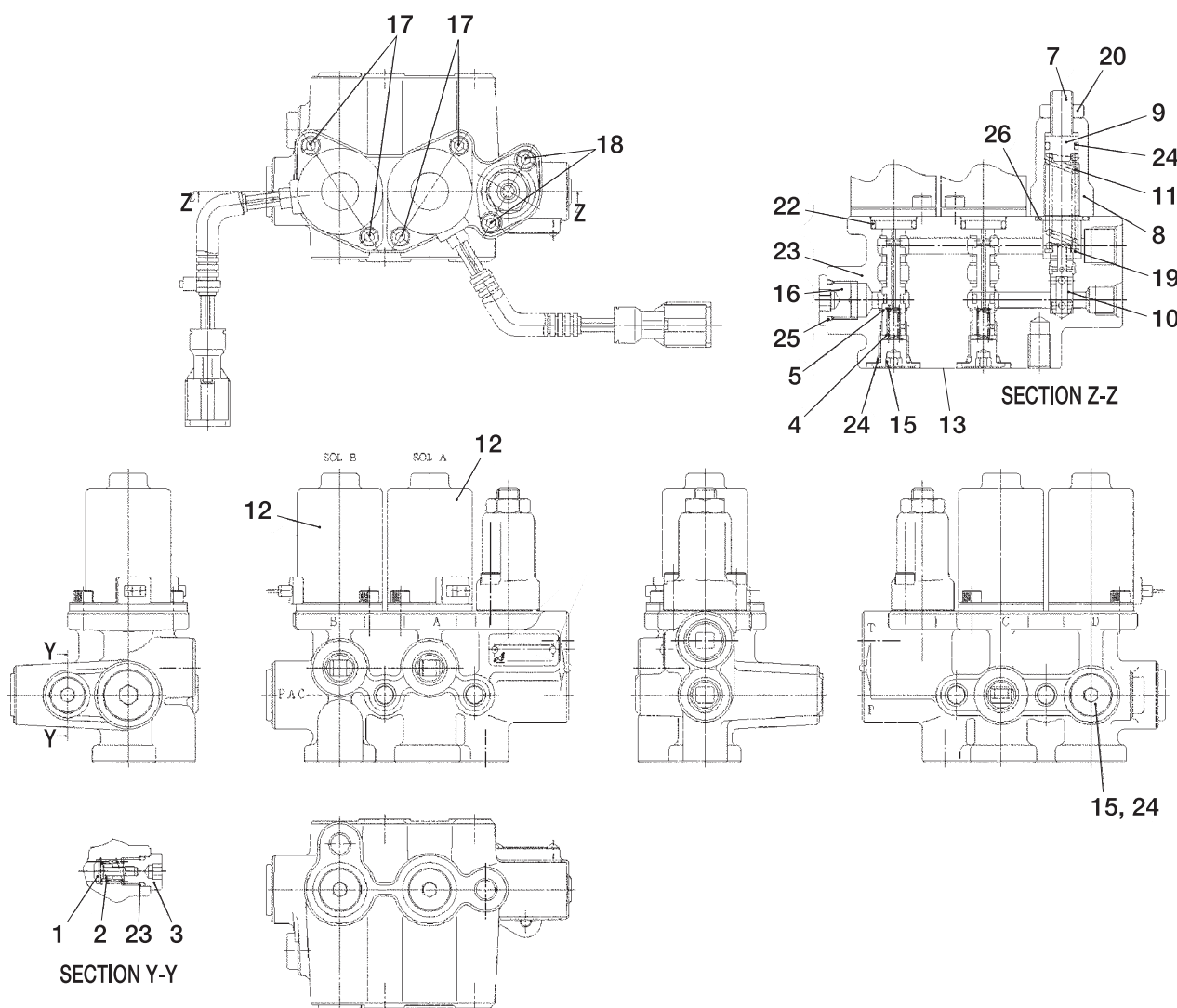
Inspection and adjustment

Checking the parts

Part	Criteria	Action
O-ring	—	• Replace
Seal	—	• Replace
Spool	• Wear on the sliding surfaces is 10 µm or more than the non-sliding surfaces. • Scratches on the sliding surfaces • Spool does not move smoothly.	• Replace • Replace • Replace
Push rod	• Tip is worn 1 mm or more • Scratches on the sliding surfaces	• Replace • Replace
Plug	• Imperfect sealing due to damage	• Repair or replace
Controls	• Looseness in the pin, shaft or joint of the controls results in 2 mm play, or more. • Wear of the pin, shaft or joint of the controls results in 2 mm play, or more.	• Tighten to the specified torque • Replace
Casing, port plate	• Scratches, rust, or corrosion at the parts in sliding contact with the spool. • Scratches, rust, or corrosion of the part of the seal in contact with the O-ring	• Replace • Repair or replace

SOLENOID VALVE (LEVER LOCK)

Construction



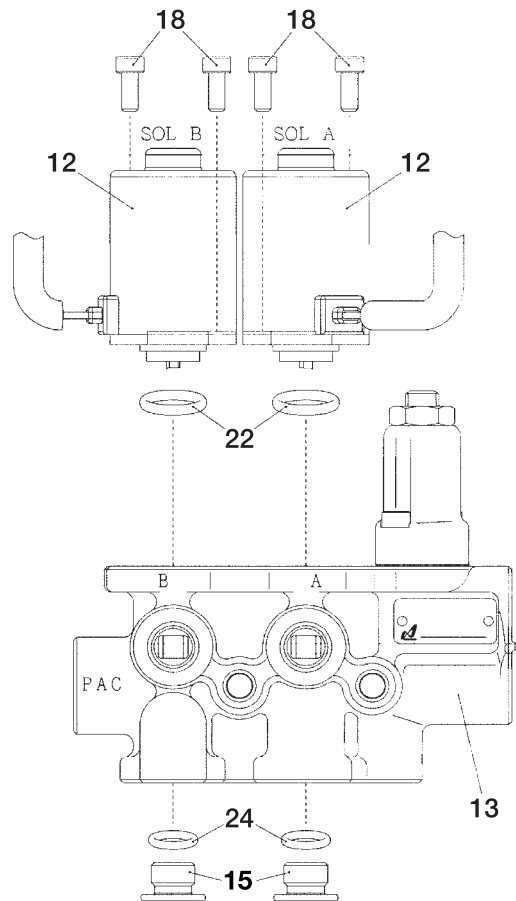
4K6AX01

- | | |
|-----------------|---------------|
| 1. Plunger | 15. Plug |
| 2. Spring | 16. Plug |
| 3. Plug | 17. Cap screw |
| 4. Spring | 18. Cap screw |
| 5. Spool | 19. Washer |
| 7. Adjust screw | 20. Nut |
| 8. Cover | 22. O-ring |
| 9. Plug | 23. O-ring |
| 10. Plunger | 24. O-ring |
| 11. Spring | 25. O-ring |
| 12. Solenoid | 26. O-ring |
| 13. Body | |

Disassembly

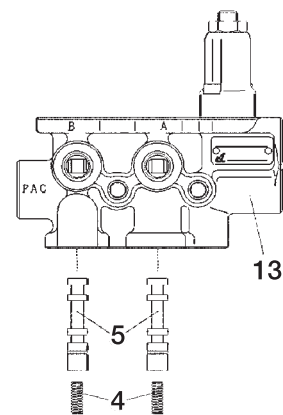
Solenoid valve

1. Remove the cap screws (13).
 🔑 Cap screw: 3.9 N·m (2.9 ft-lb.)
2. Take out the solenoids (12) and remove the O-rings (22).
 - Place alignment marks on the solenoids and the body for easy reassembly.
 - Take care not to let the push rod drop out.
 - When assembling, be sure to fit the O-rings (22) to the solenoids (12) before installing them on the body (13).
3. Take out the plugs (15) and remove the O-rings (24).



4K6AX021

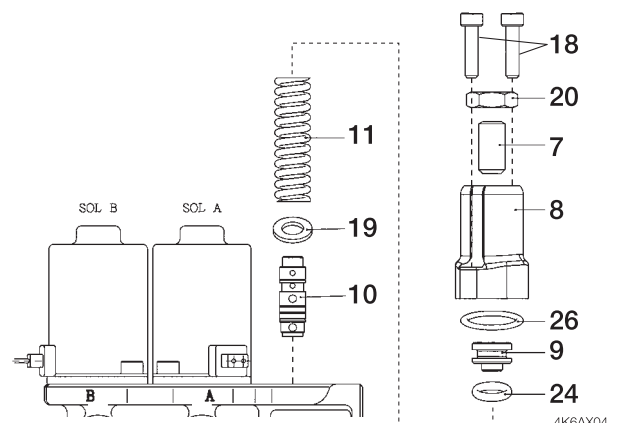
4. Remove the springs (4) and spools (5) from the body (13).



4K6AX03

Relief valve

1. Remove the nut (20).
 🔑 Nut: 15.7 N·m (11.6 ft-lb.)
2. Remove the adjust screw (7).
3. Remove the cap screws.
 🔑 Cap screw: 3.9 N·m (2.9 ft-lb.)
4. Take out the cover (8) and remove the plug (9) and O-ring (26).
5. Remove the O-ring (24), spring (11), washer (19) and plunger (10).



4K6AX04

Check valve

1. Remove the plug (3) from body (13).

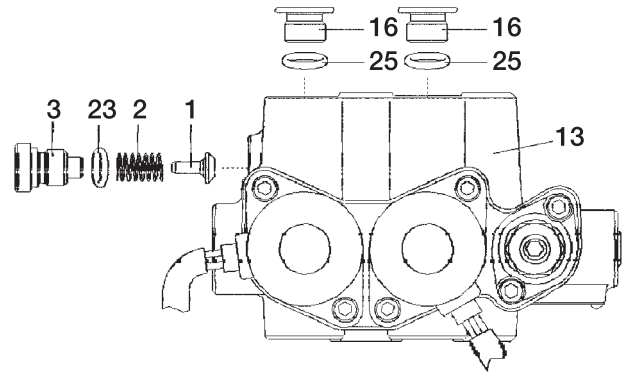
🔑 Plug: 21.0 N·m (15.5 ft-lb.)

2. Remove the spring (2) and the plunger (1).

3. Remove the O-ring (23).

4. Remove the plugs (16) and O-rings (25).

🔑 Plug: 26.5 N·m (19.5 ft-lb.)



4K6AX05

Assembly

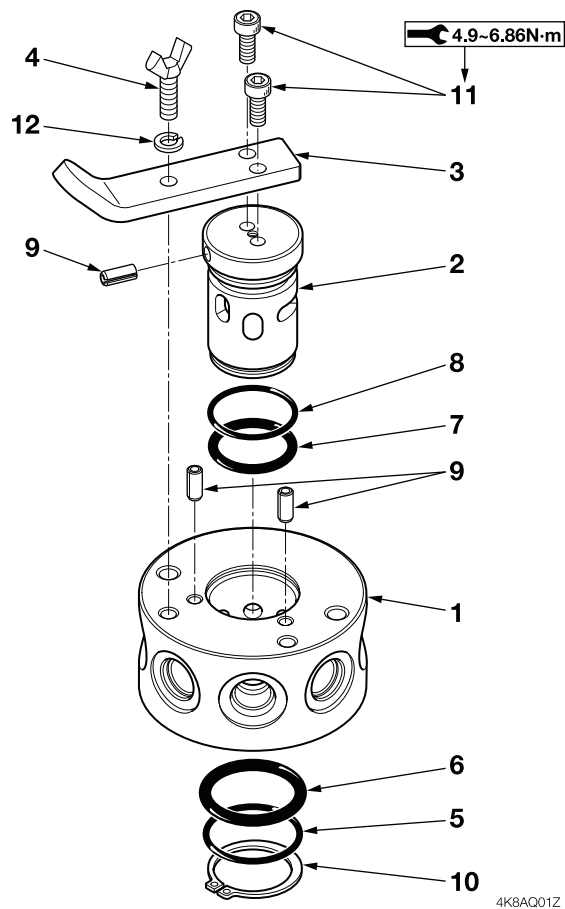
For assembly, follow the same procedure as for disassembly in the reverse order by referring to the construction diagram.

Inspection and adjustment**Checking the parts**

Parts	Judgment criteria	Treatment
Coil	• When the solenoid is burned or short-circuited, or has a wire break • Wiring short-circuit or wire break	Replace Replace
Body	• Scratches, rust or corrosion at the sliding parts and the spool • Scratches, rust or corrosion of the seal part in contact with the O-ring • Other damage considered to impair normal function	Replace Replace Replace
Spool	• Scratches on the outer circumference, on which the fingernails get caught • Movement is not smooth.	Replace Repair or replace
Spring	• Rust, corrosion, deformation, breakage or other notable damage	Replace
O-ring	—	Replace

SELECTOR VALVE

Construction



- 1. Body
- 2. Rotor
- 3. Lever
- 4. Bolt
- 5. O-ring
- 6. O-ring
- 7. O-ring
- 8. O-ring
- 9. Spring pin
- 10. Snap ring
- 11. Cap screw
- 12. Washer

4K8AQ01Z

Disassembly and Assembly

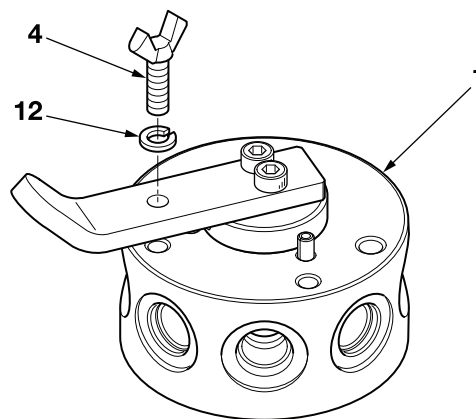
The numbers in parentheses () listed after the names of parts in this document match the numbers used in the construction diagrams and parts lists.

General Precautions

- Perform disassembly and assembly work in a clean place. Provide clean containers to hold parts during disassembly.
- Clean around the ports before disassembly. Remove paint around connectors with a wire brush.
- Clean the disassembled parts with wash oil.
- Put alignment marks on all parts to reassemble them in the same positions.
- After each disassembly, replace all seals and apply a thin layer of grease to them.
- Check each part for abnormal wear or seizing. Remove any burrs with sandpaper.
- Do not move adjusting screws, unless absolutely necessary.

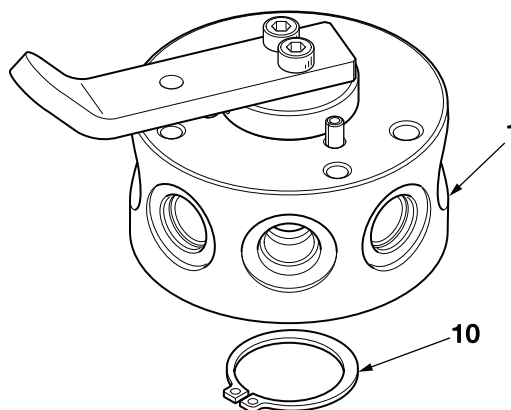
Disassembly

1. Remove the bolt (4) and washer (12) from the body (1).



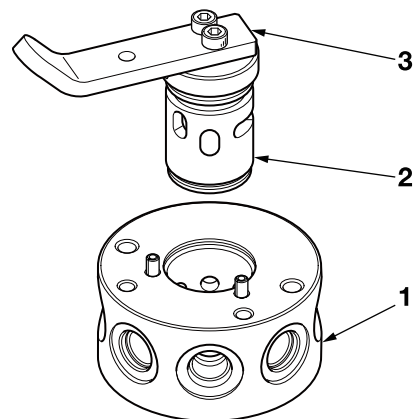
4K8AQ02Z

2. Remove the snap ring (10).



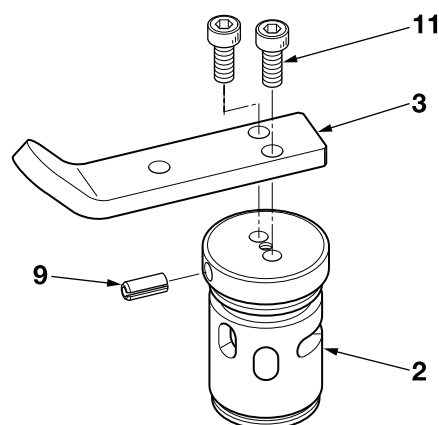
4K8AQ03Z

3. Remove the rotor (2) with the lever (3) attached from the body (1).



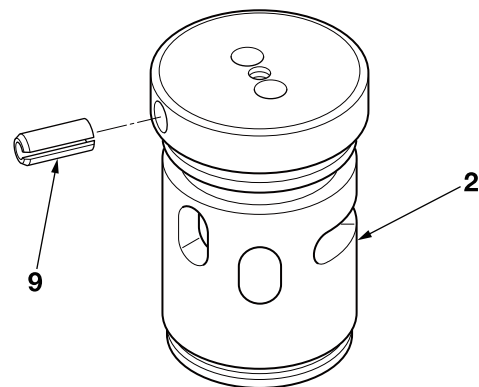
4K8AQ04Z

4. Remove the cap screws (11) and remove the lever (3) from the rotor (2).

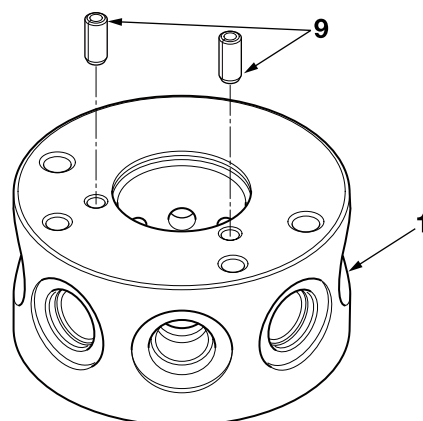


4K8AQ05Z

5. Remove the spring pins (9) from the body (1) and rotor (2).

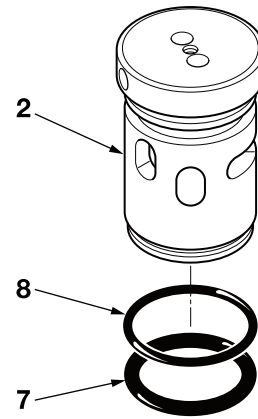


4K8AQ06Z

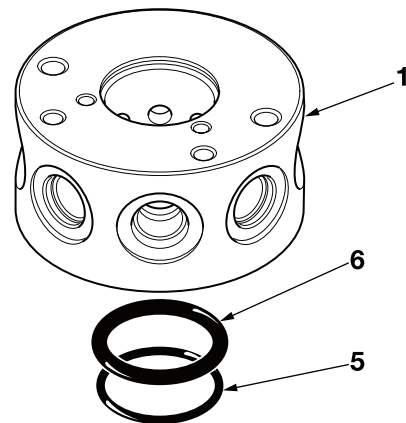


4K8AQ07Z

6. Remove the O-rings (5) (6) (7) (8) from the body (1) and rotor (2).



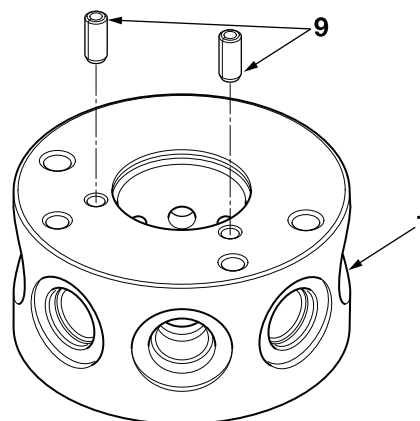
4K8AQ08Z



4K8AQ09Z

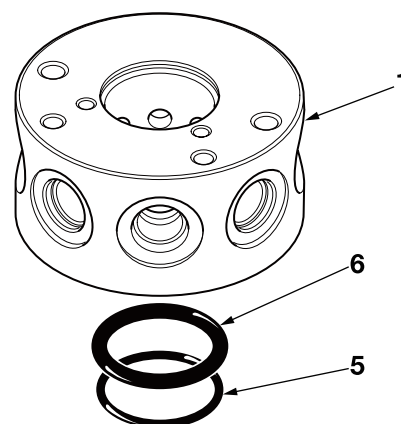
Assembly

1. Install the spring pins (9) in the body (1).
 - Lightly tap with a hammer.



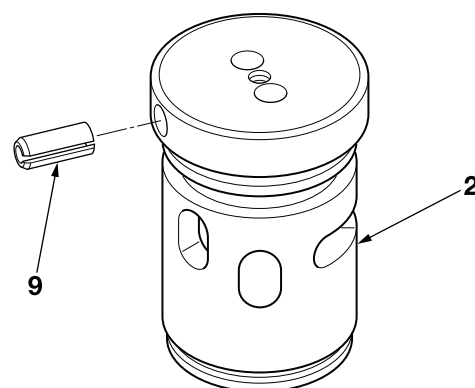
4K8AQ07Z

2. Fit the O-rings (5) (6) to the body (1).



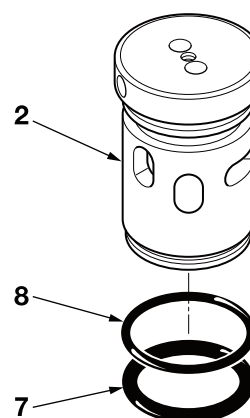
4K8AQ09Z

3. Install the spring pin (9) in the rotor (2).
 - Lightly tap with a hammer.



4K8AQ06Z

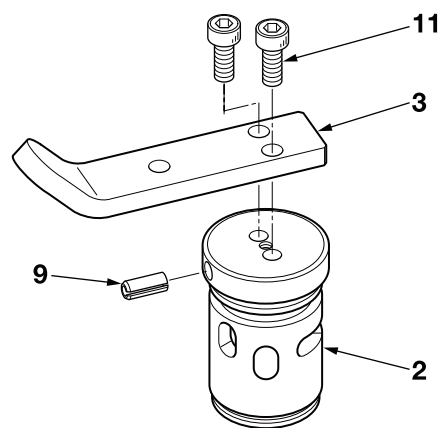
4. Fit the O-rings (7) (8) to the rotor (2).



4K8AQ08Z

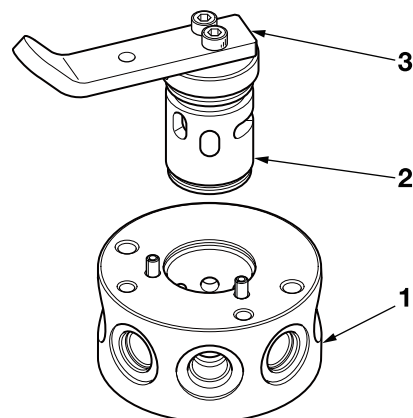
5. Attach the lever (3) to the rotor (2). Tighten the cap screws (11).

🔑 Cap screw: 4.9 to 6.86 N·m



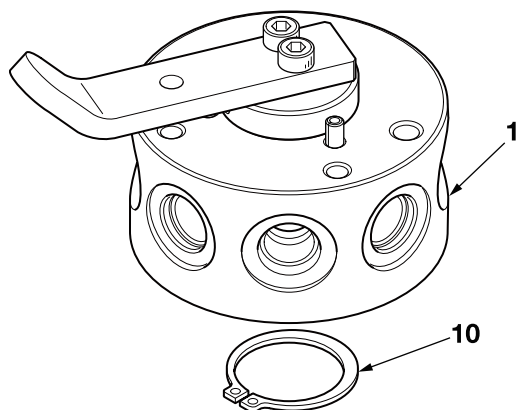
4K8AQ05Z

6. Install the rotor (2) to the body (1).



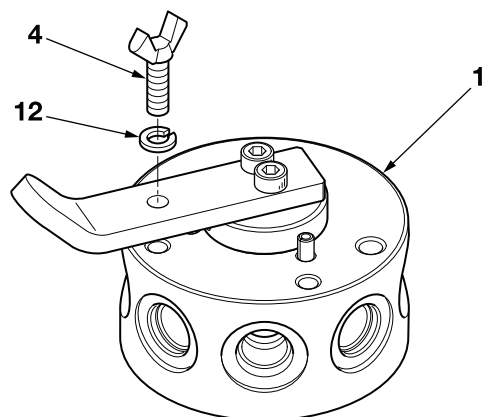
4K8AQ04Z

7. Fit the snap ring (10).



4K8AQ03Z

8. Attach the bolt (4) and washer (12) to the body (1).



4K8AQ02Z

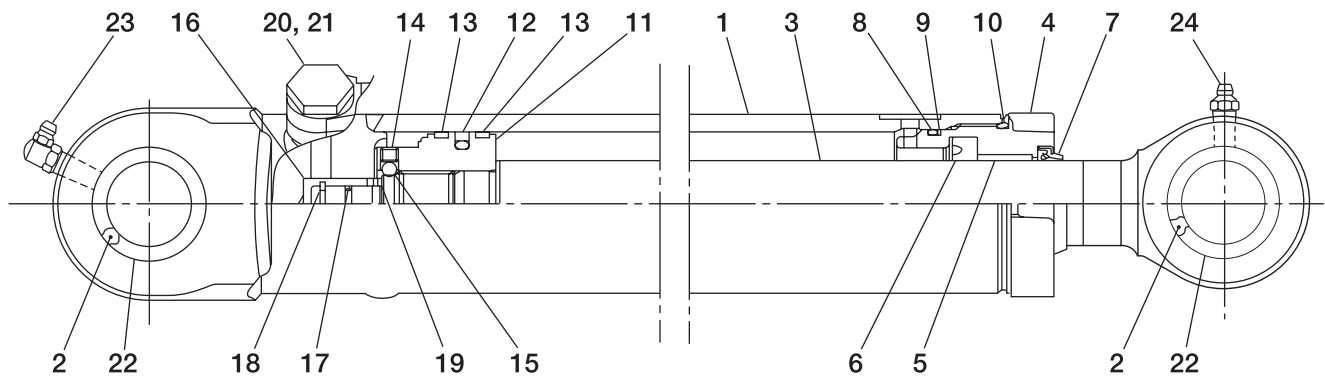
Inspection and adjustment**Checking the parts**

Part	Criteria	Action
O-ring	—	• Replace
Seal	—	• Replace
Spool	• Wear on the sliding surfaces is 10 µm or more than the non-sliding surfaces. • Scratches on the sliding surfaces • Spool does not move smoothly.	• Replace • Replace • Replace
Push rod	• Tip is worn 1 mm or more • Scratches on the sliding surfaces	• Replace • Replace
Plug	• Imperfect sealing due to damage	• Repair or replace
Controls	• Looseness in the pin, shaft or joint of the controls results in 2 mm play, or more. • Wear of the pin, shaft or joint of the controls results in 2 mm play, or more.	• Tighten to the specified torque • Replace
Casing, port plate	• Scratches, rust, or corrosion at the parts in sliding contact with the spool. • Scratches, rust, or corrosion of the part of the seal in contact with the O-ring	• Replace • Repair or replace

CYLINDERS

Construction

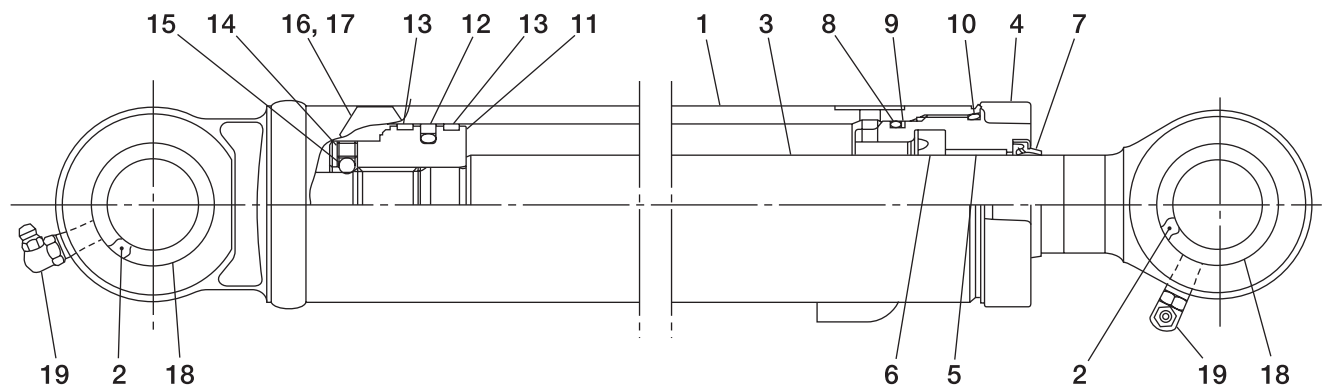
Boom cylinder



4L0AX01

- | | | |
|----------------|---------------------|--------------------|
| 1. Tube | 9. Backup ring | 17. Cushion seal |
| 2. Bushing | 10. O-ring | 18. Stopper |
| 3. Piston rod | 11. Piston | 19. Snap ring |
| 4. Rod cover | 12. Piston packing | 20. Plug |
| 5. Bushing | 13. Wear ring | 21. O-ring |
| 6. Rod packing | 14. Set screw | 22. Dust seal |
| 7. Dust seal | 15. Ball | 23. Grease fitting |
| 8. O-ring | 16. Cushion bearing | 24. Grease fitting |

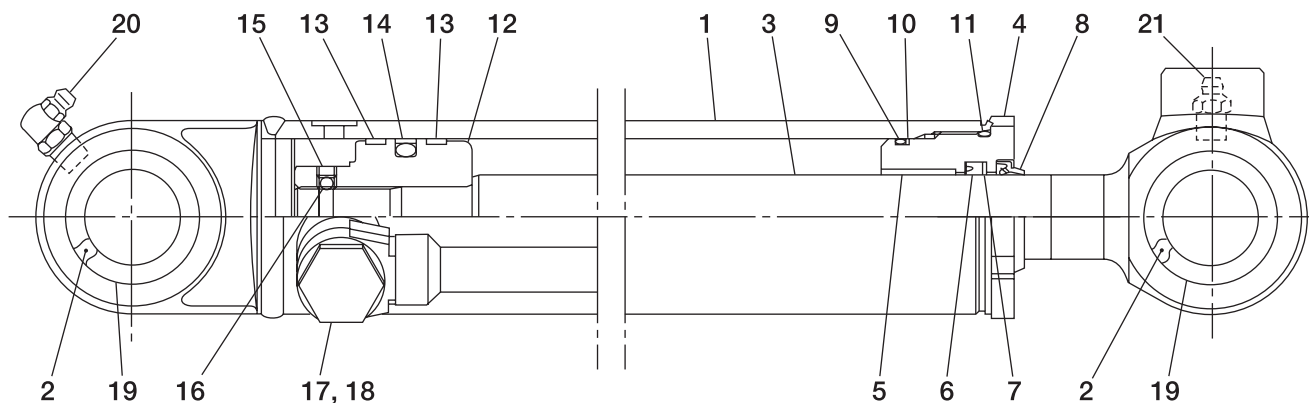
Arm cylinder



4L0AX02

- | | | |
|----------------|--------------------|--------------------|
| 1. Tube | 8. O-ring | 15. Ball |
| 2. Bushing | 9. Backup ring | 16. Plug |
| 3. Piston rod | 10. O-ring | 17. O-ring |
| 4. Rod cover | 11. Piston | 18. Dust seal |
| 5. Bushing | 12. Piston packing | 19. Grease fitting |
| 6. Rod packing | 13. Wear ring | |
| 7. Dust seal | 14. Set screw | |

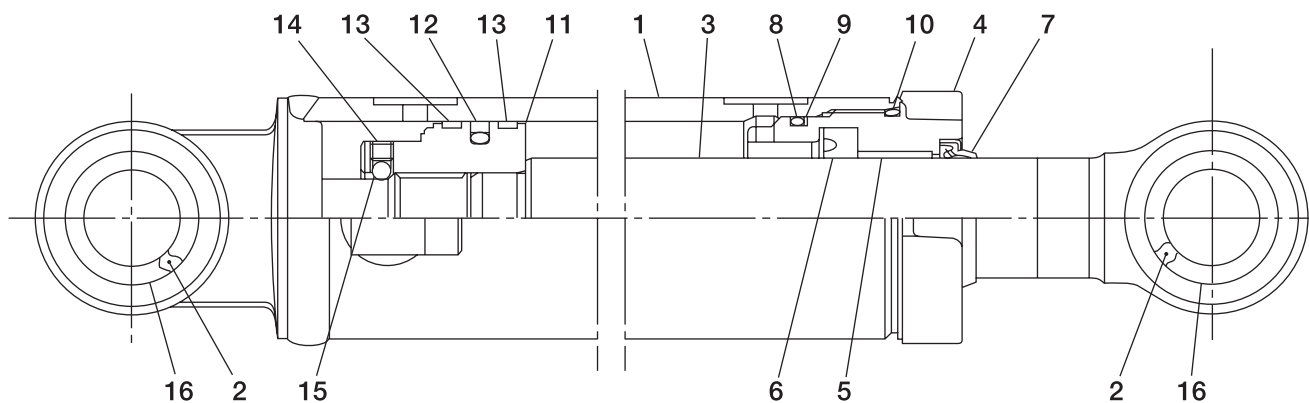
Bucket cylinder



4L0AX03

- | | | |
|----------------|--------------------|--------------------|
| 1. Tube | 8. Dust seal | 15. Set screw |
| 2. Bushing | 9. O-ring | 16. Ball |
| 3. Piston rod | 10. Backup ring | 17. Plug |
| 4. Rod cover | 11. O-ring | 18. O-ring |
| 5. Bushing | 12. Piston | 19. Dust seal |
| 6. Rod packing | 13. Wear ring | 20. Grease fitting |
| 7. Backup ring | 14. Piston packing | 21. Grease fitting |

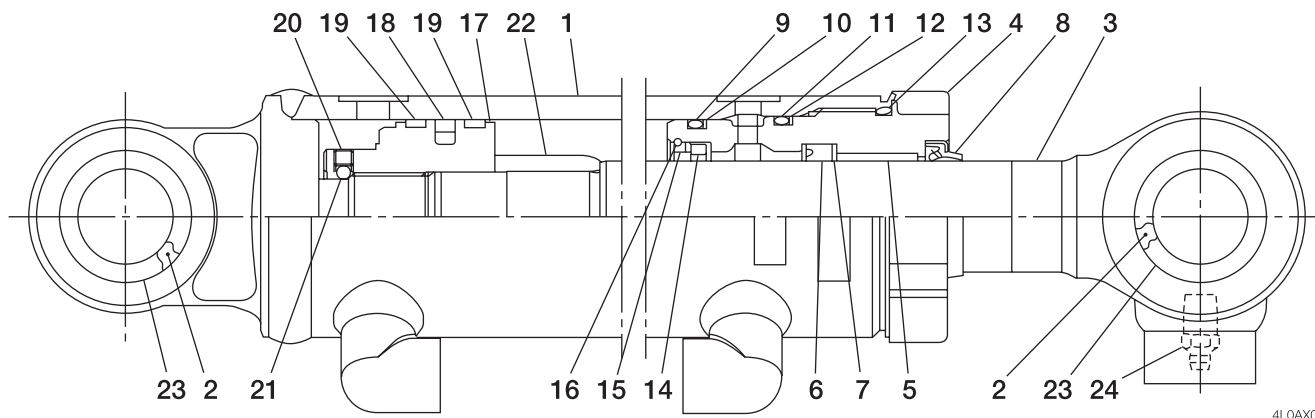
Dozer blade cylinder



4L0AX04

- | | | |
|----------------|--------------------|---------------|
| 1. Tube | 7. Dust seal | 13. Wear ring |
| 2. Bushing | 8. O-ring | 14. Set screw |
| 3. Piston rod | 9. Backup ring | 15. Ball |
| 4. Rod cover | 10. O-ring | 16. Dust seal |
| 5. Bushing | 11. Piston | |
| 6. Rod packing | 12. Piston packing | |

Swing cylinder



4L0AX05

- | | | |
|----------------|------------------|---------------------|
| 1. Tube | 9. O-ring | 17. Piston |
| 2. Bushing | 10. Backup ring | 18. Piston packing |
| 3. Piston rod | 11. O-ring | 19. Wear ring |
| 4. Rod cover | 12. Backup ring | 20. Set screw |
| 5. Bushing | 13. O-ring | 21. Ball |
| 6. Rod packing | 14. Cushion ring | 22. Cushion bearing |
| 7. Backup ring | 15. Spacer | 23. Dust seal |
| 8. Dust seal | 16. Stopper | 24. Grease fitting |

Special tools

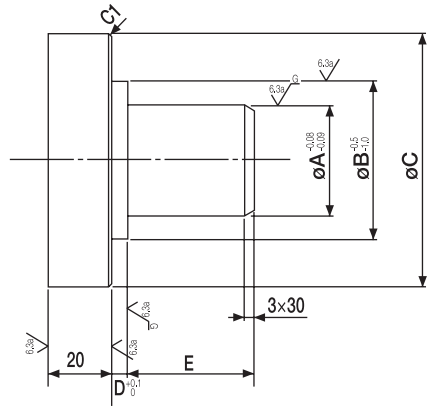
Unit: mm

Installation jig B

Quantity: 1

Material: S45C

	A	B	C	D	E
Boom	35	45	54	5	35
Arm	35	45	54	5	35
Bucket	30	40	49	5	30
Blade	30	40	49	5	30
Swing	30	40	49	5	30



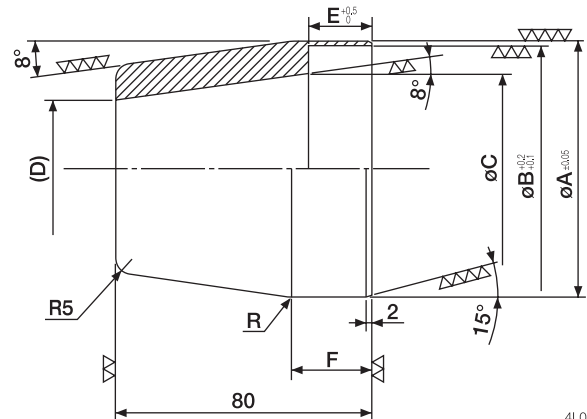
4LOAX06

Sliding jig C

Quantity: 1

Material: STKM13C

	A	B	C	D	E	F
Boom	60.5	58.3	40	20.8	12.3	20
Arm	60.5	58.3	40	20.8	12.3	20
Bucket	50.5	48	30	10.8	12.3	20
Blade	60.5	58.3	40	20.8	12.3	20
Swing	60.5	58.3	40	20.8	12.3	20



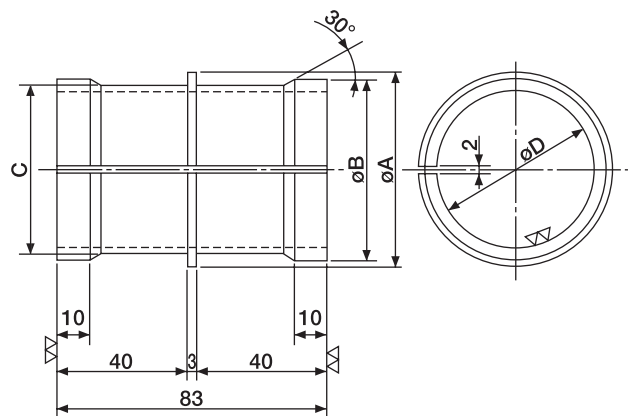
4L0AX07

Fitting jig D

Quantity: 1

Material: Nylon

	A	B	C	D
Boom	65	61	57	53
Arm	65	61	57	53
Bucket	55	51	47	43
Blade	65	61	57	53
Swing	65	61	57	53



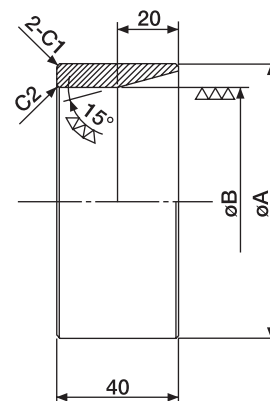
4LOAX08

Corrective jig E

Quantity: 1

Material: STKM13C

	A	B
Boom	75	60
Arm	75	60
Bucket	65	50
Blade	75	60
Swing	75	60

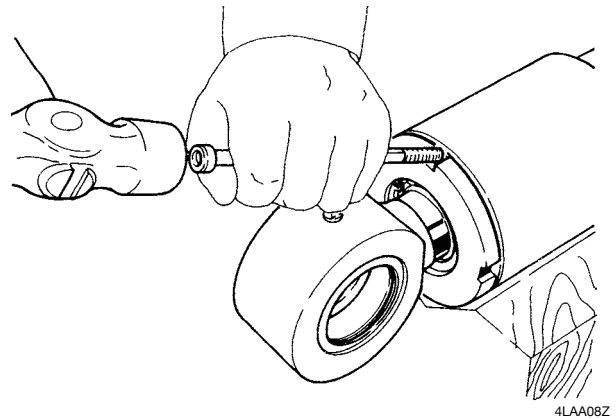
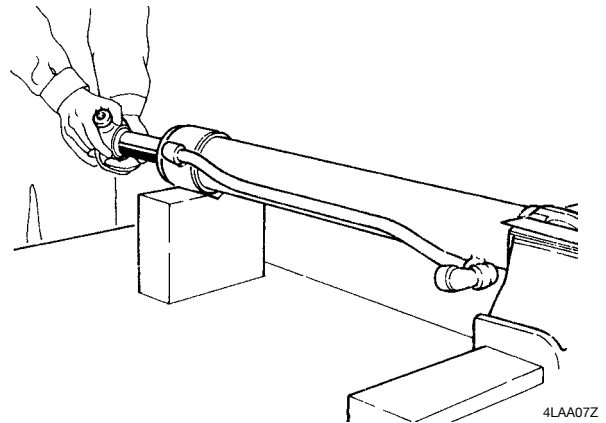


4L0AX09

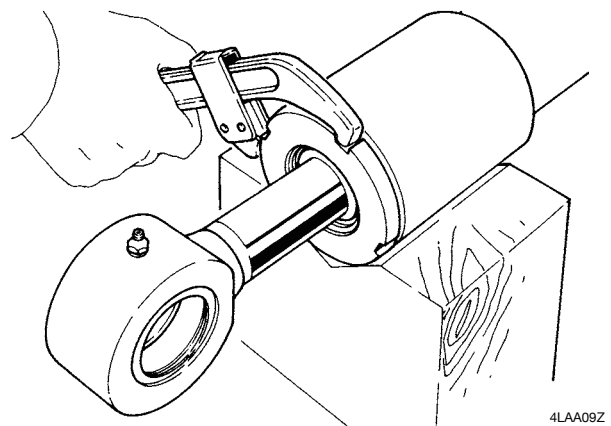
Disassembly

Cylinder assembly

1. Keep the cylinder in a level position by securing the clevis of the tube in a vise and placing a wooden support under the other end.
2. Drain the remaining hydraulic oil from the cylinder.
 - Move the piston rod slowly to prevent the hydraulic oil from spurting out.
3. Disengage the anti-rotation lock of the rod cover.
 - Since the anti-rotation lock is built into the cylinder tube, take care not to damage the tube when disengaging the lock.

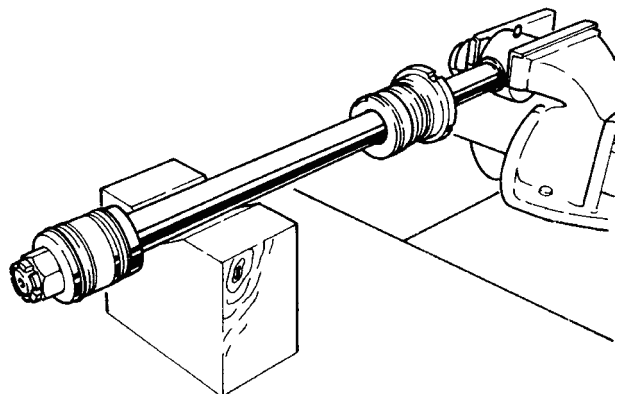


4. Loosen the rod cover.
 - Pull out the piston rod approximately 200 mm (7.9 in.) beforehand.
 - Cover the piston rod to protect it from dents.
5. Pull out the piston rod assembly from the tube.
 - Pull it out straight so as not to damage the sliding surface.



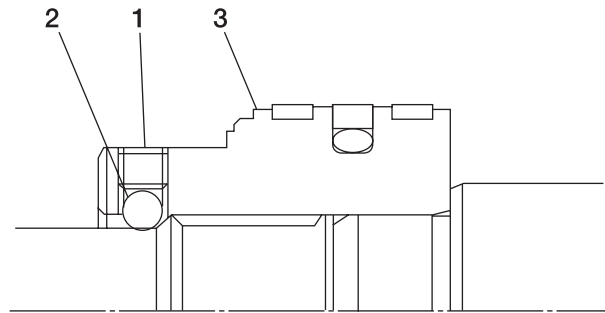
Piston rod assembly

1. Secure the piston rod assembly in a level position.



2. Remove the piston assembly.

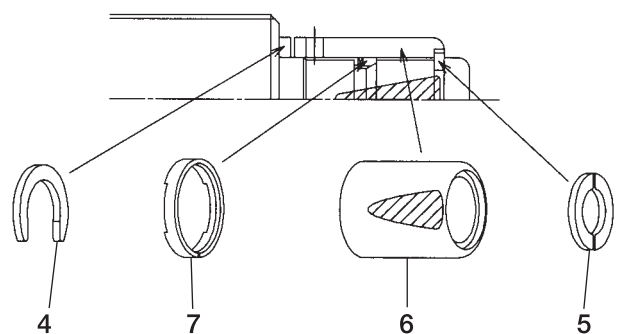
- a. Take out the setscrew (1) and remove the ball (2).
 - The setscrew (1) is caulked in two places with a punch. Grind off the caulked portions with a hand drill.
- b. Remove the piston assembly (3).
- c. Pull out the cushion bearing (4). (Boom cylinder, swing cylinder)



4L0AX10

<Only for boom cylinder (c to f)>

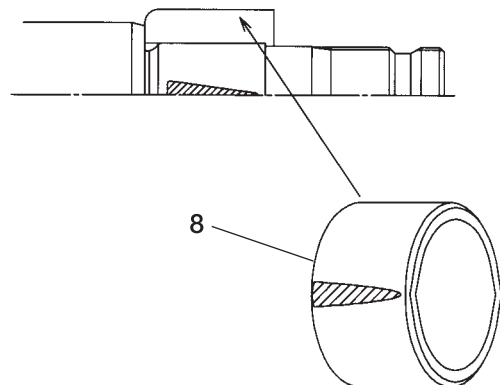
- c. Remove the snap ring (4).
 - When removing, lightly tap the ring with a plastic hammer while taking care not to damage the piston rod or cushion bearing.
- d. Remove the stopper (5) (double-split).
 - The stopper (5) can be removed by sliding the cushion bearing (6) to the piston rod side.
- e. Remove the cushion ring (6).
- f. Remove the cushion seal (7).



4L0AX11

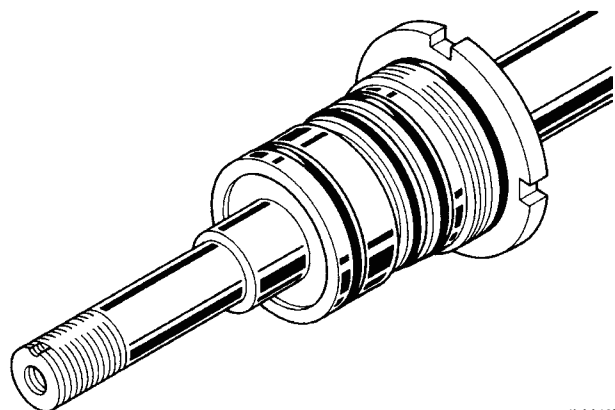
<Only for swing cylinder>

- g. Remove the cushion bearing (8).



4L0AX12

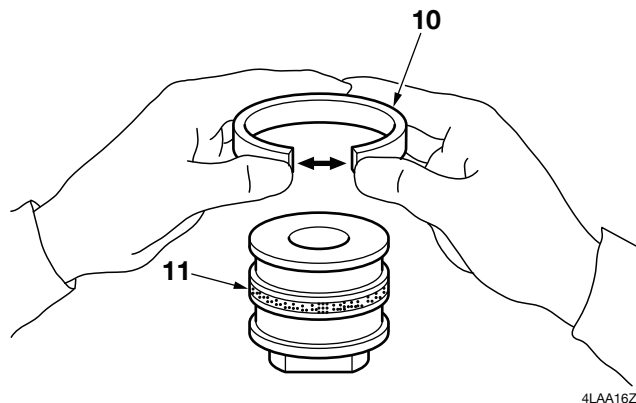
3. Remove the rod cover assembly.



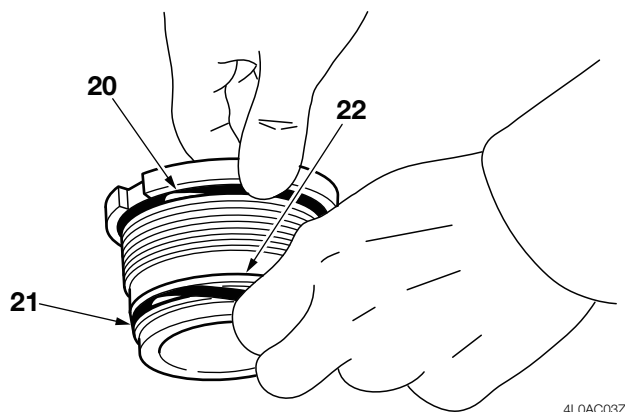
4LAA13Z

Piston

1. Remove the wear rings (10).
 - Spread the wear ring just enough to disengage it in axial direction.
2. Remove the piston packing from the piston.

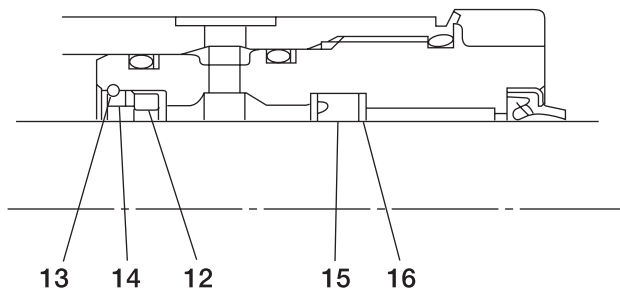
**Rod cover**

1. Remove the O-rings (20) and (21) and the backup ring (22) from the outer diameter section of the rod cover.



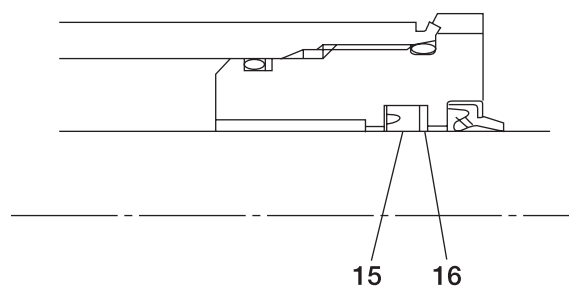
<Only for swing cylinder>

2. Remove the cushion ring.
 - a. Remove the stopper (13).
 - b. Remove the spacer (14).
 - c. Remove the cushion ring (12).



4LOAX13

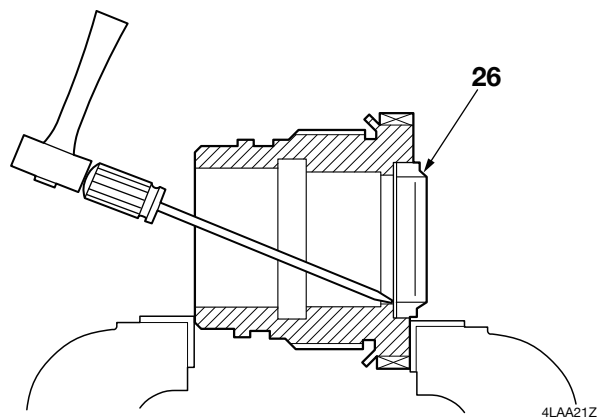
3. Remove the rod packing.
 - a. Remove the rod packing (15).
 - b. Remove the backup ring (16). (Bucket cylinder, Swing cylinder)



4LOAX14

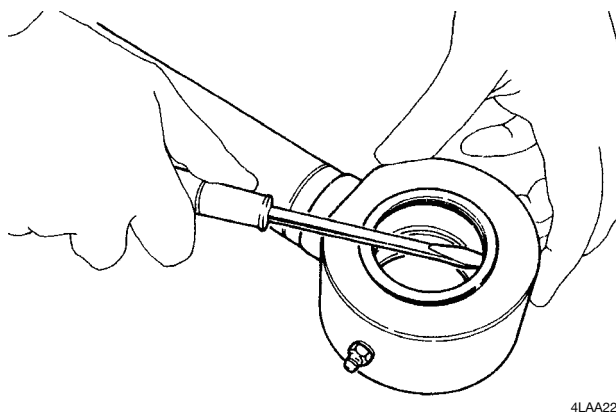
4. Remove the dust seal (26).

- Tap alternately on several points around the inner circumference of the metal ring, gradually pushing the seal out of the groove.



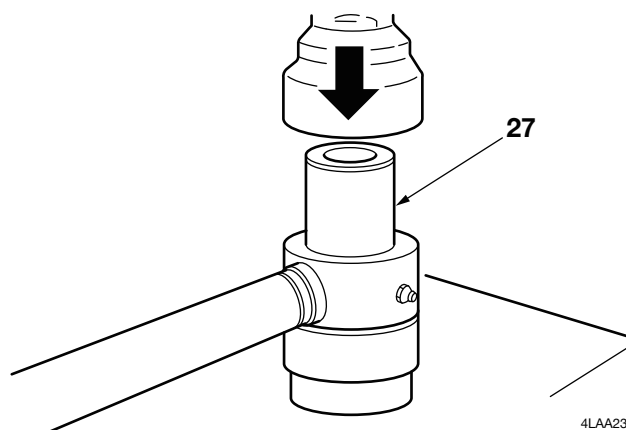
Clevis

1. Remove the dust seals from the tube and the piston rod clevis.



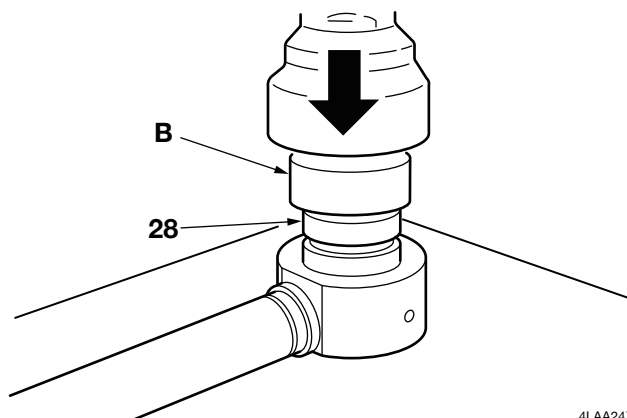
2. Remove the bushing.

- Pull out the bushing by using a press and the supporting metal (27)

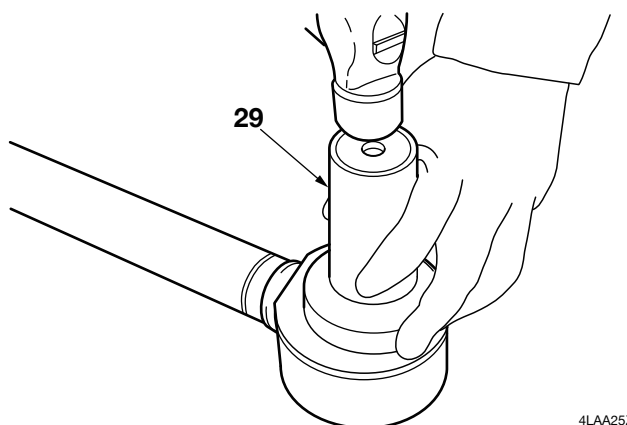


Assembly**Clevis**

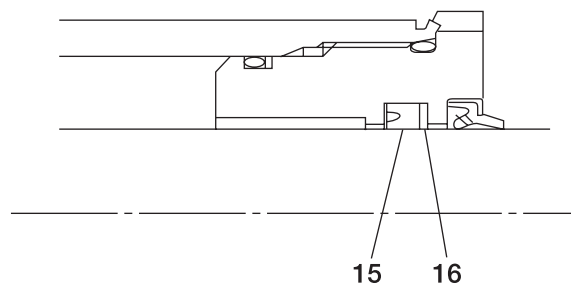
1. Using the installation jig B, press fit the bushings (28) into the piston rod and tube.



2. Install the dust seal by using the supporting metal (29).

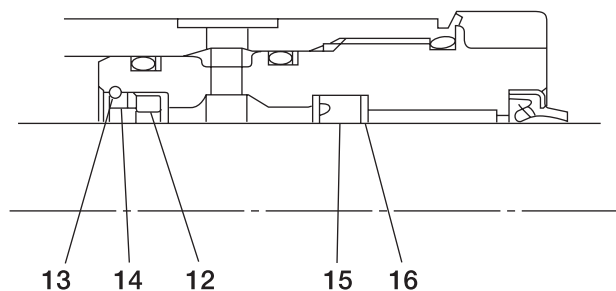
**Rod cover**

1. Install the rod packing.
 - a. Install the backup ring (16). (Bucket cylinder, Swing cylinder)
 - b. Install the rod packing (15).



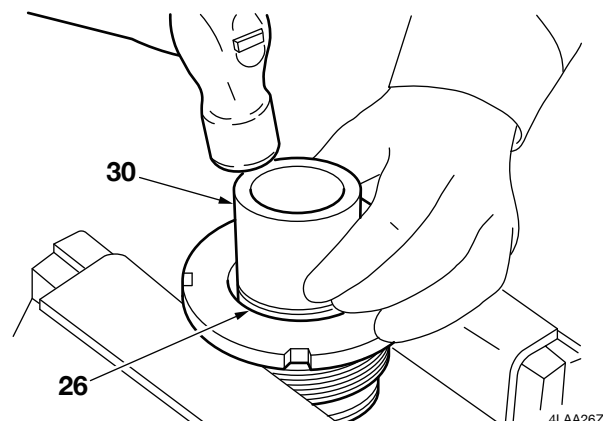
<Only for swing cylinder>

2. Install the cushion ring.
 - a. Install the cushion ring (12).
 - b. Install the spacer (14).
 - c. Install the stopper (13).



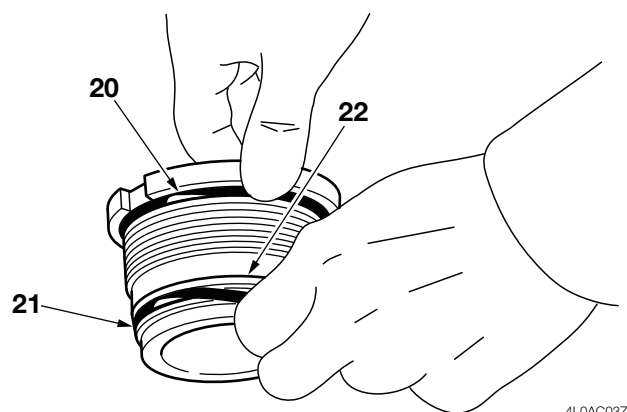
3. Install the dust seal (26).

- For a dust seal with a metal ring around its perimeter, use a supporting metal (30) for installation.



4. Install the backup ring (22) and the O-rings (20) and (21).

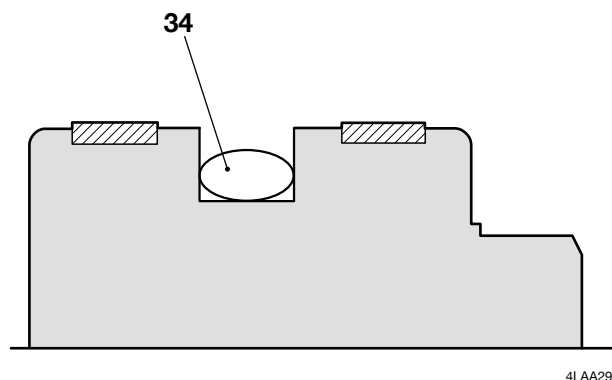
- Make sure that the cut portion of the backup ring does not get out of place.

**Piston**

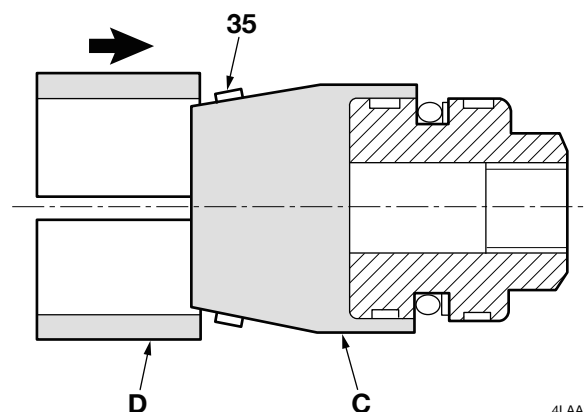
1. Install the piston packing on the piston.

a. Install the O-ring (34).

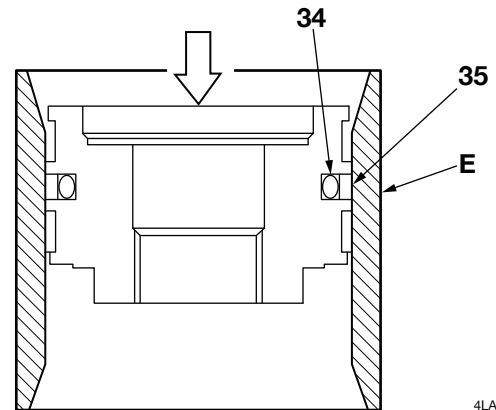
- If the O-ring is twisted after fitted, correct it.



b. Cover the piston with the sliding jig C, and then, using the fitting jig D, quickly insert the slipper ring (35).



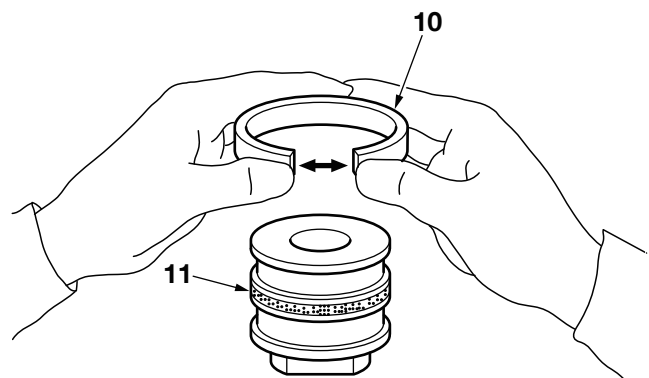
- c. Since the slipper ring (35) is extended when it is installed, correct it using the corrective jig E.



4LAA31Z

2. Install the wear ring (10).

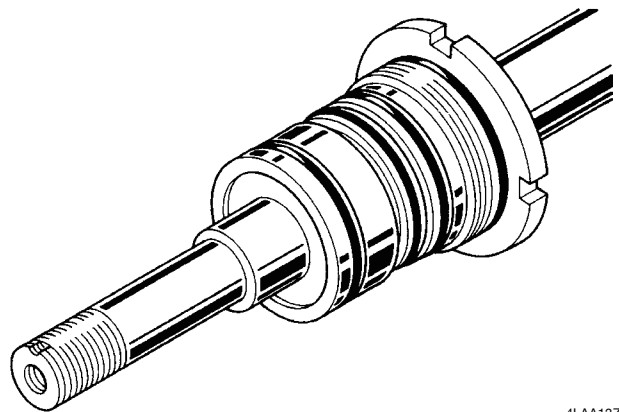
- Spread the wear ring (10) just enough so that it can be installed on the piston in axial direction.



4LAA16Z

Piston rod assembly

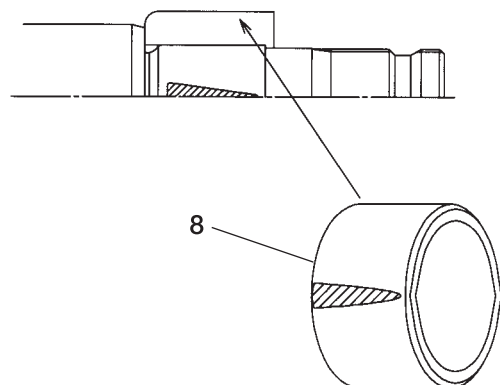
1. Install the rod cover assembly on the piston rod.



4LAA13Z

<Only for swing cylinder>

2. Install the cushion bearing on the piston rod.
- The cushion bearing must be installed in the correct direction. Place the worked surface portion facing the correct side as shown in the figure.

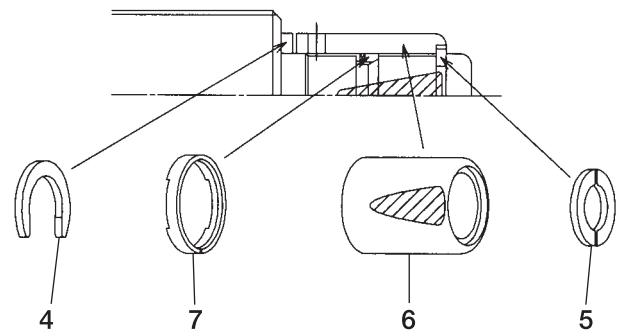


4LOAX12

3. Install the piston on the piston rod.

<Only for boom cylinder (a to d)>

- Place the cushion seal (7) in the groove with the seal's slitted portion facing the thread side.
- Install the cushion bearing (6) with its worked surface portion facing the correct side as shown in the figure.
- Install the stopper (5) in the groove.
- Push the cushion bearing (6) fully to the stopper side, and then install the snap ring.

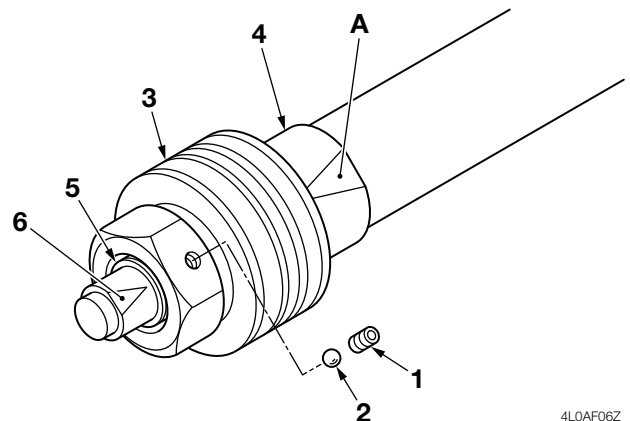


4LOAX11

- Install the piston (3) and tighten it.
- Insert the ball (2), tighten the set screw (1) and caulk at two points with a punch.

Piston, set screw

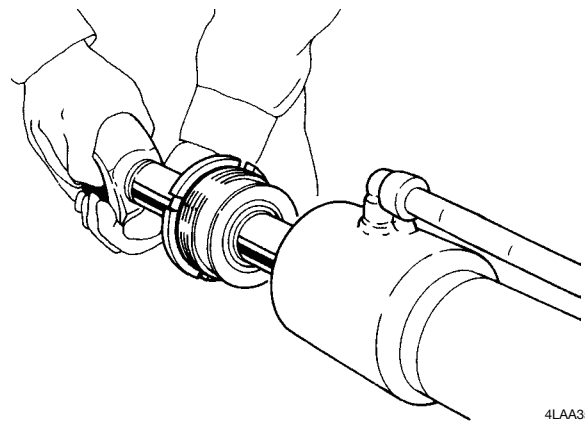
Cylinders	Piston (N·m)	Set screw (N·m)
Boom	479 (353 ft-lb.)	6.8 (5.0 ft-lb.)
Arm	479 (353 ft-lb.)	6.8 (5.0 ft-lb.)
Bucket	245 (180 ft-lb.)	6.8 (5.0 ft-lb.)
Blade	365 (269 ft-lb.)	6.8 (5.0 ft-lb.)
Swing	479 (353 ft-lb.)	6.8 (5.0 ft-lb.)



4LOAF06Z

Cylinder assembly

- Secure the tube in a level position, and insert the piston rod assembly into the tube.
 - When inserting, align the center of the piston rod with the center of the tube. Insert the assembly straight so as not to damage the seal.

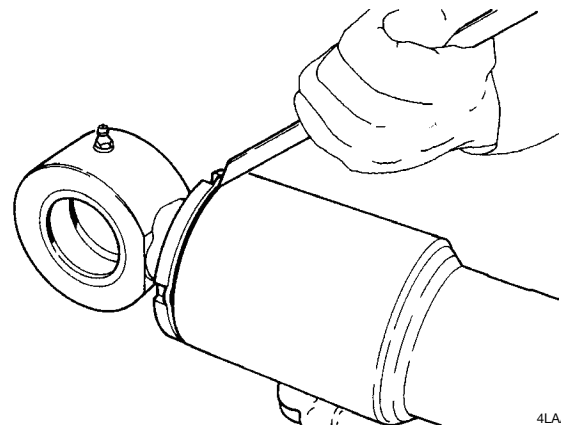


4LAA35Z

2. Tighten the rod cover.

Rod cover

Cylinders	Rod cover (N·m)
Boom	304 (224 ft-lb.)
Arm	304 (224 ft-lb.)
Bucket	255 (188 ft-lb.)
Blade	304 (224 ft-lb.)
Swing	304 (224 ft-lb.)



4LAA36Z

3. Bend down the lock rib on the tube and fit it into the notch of the rod cover to lock it.

Inspection and adjustment

Inspection after disassembly

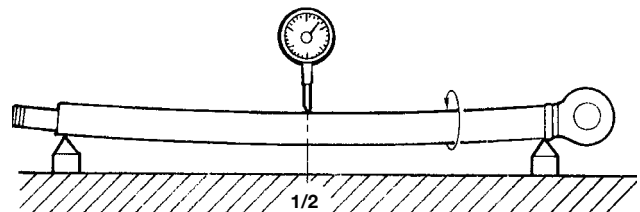
Clean each part thoroughly with cleaning oil, then carry out the following checks. When a cylinder has been disassembled, replace all the seals with new ones.

1. Piston rod

- Replace the rod if there are cracks.
- If the threads are damaged, repair them or replace the rod.
- If the plating layer of the plated portion is broken, rusted or scratched, replace the rod.
- If the rod is bent more than the limit of 1 mm (0.04 in.) in 1 m (3.3 ft.), replace it. (For the measurement method, refer to the figure on the right.)
- If the inner diameter of the clevis bushing is worn, replace the bushing.

Measuring the bend

- a. Support the portion of the rod with the same diameter at both ends on V-blocks.
- b. Set a dial gauge at the center between the two blocks.
- c. Rotate the rod and take a reading of the maximum and minimum run-out indicated by the dial gauge. If the bending of the rod is within the above limit, yet is bent a lot in a small distance so that it will not move smoothly, replace the rod if it makes a squeaking sound in the operation test after reassembly or if it catches during movement.



4LAA37Z

2. Tube

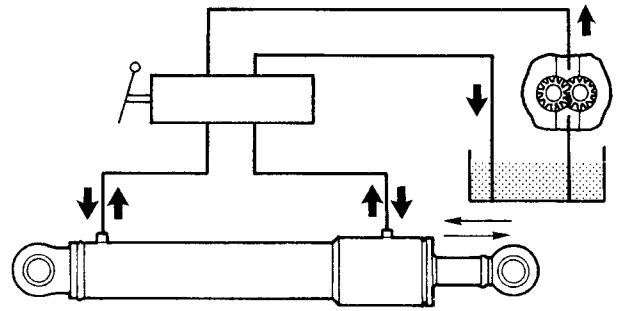
- If there are cracks in the welded portion, replace the tube.
- Replace the tube if the inside surface is scratched or if it leaks hydraulic oil.
- If the inner diameter of the clevis bushing is worn, replace the bushing.

3. Rod cover

- If the bushing inner diameter is worn and the clearance with the piston rod is greater than 0.25 mm (0.0098 in.), replace the bushing.
- If the inside surface of the bushing is scratched, and the scratches are deeper than the depth of the coating layer, replace the bushing.

Inspection after assembly**No load operation test**

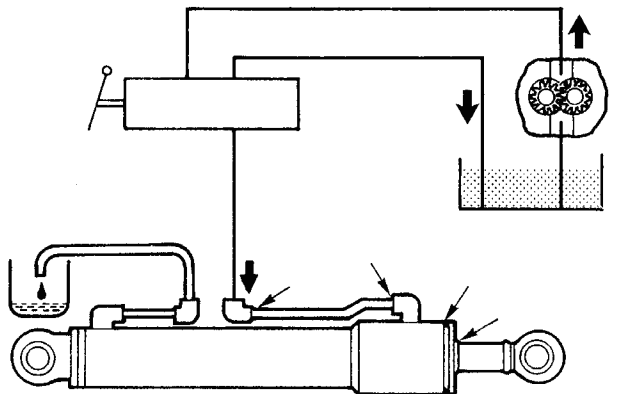
1. Place the cylinder in a horizontal position with no load.
2. Apply gentle pressure alternately to the ports at both ends, operating the piston rod 5 or 6 times.
3. Make sure there is no abnormality in the operating condition.



4LAA38Z

Leak test**External leak**

1. Apply test pressure for 3 minutes each to the retraction side and the extension side.
2. Make sure there are no abnormalities such as external leakage or permanent deformation, etc. in the rod seal, the rod cover mount, or in any welded portion.



4LAA39Z

Internal leak

1. Disconnect the extension side hose.
2. Apply test pressure to the retraction side for 3 minutes.
3. Measure the amount of oil that has leaked from the extension side.
 - The amount of leakage should be 1 mL (0.034 fl.oz) /3 min or less.

Bleeding air from the hydraulic cylinder

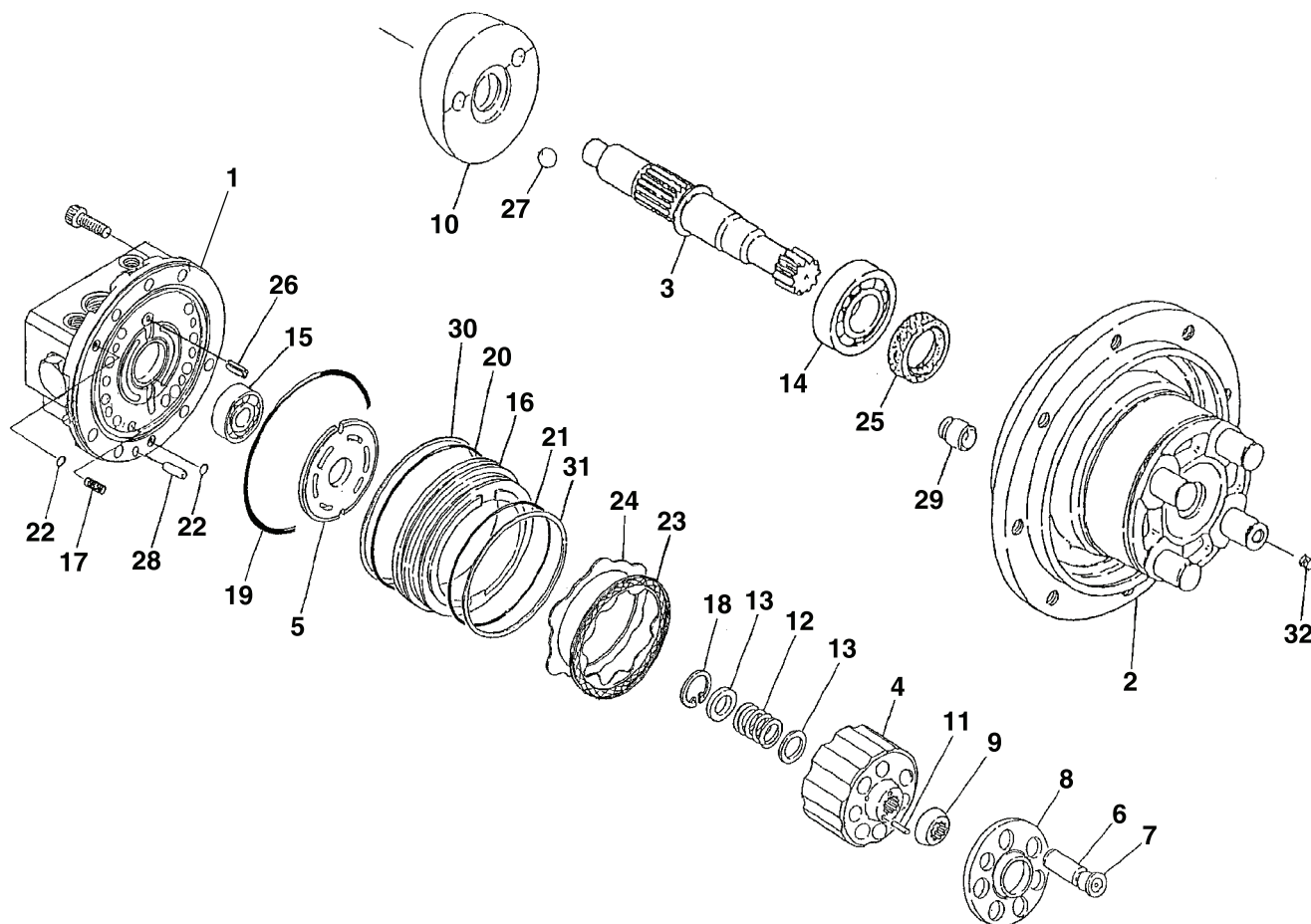
Bleed the air out of the cylinder when the cylinder is removed or when the hydraulic piping, etc. is disconnected.

1. Start the engine and let it idle for approximately 5 minutes.
2. With the engine running at slow speed, extend and retract the cylinder 4 or 5 times.
 - Move the piston rod to a position 100 mm (3.94 in.) before the end of the stroke, being careful not to relieve air.
3. With the engine at top speed, repeat the operation in (2), then with the engine running at slow speed, move the piston rod to the stroke end to relieve air.

TRAVEL MOTOR

Construction

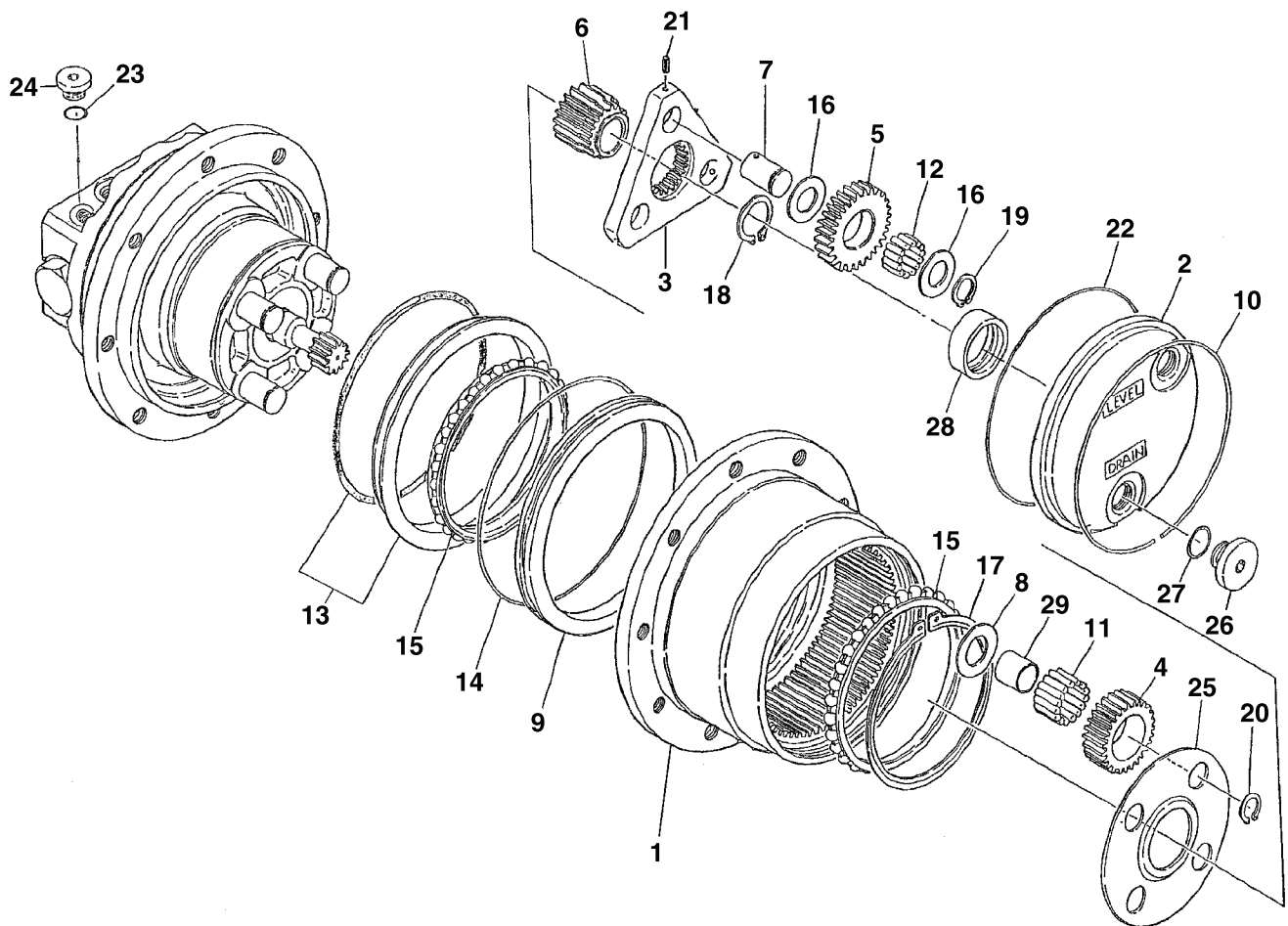
Hydraulic motor



4M0A101Z

- | | | |
|-------------------|------------------|----------------------|
| 1. Valve body | 12. Spring | 23. Friction disc |
| 2. Flange holder | 13. Retainer | 24. Center disc |
| 3. Shaft | 14. Bearing | 25. Oil seal |
| 4. Cylinder block | 15. Bearing | 26. Spring pin |
| 5. Valve plate | 16. Break piston | 27. Ball |
| 6. Piston | 17. Spring | 28. Pin |
| 7. Shoe | 18. Snap ring | 29. 2nd-speed piston |
| 8. Shoe holder | 19. O-ring | 30. Backup ring |
| 9. Guide | 20. O-ring | 31. Backup ring |
| 10. Swash plate | 21. O-ring | 32. Plug |
| 11. Pin | 22. O-ring | |

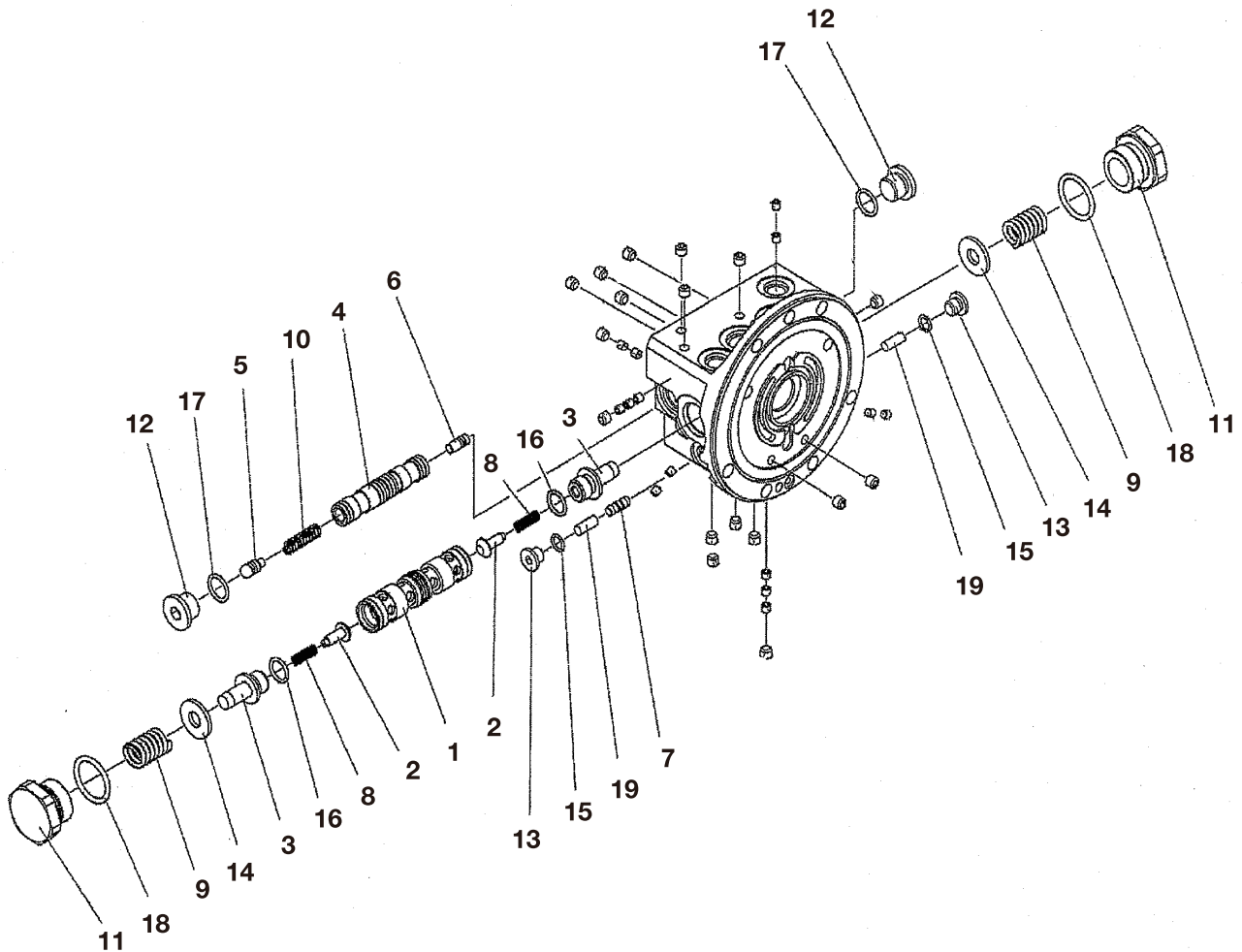
Reduction gears



4M0AI02Z

- | | | |
|-------------------|-------------------|-------------------|
| 1. Housing | 11. Needle | 21. Spring pin |
| 2. Cover | 12. Needle | 22. O-ring |
| 3. Carrier 2 | 13. Floating seal | 23. O-ring |
| 4. Planet gear B1 | 14. O-ring | 24. Plug |
| 5. Planet gear B2 | 15. Bearing | 25. Thrust washer |
| 6. Sun gear S1 | 16. Thrust washer | 26. Plug |
| 7. Pin | 17. Snap ring | 27. O-ring |
| 8. Thrust washer | 18. Snap ring | 28. Ring |
| 9. Seal ring | 19. Snap ring | 29. Ring |
| 10. Snap ring | 20. Snap ring | |

Valves



4M0AX01

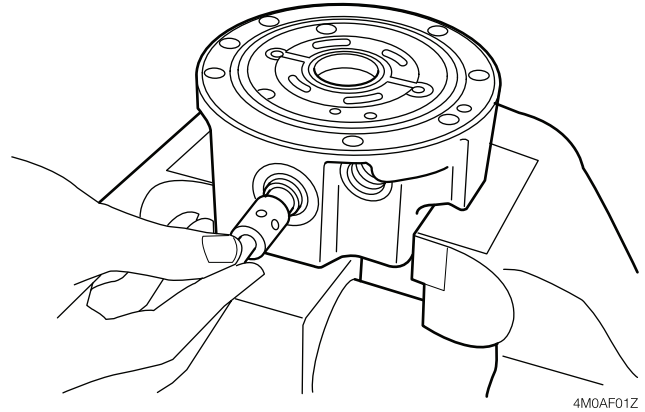
- | | | |
|-----------------|------------------|------------|
| 1. Spool | 7. Shuttle spool | 13. Plug |
| 2. Check valve | 8. Spring | 14. O-ring |
| 3. Spring guide | 9. Spring | 15. O-ring |
| 4. Spool | 10. Plug | 16. O-ring |
| 5. Spool | 11. Plug | 17. O-ring |
| 6. Spool | 12. Plug | 18. O-ring |

Assembly

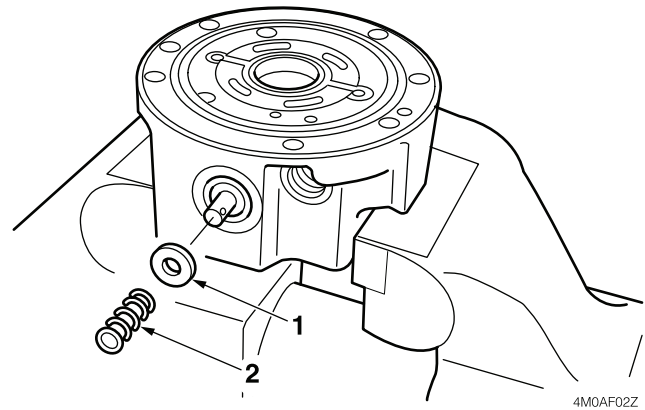
The assembly procedures are given below. For disassembly, follow the same procedures as for assembly but in the reverse order by referring to the construction diagram.

Counter balance valve and hydraulic motor

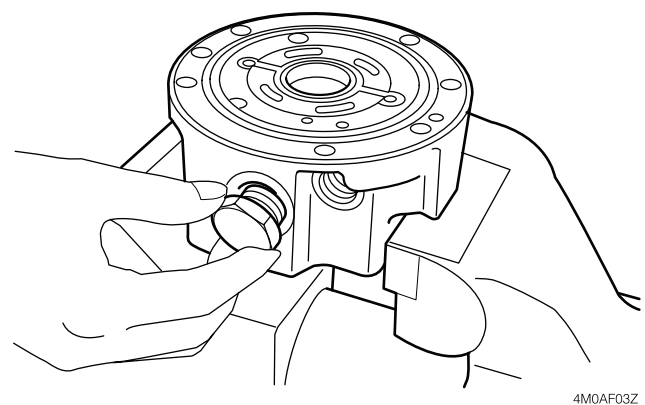
1. Secure the valve body in a vise, and insert the spool into the valve body.
 - Insert an aluminum plate or the like between the motor and the vise to prevent the outer surface of the valve body from becoming damaged.
 - Do not further disassemble the spool assembly.



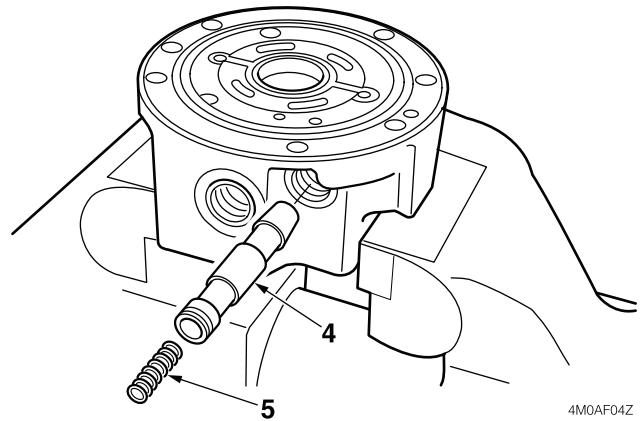
2. Attach the rings (1) and springs (2) to both ends of the spool.



3. Attach the O-rings to the plugs, and tighten the plugs on both ends of the body.
⚙️ Plug: 127 to 167 N·m (93.7 to 123.2 ft.-lb)

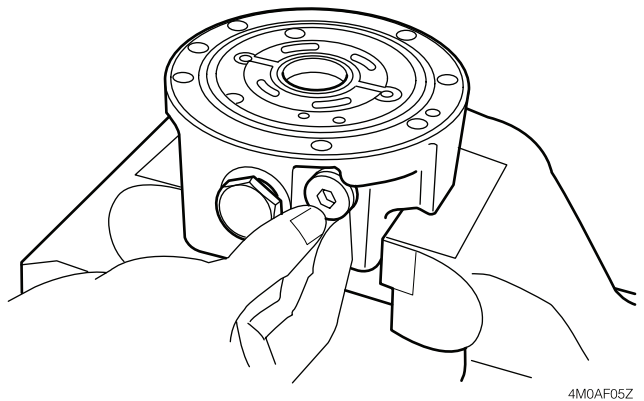


4. Insert the 2-speed spool (4) and spring (5) into the valve body.

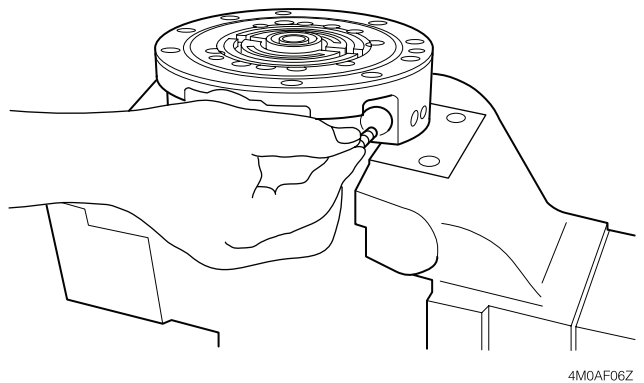


5. Attach the O-rings to the plugs, and tighten the plugs on each end of the body.

🔑 Plug: 46 to 51 N·m (33.9 to 37.6 ft.-lb)

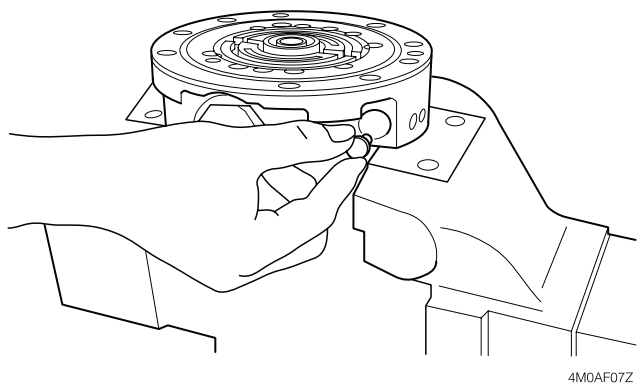


6. Insert the shuttle and the needles (on both sides).

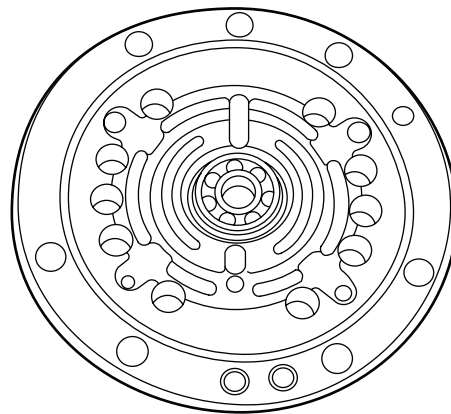


7. Attach the O-rings to the plugs, and tighten the plugs on both ends of the body.

🔑 Plug: 59 N·m (43.5 ft.-lb)

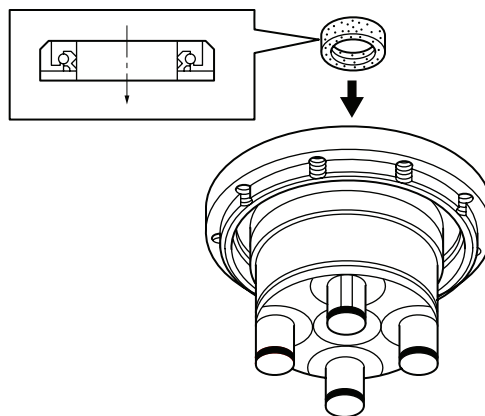


8. Attach the O-rings (large and small) to the valve body.



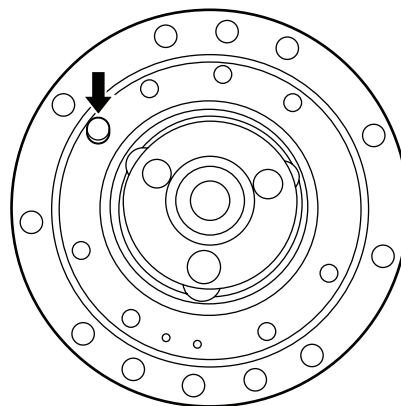
4M0AF08Z

9. Press-fit the oil seal into the flange holder.
- Do not disassemble the oil seal unless necessary.
-  Add grease between the lips of the oil seal.



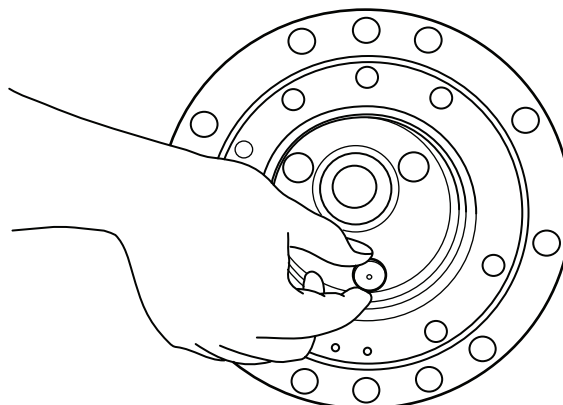
4M0AF09Z

10. Insert the pin.



4M0AF10Z

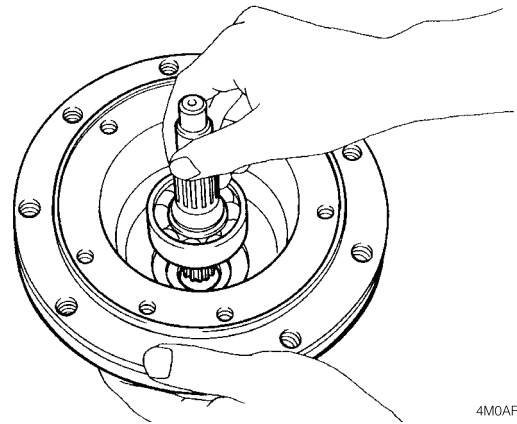
11. Insert the 2nd-speed piston.



4M0AF11Z

12. Insert the shaft into the flange holder.

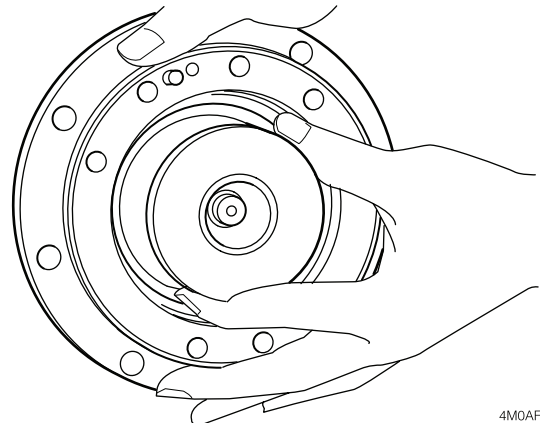
- The bearing is press-fitted and thus cannot be disassembled.
- Be careful not to damage the oil seal with the shaft.



4M0AF12Z

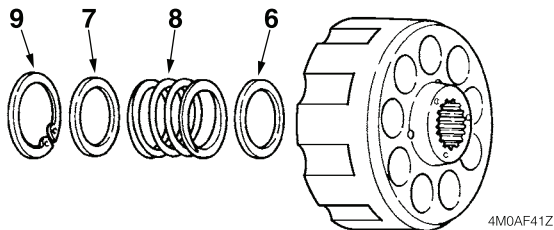
13. Place the balls and the swash plate in the flange holder.

- Apply hydraulic oil to the sliding surfaces of the swash plate.

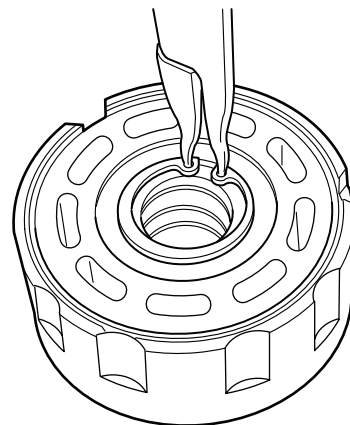


4M0AF13Z

14. Mount the retainer (6), spring (8), and retainer (7) on the cylinder block, and secure the parts in place with the snap ring (9).

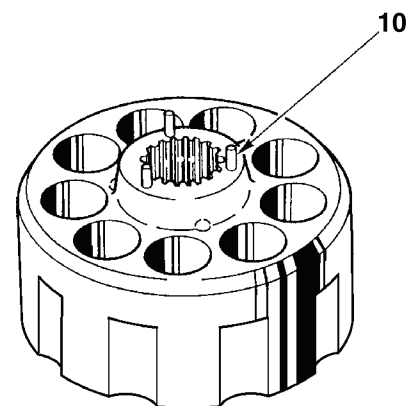


4M0AF41Z



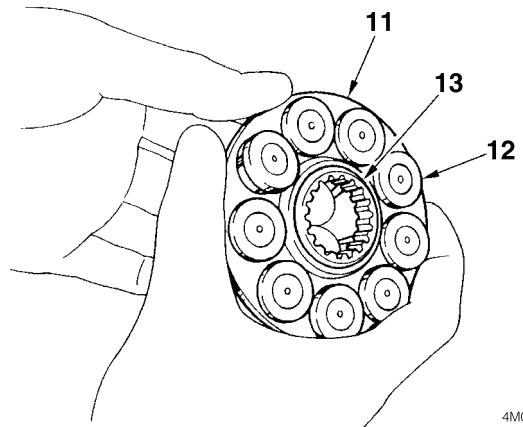
4M0AF14Z

15. Insert the 3 pins (10) into the cylinder block.

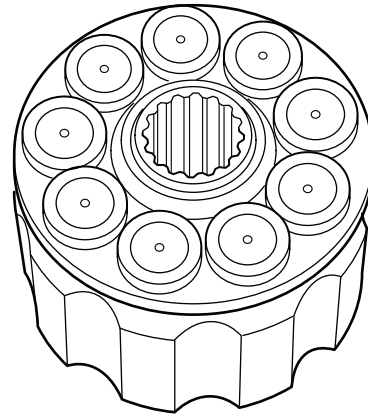


4M0AF15Z

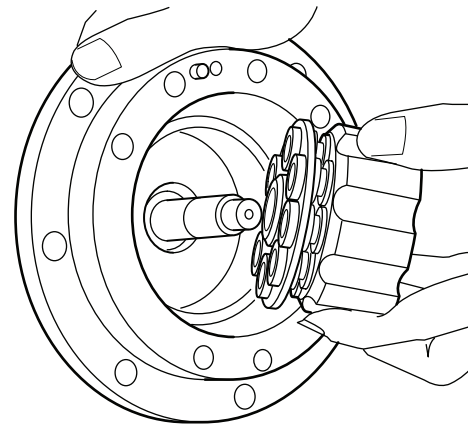
16. Insert the piston (12) and guide (13) into the shoe holder (11) to form the shoe holder assembly.



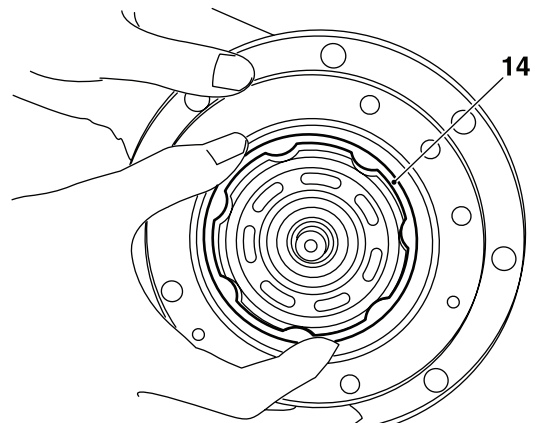
17. Place the shoe holder assembly into the cylinder block to form the cylinder block assembly.



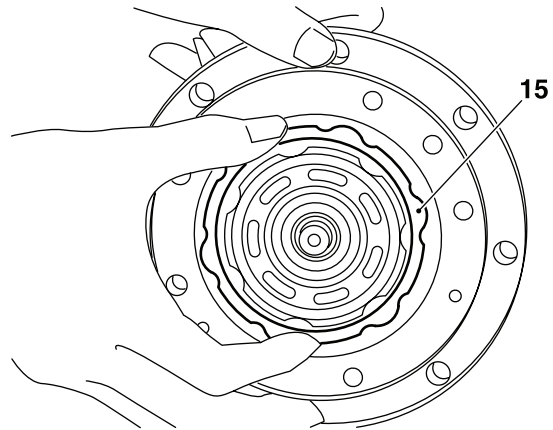
18. Insert the cylinder block assembly into the flange holder.
- Insert the cylinder block assembly in such a manner that the shoe will touch the swash plate.



19. Install the friction disc (14) in the groove on the cylinder block.

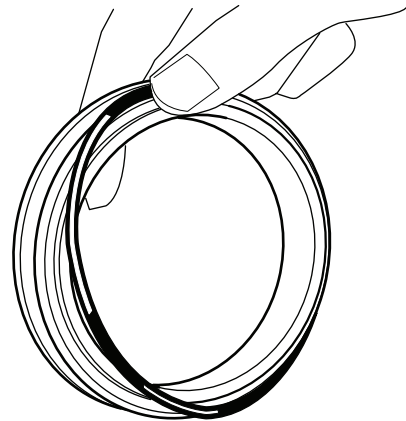


20. Insert the center disc (15) into the groove on the flange holder.



4M0AI05Z

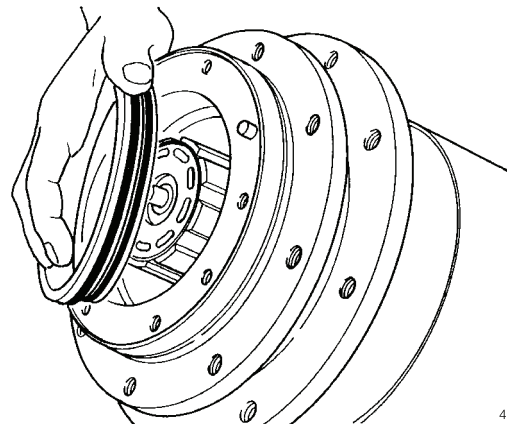
21. Attach the two O-rings and two backup rings to the brake piston.
- Attach the O-rings on the inside and then attach the backup rings on the outside.



4M0AF21Z

22. Attach the brake piston assembly to the flange holder.

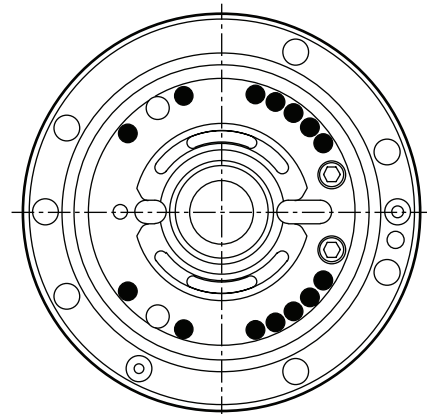
- Apply grease to the O-rings, and make sure that the seal material does not get caught in the parts.



4M0AF22Z

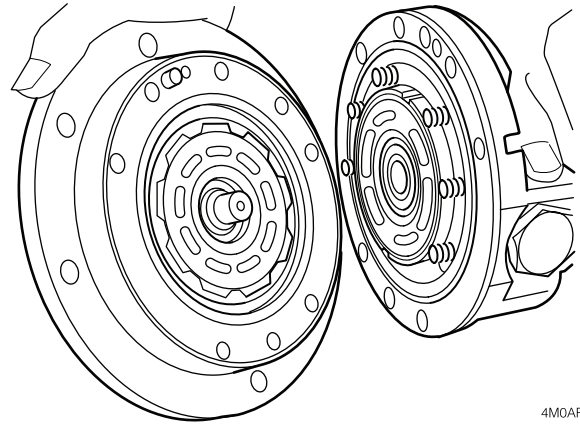
23. Attach the valve plate to the flange holder, and insert the springs into the spring holes.

- The symbols "●" in the figure indicate the installation positions of the springs.
- Install the valve plate so that its copper surface faces the cylinder block.
- Apply grease to the valve plate and springs. Avoid dropping them.



4M0AI06Z

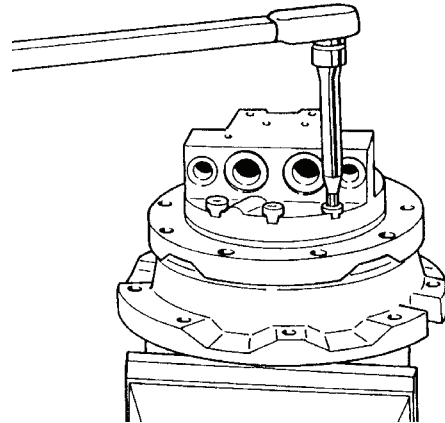
24. Fill the flange holder with 100 ml (3.4 fl.oz) hydraulic oil, and align the valve body with the flange holder.



4M0AF24Z

25. Secure the hydraulic motor in a vise, and tighten the screws.

-  Screw: 28.4 to 30.4 N·m (20.9 to 22.4 ft.-lb)
- Insert an aluminum plate or the like between the motor and the vise to prevent the outer surface of the valve body from becoming damaged.

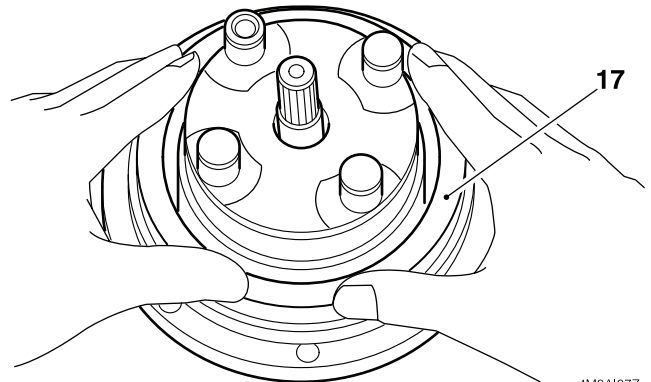


4M0AF25Z

Reduction gears

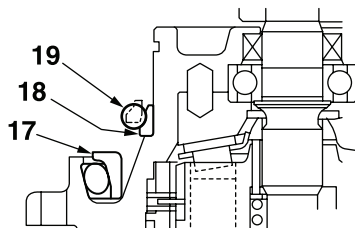
1. Attach the floating seat (17) and the O-ring to the flange holder.

-  Apply grease to the O-ring.

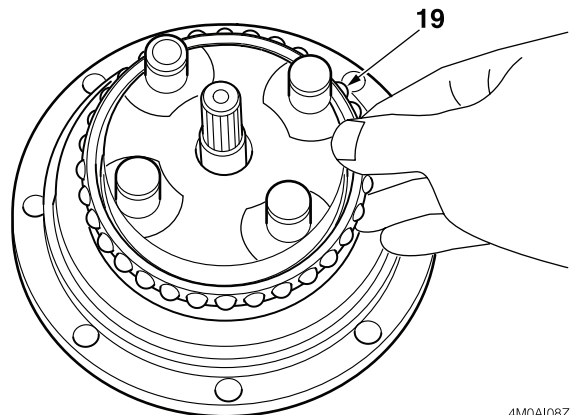


4M0AI07Z

2. Insert the inner race (18) of the bearing and the steel balls (19) with retainers into the flange holder.



4M0AI09Z

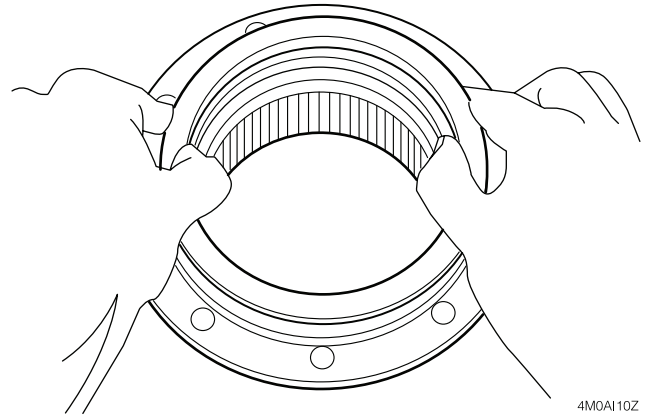


4M0AI08Z

3. Fit the O-ring to the seal ring and then attach them to the housing.

- Align the seal ring pin with the pin hole on the housing.

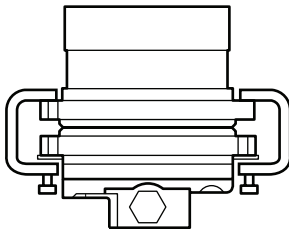
 Apply grease to the O-ring.



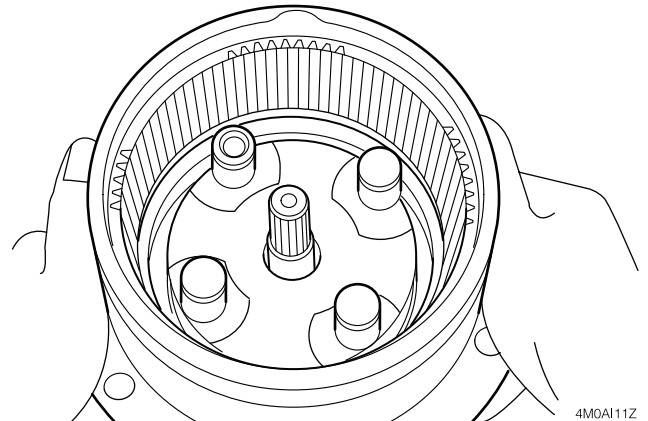
4M0AI10Z

4. Attach the housing, and insert the hydraulic motor.

- Tighten the housing and the hydraulic motor flanges with a C clamp or a hydraulic press.

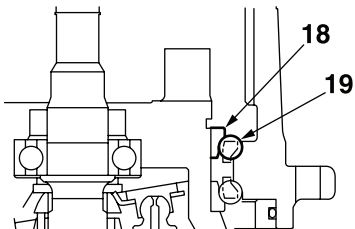


4M0AF43Z

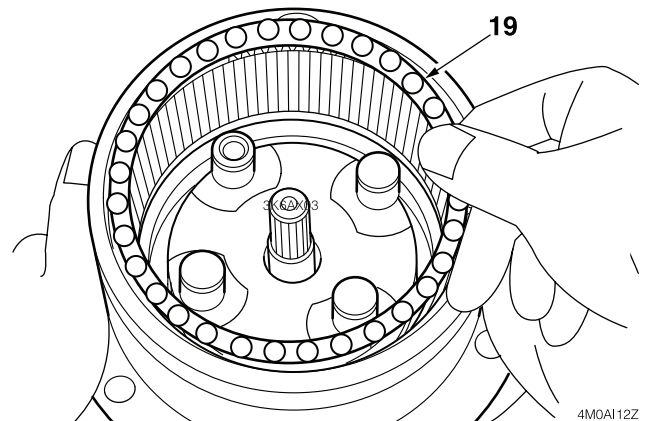


4M0AI11Z

5. Insert the steel balls (19) with retainers of the bearing and the inner race (18) into the flange holder.

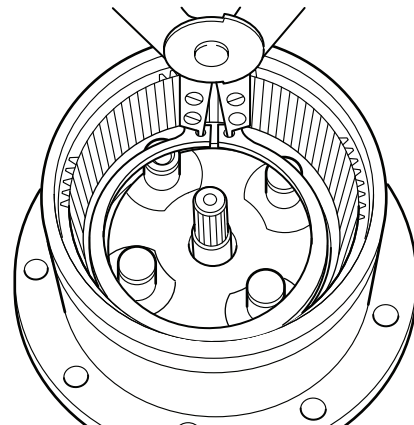


4M0AI13Z



4M0AI12Z

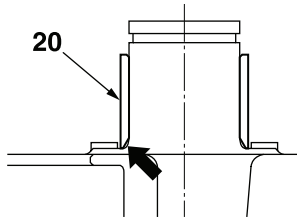
6. Insert the snap ring.



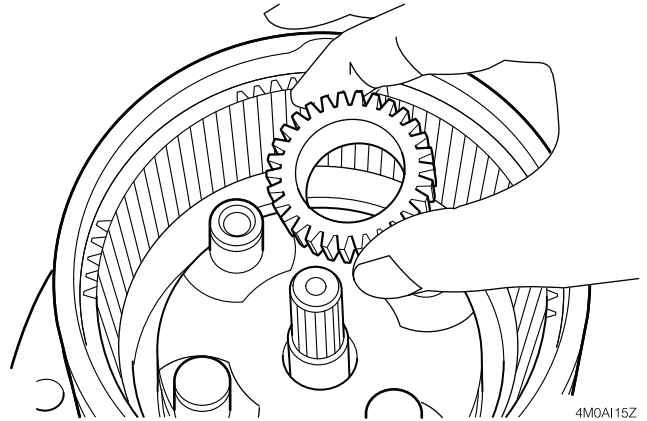
4M0AI14Z

7. Place the rings, thrust washers, planet gears B1, and needles on the pins.

- Be sure to attach the ring (20) in the correct direction. The side with the chamfered internal diameter must be on the motor side.



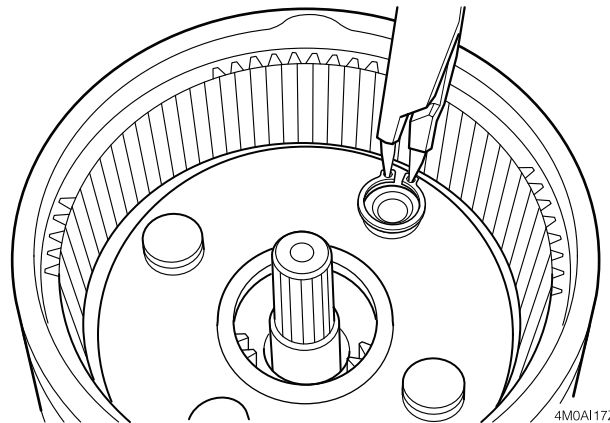
4M0AI16Z



4M0AI15Z

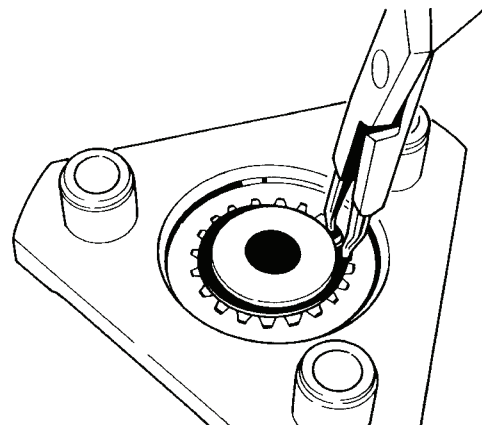
8. Attach the thrust washer, and secure it in place with the snap rings.

- Do not spread the snap ring open more than necessary.
- Insert the snap ring with the edge facing the cover.



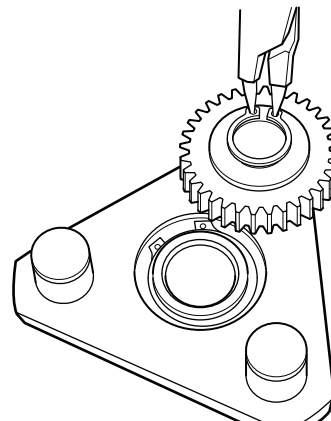
4M0AI17Z

9. Insert the sun gear S1 into the carrier 2, and secure it in place with a snap ring.



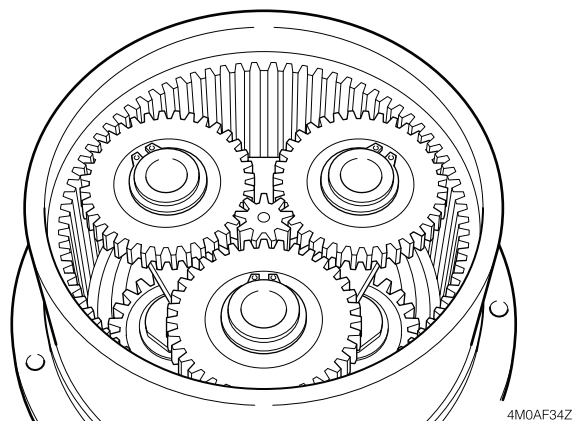
4M0AF31Z

10. Insert the thrust washers, planet gears B2, needles, and thrust washers into carrier 2, and secure them in place with a snap ring.

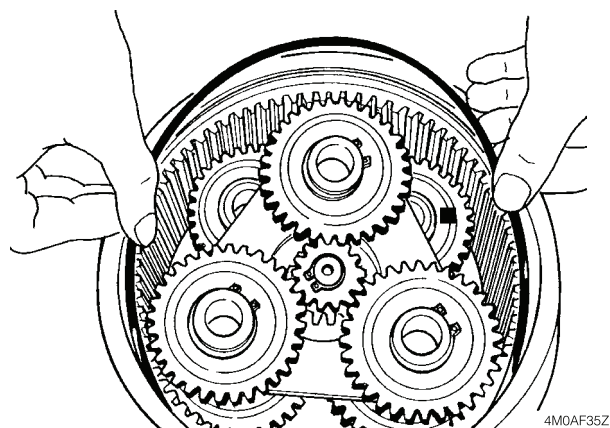


4M0AF32Z

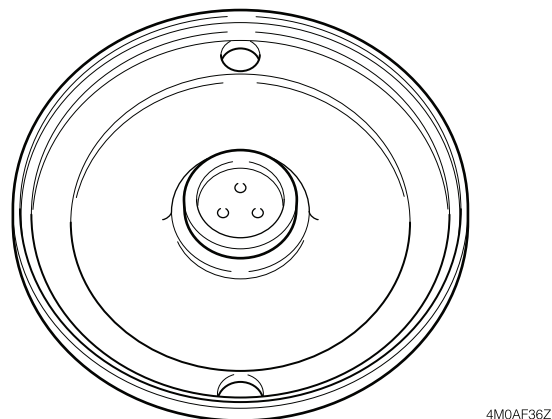
11. Insert the carrier 2 assembly into the housing.



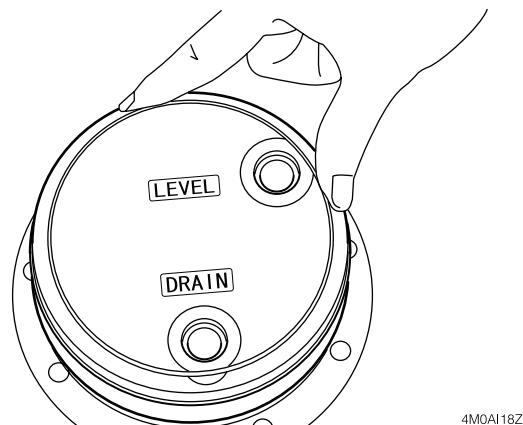
12. Attach the O-ring to the housing.



13. Place the ring on the cover.
🔧 Apply grease.

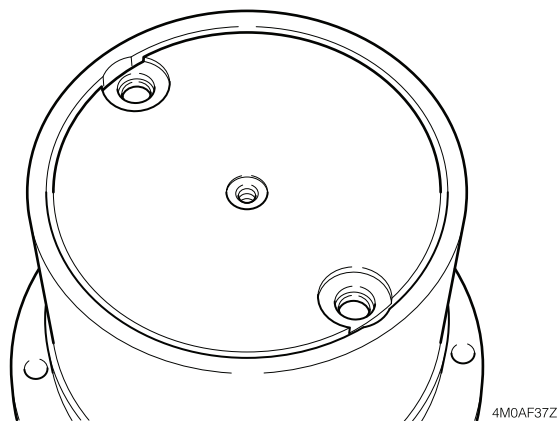


14. Add 330 ml (11.2 fl.oz) of lubricant.



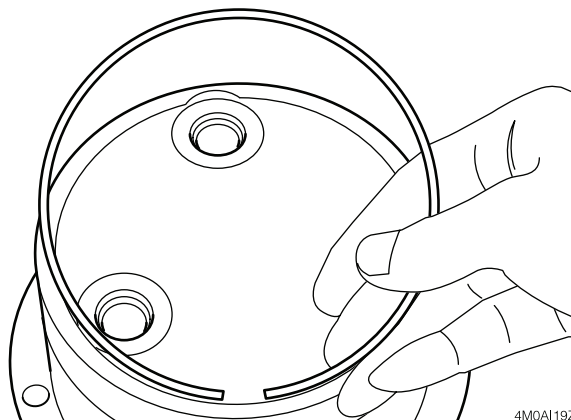
15. Attach the cover to the housing.

- Align the notch on the housing with the drain plug hole.



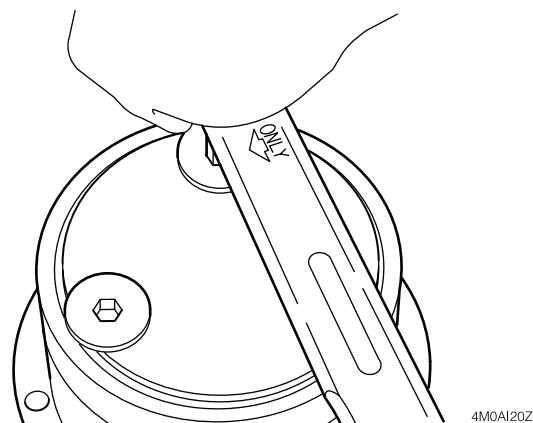
16. Attach the snap ring to secure the cover in place.

- Set a flat head screwdriver against the edge of the snap ring to hammer it in around its circumference.



17. Attach the O-ring to the plug, and insert it into the cover.

- Plug: 46 to 51 N·m (33.9 to 37.6 ft.-lb)



Inspection and adjustments

Use limit for parts

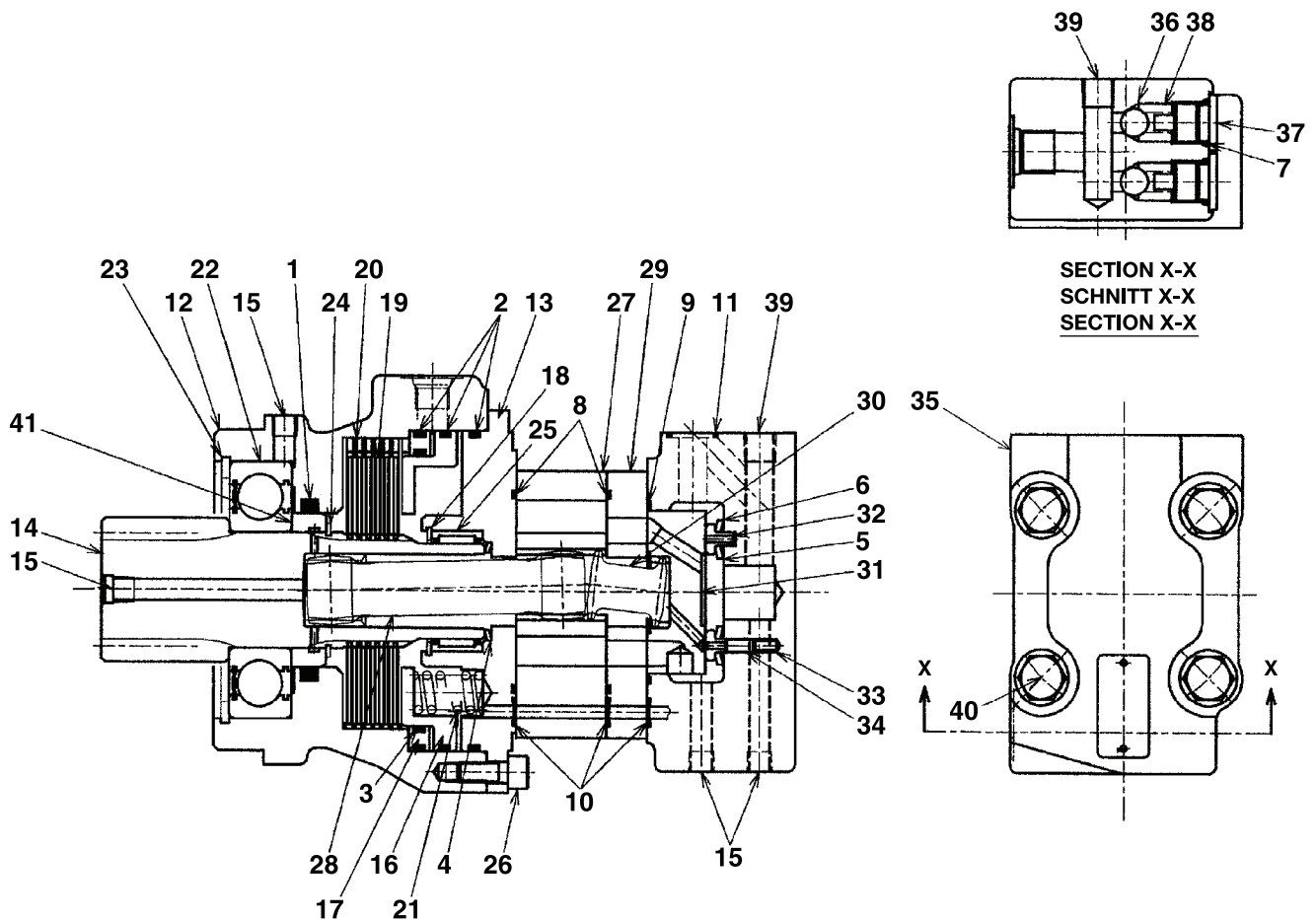
Part	Item to check	Criteria	Action
Floating seal	Sliding surface	If there are abnormal scratches, wear, or seizure on the surface	Replace
Angular bearing	Rolling surface	If there are abnormal scratches, or flaking on the ball or race	Replace
Planet gear	Gear tooth surface	If there are abnormal scratches, wear or flaking of the tooth surfaces (if pitting covers 10% or more of the area engaging with the tooth surface).	Replace
Inner race	Rolling surface	If there are abnormal scratches, wear, or flaking on the rolling surface	Replace
Needle	Needle surface	If there are abnormal scratches, wear, or flaking on the surface	Replace
Thrust washers	Sliding surface	If there are abnormal scratches, wear, or seizure on the surface	Replace
Housing, sun gear, drive gear	Gear tooth surface	If there are abnormal scratches, wear or flaking of the tooth surfaces (if pitting covers 10% or more of the area engaging with the tooth surface).	Replace
Thrust plate	Sliding surface	If there are abnormal scratches, wear, or seizure on the surface	Replace
O-rings	—	—	Replace
Shaft	Oil seal surface	If there are abnormal scratches, wear, or seizure on the surface	Replace
Ball bearing	Sliding surface	If there are abnormal scratches, or flaking on the ball or race	Replace
Oil seal	—	—	Replace
Swash plate	Surface of the sliding part with the piston assembly	If there are abnormal scratches ((0.02 mm (0.0008 in.) or more), wear, or seizure on the surface	Replace
Cylinder block	Cylinder block-to-piston assembly clearance	0.04 mm (0.002 in.) or more	Replace
	Sliding surface with the valve plate	If there are abnormal scratches (0.02 mm (0.0008 in.) or more), wear, or seizure on the surface	Repair with a lapping tool (#1000) or replace
Piston assembly	Piston assembly-to-cylinder block clearance	0.04 mm (0.002 in.) or more	Repair with a lapping tool (#1000) or replace the cylinder block and piston assembly together
	Sliding surface with the swash plate	If there are abnormal scratches (0.02 mm (0.0008 in.) or more), wear, or seizure on the surface	
	Play of piston shoe	0.04 mm (0.002 in.) or more	
Valve plate	Sliding surface with the cylinder block	If there are abnormal scratches (0.02 mm (0.0008 in.) or more), wear, or seizure on the surface	

Part	Item to check	Criteria	Action
Valve body	Sliding surface with the spool	If there are abnormal scratches, wear, or seizure on the surface	Replace both the valve body and spool
Spool	Sliding surface with the valve body	If there are abnormal scratches, wear, or seizure on the surface	
	Sliding surface with the check valve	If there are abnormal scratches, wear, or seizure on the surface	Replace both the spool and check valve
Check valve	Sliding surface with the spool	If there are abnormal scratches, wear, or seizure on the surface	
	Spool and seat surfaces	If there is contact with the seat along the entire circumference	

SLEW MOTOR

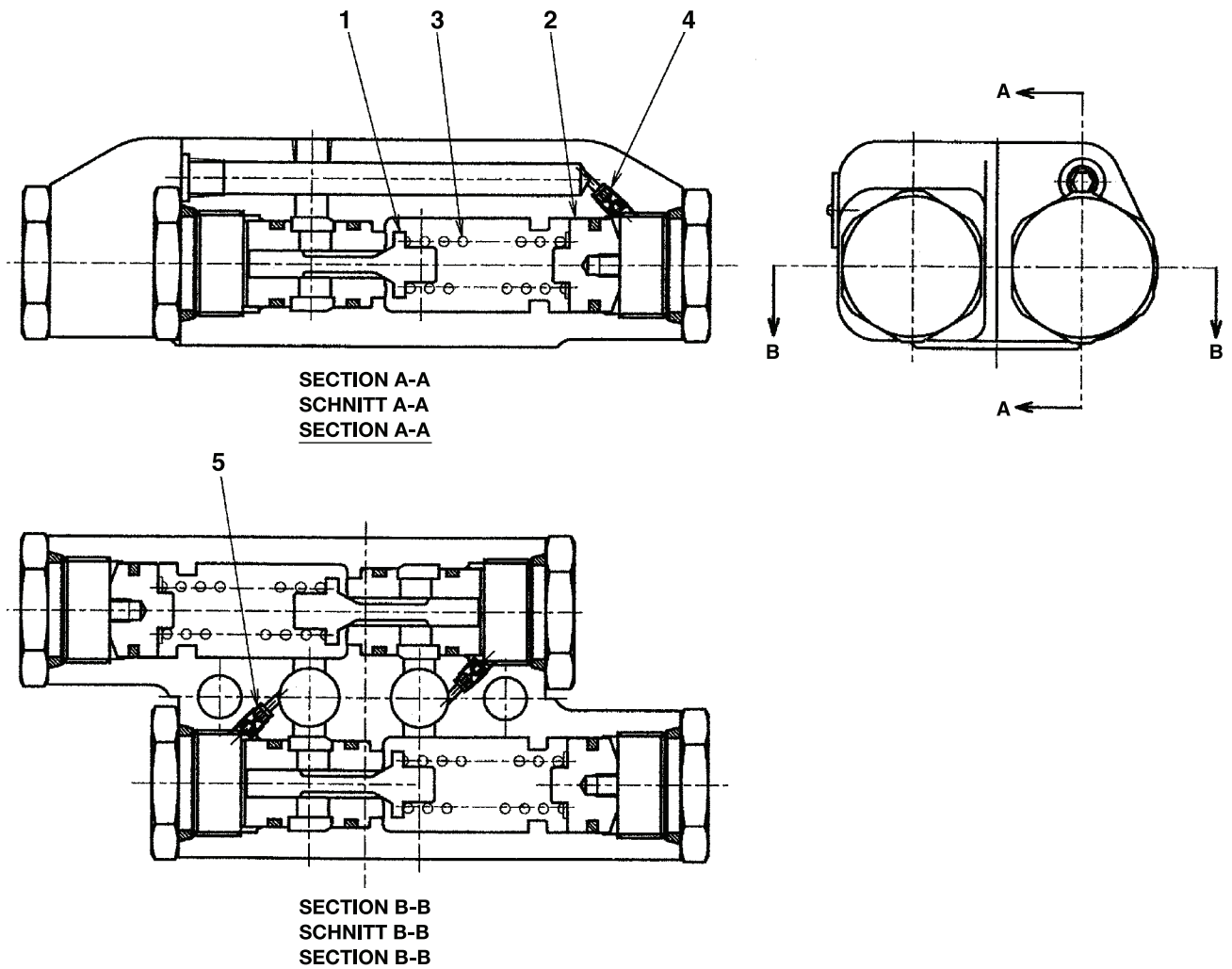
Construction

Hydraulic motor



4N0A101Z

- | | | | |
|--------------------|---------------------|----------------------|-------------------|
| 1. X-ring | 12. Bearing housing | 23. Snap ring | 34. Pin |
| 2. O-ring | 13. Flange mounting | 24. Snap ring | 35. Valve housing |
| 3. O-ring | 14. Pinion gear | 25. Rear bearing | 36. Ball |
| 4. Shaft face seal | 15. Plug | 26. Socket bolt | 37. Plug |
| 5. Inner face seal | 16. Break piston | 27. Gerolot | 38. Spring |
| 6. Outer face seal | 17. Ring | 28. Drive gear | 39. Plug |
| 7. O-ring | 18. Snap ring | 29. Valve plate | 40. Bolt |
| 8. O-ring | 19. Friction disc | 30. Valve drive gear | 41. Collar |
| 9. O-ring | 20. Center disc | 31. Valve | |
| 10. O-ring | 21. Spring | 32. Balancing ring | |
| 11. O-ring | 22. Front bearing | 33. Spring | |

Brake valve

4N0A102Z

1. Plunger
2. Pinion
3. Spring
4. Timer orifice
5. Damper orifice

Disassembly and assembly

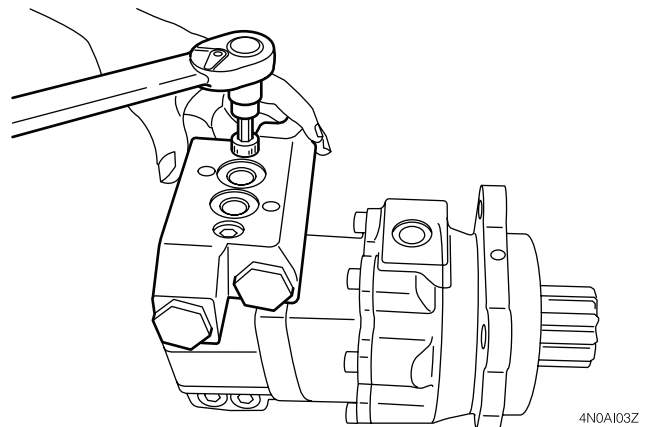
General precautions

- Perform disassembly and assembly work in a clean place. Provide clean containers to hold parts during disassembly.
- Before disassembly, clean around the ports and remove coating or thread-locking compound on the joints with a wire brush.
- Clean disassembled parts with dedicated cleaning oil.
- Apply hydraulic oil on the sliding surfaces and thin layer of grease on the seals before assembly.
- Replace seals with new ones after each disassembly.
- Check each part for abnormal wear or seizing. Remove any burrs with sandpaper.

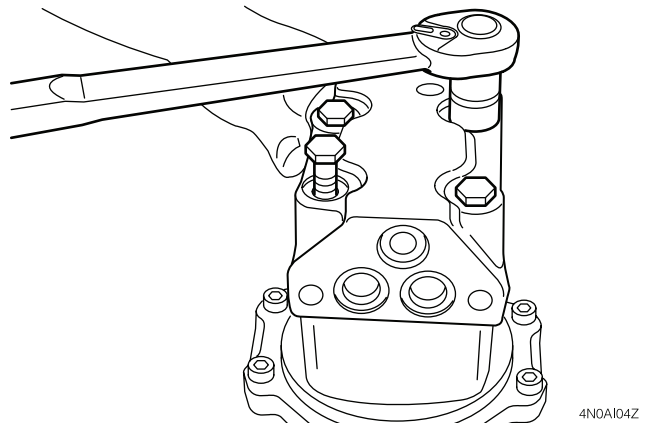
Disassembly

1. Take out the socket bolts, and remove the break valve.

- Place the shaft downward, and secure the flange section in place with a vice before starting disassembling.

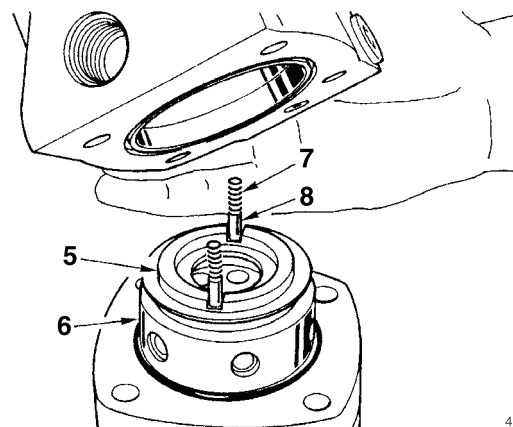


2. Take out the bolts, and remove the valve housing.

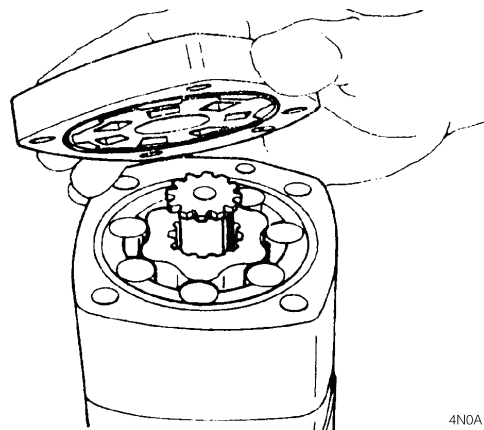


3. Take out the valve housing, and remove the balancing ring (5) and valve (6).

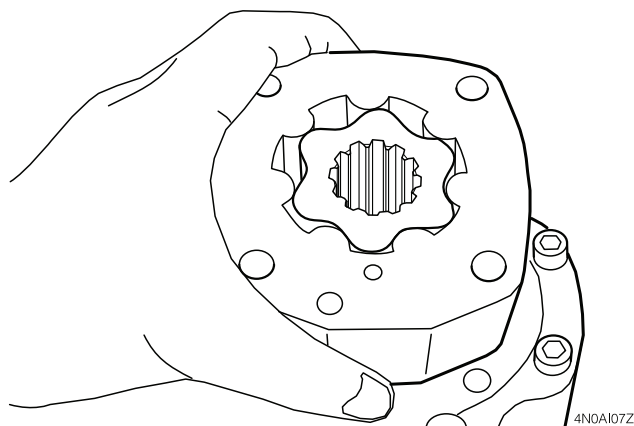
- Make sure not to lose the spring (7) and the pin (8) for the balancing ring.



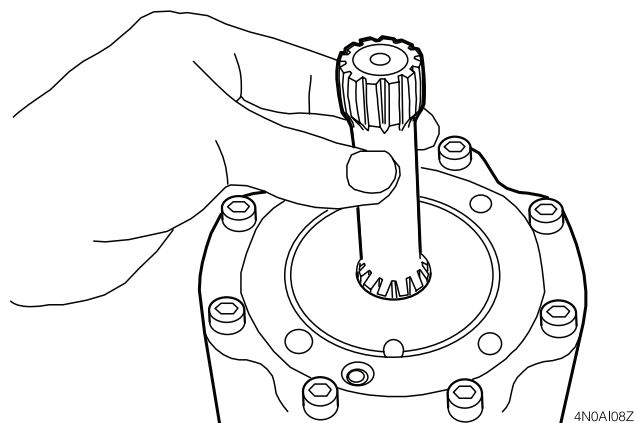
4. Remove the valve plate and the valve drive gear.



5. Remove the gerolol.

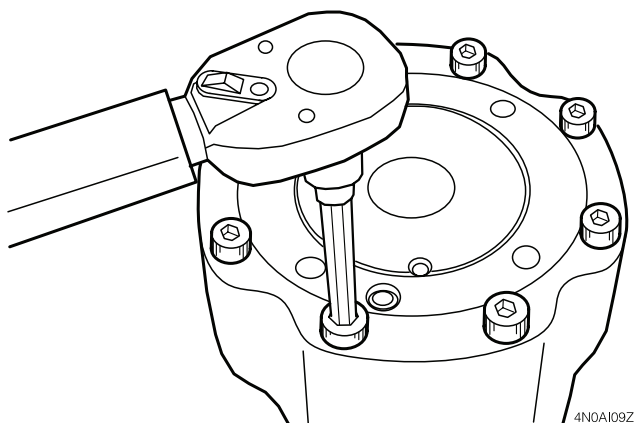


6. Remove the drive.

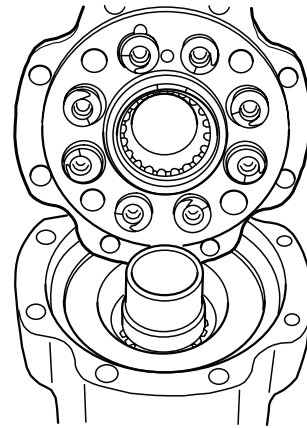


7. Take out the socket bolts, and remove the flange mounting.

- Do not disassemble the rear bearing unless necessary.

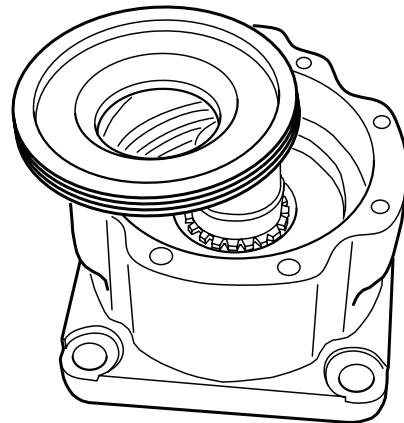


8. Remove the spring from the flange mounting.



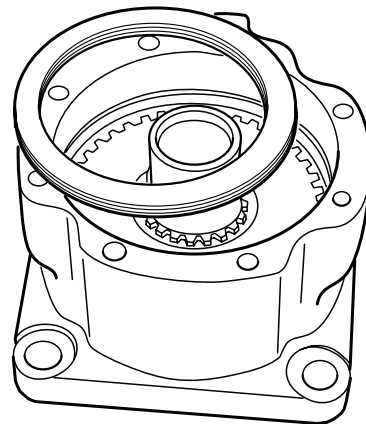
4N0A110Z

9. Remove the brake piston.



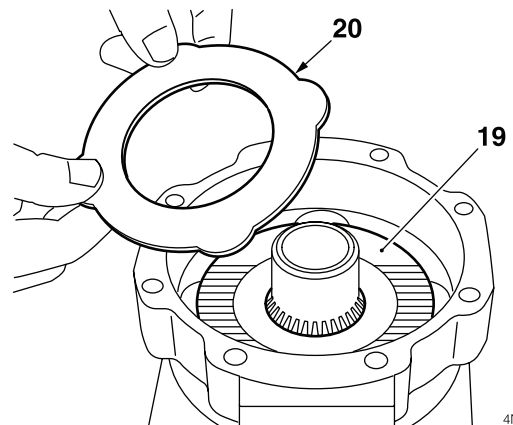
4N0A111Z

10. Remove the ring.



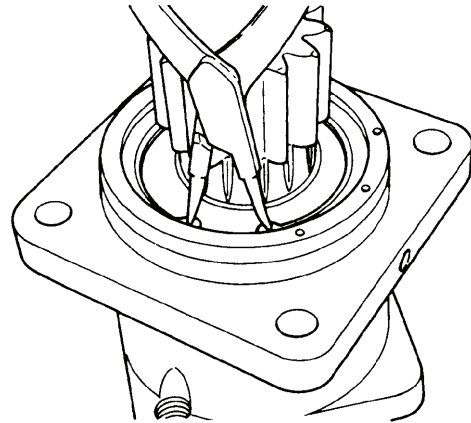
4N0A112Z

11. Remove the center disc (20), the friction disc (19), and the plate.



4N0A113Z

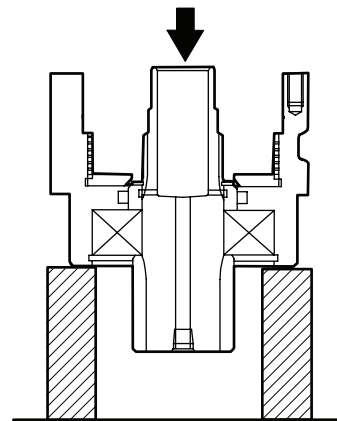
12. Remove the snap ring.



4N0A114Z

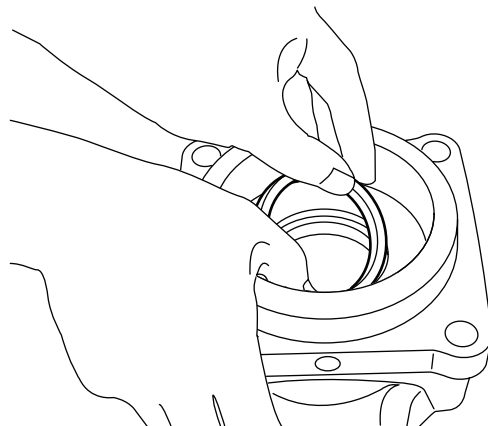
13. Remove the pinion gear.

- Pull out the shaft assembly with a press using a support.
- Do not disassemble the ball bearing and collar unless necessary.



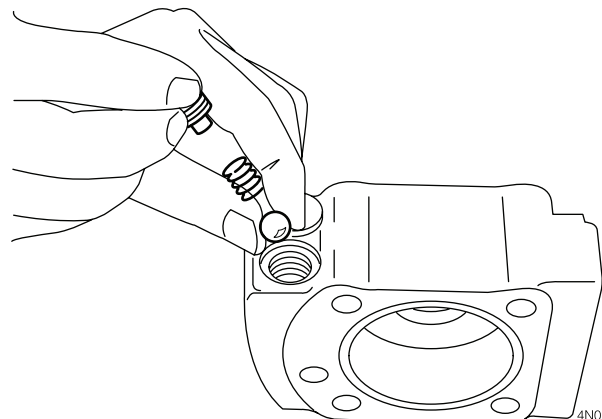
4N0A115Z

14. Remove the X-ring from the bearing housing.



4N0A116Z

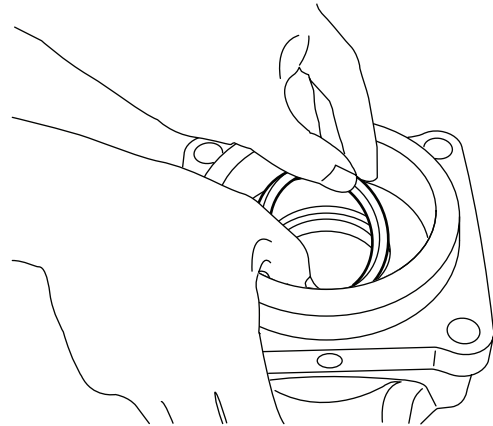
15. Remove the plug, spring, and ball from the valve housing.



4N0A117Z

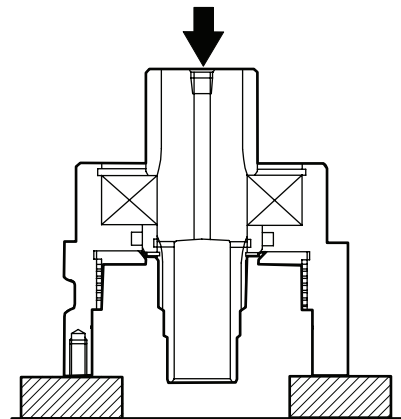
Assembly

1. Insert the X-ring into the bearing housing.



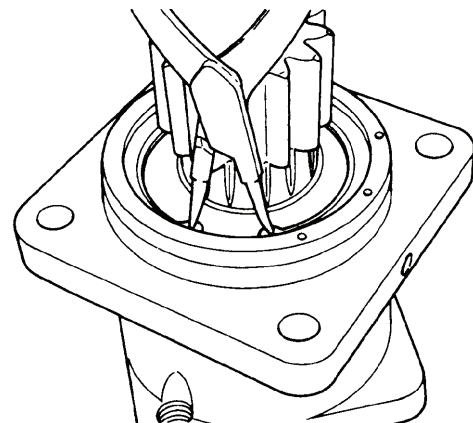
4N0A116Z

2. Insert the shaft into the bearing housing.
 - Using a support, press-fit the shaft with a press.



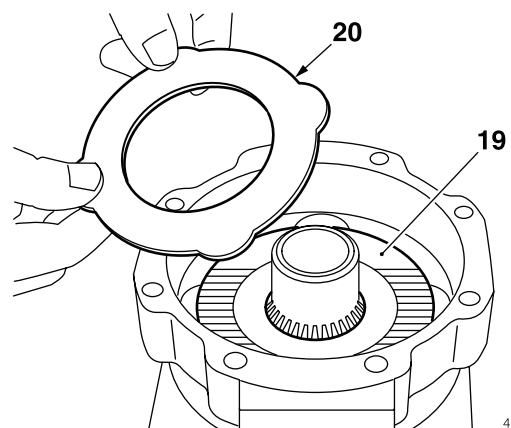
4N0A118Z

3. Attach the snap ring to secure the front bearing in place.



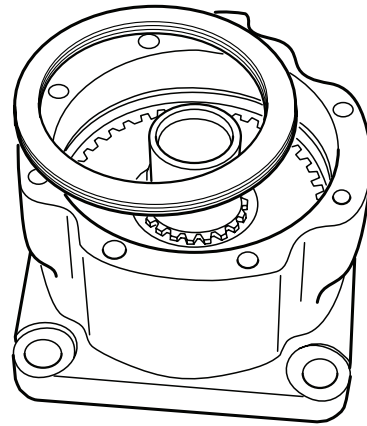
4N0A114Z

4. Insert the center disc (20) and the friction disc (19) alternately in this order.
 - Insert the disks in the correct order.



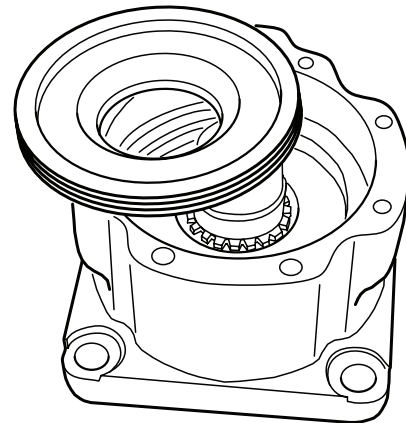
4N0A113Z

5. Fit the O-rings to the inner part and outer part of the ring and then insert the ring into the bearing housing.



4N0A112Z

6. Fit the O-ring to the piston and then insert them into the housing.



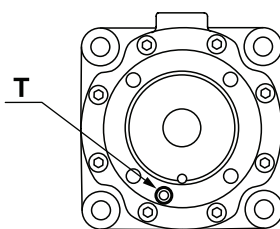
4N0A111Z

7. Fit the O-ring to the flange mounting, and insert the spring.

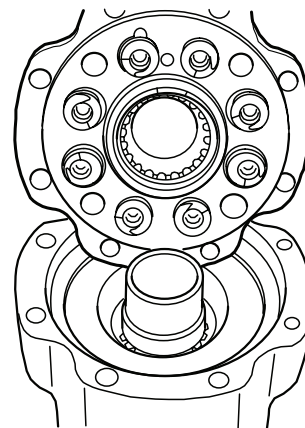
- Apply grease to the spring, and avoid dropping it.

8. Attach the flange mounting to the bearing housing.

- Attach the flange mounting so that the drain port T is positioned as shown in the figure below.



4N0A119Z

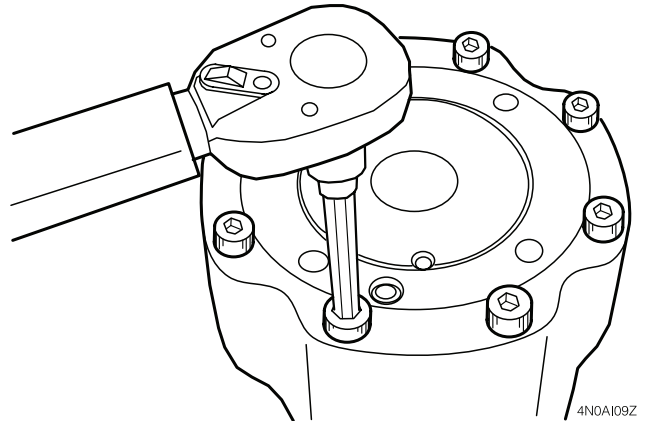


4N0A110Z

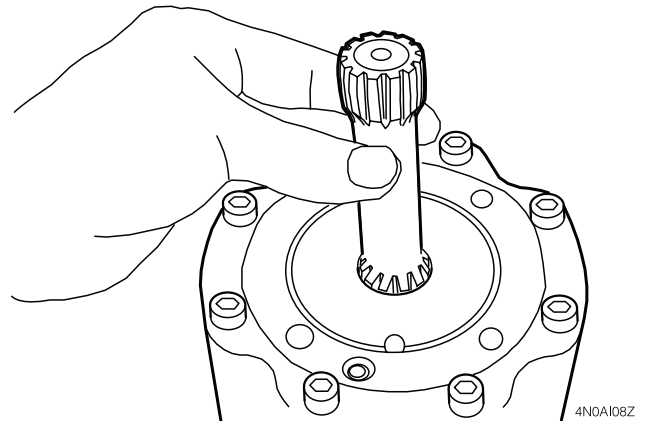
9. Tighten the socket bolts.

- Apply Loctite #242 to the socket bolt.

🔑 Bolt: 34.3 N·m (29.3 ft.-lb)

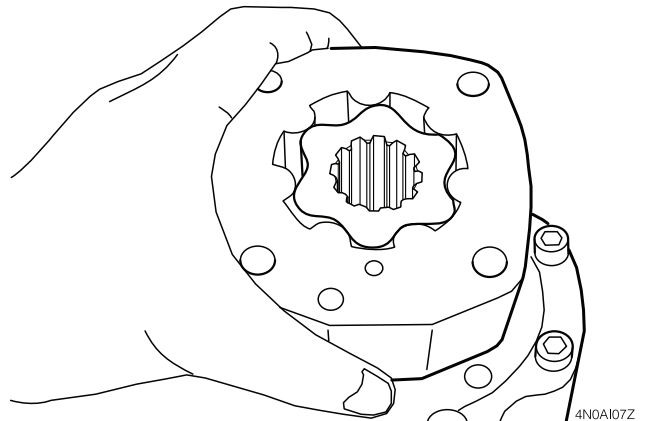


10. Insert the drive gear.



11. Fit the O-rings (large and small) to the flange mounting, and attach them to the gerolor.

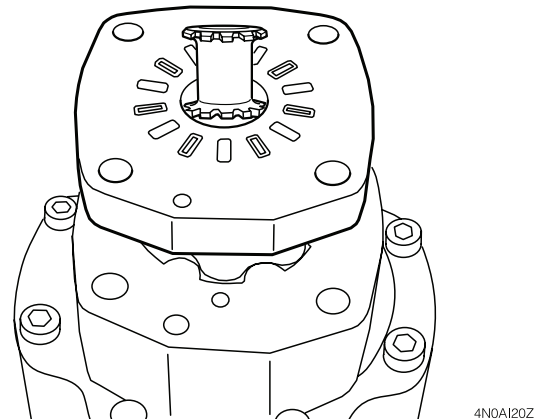
- When installing, be sure to align the flange mounting with the gerolor drain hole.



12. Insert the valve drive into the gerolor.

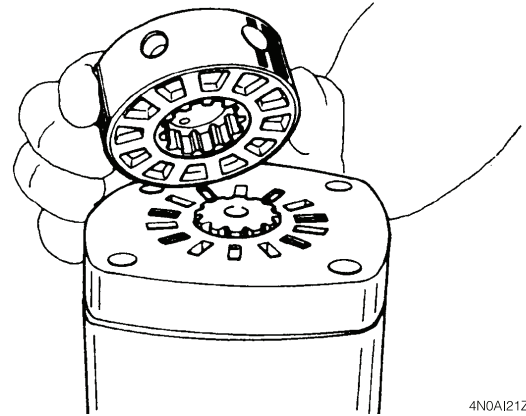
13. Fit the O-rings (large and small) to the valve plate, and insert them into the gerolor.

- When inserting, be sure to align the valve plate with the gerolor drain hole.

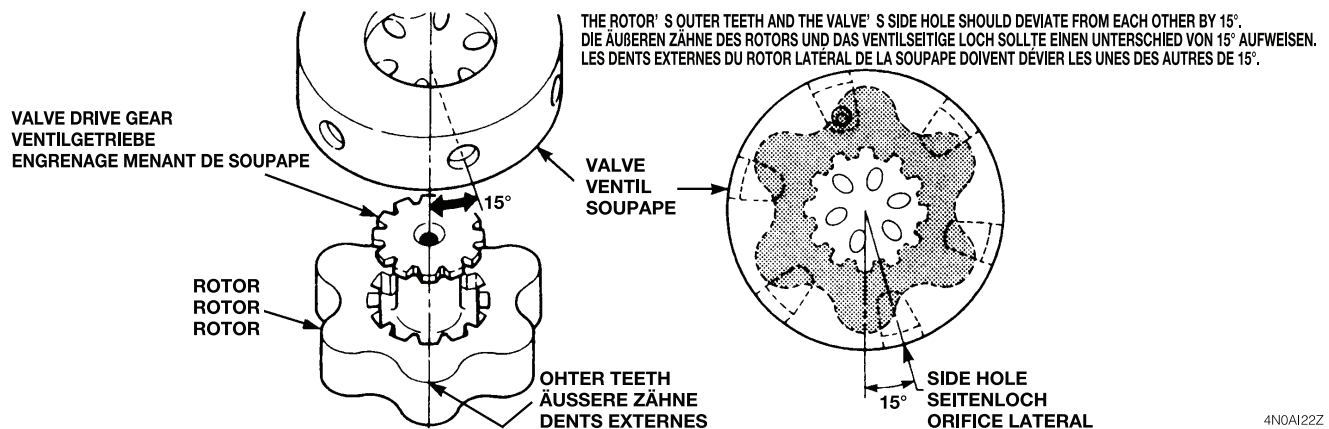


14. Attach the valve.

Important: The valve timing determines the rotation direction of the motor. Carefully attach the valve by referring to the figure below.



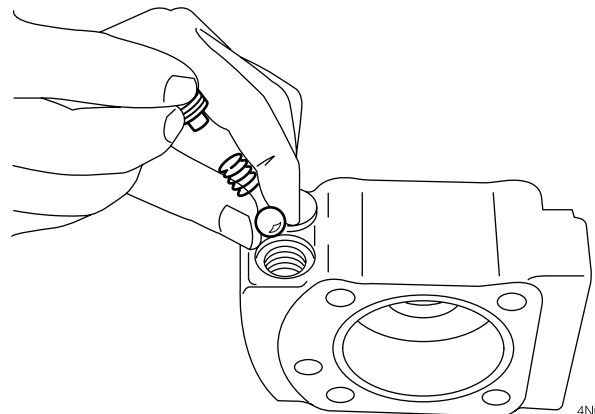
4N0A121Z



4N0A122Z

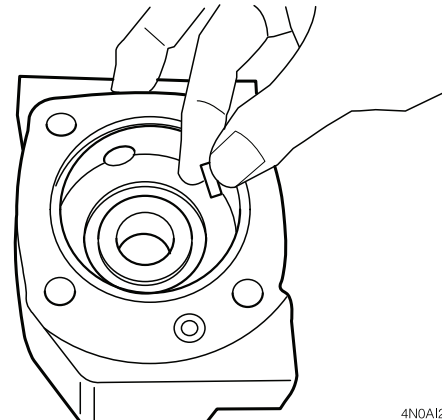
15. Insert the plug, spring, and ball into the valve housing.

⚙️ Plug: 58.8 N·m (43.4 ft.-lb)



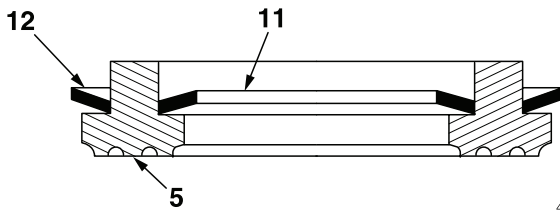
4N0A123Z

16. Insert the spring and pin into the valve housing.

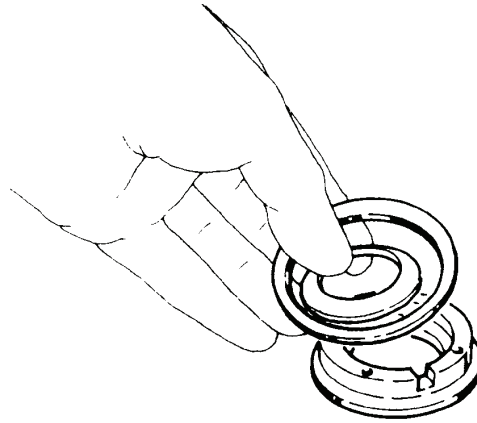


4N0A124Z

17. Fit the inner face seal (11) and the outer face seal (12) to the balancing plate (5).

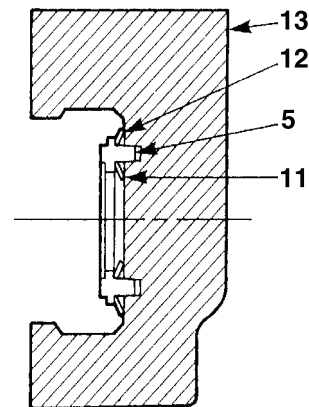


4N0AI25Z



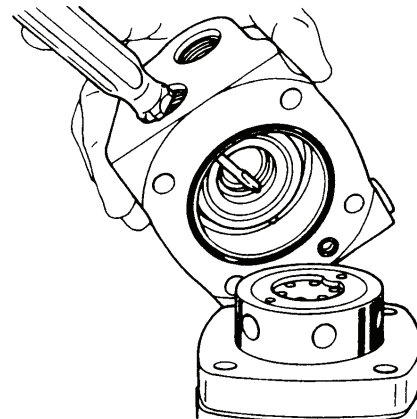
4N0AI26Z

18. Align the notch on the balancing plate (5) with the pin, and attach the plate to the valve housing (13).



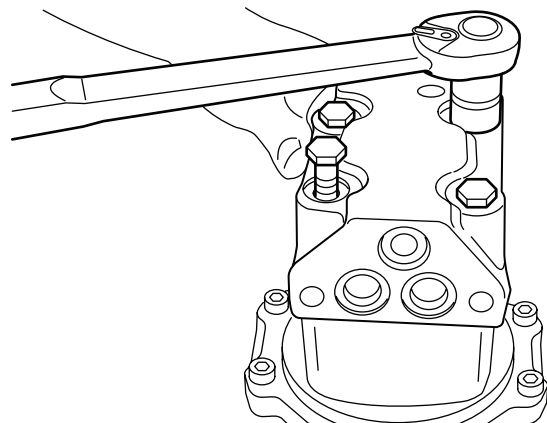
4N0AI27Z

19. Attach the O-rings (large and small) to the housing.
20. Attach the valve housing to the valve while preventing the balancing plate from becoming disconnected by pushing against it with a thin bar, such as a screwdriver, inserted from the port.
- When attaching, be sure to align the drain hole on the valve housing with the drain hole on the valve plate.



4N0AI28Z

21. Align the bolt holes, and tighten the bolts.
- Apply Loctite #242 to the bolt threads.
- 🔧 Bolt: 53 N·m (39.1 ft.-lb)

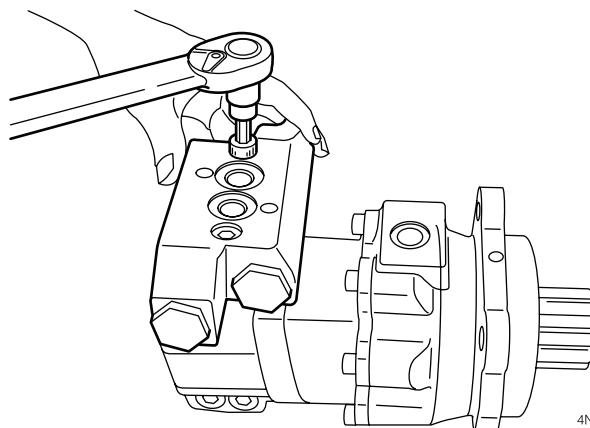


4N0AI04Z

22. Insert the O-ring into the housing.

23. Attach the brake valve to the hydraulic motor, and tighten with socket bolts.

🔑 Socket bolt: 54 N·m (39.3 ft.-lb)



4N0AI03Z

Inspection and adjustments

Checking the parts

Brake valve

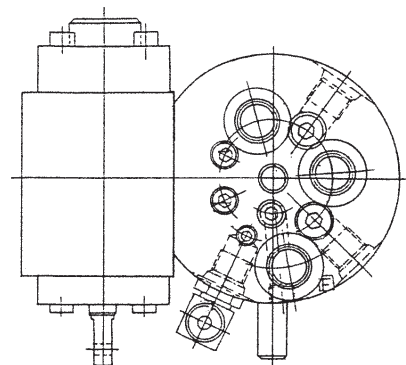
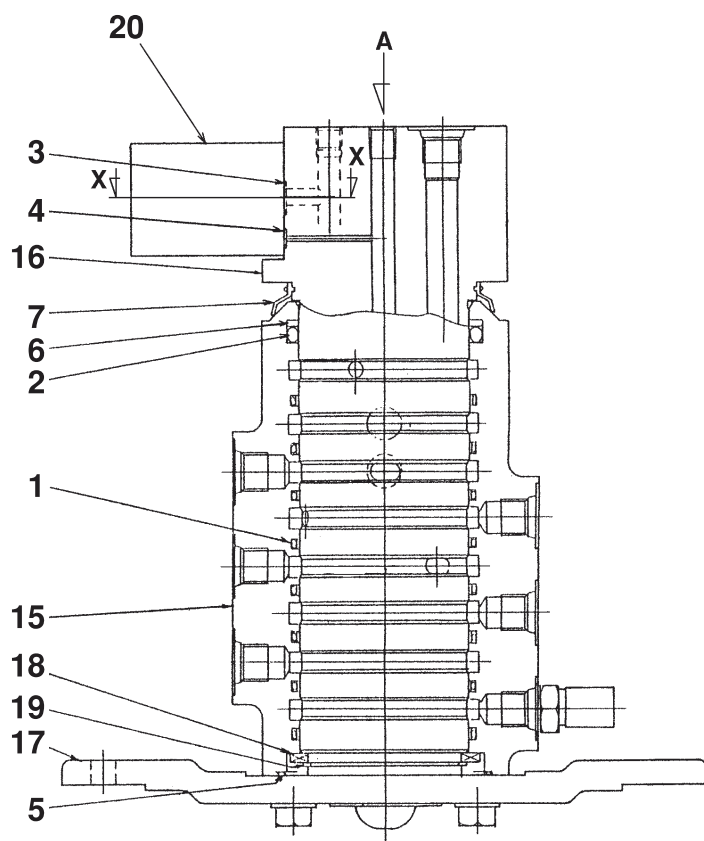
Part	Criteria	Action
Body	- If there is severe damage to sliding parts or excessive surface roughness - If there is damage, etc. that allows oil leakages to occur	- Replace - Replace
Relief valve assembly	- If there are abnormal drops in the set pressure - If there is vibration due to the set pressure being unstable - If there is increased leakage due to faulty seating	- Replace - Replace - Replace
Spring	If there is a high degree of breakage or deformation	Replace
Steel ball	If there is damage, etc. that allows oil leakages to occur	Replace

Hydraulic motor

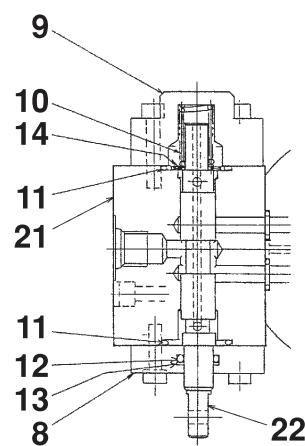
Part	Criteria	Action
Shaft	- If there is pitting, abrasion, etc. occurring on the surfaces of the gear teeth - If there is flaking or pitting occurring on rolling surfaces	- Replace - Replace
Ball bearing	- If there are abnormalities occurring in rotation (abnormal noise generated, rotation not smooth, etc.) - If there is flaking, abrasion, etc. occurring on rolling surfaces	- Replace - Replace
Valve drive	If there is pitting, abrasion, etc. occurring on the surfaces of the gear teeth	Replace
Drive gear	If there is excessive wear on the spline	Replace
Inner face seal Outer face seal	If there is damage, etc. that allows oil leakages to occur	Replace
Steel ball	If there is damage, etc. that allows oil leakages to occur	Replace
Gerolor	- If there is pitting, abrasion, etc. occurring on the surface of the gear teeth - If there are abnormalities occurring in rotation (abnormal noise generated, rotation not smooth, etc.)	- Replace - Replace

SWIVEL JOINT

CONSTRUCTION



VIEW A



SECTION X-X

C4D707E

- | | | |
|-----------------|-----------------|-----------------------|
| 1. Slipper Seal | 9. Cover | 17. Flange |
| 2. O-ring | 10. Spring | 18. Thrust Ring |
| 3. O-ring | 11. O-ring | 19. Snap Ring |
| 4. O-ring | 12. O-ring | 20. Selector Assembly |
| 5. O-ring | 13. Backup Ring | 21. Body |
| 6. Backup Ring | 14. Washer | 22. Spool |
| 7. Dust Seal | 15. Hub | |
| 8. Cover | 16. Shaft | |

DISASSEMBLY AND ASSEMBLY

General Cautions

- Carry out disassembly and assembly operations in a clean place and provide clean containers to place the disassembled parts in.
- Before disassembly, clean around the ports and remove the paint from each joint using a wire brush.
- Clean all disassembled parts in cleaning solvent. Use a lint free cloth, or air dry the parts.
- Make match marks on each part so that they will be assembled in the same positions when assembled.
- Replace all seals with new ones each time the hydraulic units is disassembled.
- Check each part to make sure there is no abnormal wear or seizing and use sandpaper, etc. to remove any burrs, sharp edges, etc.
- Do not turn adjusting screws if not required.
- Apply hydraulic oil to sliding surfaces and apply a thin coating of grease to seals when assembling them.

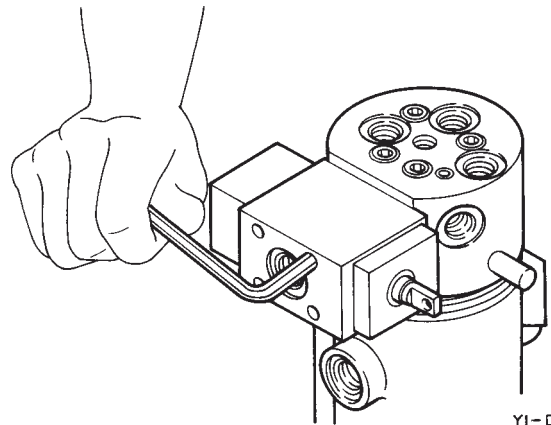
The following describes the disassembly procedure. For assembly, follow the disassembly procedure in the reverse order.

Disassembly

Selector

1. Remove the cap screw, and take off the selector and O-ring from the shaft of the swivel joint.

⌚ Cap Screw: 6.9 N·m(5.1 ft-lb.)



Y1-D704

2. Loosen the cap screw and remove the cover (1). Then remove the spring (2) and washer (3) from the spool (4).

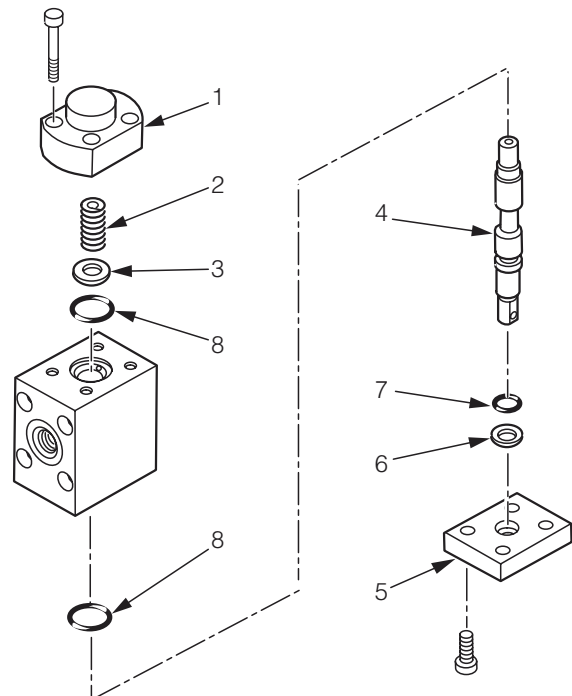
3. Remove the spool (4) from the body.

4. Loosen the cap screw and remove the cover (5), backup ring (6) and O-ring (7).

- When assembling, confirm that the spool moves smoothly.

⌚ Cap Screw: 6.9 N·m(5.1 ft-lb.)

5. Remove the O-ring (8) from the body assembly.



C4D705

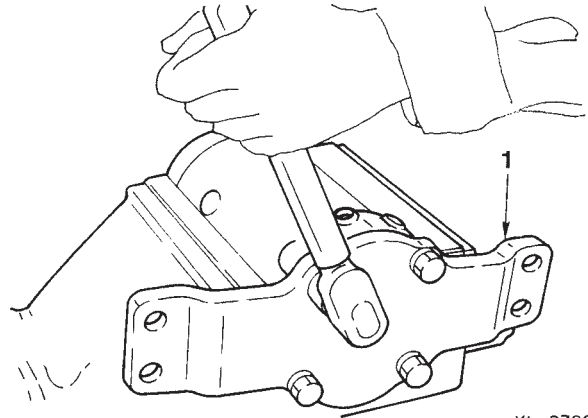
Swivel Joint

1. Take out the bolts and remove the spring washers, then remove the flange (1) from the hub.

⚙ Bolt: 27.5 N·m

- During assembly, place a pipe on the stopper pin of the shaft and check if the shaft rotates.

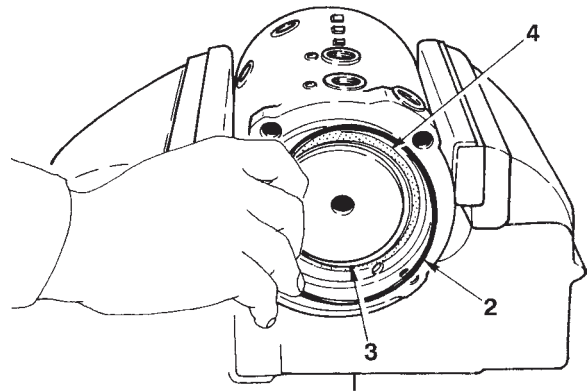
Cap Screw: 6.9 N·m(5.1 ft-lb.)



YI-D709

2. Remove the O-ring (2), snap ring (3) and thrust ring (4).

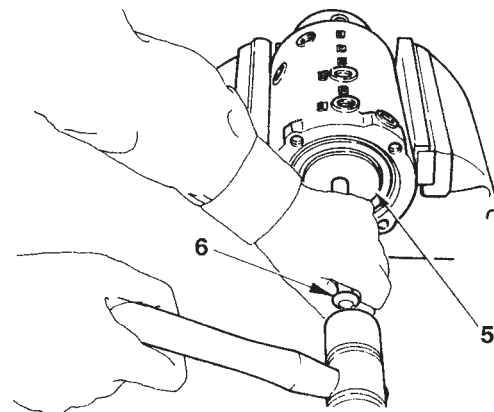
- During assembly, make sure the snap ring fits securely in the groove.



YI-D710

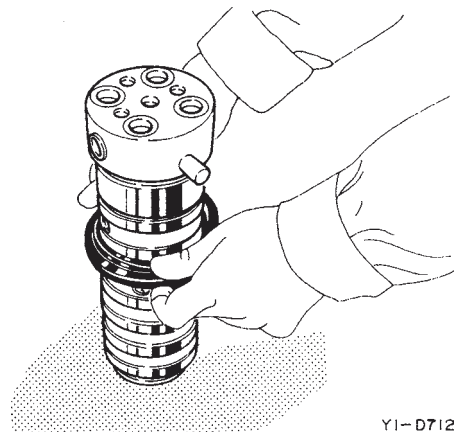
3. Remove the shaft (5) from the hub.

- Place a knock pin (6) against the shaft end and tap with a hammer. Select a knock pin (6) made of copper or plastic, etc..
- During assembly, apply a thin coat of hydraulic oil to the outer circumference of the shaft.



YI-D711

4. Remove the dust seal from the shaft.



YI-D712

5. Remove the seals from the inside diameter of the hub.
 - Check the positions of the seals in the structural drawing.
 - Use an O-ring tooth or eyelet with a sharp point on the end, etc.
 - Do not deform or bend the slipper seal strongly in any one place.
 - During assembly, O-rings should not be twisted when they are fitted in place.



Y1-D713

Inspection and adjustment

Inspection procedures and remedial actions

Inspection interval	Inspection point	Inspection procedure	Action
2000 hours	Seals preventing external leakage of oil	Check if oil is leaking externally.	If a leak is found, replace the O-rings.
4000 hours	All seals	—	Replace all seal parts.
Disassemble and inspect regardless of leaks	All sliding surfaces	Check for abnormal wear, scratching, or corrosion due to seizing or trapped foreign matter.	Remedy in accordance with the use limit of parts.
Disassembly due to malfunction	All parts	Check for abnormal wear, scratching, or corrosion due to seizing or trapped foreign matter.	Remedy in accordance with the limit of use of parts. Replace the seal kit.

Use limit for parts

Hub, shaft

Part	Criteria	Action
Areas in sliding contact with seals	High-frequency induction-hardened surfaces worn away; peeling due to seizing or trapping of foreign matter	Replace
Sliding surfaces of hub and shaft (excepting seals)	- Abnormal wear or scratches 0.1 mm (0.004in.) deep or more due to seizing or trapping of foreign matter - Scratches 0.1mm (0.004in.) deep or more	- Replace - Repair with a grindstone
Sliding surfaces of thrust ring	- Wear exceeding 0.5 mm(0.002in.) or abnormal wear - Wear not exceeding 0.5 mm(0.002in.) - Repairable scratches due to seizing or trapping of foreign matter that do not exceed the 0.5 mm (0.002in.) wear limit	- Replace - Repair to make surfaces smooth - Repair to make surfaces smooth

Flange

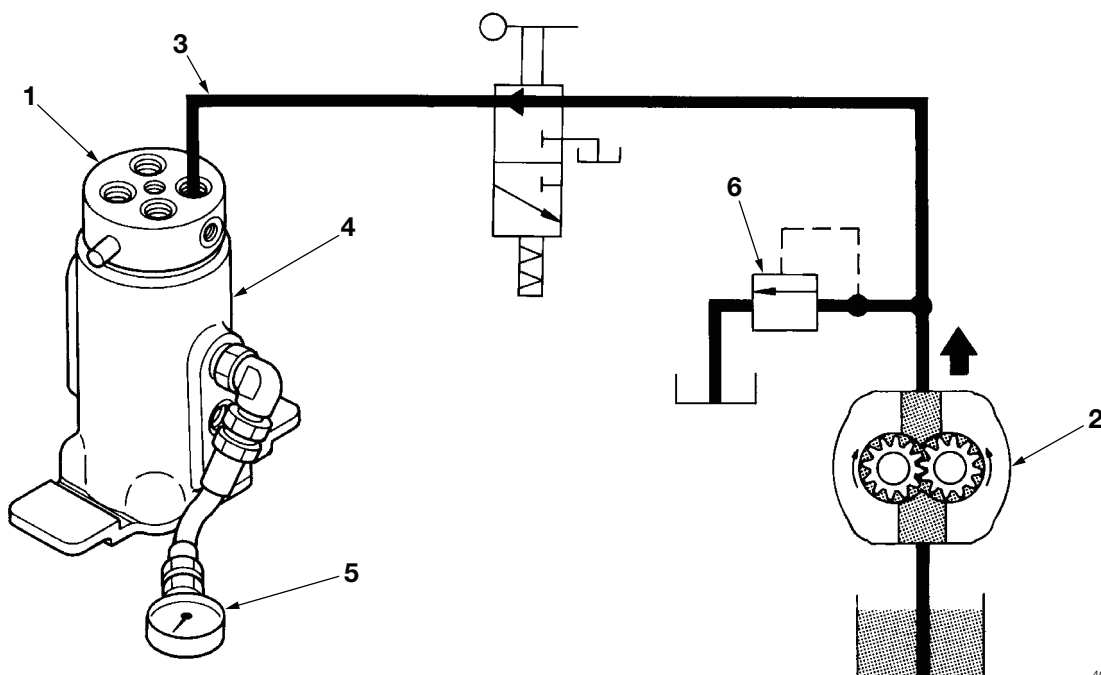
Part	Criteria	Action
Areas in sliding contact with shaft	- Wear exceeding 0.5 mm(0.002in.) or abnormal wear - Wear not exceeding 0.5 mm(0.002in.) - Repairable scratches due to seizing or trapping of foreign matter that do not exceed the 0.5 mm (0.002in.) wear limit	- Replace - Repair to make surfaces smooth - Repair to make surfaces smooth

Thrust ring

Criteria	Action
Wear exceeding 0.5 mm(0.002in.) or abnormal wear	Replace
Wear not exceeding 0.5 mm(0.002in.)	Repair to make surfaces smooth
Repairable scratches due to seizing or trapping of foreign matter that do not exceed the 0.5 mm(0.002in.) wear limit	Repair to make surfaces smooth

Inspection after assembly

After assembly, perform an oil leak test on each circuit using the apparatus shown in the figure.



400AF08Z

1. Connect the pipe (3) from the hydraulic pump (2) to the shaft (1) side port.
2. Connect the pressure gauge (5) to the hub (4) side.
 - Increase the pressure gradually to 20.6 MPa (2900PSI) while adjusting the relief valve (6). Perform the leak test for one minute.
 - Open the neighboring ports on both sides and visually check for leaks from the ports.
 - Perform a color check to detect external leaks.

TROUBLESHOOTING **5**

ABOUT THE TROUBLESHOOTING SECTION

This "Troubleshooting" section describes the fault diagnosis and corrective actions mainly for hydraulic systems. The cause of the problem can be investigated by following the steps in the chart shown at the beginning of each item.

Notes on troubleshooting and servicing

1. Do not disassemble the faulty part without first investigating a, b, and c below.
 - a. Ask the user the following questions.
 - The situation when the fault occurred.
 - Any abnormalities or changes before the fault occurred.
 - Any faulty parts other than the part in question.
 - Any identical failure in the past
 - b. Drive the machine yourself and confirm the faulty condition.
 - Determine if it is really faulty by referring to the performance criteria. Note that such determination may differ depending on the person.

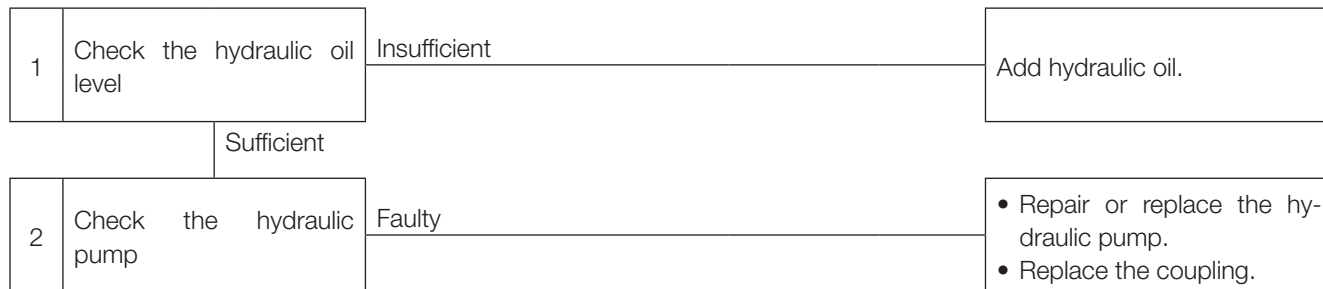
Important

By operating the user's machine, you could make a bad situation worse. Therefore, before driving the machine, always ask the user's permission to do so.

- c. Determine the cause of trouble based on the information obtained from the user and by driving the machine yourself. Also remember that once the machine has been disassembled, it is almost impossible to reproduce the conditions of the trouble, and so there will be no second chance to find out the true cause. Therefore be sure to find the true cause of the trouble before attempting disassembly.
2. When multiple causes are suspected, start with the simplest one.
3. Think why the trouble occurred and try to correct the root cause of the problem.

OVERALL MACHINE

No operation is possible.



1. Check the hydraulic oil level.

Check the hydraulic oil tank level.

☞ “4. Disassembly and assembly, Hydraulic oil tank”

When adding, use the same brand of oil currently being used.

☞ “2. Service data, Fuel and lubricant table”

2. Check the hydraulic pump.

- Check the discharge pressure of the pumps P1 and P2 (piston pumps).

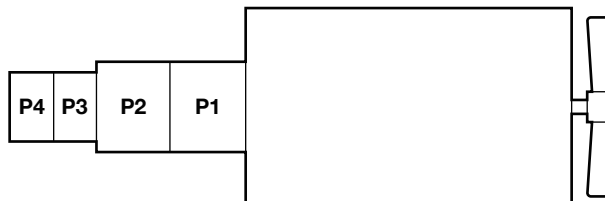
☞ “2. Service data, Performance criteria”

☞ “5. Troubleshooting, Piston pump”

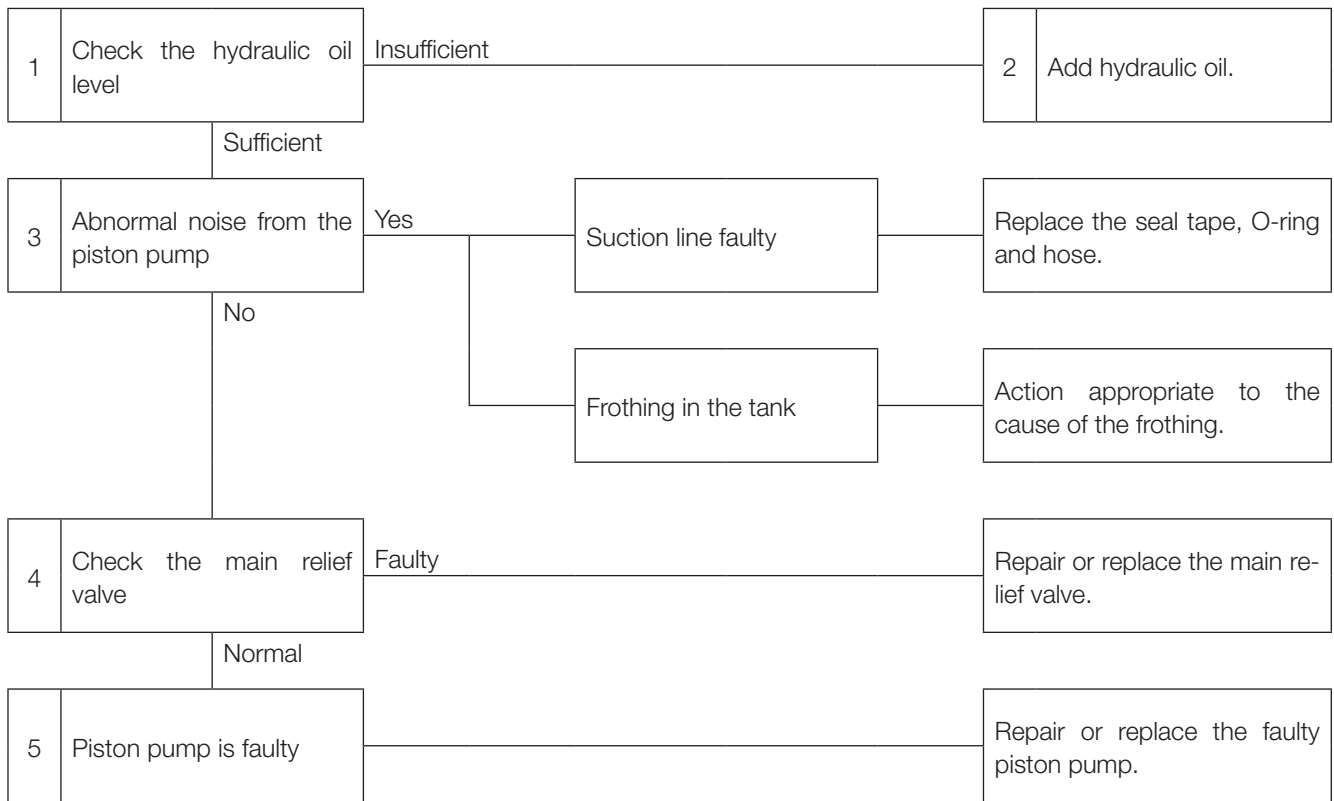
- Check the pumps P3 and P4 (gear pumps).

☞ “2. Service data, Performance criteria”

☞ “5. Troubleshooting, Piston pump”



2DAA01Z

All systems working, but insufficient force.**1. Check the hydraulic oil level.**

☞ “4. Disassembly and assembly, Hydraulic oil tank”

2. Add hydraulic oil.

☞ “No operation is possible, 1. Check the hydraulic oil level.”

3. Abnormal noise from the piston pump.

The noise is likely to be caused by cavitation in the pump, due to a faulty suction line. Check the following.

- a. The line for sucking the hydraulic oil
 - Apply grease or oil on the suspected faulty sections and check for a change (check if air is being sucked).
- b. Clogging in the suction filter
- c. Pressurize the hydraulic tank.

☞ “4. Disassembly and assembly, Hydraulic tank”

4. Check the main relief valve.

Measure the relief pressure of the main relief valve.

- If the measured value is within specifications, the valve is normal.

 "2. Service data, Performance criteria"

If the pressure of the main relief valve is low, adjust it to the set pressure by gradually tightening the set-screw.

- If the pressure does not increase after tightening the setscrew by 1/4 turn, the relief valve is faulty.

5. Piston pump is faulty.

If the inside of the pump is excessively worn or damaged, it is likely that metal pieces are in the hydraulic oil. If this is the case, do the following.

- Replace the elements of the line filter and the spin filter.
- Replace the hydraulic oil or perform flushing.
- When replacing the hydraulic oil, clean the tank and the suction strainer.

 "4. Disassembly and assembly, Piston pump"

Boom, bucket, slew and arm fail to move or are too slow.

1	Check the gear pump (P4)	Faulty	- Repair or replace the gear pump - Replace the coupling
	Normal		
2	Check the fuse	Faulty	Replace the fuse
	Normal		
3	Check the limit switch	Faulty	Adjust or replace the limit switch
	Normal		
4	Check the lever lock solenoid valve	Faulty	Repair or replace the lever lock solenoid valve
	Normal		
5	Check the pilot relief valve	Faulty	Repair or replace the pilot relief valve
	Normal		
6	Check the pilot valve	Faulty	Repair or replace the pilot valve

1. Check the gear pump (P4)

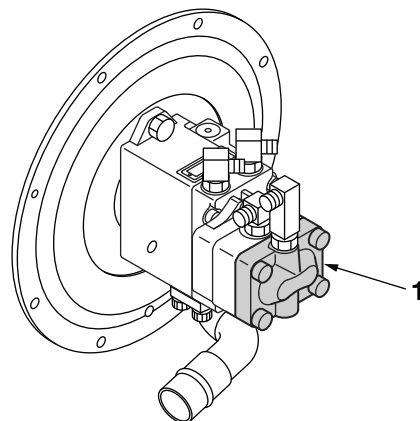
Check the gear pump (P4) (1) which supplies hydraulic pressure to the pilot valve.

- The inspection procedure is the same as for the piston.

☞ “2. Service data, Performance criteria”

☞ “5. Troubleshooting, Piston pump”

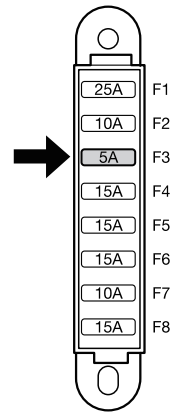
Also, check the line filter for clogging, and clean it as necessary.



5B0A101Z

2. Check the fuse

Check the fuse in the power supply circuit that operates the pilot solenoid valve.



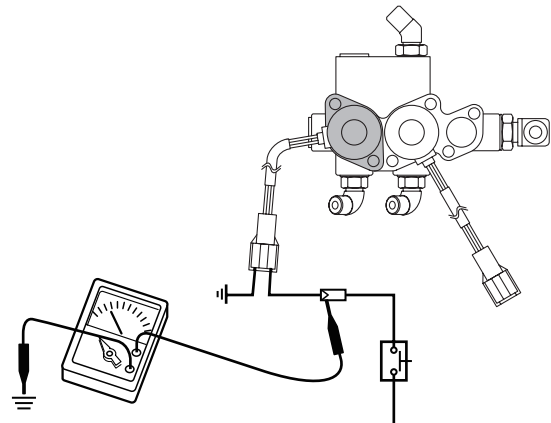
5B0AX01

3. Check the limit switch

Turn the limit switch on, by moving the lever stand to the driving position.

Then check the voltage at the lever lock solenoid valve with a tester.

If there is voltage, the switch works normally.

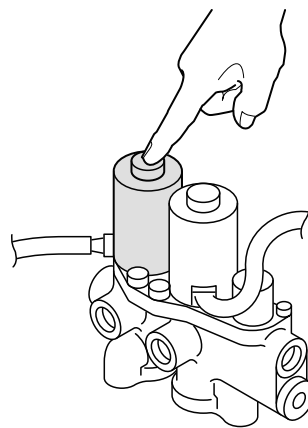


5B0AQ02Z

4. Check the lever lock solenoid valve

Check according to the following procedure.

- Turn the starter switch to the ON position.
- Lightly press down the protruding part on the solenoid valve.
- Move the lever stand to turn on the limit switch.
- If you feel vibration under your fingers when the spool is moved and the circuit is switched, the solenoid valve is normal.



5B0AI04Z

5. Check the pilot relief valve

Measure the relief pressure of the pilot relief valve.

- If the measured value is within specifications, the valve is normal.

☞ "2. Service data, Performance criteria"

6. Check the pilot valve

☞ "4. Disassembly and assembly, Pilot valve"

TRAVELING

No travel is possible

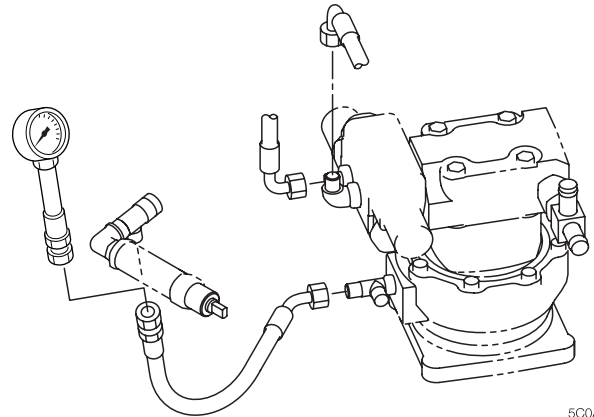


1. Check the supply pressure for the travel lever lock cylinder

Disconnect the piping connecting the solenoid valve and the travel lever lock cylinder from the cylinder side. Fit the pressure gauge to the hose just disconnected to measure the pilot pressure.

- Fit the plug to the cylinder port from which the hose was disconnected.
- If the measured value is within the specifications, the pressure is normal.

☞ "2. Service data, Performance criteria"

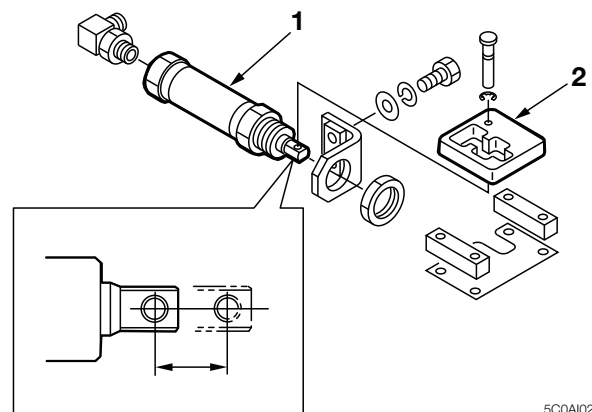


5C0AX02

2. Check the linkage

Check the operation of the travel lever lock cylinder (1) and the slide plate (2).

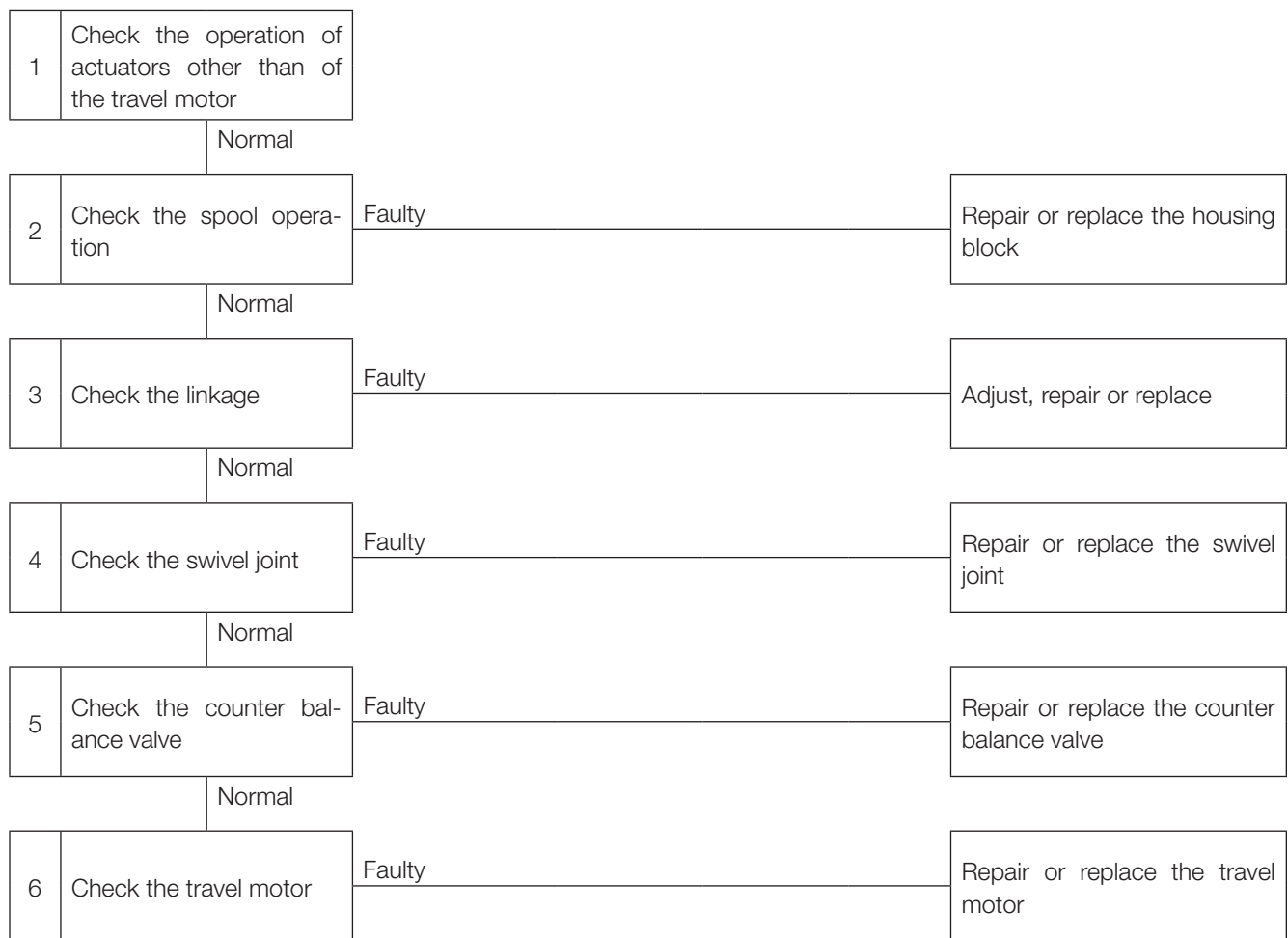
- Cylinder stroke.....10 mm (0.4 in.)
- The operations of the lever lock cylinder and the slide plate are checked. Also, the fixing bolts and nuts should be checked for the looseness.



5C0AI02Z

3. The travel lever lock cylinder is faulty

It is not possible to disassemble the travel lever lock cylinder. Replace the cylinder with a new one.

Right or left travel is impossible**1. Check the operation of actuators other than of the travel motor.**

If the right or left travel is impossible, operate each actuator of the devices listed in the table on the right. If operation is faulty, inspect the main relief valve and piston pump.

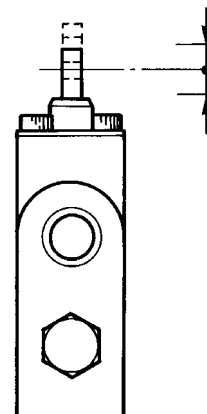
Problem	Lever to operate	Device to check	
		Relief valve	Pump
Right travel	Boom	R1	P1
Left travel	Arm	R2	P2

2. Check the spool operation

- Spool stroke.....7 mm (0.3 in.)
- If the spool is sticking, try to take it out.

If it can't be taken out or is scratched, replace the housing block.

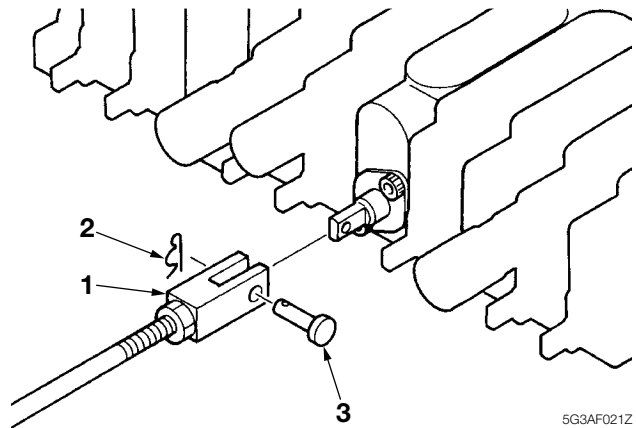
One cause of the spool not operating properly could be that the return spring installation bolt is loose.



5G3AF01Z

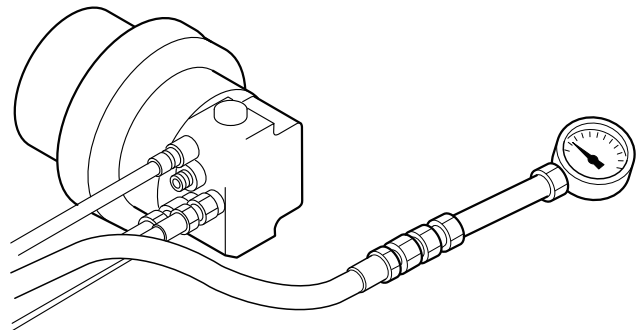
3. Check the linkage

To check the linkage, remove the R pin (2) and pin (3) which connect the spool and the yoke (1), and then inspect the yoke (1) movement.

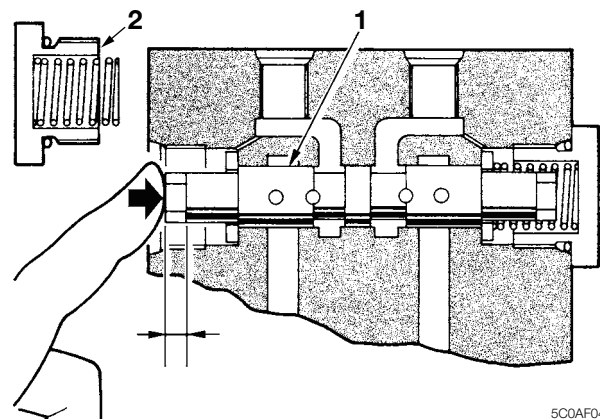
**4. Check the swivel joint**

- Disconnect the hose connecting the swivel joint and the counter balance valve from the counter balance valve. Fit the pressure gauge to the hose just disconnected.
- Operate the travel lever and measure the pressure.
- If the measured value is within specifications, the swivel joint is normal.

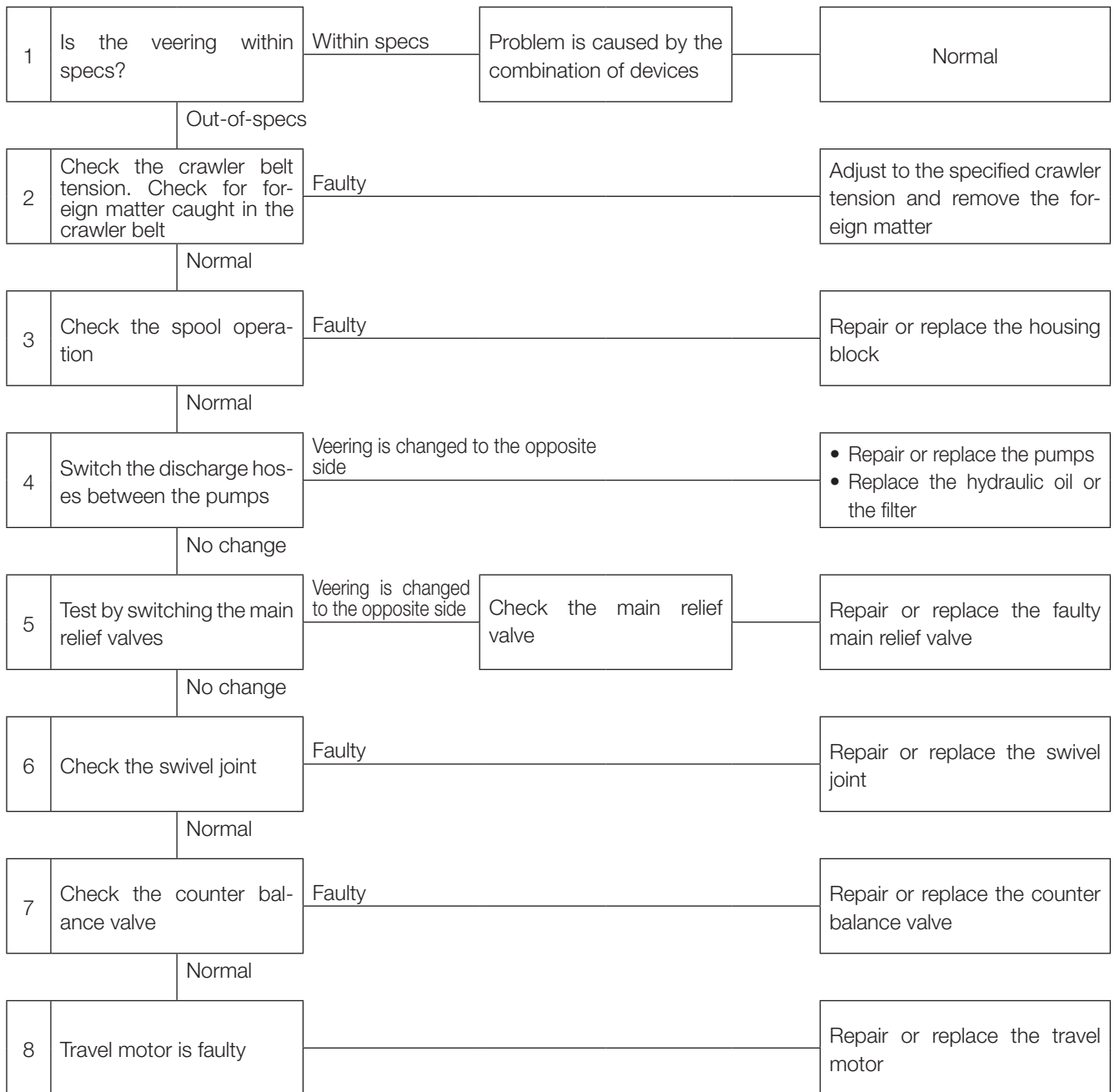
☞ “2. Service data, Performance criteria”

**5. Check the counter balance valve**

- If neither forward nor reverse travel is possible, the spool (1) of the counter balance valve could be sticking in the neutral position.
- If either forward or reverse travel is possible, the spool (1) of the counter balance valve could be sticking in a position other than the neutral position.
- Remove the counter balance valve plug (2) and push the spool (1) with a finger. If it moves smoothly about 6 mm (0.2 in.), the counter balance valve is normal.

**6. Check the travel motor**

☞ “4. Disassembly and assembly, Travel motor”

Right or left travel speed decelerates, causing the machine to veer to one side

1. Is the veering within specs?

If the veering is within specifications, the machine is normal. Problem is caused by the combination of devices.

☞ "2. Service data, Performance criteria"

2. Check the crawler tension

☞ "2. Service data, Performance criteria"

3. Check the spool operation

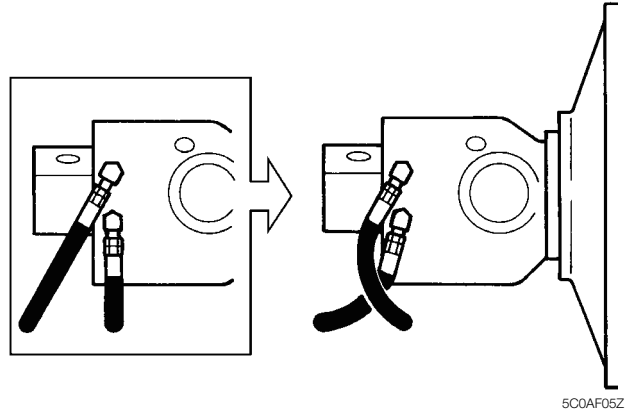
☞ "No travel is possible, 2. Check the linkage."

4. Switch the discharge hoses between the pumps

Switch the discharge hoses between the pumps P1 and P2. If the veering direction is changed to the opposite side, the pumps are faulty.

- Disassemble and check the pump

☞ "4. Disassembly and assembly, Hydraulic pump"



5C0AF05Z

5. Test by switching the main relief valves

Switch the main relief valves between the right travel circuit and the left travel circuit, and operate the machine. If the veering is changed to the opposite side, one of the main relief valves is faulty.

- Check the main relief valve

☞ "5. Troubleshooting, Overall machine, All systems working, but insufficient force, 4. Check the main relief valve."

6. Check the swivel joint

☞ "Right or left travel is impossible, 4. Check the swivel joint"

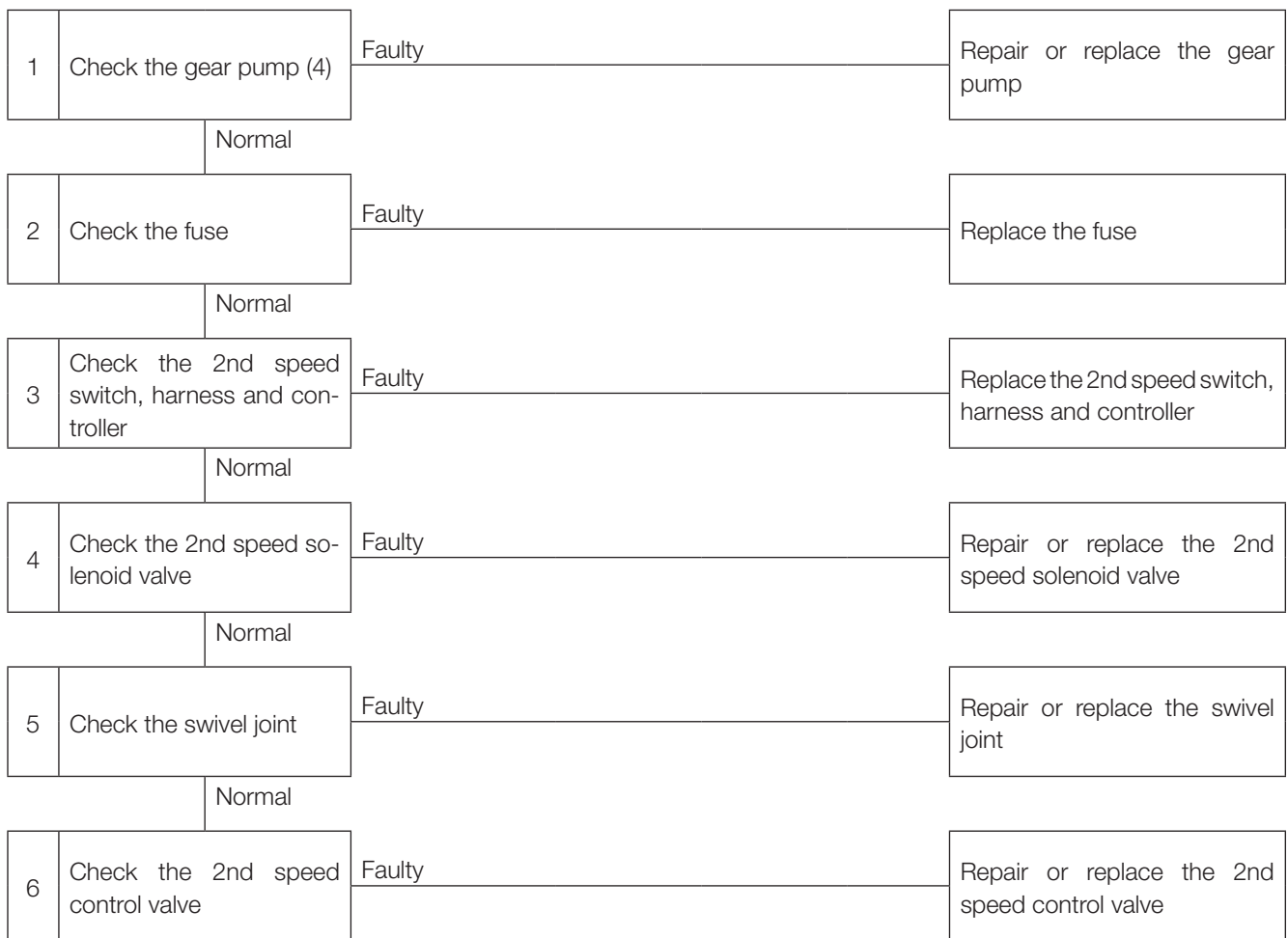
7. Check the counter balance valve

Check to see if the spool of the counter balance valve moves smoothly.

☞ "Right or left travel is impossible, 5. Check the counter balance valve"

8. Check the travel motor

☞ "4. Disassembly and assembly, Travel motor"

2nd speed travel is not possible**1. Check the gear pump (4)**

Check the gear pump (4) that supplies hydraulic pressure for the 2nd speed switching.

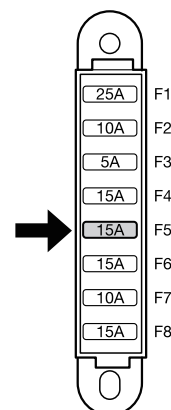
☞ “2. Service data, Performance criteria”

☞ “5. Troubleshooting, Piston pump”

Also, check the line filter for clogging, and clean it as necessary.

2. Check the fuse

Check the fuse in the power supply circuit that activates the 2nd speed solenoid valve.



5C0AX03

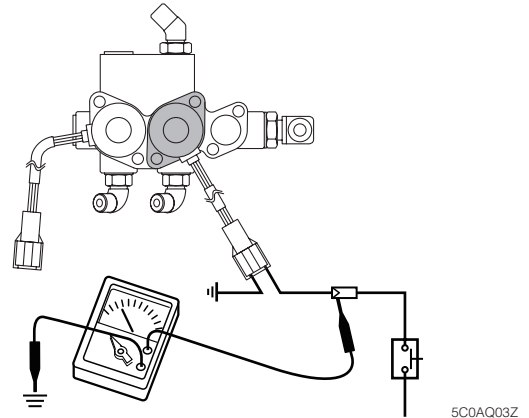
3. Check the 2nd speed switch, harness and controller

- a. Press the switch to turn it on. Use a tester to check if a voltage is applied.

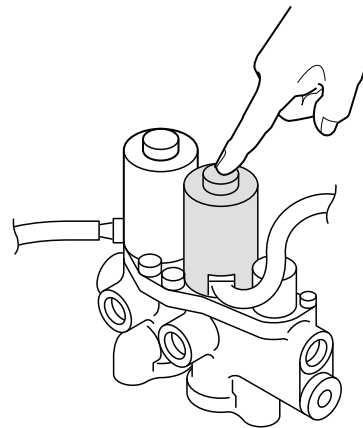
The switch is normal if a voltage is applied.

- b. Check the harness continuity.
- c. Check the switch.
- d. Check the controller.

☞ "2. Service data, Electric circuit diagram"

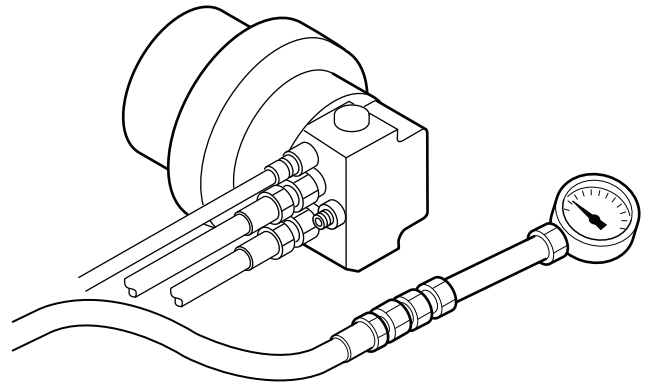
**4. Check the 2nd speed solenoid valve**

- a. Turn the starter switch to the ON position.
- b. Lightly press down the protruding part on the solenoid end.
- c. Move the lever stand to turn on the limit switch.
- d. If you feel vibration under your fingers when the spool is moved and the circuit is switched, the solenoid valve is normal.

**5. Check the swivel joint**

Disconnect the hose connecting the swivel joint and the 2nd speed control valve from the 2nd speed control valve. Fit the pressure gauge to the hose just disconnected, and then turn on the 2nd speed switch.

- Supply pressure: 3.4 MPa (493 PSI)

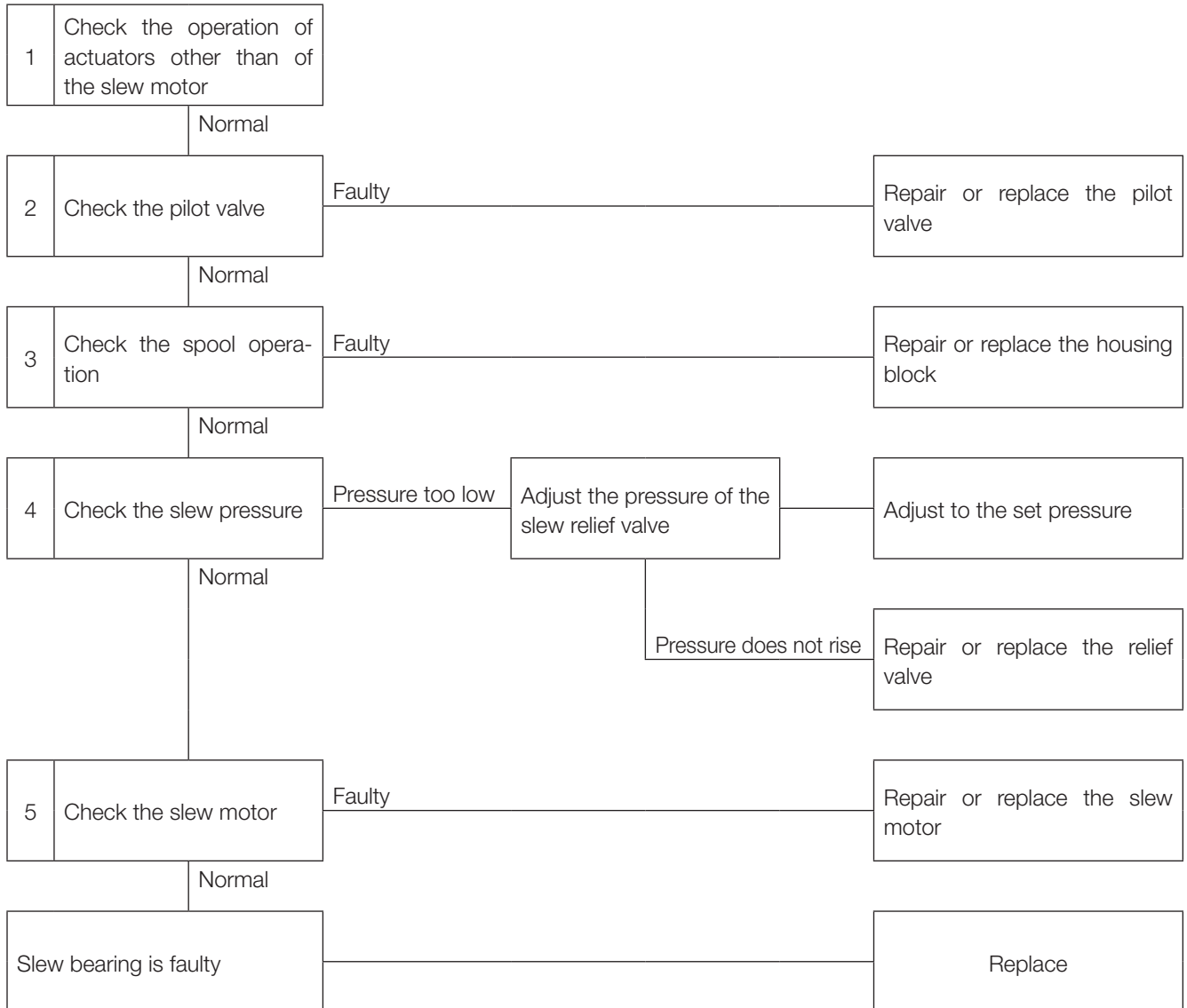
**6. 2nd speed control valve is faulty**

Check if the spool of the 2nd speed control valve is sticking or if foreign matter is caught in the spool.

☞ "4. Disassembly and assembly, Travel motor"

SLEWING

No slewing is possible



1. Check the operation of actuators other than of the slew motor

Determine if only the slew motor is faulty by checking the operation of actuators for the devices listed in the table on the right. If one of them is faulty, check the main relief valve and the hydraulic pump (main).

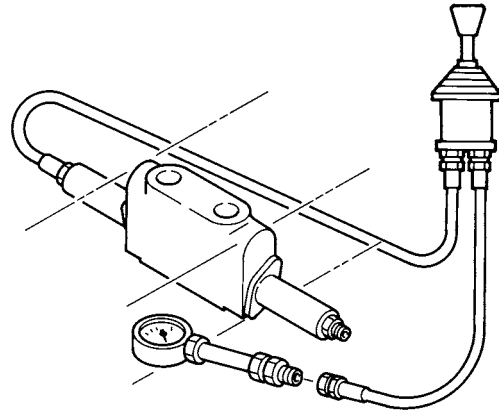
☞ "5. Troubleshooting, Overall machine, All systems working, but insufficient force"

Lever to operate	Device to check	
	Relief valve	Pump
Blade	R3	P3

2. Check the pilot valve

Disconnect the hose connecting the pilot valve and the control valve (slew block) from the control valve. Fit the pressure gauge to the hose just disconnected.

- Insert a plug into the control valve port.
- Operate the lever (slew) and measure the pressure.
- If the pressure is between 0 and 3.4 MPa (0 to 493 PSI) depending on the lever angle, the pilot valve is normal.



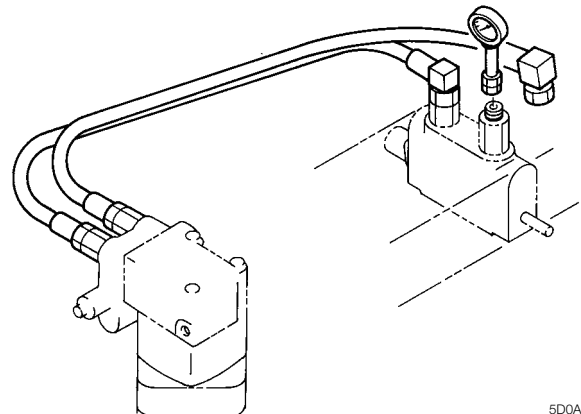
5D0A101Z

3. Check the spool operation

Disconnect the hose connecting the control valve (slew block) and the slew motor from the control valve. Fit the pressure gauge to the discharge port on the control valve.

- Operate the lever (slew) and measure the pressure.
- If the measured value is as below, the spool is normal.

Supply pressure: 20.0 MPa (2901 PSI)



5D0A102Z

4. Check the slew pressure

Measure the pressure at the right and left slew relief valves.

- If the measured value is within specifications, the slew pressure is normal.

☞ "2. Service data, Performance criteria"

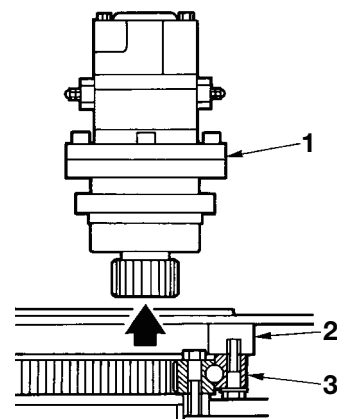
If the pressure adjustment is possible, the adjustment of the slew relief valve is faulty. If the pressure adjustment is not possible, the slew relief valve is faulty.

5. Check the slew motor

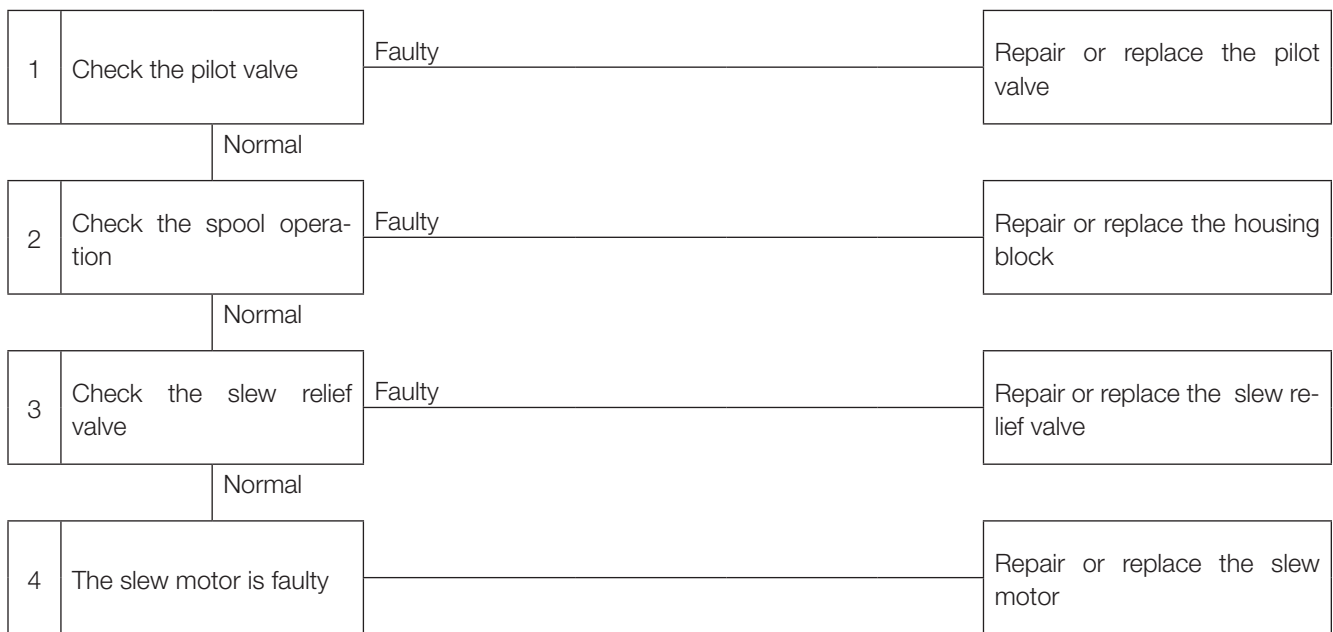
Separate the slew motor (1) from the turntable (2), and then try turning the turntable (2).

- Does not turn.....The slew bearing (3) is faulty.
- Turns.....The slew motor (1) is faulty.

☞ "4. Disassembly and assembly, Travel motor"



5D0A103Z

Slew right or left is not possible**1. Check the pilot valve**

It is likely that only the pilot valve spool on the side where slewing is not possible is faulty.

☞ “No slewing is possible, 2. Check the pilot valve”

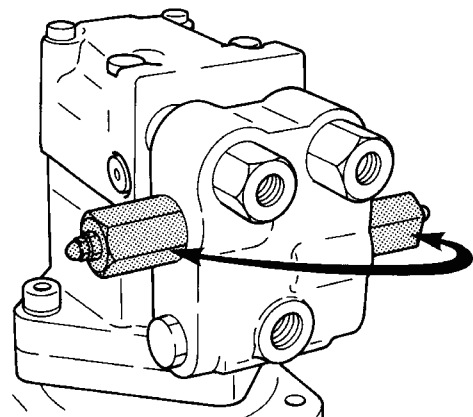
2. Check the spool operation

It is likely that the spool does not move in the direction in which slewing is not possible.

☞ “No slewing is possible, 3. Check the spool operation”

3. Check the slew relief valve

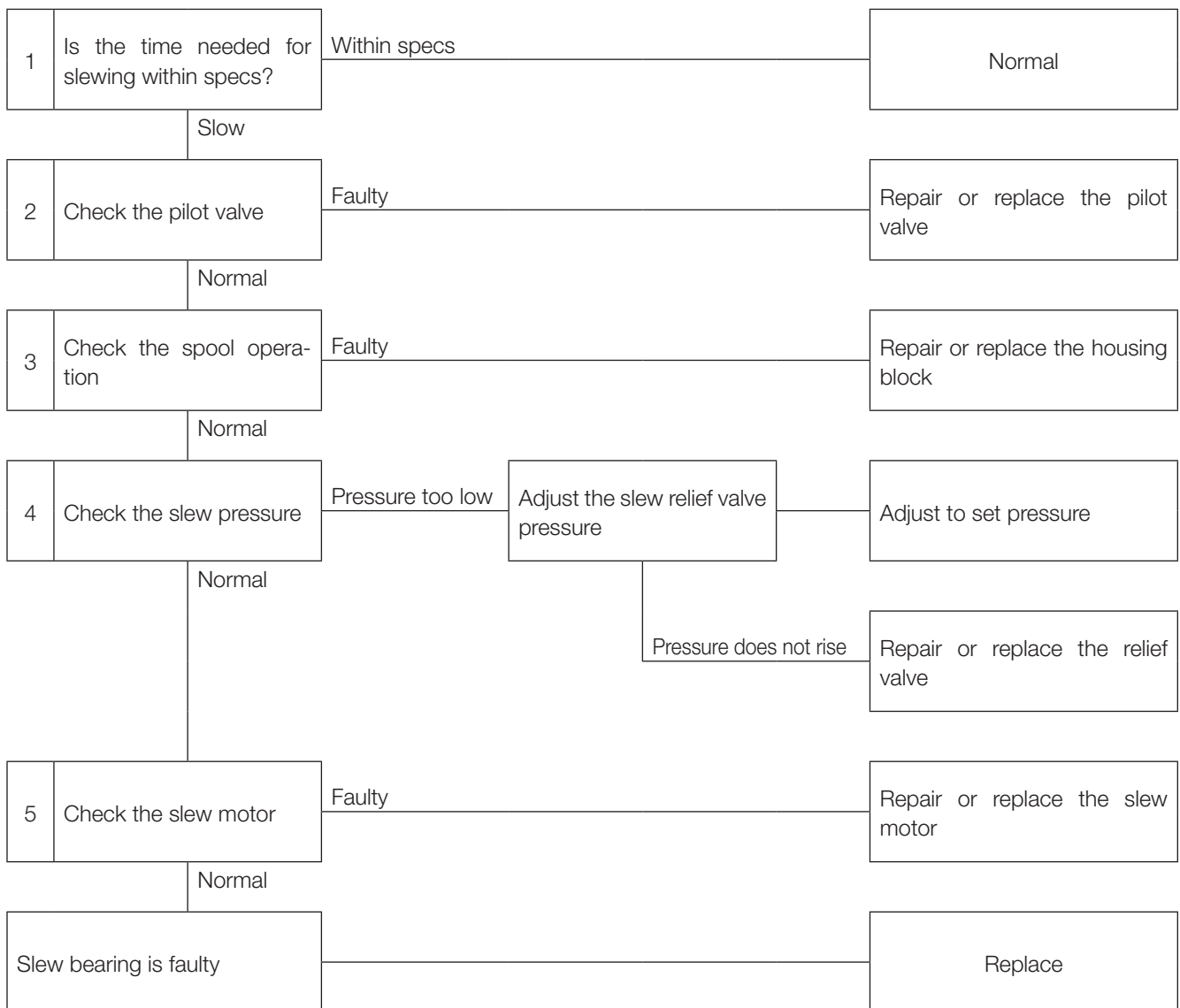
Switch between the left and right slew relief valves. If slewing becomes possible, the relief valve is faulty.



5D0A104Z

4. The slew motor is faulty

☞ “4. Disassembly and assembly, Slew motor”

Slewing is slow or lacks force**1. Is the time needed for slewing within specifications?**

☞ "2. Service data, Performance criteria"

2. Check the pilot valve

☞ "No slewing is possible, 2. Check the pilot valve"

3. Check the spool operation

☞ "No slewing is possible, 3. Check the spool operation"

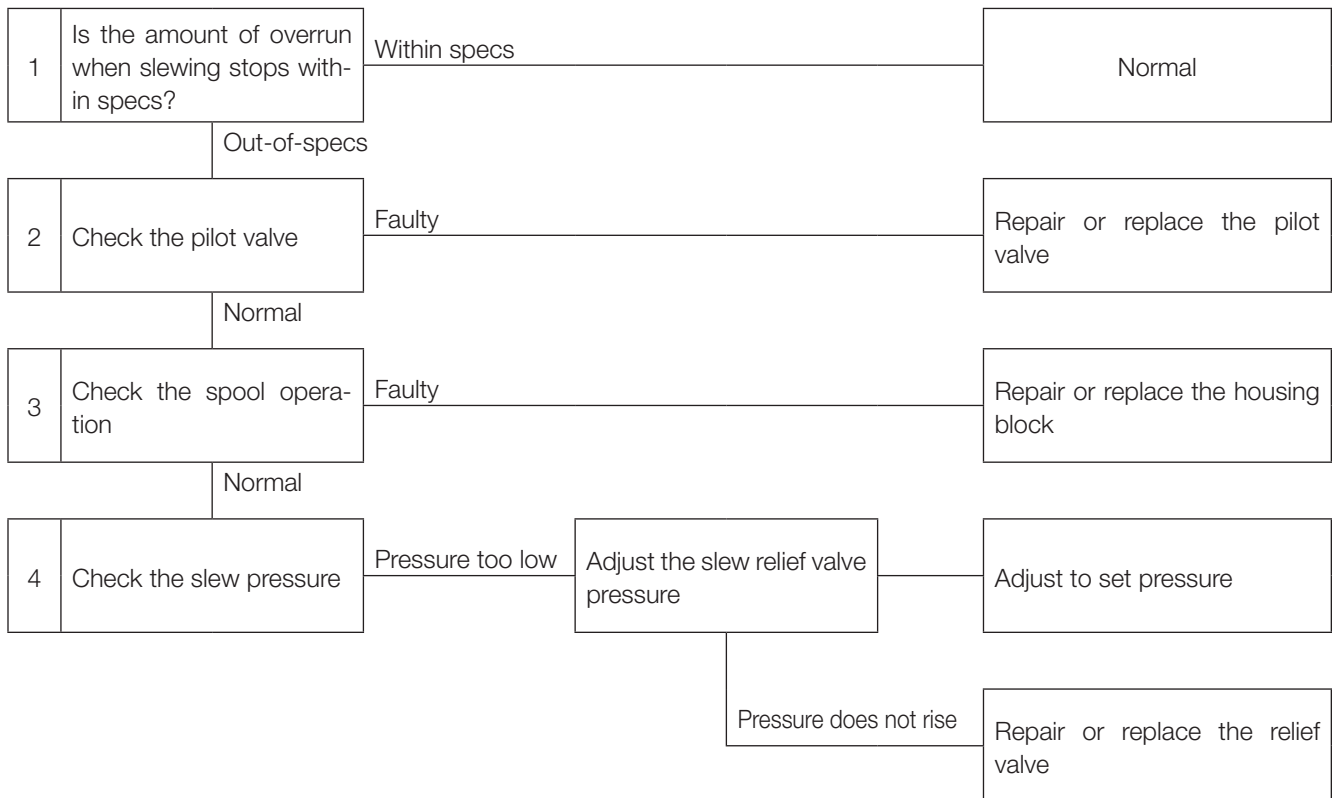
4. Check the slew pressure

☞ "No slewing is possible, 4. Check the slew pressure"

5. Check the slew motor

☞ "4. Disassembly and assembly, Slew motor"

The machine slews, but overruns a lot when slewing stops, or slewing cannot be stopped



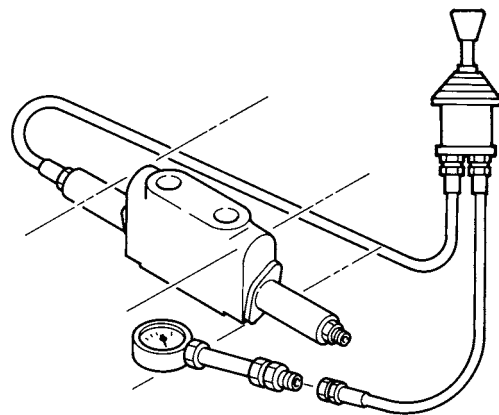
1. Is the amount of overrun when slewing stops within specs?

☞ "2. Service data, Performance criteria"

2. Check the pilot valve

Check if the spool of the pilot valve returns to the neutral position when the operation lever (slew) is released after operation. Disconnect the hose connecting the pilot valve and control valve (slew block) from the control valve. Fit the pressure gauge to the hose just disconnected.

- Operate the lever (slew) and then release it to read the pressure gauge.
- If the pressure is zero, the pilot valve is normal.

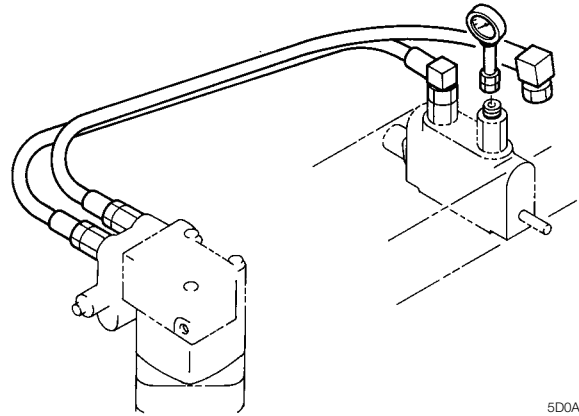


5D0AI01Z

3. Check the spool operation

Check if the spool of the control valve (slew block) returns to the neutral position when the operation lever (slew) is released after operation. Disconnect the hose connecting the control valve (slew block) and the slew motor from the control valve. Fit the pressure gauge to the discharge port on the control valve.

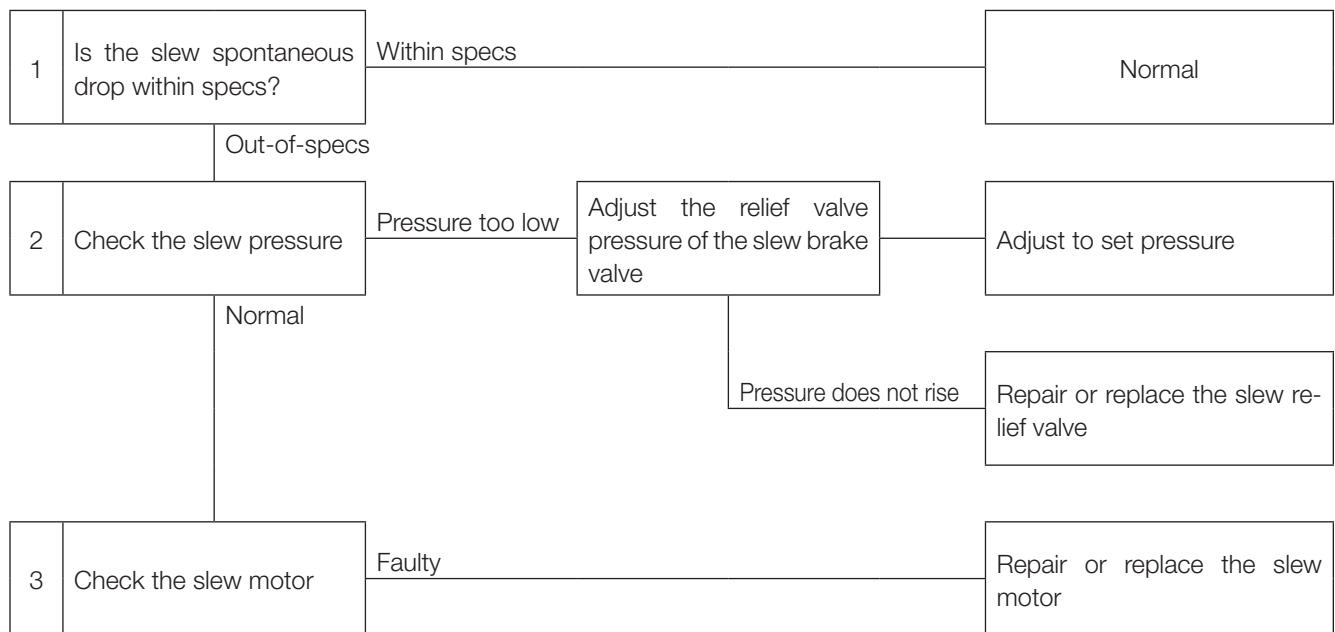
- Operate the lever (slew) and then release it to read the pressure gauge.
- If the pressure is zero, the spool is normal.



5D0AI02Z

4. Check the slew pressure

☞ “No slewing is possible, 4. Check the slew pressure”

When stopped on a slope, the upperstructure cannot maintain its posture**1. Is the slew spontaneous drop within specs?**

☞ "2. Service data, Performance criteria"

2. Check the slew pressure

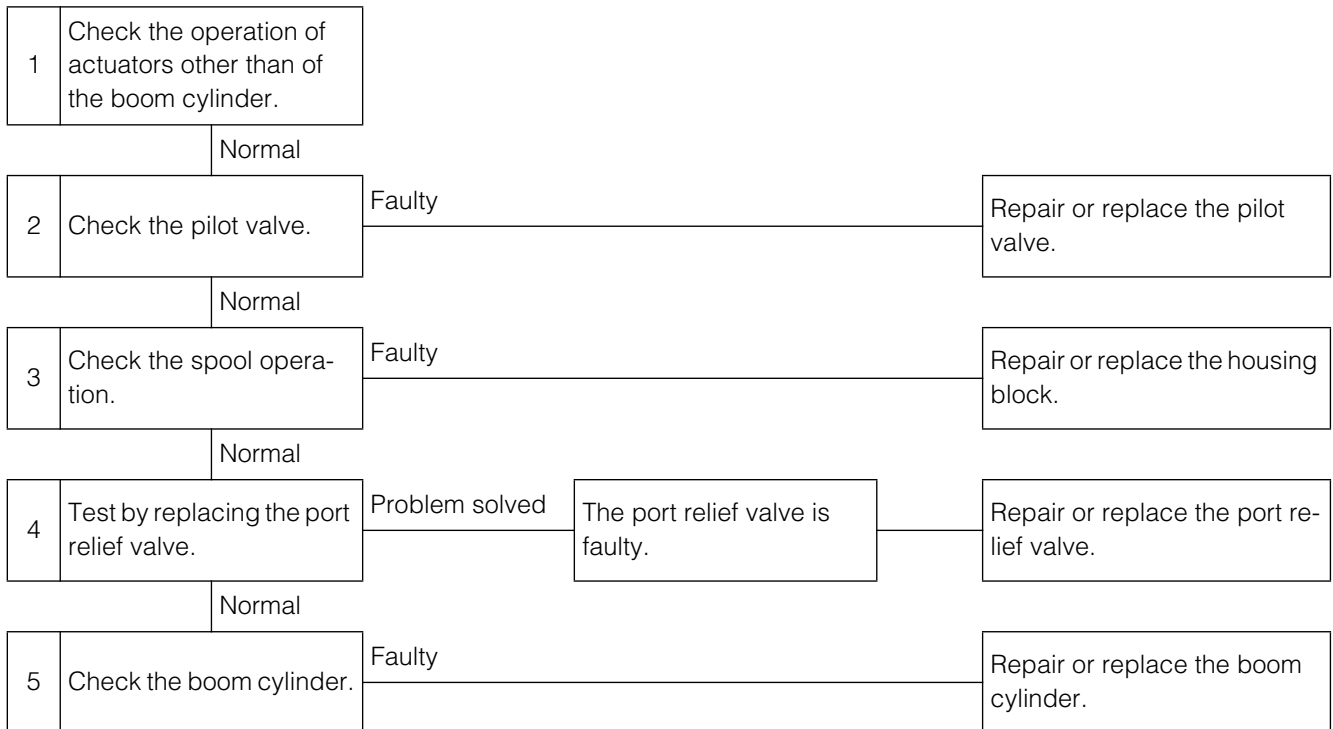
☞ "No slewing is possible, 4. Check the slew pressure"

3. Check the slew motor

☞ "4. Disassembly and assembly, Slew motor"

BOOM

The boom cylinder does not move



1. Check the operation of actuators other than of the boom cylinder.

Determine if only the boom cylinder is faulty by checking the operation of actuators for the devices listed in the table on the right. If one of them is faulty, check the main relief valve and the hydraulic pump (main).

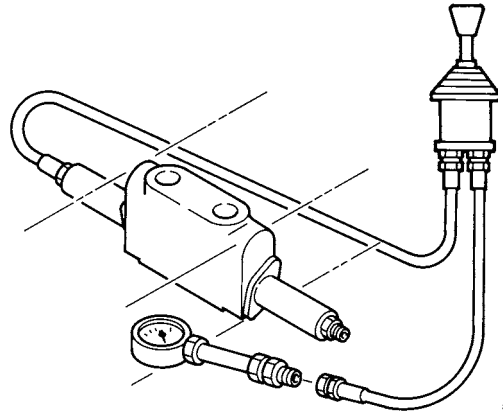
 "5. Troubleshooting, Overall machine, All systems working, but insufficient force"

Lever to operate	Device to check	
	Relief valve	Pump
Right travel	R1	P1

2. Check the pilot valve.

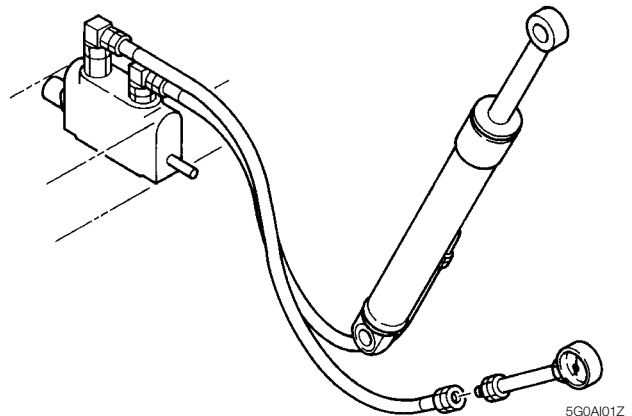
Disconnect the hose connecting the pilot valve and the control valve (boom block) from the control valve. Fit the pressure gauge to the hose just disconnected.

- Operate the lever (boom) and measure the pressure.
- If the pressure is between 0 and 3.4 MPa (0 to 493 PSI) depending on the lever angle, the pilot valve is normal.

**3. Check the spool operation.**

Disconnect the hose connecting the control valve (boom block) and the boom cylinder from the cylinder. Fit the pressure gauge to the discharge port on the control valve.

- Operate the lever (boom) and measure the pressure.
Supply pressure: 21.0 MPa (3045 PSI)

**4. Test by replacing the port relief valve.**

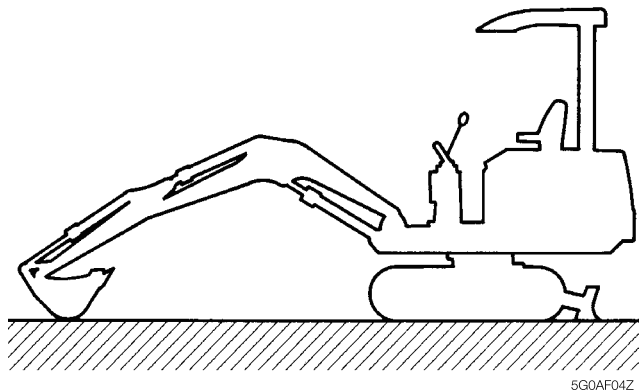
Replace the port relief valve in question with a normal port relief valve. If the boom cylinder operates with the replacement valve, the port relief valve used on the boom side is faulty.

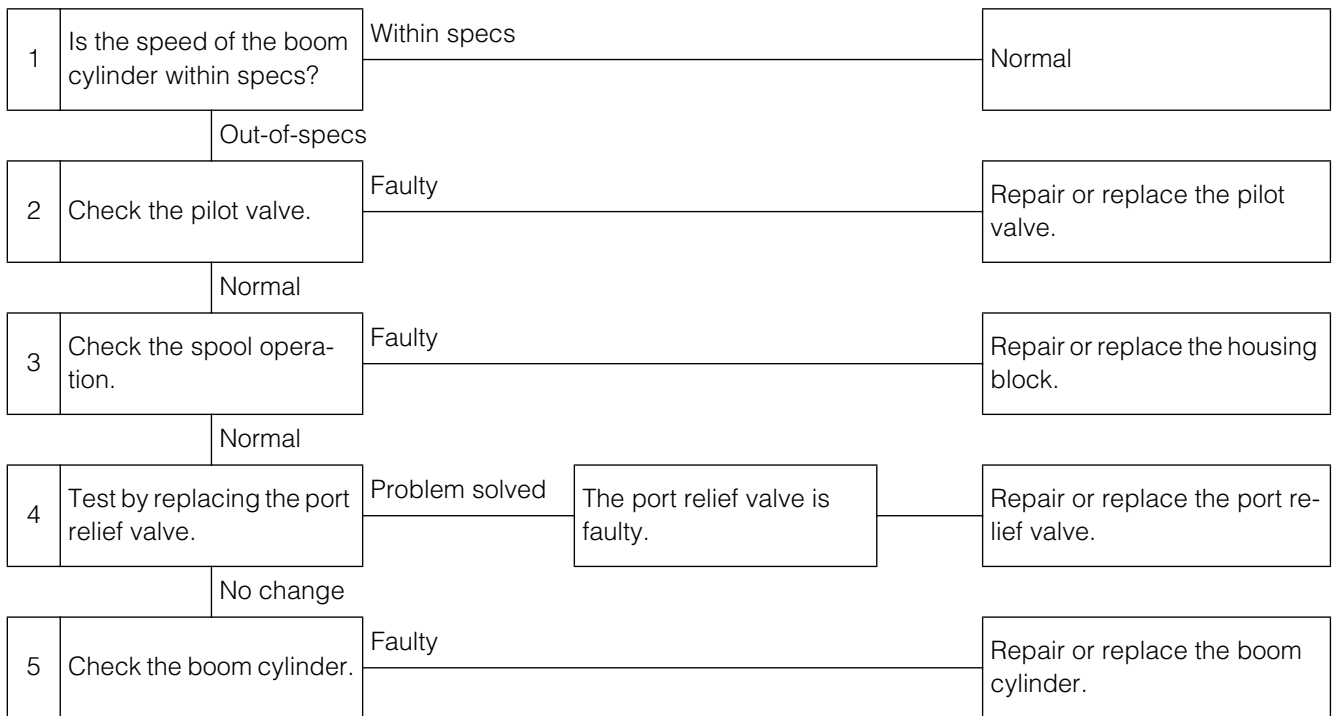
Make sure to return the port relief valve to its regular position after the above inspection.

5. Check the boom cylinder.

- Disconnect the hose connecting the control valve and the boom cylinder from the control valve side.
- Connect the hose just disconnected to the arm or bucket block.
- Try to operate the boom cylinder. If the cylinder fails to operate, the cylinder is faulty.

Before performing steps "a" through "c" above, fully extend the bucket cylinder, completely retract the arm cylinder and lower the bucket to the ground.



Boom cylinder operation is slow or lacks force.**1. Is the speed of the boom cylinder within specs?**

☞ "2. Service data, Performance criteria"

2. Check the pilot valve.

☞ "The boom cylinder does not move, 2. Check the pilot valve"

3. Check the spool operation.

☞ "The boom cylinder does not move, 3. Check the spool operation"

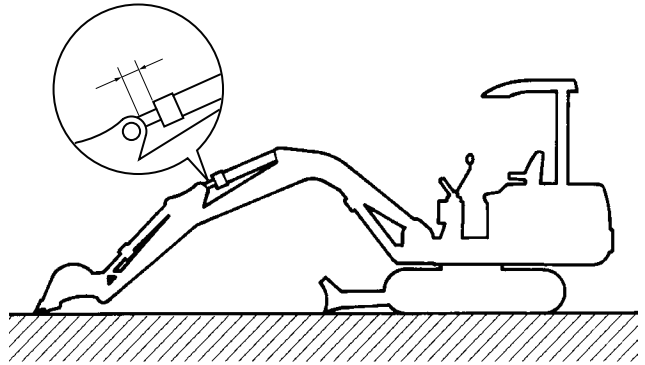
4. Test by replacing the port relief valve.

☞ "The boom cylinder does not move, 4. Test by replacing the port relief valve"

5. Check the boom cylinder.

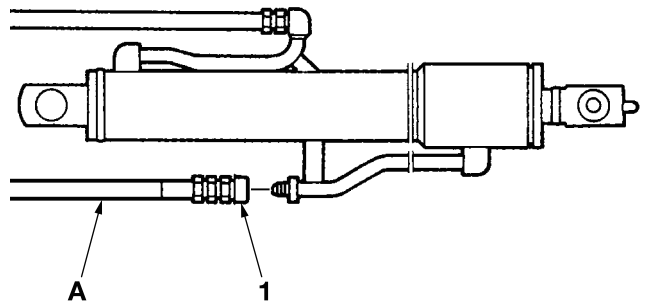
Check for leakage inside the boom cylinder (1)

- a. With the bucket cylinder fully retracted and the arm cylinder extended slightly from the fully retracted position, lower the bucket tip to the ground.



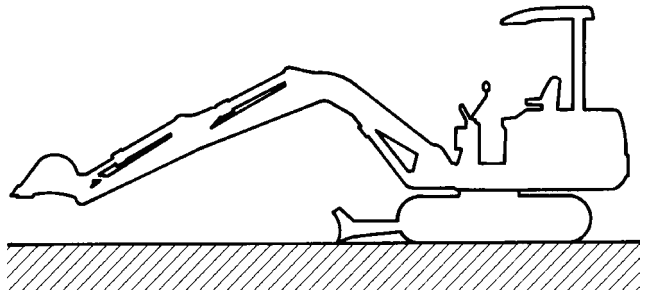
5G0AF05Z

- b. Disconnect hose (A) from the rod side only and drain oil from the piping. Insert a plug (1) into the disconnected hose.



5G0AF06Z

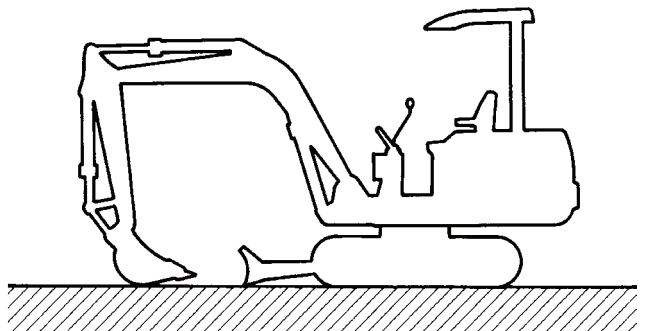
- c. Retract the arm cylinder to lift the bucket off the ground. If oil leaks from the cylinder piping from which the hose was disconnected and the boom cylinder rod retracts, the cylinder is leaking internally. If no oil leaks from the cylinder piping and the boom cylinder rod retracts, the control valve is leaking internally.



5G0AF07Z

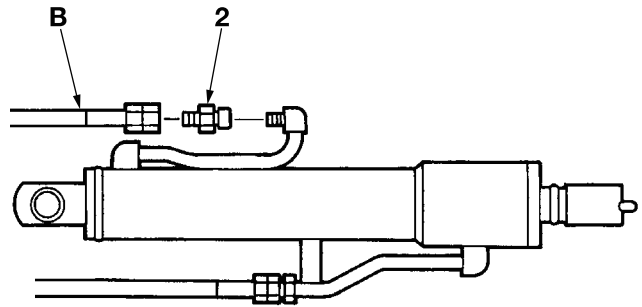
Check for leakage inside the boom cylinder (2).

- a. Set the machine in the posture shown in the figure.



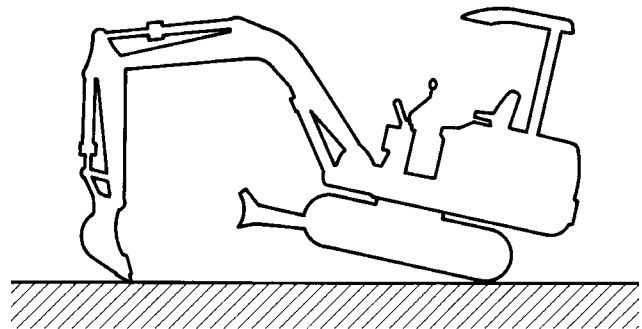
5G0AF08Z

- b. Disconnect hose (B) from the head side only and drain oil from the cylinder piping. Insert a plug (2) into the disconnected hose.



5G0AF09Z

- c. Operate the bucket to raise the machine body. If oil leaks from the cylinder piping from which the hose was disconnected and the boom cylinder rod extends, the cylinder is leaking internally. If no oil leaks from the cylinder piping and the boom cylinder rod extends, the control valve is leaking internally. If the cylinder is damaged internally, the system will need to be flushed out to remove any debris.



5G0AF10Z

When the control lever is pulled slowly, the boom drops temporarily.

1	Check the load check valve in the control valve.	Faulty	Repair or replace the housing block.
		Normal	
2	Check for leakage inside the boom cylinder.	Faulty	Repair or replace the boom cylinder.

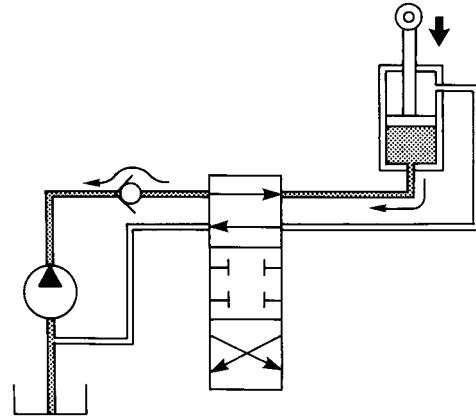
1. Check the load check valve in the control valve.

- Disconnect the control valve end of the hose connecting the control valve and the boom cylinder together.
- Connect the disconnected hose to the arm or bucket block.
- Operate the boom cylinder.
If the boom cylinder operates normally, it indicates that the load check valve is faulty.

Before performing steps a to c above, set the machine posture as follows.

- Fully extend the bucket cylinder, fully retract the arm cylinder, and rest the bucket on the ground.

When the spool first starts to pull, the oil pressure is low and the flow rate is low. If the load check valve is faulty, the oil will temporarily flow backward due to the load applied to the boom cylinder. As a result, the boom temporarily drops.



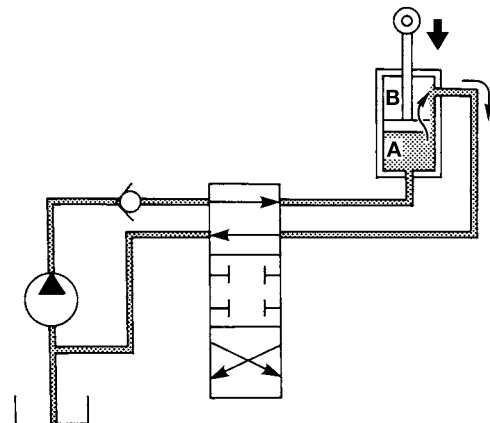
5G0AF11Z

2. Check for leakage inside the boom cylinder.

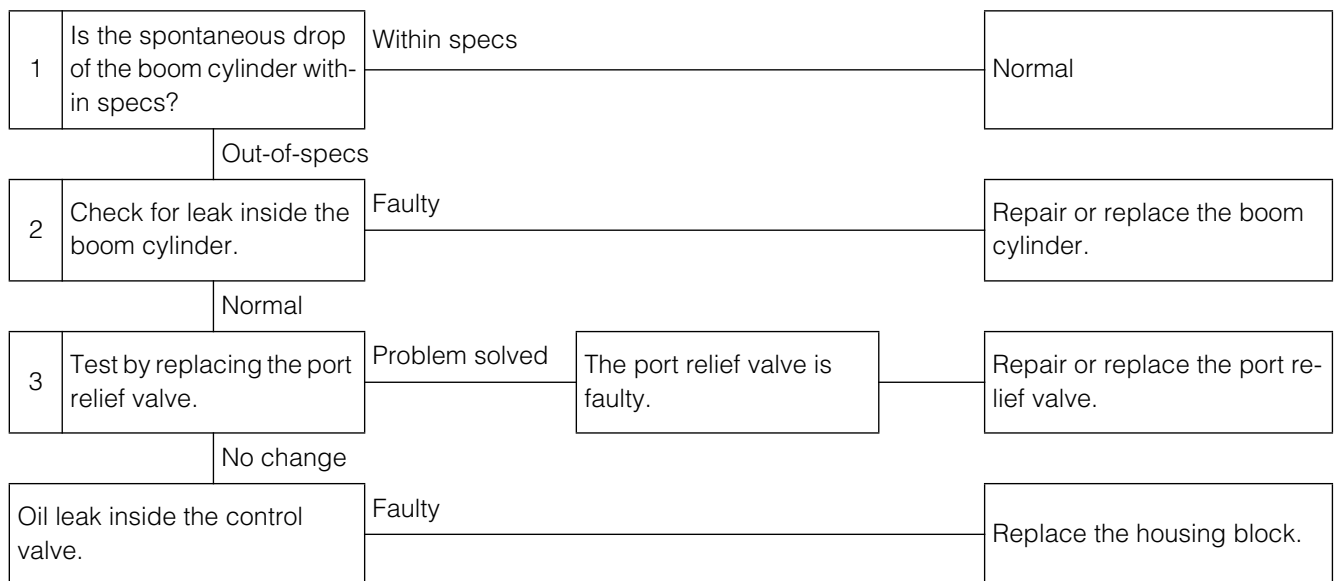
If the oil flows from the head side (A) to the rod side (B) due to a faulty boom cylinder piston or tube, the boom temporarily drops because of the low oil pressure and small flow rate when the spool first starts to pull. Also, the cylinder will have insufficient drive force. However, the amount of spontaneous drop will also be large in this case.

- Check the cylinder.

☞ “Boom cylinder is slow or lacks force, 5. Check for boom cylinder.”



5G0AF12Z

Spontaneous drop of the boom cylinder is too large.

1. Is the spontaneous drop of the boom cylinder within specs?

☞ "2. Service data, Performance criteria"

2. Check for leak inside the boom cylinder.

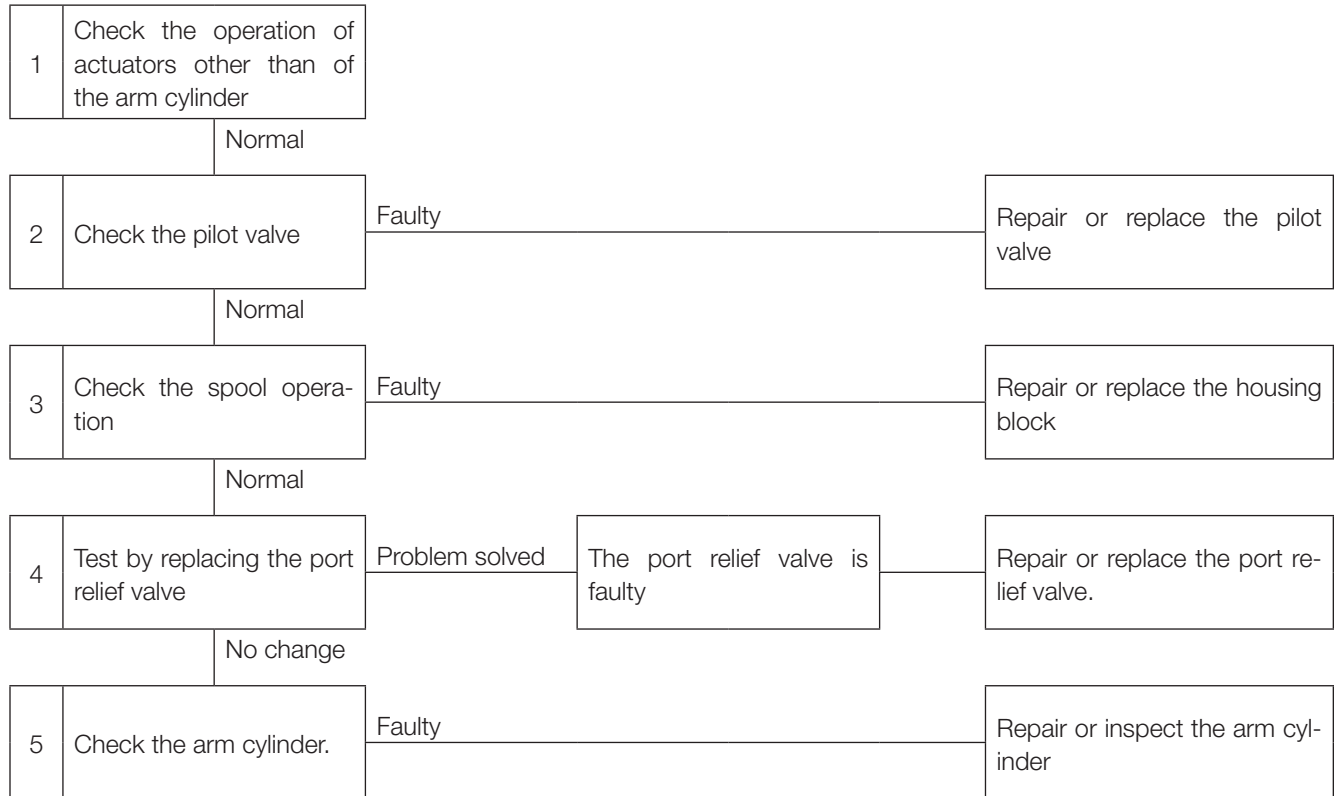
☞ "Boom cylinder operation is slow or lacks force, 5. Check the boom cylinder"

3. Test by replacing the port relief valve.

☞ "The boom cylinder does not move, 4. Test by replacing the port relief valve"

ARM

Arm cylinder does not move



1. Check the operation of actuators other than of the arm cylinder

Determine if only the arm cylinder is faulty by checking the operation of actuators for the devices listed in the table on the right.

If it is faulty, check the main relief valve and the hydraulic pump (main).

☞ “5. Troubleshooting, Overall machine, All systems working, but insufficient force”

Lever to operate	Device to check	
	Relief valve	Pump
Left travel	R2	P2

2. Check the pilot valve

Disconnect the hose connecting the pilot valve and the control valve (arm block) from the control valve. Fit the pressure gauge to the hose just disconnected.

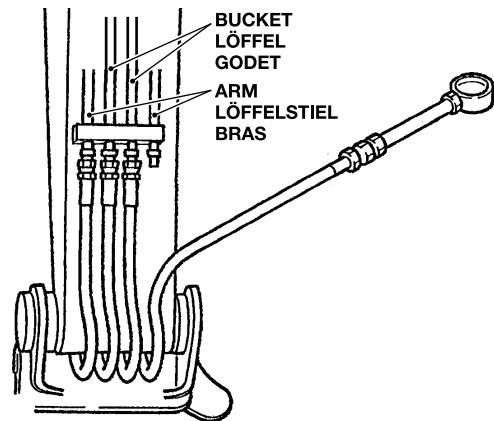
- Operate the lever (arm) and measure the pressure.
- If the pressure is between 0 and 3.4 MPa (0 to 493 PSI) depending on the lever angle, the pilot valve is normal.

3. Check the spool operation

Disconnect the arm hose connected to the pipe at the boom foot, then install a pressure gauge in the disconnected hose.

- Operate the lever (arm) and measure the pressure.
- If the measured value is within the specifications, the spool is normal.

Supply pressure: 21.0 MPa (3046 PSI)



5G1AF02Z

4. Test by replacing the port relief valve

Replace the port relief valve in question with a normal port relief valve. If the arm cylinder operates with the replacement valve, the port relief valve used on the boom side is faulty.

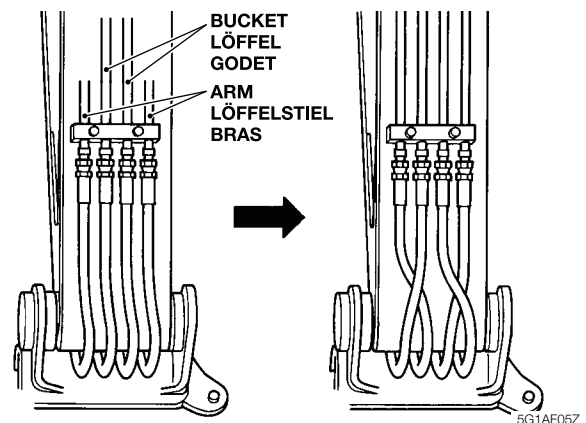
Make sure to return the port relief valve to its regular position after the above inspection.

5. Check the arm cylinder

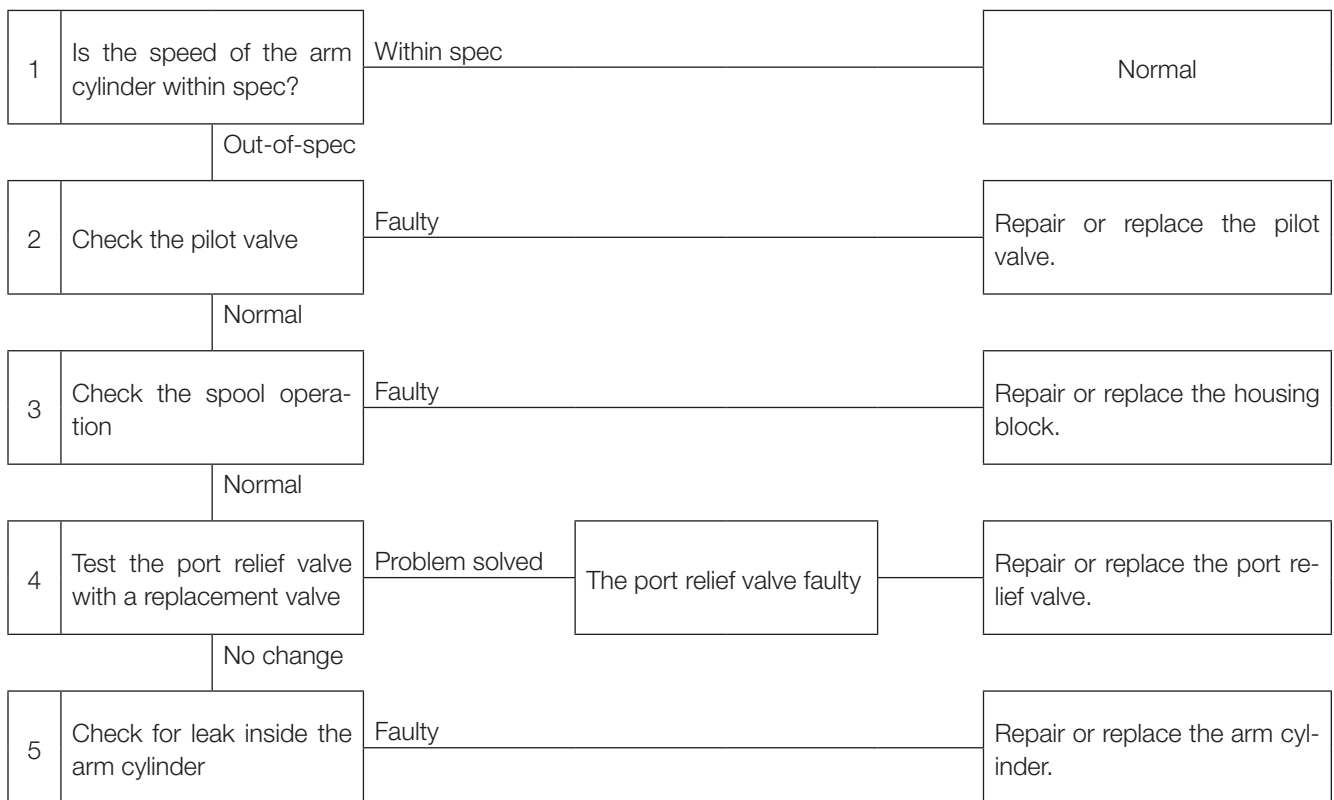
Switch between the arm hose and the bucket hose connected to the piping at the boom foot.

- Move the lever (bucket) and try to operate the arm cylinder.
- If the cylinder fails to operate, it is faulty.

Before performing the steps above, fully extend the bucket cylinder, completely retract the arm cylinder and lower the bucket to the ground.



5G1AF05Z

Arm cylinder operation is slow or lacks force**1. Is the speed of the arm cylinder within spec?**

☞ "2. Service data, Performance criteria"

2. Check the pilot valve.

☞ "Arm cylinder does not move, 2. Check the pilot valve"

3. Check the spool operation.

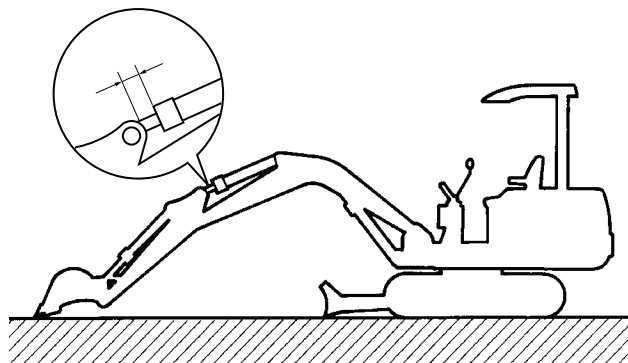
☞ "Arm cylinder does not move, 3. Check the spool operation"

4. Test the port relief valve with a replacement valve.

☞ "Arm cylinder does not move, 4. Test by replacing the port relief valve"

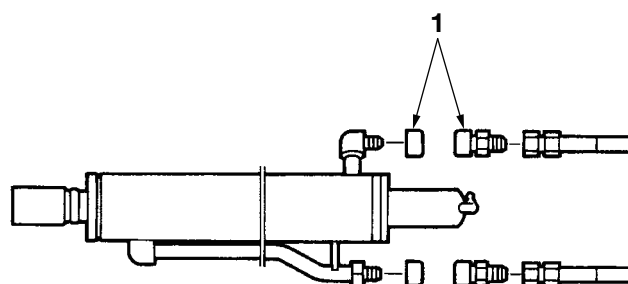
5. Check for leak inside the arm cylinder

- a. Fully retract the bucket cylinder and the arm cylinder, and then lower the bucket to the ground.



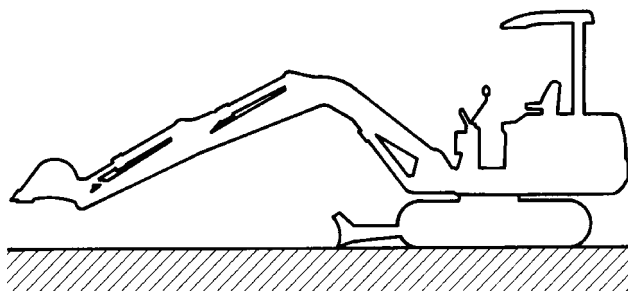
5G0AF05Z

- b. Disconnect the two hoses connected to the cylinder. Insert plugs (1) into the disconnected hoses and the cylinder piping.

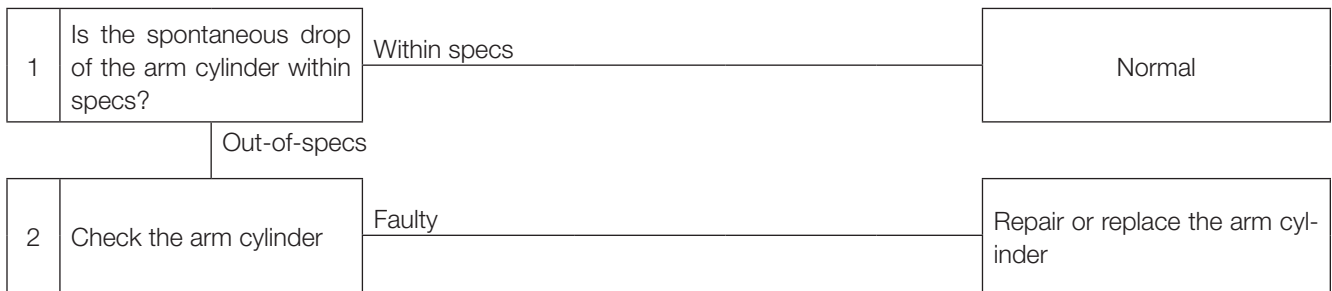


5G1AF06Z

- c. Raise the boom and lift the hoe attachment off the ground. If the arm drops, the cylinder is faulty. If not, there is a leak inside the control valve.



5G0AF07Z

Spontaneous drop of the arm is too large**1. Is the spontaneous drop of the arm cylinder within specs?**

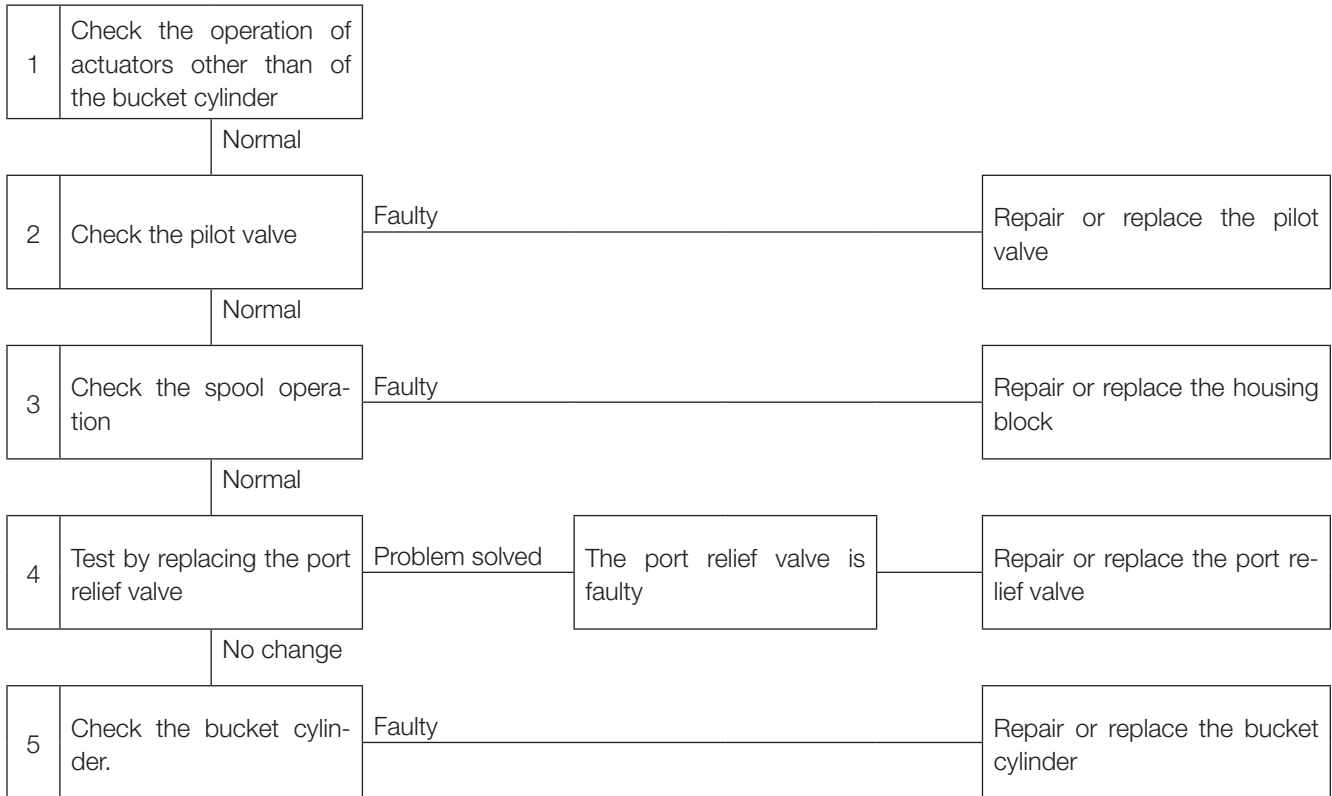
☞ "2. Service data, Performance criteria"

2. Check the arm cylinder

☞ "Arm cylinder operation is slow or lacks force, 5. Check for leak inside the arm cylinder"

BUCKET

Bucket cylinder does not move or lacks force



1. Check the operation of actuators other than of the bucket cylinder

Determine if only the bucket cylinder is faulty by checking the operation of actuators for the devices listed in the table on the right. If one of them is faulty, check the main relief valve and the hydraulic pump (main).

☞ “5. Troubleshooting, Overall machine, All systems working, but insufficient force”

Lever to operate	Device to check	
	Relief valve	Pump
Right travel	R1	P1

2. Check the pilot valve

Disconnect the hose connecting the pilot valve and the control valve (bucket block) from the control valve. Fit the pressure gauge to the hose just disconnected.

- Operate the lever (bucket) and measure the pressure.
- If the pressure is between 0 and 3.4 MPa (0 to 493 PSI) depending on the lever angle, the pilot valve is normal.

3. Check the spool operation

Disconnect the bucket hose connected to the pipe at the boom foot, then install a pressure gauge in the disconnected hose.

- Operate the lever (bucket) and measure the pressure.
- If the measured value is within the specifications, the spool is normal.

Supply pressure: 21.0 MPa (3046 PSI)

4. Test by replacing the port relief valve

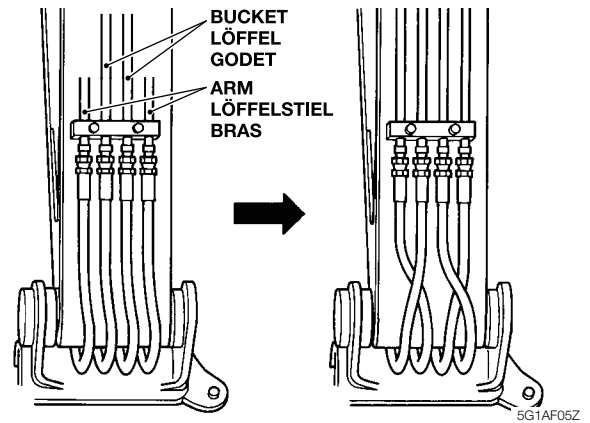
Replace the port relief valve in question with a port relief valve used for a normal boom. If the bucket cylinder operates normally with the replacement valve, the port relief valve used on the bucket side is faulty.

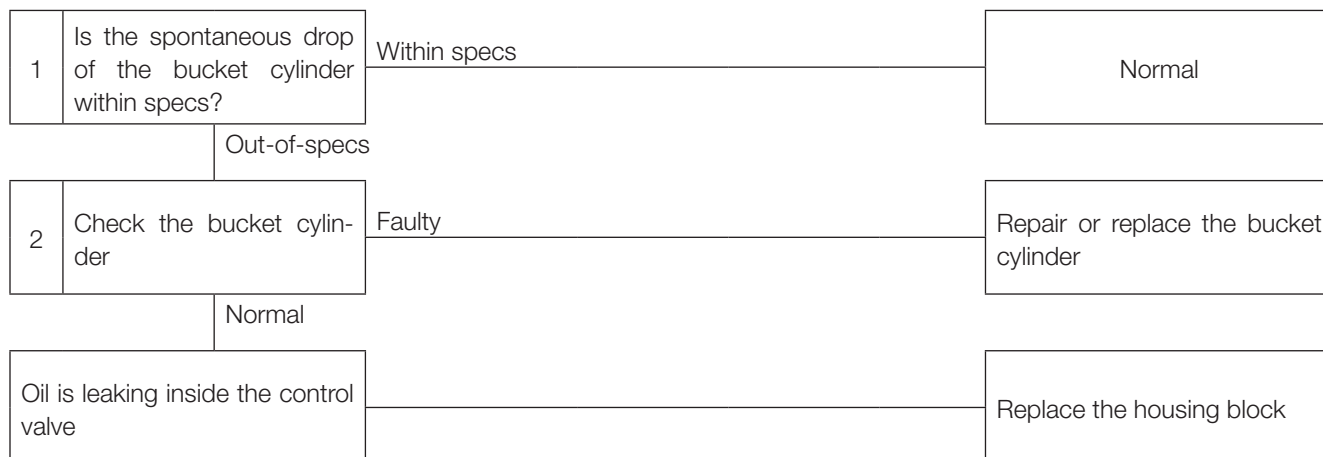
5. Check the bucket cylinder

Switch between the arm hose and the bucket hose connected to the piping at the boom foot.

- Move the lever (arm) to operate the bucket cylinder.
- If the cylinder fails to operate, it is faulty.

Before performing the steps above, fully extend the bucket cylinder, completely retract the arm cylinder and lower the bucket to the ground.

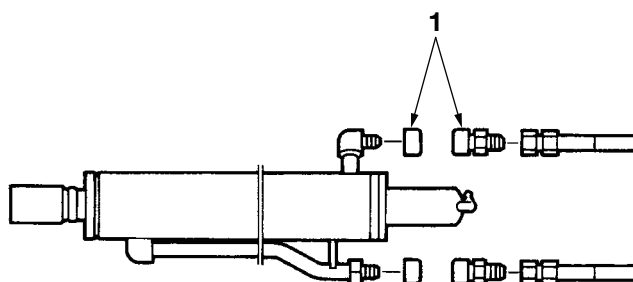


Spontaneous drop of the bucket is too large**1. Is the spontaneous drop of the bucket cylinder within specs?**

☞ "2. Service data, Performance criteria"

2. Check the bucket cylinder

- Fully extend the bucket cylinder, completely retract the arm cylinder, and lower the bucket to the ground.
- Disconnect the two hoses connected to the cylinder. Insert plugs (1) into the disconnected hoses and the piping.

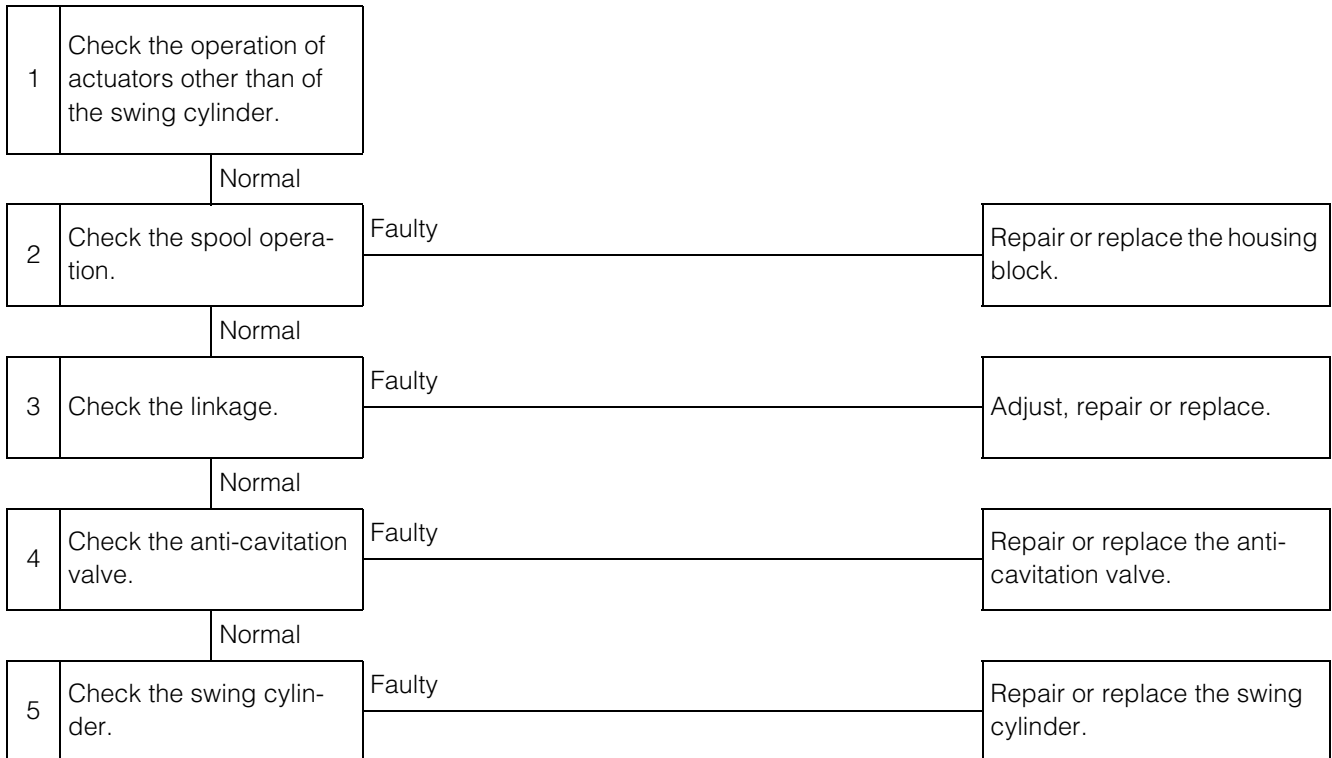


5G1AF06Z

- Raise the boom and lift the hoe attachment off the ground. If the bucket drops, the cylinder is faulty. If not, there is a leak inside the control valve.

BOOM SWING

Swing cylinder does not move.



1. Check the operation of actuators other than of the swing cylinder.

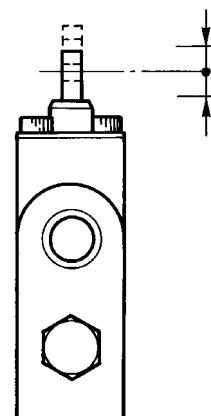
Determine if only the boom swing cylinder is faulty by checking the operation of actuators for the devices listed in the table on the right. If one of them is faulty, check the main relief valve and the hydraulic pump (main).

☞ "5. Troubleshooting, Overall machine, All systems working, but insufficient force"

2. Check the spool operation.

- Spool stroke: 7 mm (0.3. in.)
 - If the spool is sticking, try to take it out.
If it can't be taken out or is scratched, replace the housing block.
- Note that the faulty spool operation could be caused by the loosened bolt used for the return spring.

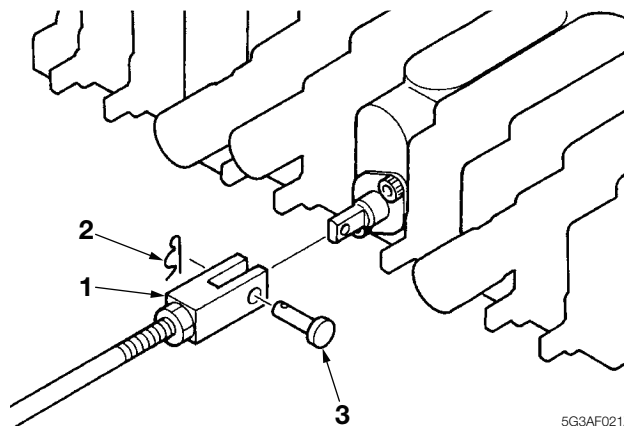
Lever to operate	Device to check	
	Relief valve	Pump
Right travel	R2	P2



5G3AF01Z

3. Check the linkage

To check the linkage, remove the R pin (2) and pin (3) used to connect the spool and the yoke (1), and then inspect the yoke (1) movement.



4. Check the anti-cavitation valve

If only the right swing is inoperable, it is likely that foreign matter is caught in the anti-cavitation valve or the valve is sticking.

5. Check the swing cylinder

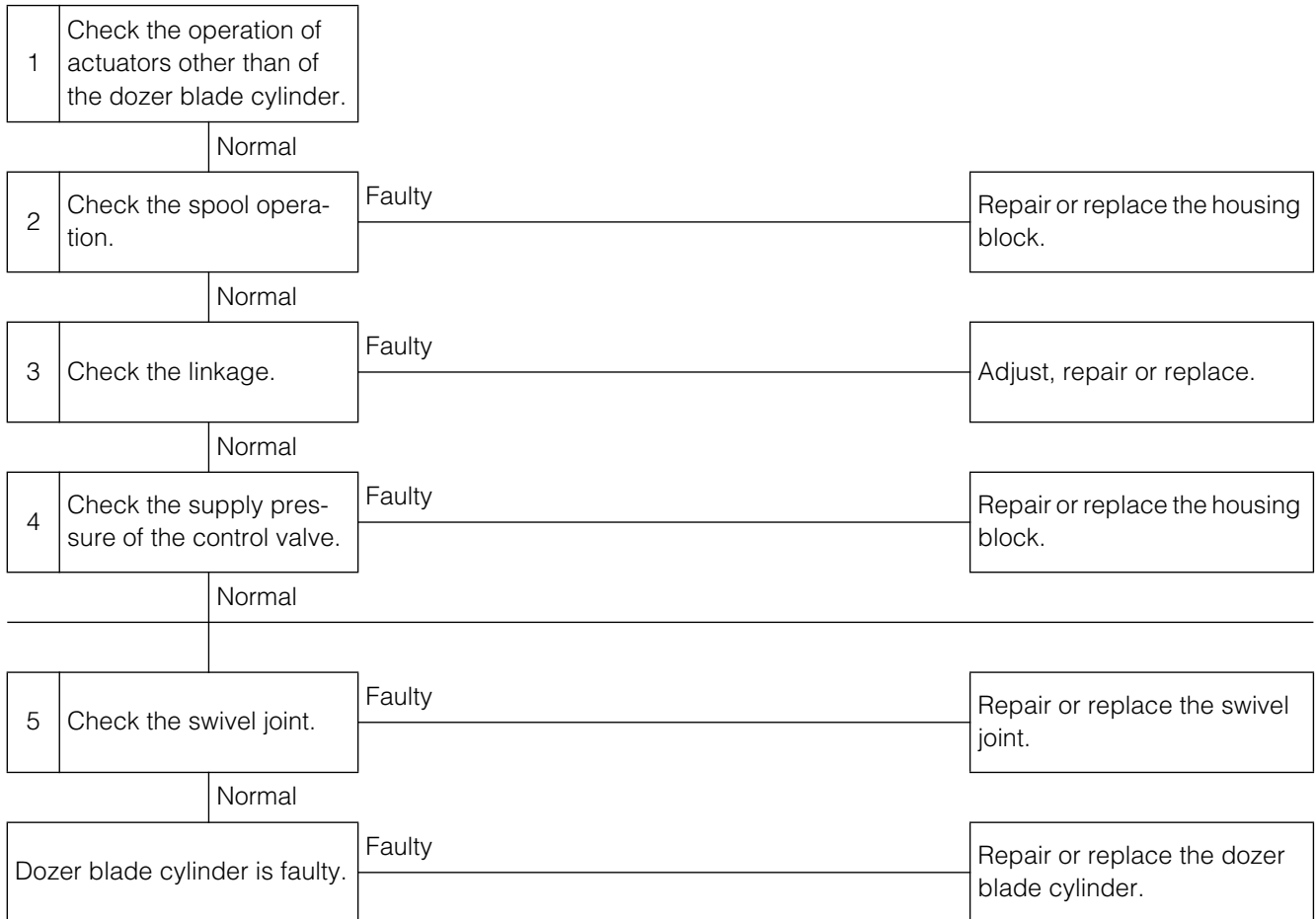
Disconnect the hose connecting the swing cylinder and the control valve from the control valve and measure the supply pressure in the control valve. If the supply pressure is normal, the swing cylinder is faulty.

- If the measured value is as below, the supply pressure is normal.

Supply pressure: 21.0 MPa (3046 PSI)

DOZER BLADE

Dozer blade cylinder does not move or lacks force.



1. Check the operation of actuators other than of the dozer blade cylinder.

Determine if only the dozer blade cylinder is faulty by checking the operation of actuators for the devices listed in the table on the right. If one of them is faulty, check the main relief valve and the hydraulic pump (main).

☞ “5. Troubleshooting, Overall machine, All systems working, but insufficient force”

2. Check the spool operation.

☞ “5. Troubleshooting, Boom swing, Swing cylinder does not move, 2. Check the spool operation”

3. Check the linkage.

☞ “5. Troubleshooting, Boom swing, Swing cylinder does not move, 3. Check the linkage”

Lever to operate	Device to check	
	Relief valve	Pump
Slew	R3	P3

4. Check the supply pressure of the control valve.

Disconnect one of the hoses connected to the control valve housing block (blade). Fit the pressure gauge to the hose just disconnected. Operate the lever (blade) and check the supply pressure of the valve.

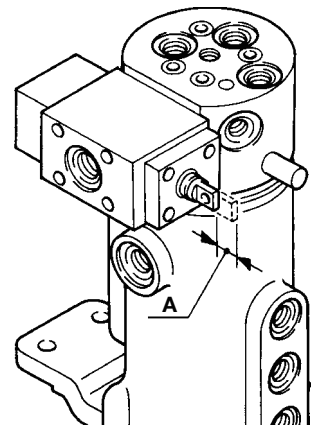
- If the value indicated is not as below, the housing block is faulty.
Supply pressure: 20.0 MPa (2900 PSI)

When only "Dozer Blade Lower" is impossible

- Replace the port relief valve in question with a port relief valve used for a normal arm. If the dozer blade cylinder operates normally with the replacement valve, the port relief valve used on the dozer blade side is faulty.

5. Check the swivel joint.

- inspect the spool stroke "A" of the selector on the swivel joint, and check if the spool is correctly switched to the blade side.
 - Spool stroke "A"6 mm (0.2 in.)
- Disconnect the hose between the swivel joint and the blade cylinder from the cylinder side. Install a pressure gauge on the hose just disconnected and operate the lever (blade).
 - If the value indicated is different from the value given below, the swivel joint is faulty.
Supply pressure: 20.0 MPa (2900 PSI)



5G5A102Z

The spontaneous drop of the dozer blade is too large, or the dozer blade cannot support the machine.

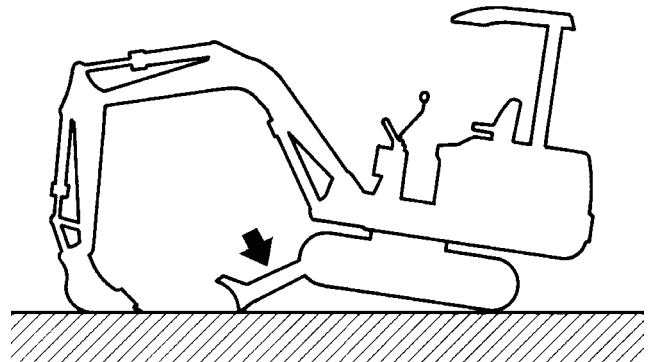
1	Is the spontaneous drop of the dozer blade within specs?	Within specs	Normal
		Out-of-specs	
2	Check for leakage inside the dozer blade cylinder.	Faulty	Repair or replace the housing block.
		Normal	
3	Inspect the swivel joint and the control valve.	Faulty	Repair or replace the swivel joint or control valve.

1. Is the spontaneous drop of the dozer blade within specs?

☞ "2. Service data, Performance criteria"

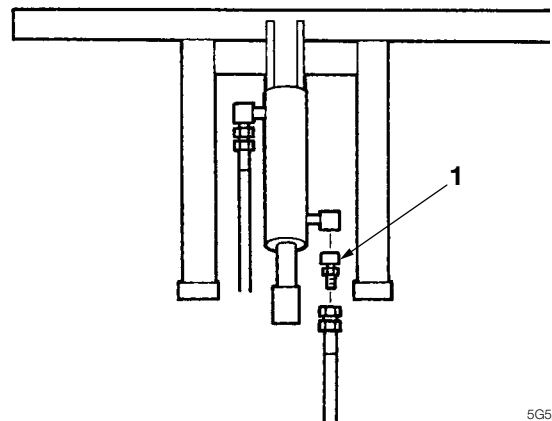
2. Check for leakage inside the dozer blade cylinder.

a. Using the hoe attachments, raise the machine, then lower the blade fully.



5G5AF03Z

b. Disconnect the hose from the rod side of the dozer blade cylinder and drain oil from the piping. Install the plug (1) on the hose just disconnected.



5G5AF04Z

c. Raise the dozer boom and apply a load on the blade.

- If the machine drops while oil drains from the cylinder's piping, the cylinder is faulty.
If the machine drops even though no oil drains out, the control valve or the swivel joint is faulty.
If the machine cannot be supported by the blade, try replacing the port relief valve with a normal one. If the blade can support the machine after this replacement, then the port relief valve is faulty.

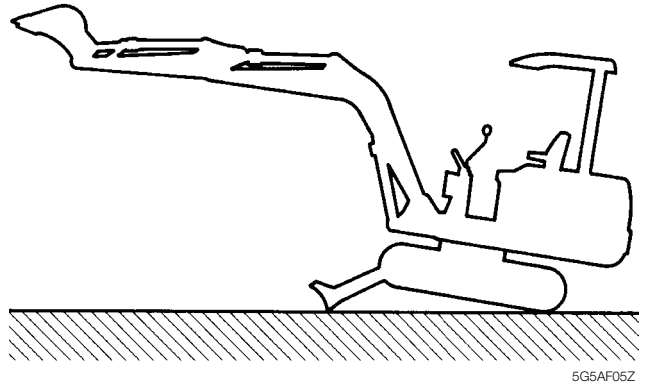
3. Inspect the swivel joint and the control valve.

Disconnect the hose connecting the swivel joint and control valve from the control valve. Insert a plug into the hose just disconnected.

Apply a load to the blade by following the steps 2 (a) through (c) above.

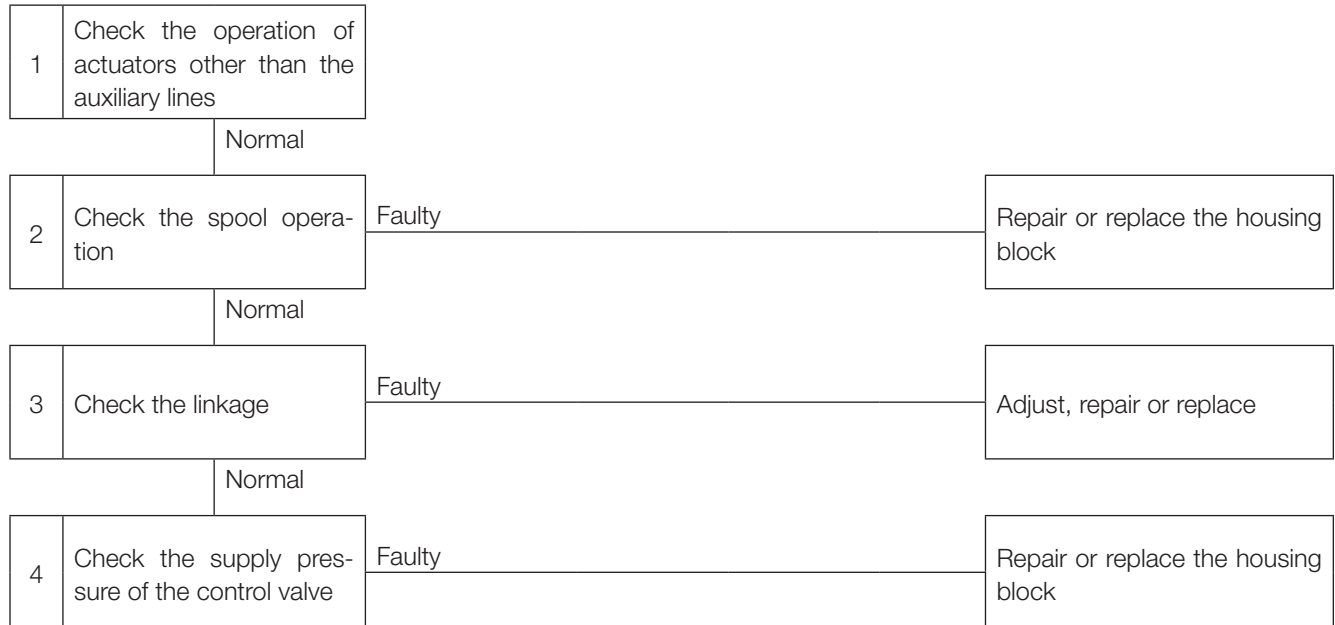
If the machine drops, the swivel joint is faulty.

If the machine does not drop, there is a leak inside the control valve.



AUXILIARY HYDRAULICS (1ST)

Prescribed pressure is not supplied to the auxiliary lines.



1. Check the operation of actuators other than the auxiliary lines.

Determine if only the auxiliary lines is faulty by checking the operation of actuators for the devices listed in the table on the right. If one of them is faulty, check the main relief valve and the hydraulic pump (main).

☞ “5. Troubleshooting, Overall machine, All systems working, but insufficient force”

Lever to operate	Device to check	
	Relief valve	Pump
Swing	R2	P2

2. Check the spool operation.

☞ “5. Troubleshooting, Traveling, Right or left travel is impossible, 2. Check the spool operation”

3. Check the linkage.

☞ “5. Troubleshooting, Traveling, Right or left travel is impossible, 3. Check the linkage”

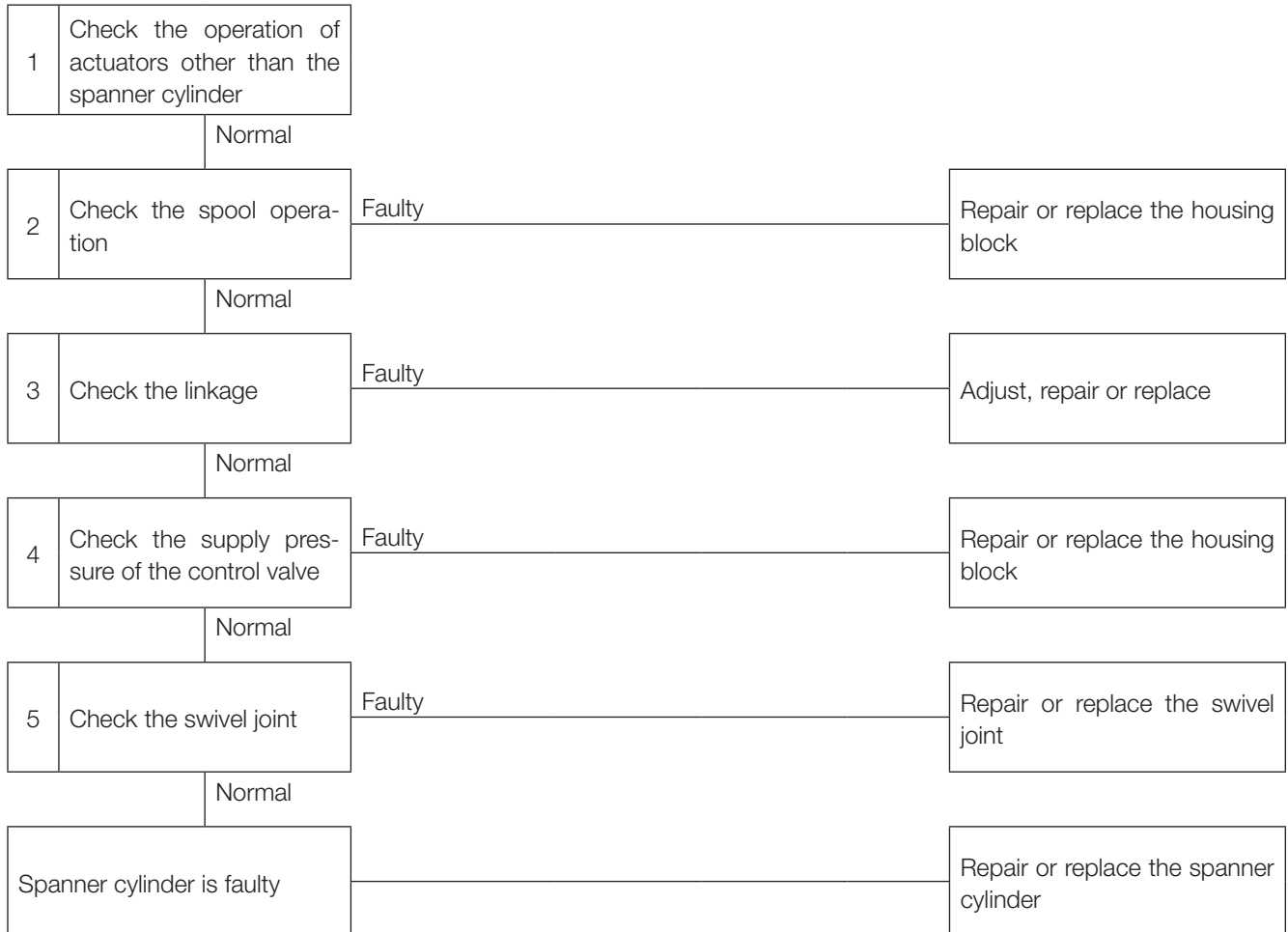
4. Check the supply pressure of the control valve.

Disconnect one of the hoses connected to the control valve housing block (1st auxiliary lines). Fit the pressure gauge to the hose just disconnected. Operate the lever (1st auxiliary lines) and check the supply pressure of the valve.

- If the value indicated is not as below, the housing block is faulty.
Supply pressure: 21.0 MPa (3046 PSI)

SPANNER

Spanner cylinder does not move or lacks force



Switching between the blade cylinder operation and the spanner cylinder operation can be done by operating the lever. Therefore, checking procedure for the spanner cylinder is similar to that for the blade cylinder.

☞ “5. Troubleshooting, Dozer blade”

1. Check the operation of actuators other than the spanner cylinder.

2. Check the spool operation.

☞ “5. Troubleshooting, Traveling, Right or left travel is impossible, 2. Check the spool operation”

3. Check the linkage.

☞ “5. Troubleshooting, Traveling, Right or left travel is impossible, 3. Check the linkage”

4. Check the supply pressure of the control valve.

Disconnect one of the hoses connected to the control valve housing block (spanner). Fit the pressure gauge to the hose just disconnected. Operate the lever (spanner) and check the supply pressure of the valve.

- If the value indicated is not as below, the housing block is faulty.

Supply pressure: 20.0 MPa (2900 PSI)

5. Check the swivel joint

- a. Inspect the spool stroke "A" of the selector on the swivel joint, and check if the spool is correctly switched to the blade side.
 - Spool stroke "A"6 mm (0.2 in.)
- b. Disconnect the hose between the swivel joint and the spanner cylinder from the cylinder side. Install a pressure gauge on the hose just disconnected and operate the lever (spanner).
 - If the value indicated is different from the value given below, the swivel joint is faulty.
Supply pressure: 20.0 MPa (2900 PSI)

PISTON PUMP

Symptoms	Major causes	Remedies
Noise is too loud, unusual sound is heard	- Suction hose is crushed or suction filter is clogged. - Joint in the suction side is loose and sucking air. - Cavitation is being produced due to too high viscosity of the hydraulic oil. - Pump and engine are not center aligned. - Frothing of hydraulic oil. - Engine RPM is too high. - Mechanical damage to the parts (e.g., bearing).	- Remove the dirt and correct the crushing. - Retighten each joint. - Replace with hydraulic oil of proper viscosity. - Center them again. - Investigate the cause of frothing and correct it. - Run at the rated RPM. - Replace the damaged part(s) or the pump.
Discharge is insufficient	- Engine RPM is too low. - Oil temperature is too high. - Viscosity of hydraulic oil is too high. - Pump volume efficiency becomes low. - Hydraulic oil tank level is too low. - Clogging in the suction piping or the suction filter. - Leak volume of hydraulic devices other than the pump is increased.	- Run at the rated RPM. - Stop running, and check the temperature again after the oil cools down. - Replace with hydraulic oil of proper viscosity. - Replace the pump. - Add oil to the specified level. - Clean the piping. - Repair or replace the leaking hydraulic device.
Pressure is not increased	- Set pressure for the relief valve drops. - Leak volume of hydraulic devices other than the pump is increased. - Pump volume efficiency becomes low.	- Set the relief valve pressure again. - Repair or replace the leaking hydraulic device. - Replace the pump.
Abnormal heat is generated	- Leak volume from the pump is increased. - Mechanical damage to the parts (e.g., bearing). - Seizing on the sliding part.	- Replace the pump. - Replace the damaged part(s) or the pump. - Replace the damaged part(s) or the pump.
Oil leak	- Seals are damaged. - Sliding part between the shaft and the oil seal is worn out. - Plugs and bolts are loosened.	- Replace the seal(s). - Replace the shaft or the pump. - Retighten the plugs and bolts, or replace the seals.

GEAR PUMP

☞ “4. Disassembly and assembly, Gear pump”

Symptoms	Major causes	Remedies
No discharging operation	• Direction of rotation is incorrect. • Hydraulic oil tank level is too low. • Clogging in the suction piping or the suction filter. • Viscosity of hydraulic oil is too high. • RPM is too low.	• Rotate in the rated direction. • Add oil to the specified level. • Clean the piping. • Replace with hydraulic oil of proper viscosity. • Run at the rated RPM.
Noise is too loud, unusual sound is heard	• Cavitation is being produced due to the crushed hose or clogged filter of the suction side. • Joint in the suction side is loose and sucking air. • Cavitation is being produced due to too high viscosity of the hydraulic oil. • Pump and engine are not center aligned. • Frothing of hydraulic oil.	• Remove the dirt and correct the crushing. • Retighten each joint. • Replace with hydraulic oil of proper viscosity. • Center them again. • Investigate the cause of frothing and correct it.
Oil leak from the oil seal	• Oil seal is deformed, worn out or damaged.	• Replace the oil seal.
Oil leak from the mating surface between the housing and the flange or housing and the cover	• Body seal is damaged, or the sliding part is worn out.	• Replace with a new one.
Discharge is insufficient	• Bushing seal is damaged. • Cavitation is being produced. • Aeration is being produced. • Viscosity of hydraulic oil is too low.	• Replace the bushing seal. • Clean the suction filter and the suction piping. • Check if piping is properly screwed in. • Replace with hydraulic oil of proper viscosity.

CONTROL VALVE

🔧 “4. Disassembly and assembly, Control valve”

The problems are listed individually in the table below, but in reality, many problems have multiple causes. Therefore, try to check and eliminate each possible cause one at a time.

Symptoms	Major causes	Remedies
Oil leak from the spool seal	- Flaw is on the sealing part or the seal lip is worn out due to prolonged use. - Flaw (e.g., dents or scratches) on the sliding part of the spool seal is caused by an external factor. - The lid that is pushing the sealing parts in place is installed improperly (lid is distorted) - Old paint remains on the seal sliding part of the spool. - Tank pressure becomes too high for the performance of the sealing material.	- Replace with a new one. - Repair or replace the spool. - Correct the lid, and determine the partial wear degree of the seal. - Remove it by using thinner or mechanical force. When removing, take care not to damage the spool surface or the seal lip. - Remove the cause of the flow resistance.
Sliding part of the spool is not smooth	- Foreign matter is caught in the sliding part of the spool. - Oil film between the spool and the body becomes too thin due to the increased oil temperature. - Lubrication is disabled due to deteriorated oil. - Spool is worn out because of prolonged use or of the unbalanced force applied. - Spool is bent by the external force. - Whole valve is distorted due to the distortion of the installation surface. - Valve is operated with the pressure or the flow rate of out-of-spec. - Fixing bolts are over-tightened. - Oil stays in the lid (spring or detent) opposite to the spool operation.	- Overhaul and repair or replace. - Try to decrease the oil temperature. If the relief valve is started often, find the cause and correct it. - Oil should be replaced. The circuit also should be overhauled in some cases. - Replace the spool and the valve block assembly. - Check for the straightness of the spool, and repair or replace. - Check the distortion, independent of the installation surface (loosening the bolts will help). - For pressure, measure it with a pressure gauge. For flow rate, determine it by finding out the movement speed and capacity of the actuator. - Check if the fixing bolts are tightened with the specified torque. If not, tighten them again with the specified torque. - Oil may come out from the lid, if it is leaking in the seal of the spool. If that is the case, replace the seal.
When the actuator is being raised, it drops once	Foreign matter is caught in the seat on the load check valve, or the seat is damaged by large foreign matter.	Disassemble the valve and overhaul or replace the faulty part(s).

Symptoms	Major causes	Remedies
Spool's neutral position cannot be maintained (cylinder drops)	• There are cases of a large oil leak inside the cylinder. • Since the clearance between the spool and the body is too large, oil is leaking from the clearance. • Spool is not completely back in the neutral position. • Foreign matter is caught in the seat of the port relief valve or of the anti-cavitation valve, and thus the oil is bypassing the section. Or the seat is damaged.	• Check if the cylinder drops spontaneously when it is held. If the cylinder is faulty, disassemble and repair it. • Replace the spool and the valve block assembly. • Manual: Check if the link mechanism is interfering with others. Hydraulic operation: Check the pilot pressure. • Disassemble, overhaul or replace.
Load cannot be moved (pressure cannot be increased)	• Foreign matter is caught in the seat of the port relief valve, and thus the oil is bypassing the section. Or the seat is damaged. • Adjuster screw on the relief valve is loose. • Foreign matter is caught in the seat of the port relief valve or of the anti-cavitation valve, and thus the oil is bypassing the section. Or the seat is damaged. • Spool stroke is out-of-spec. • Oil supply from the pump is insufficient, because the pump is damaged.	• Disassemble, overhaul or replace. • Screw in the adjuster screw. If loose, set the adjustment again and fasten with a lock nut. • Disassemble, overhaul or replace. • Manual: Check if the link mechanism is interfering with others. Check if the pin or pin hole on the linking section is worn out. • Hydraulic operation: Check the pilot pressure. Check for any abnormality in the pump. If the pump is faulty, replace it and find the cause of the abnormality (e.g., faulty air sucking or oil degradation).
Load cannot be moved (pressure is being increased)	• Overloading • Mechanical resistance of related parts/devices (unrelated to the hydraulic pressure of the hydraulic oil) is large. • Large resistance is generated, because the circuit is clogged with large foreign matter or the piping is bent. • Spool stroke is out-of-spec.	• Compare with a one with standard load. • Check and add oil, modify or repair the parts/devices. • Repair if the location of clogging or bent is known. • Check if the link mechanism is interfering with others and if the pin or pin hole on the linking section is worn out.

PILOT VALVE

👉 “4. Disassembly and assembly, Pilot valve”

Symptoms	Major causes	Remedies
The secondary pressure is too low	• Primary pressure is insufficient. • The spring is broken or worn out. • The clearance between the spool and the casing is too large. • Too much play in the handle.	• Keep the primary pressure. • Replace • Replace the spool and the casing assembly. • Disassemble and assemble or replace.
The secondary pressure is unstable	• The sliding part is not smooth. • The tank line pressure fluctuates. • Air is present in the piping.	• Repair or replace. • Remove the faulty part(s) in the tank line. • Bleed air by operating the valve several times.
The secondary pressure is high	• Pressure in the tank line is high. • The sliding part is not smooth.	• Remove the faulty part(s) in the tank line. • Repair or replace.

SOLENOID VALVE

☞ “4. Disassembly and assembly, solenoid valve”

Symptoms	Major causes	Remedies
Solenoid valve does not operate	• Wiring short-circuit or wire break. • Coil assembly short-circuit or wire break. • Foreign matter is caught in the spool. • Damage on the outer circumference of the spool. • Proportional controller is faulty. • Primary pressure is insufficient.	• Replace • Replace • Overhaul and repair or replace. • Overhaul and repair or replace. • Repair or replace. • Keep the primary pressure.
Oil leakage from solenoid valve	• O-ring is damaged. • Seal nut is damaged.	• Replace • Replace

CYLINDERS

👉 “4. Disassembly and assembly, Cylinders”

Symptoms	Major causes	Remedies
Oil is leaking from the piston rod sliding surface (oil forms a ring on the piston rod, which becomes larger and starts dripping)	- Foreign matter is trapped in the inside diameter of the rod packing or dust seal. - Scratching or abnormality of the internal lip surface of the rod packing or dust seal. - Scratching on the sliding surface of the piston rod. - Peeling of the hard chromium plated surface.	- Remove the foreign matter. - Replace the faulty part(s). - Smooth the sliding surface with an oilstone (1.6 S or less). - If the leak persists after smoothing the sliding surface, replace the rod packing and other seals. - If the leak persists after replacing the seals, replace the piston rod. - Re-plate the hard chromium plating.
Oil leaking around the rod cover.	- O-ring is damaged. - Backup ring is damaged.	- Replace the faulty part(s). - Replace the faulty part(s).
Oil leaking from welded joint.	Tube welding is damaged.	Replace the faulty part(s).
Spontaneous cylinder drop (“Spontaneous drop” is defined as 0.5 mm or greater piston movement in 10 minutes when a static load is exerted on the rod. The static load is determined by multiplying the maximum operating pressure by the cylinder area.)	- Foreign matter is trapped in the wear ring sliding surface. - Scratching or abnormality of the wear ring sliding surface. - Scratching on the piston packing sliding surface. - O-ring is damaged.	- Remove the foreign matter. - Replace the faulty part(s). - Replace the faulty part(s). - Replace the faulty part(s).

TRAVEL MOTOR

☞ “4. Disassembly and assembly, Travel motor”

Hydraulic motor

Symptoms	Major causes	Remedies
Motor fails to start	- All the devices other than the motor and the reduction gears are not working correctly. - Pressure oil is not flowing properly due to abnormal wear of the motor's sliding part. - Motor is faulty, as its main components are damaged.	- Check whether the specified pressure is generated in the inlet port, and then check and repair each device. - Replace the abnormally worn out part(s). - Replace the damaged part(s).
Rated speed cannot be obtained	- Specified volume of flow is not supplied to the motor due to the faulty oil pump. - Motor volume efficiency becomes low.	- Check whether the specified pressure is generated in the inlet port, and then check and repair each device. - Check if there is abnormal wear on the sliding part; if so, repair or replace it.
Rotational fluctuations are large	- High-pressure oil is leaking from the drain port, because the motor's sliding part is worn out. - Bearing is worn out.	- Replace the abnormally worn part, if any. - Replace the abnormally worn part, if any.
Oil leak	- Oil leak due to O-ring breakage. - Oil seal is broken by the internal pressure generated in the motor case due to the abnormal wear of the sliding part of the motor. - Pressure increase in the drain piping caused by the clogging of foreign matter resulted in breakage of oil seal.	- Replace the oil seal and O-ring. - Repair the motor and replace the oil seal. - Clean the clogging in the drain piping and replace the oil seal.

2nd-speed control

Symptoms	Major causes	Remedies
Straight-ahead traveling level is low, switching to 2nd-speed travel is disabled	Spool cannot be switched. - Foreign matter is caught. - Spring is missing. - Spring is damaged. - Oil leak due to the abnormal wear of the 2nd-speed control piston. 2nd-speed control piston is missing. - Ball is abnormally worn out.	- Remove foreign matter and correct or replace the faulty part(s). - Install the spring. - Replace the spring. - Replace the 2nd-speed control piston. - Install the 2nd-speed control piston. - Replace the ball.

Parking brake

Symptoms	Major causes	Remedies
Braking force is insufficient or not evenly applied	• Disc surface is faulty. • Spring is damaged. • Bolt for manual releasing is being fitted.	• Repair or replace • Replace the spring. • Remove the bolt for manual release, and fit the plug.
Abnormal heat generation due to brake drag	• Release of braking is faulty. • Oil leak due to O-ring breakage. • Orifice is clogged. • Pilot pressure for the releasing is not working.	• Replace the O-ring. • Clean the orifice. • Check whether the specified pressure is generated in the pilot port, and then check and repair each device.

SLEW MOTOR

If you notice that the noise or heat becomes unusually high, it is likely that there is a fault in the machine. If it occurs, stop the machine immediately and try to locate the faulty section.

The table below shows the cause of the general problem and action to be taken when such problem occurs in the hydraulic circuits.

Hydraulic motor, brake valve

Symptoms	How/Where?	Major causes	Remedies
Motor fails to start	No pressure at the motor's inlet port	- Set pressure of relief valve is too low - Pump faulty - Control valve faulty	- Set correctly - Repair or replace - Repair or replace
	There is pressure at the motor's inlet port	- Load is too heavy - Hydraulic motor is faulty	- Reduce the load - Repair or replace
Motor does not speed up	Pump discharge is insufficient	Too much drain from the pump	Repair or replace the pump
	Functional problem of the motor	Drop in the motor's volumetric efficiency	Replace the motor
Direction of rotation is incorrect	- Piping - Motor valve timing	- Piping is incorrectly connected. - Motor valve timing is incorrect.	- Correct the piping. - Set the valve timing correctly
Oil is leaking	Leaking from the mating surface	- Bolts are loose - O-ring is faulty - Mating surface is scratched	- Retighten the bolts - Replace - Repair the surface with a grindstone or sand paper
Motor produces abnormal noise	Noise in the piping	Piping support is faulty	Clamp the piping

Parking brake

Symptoms	Major causes	Remedies
Cannot release the brake. Brake force is weak. Brake drags, produces noise, heat	Release pressure PB is not generated Or, supply pressure is low.	Set the release pressure PB as specified.
	Valve does not operate due to high drain pressure	Check the drain circuit for clogging and repair. If drain from the motor is too large, check and repair the motor.
	Brake piston does not operate - O-rings are abnormally worn - Sliding parts are worn or damaged - Foreign matter is caught - Wear-resistant material is worn - A spring is broken	- Replace - Repair or replace the sliding parts - Remove the foreign matter and repair or replace the sliding parts - Replace - Replace

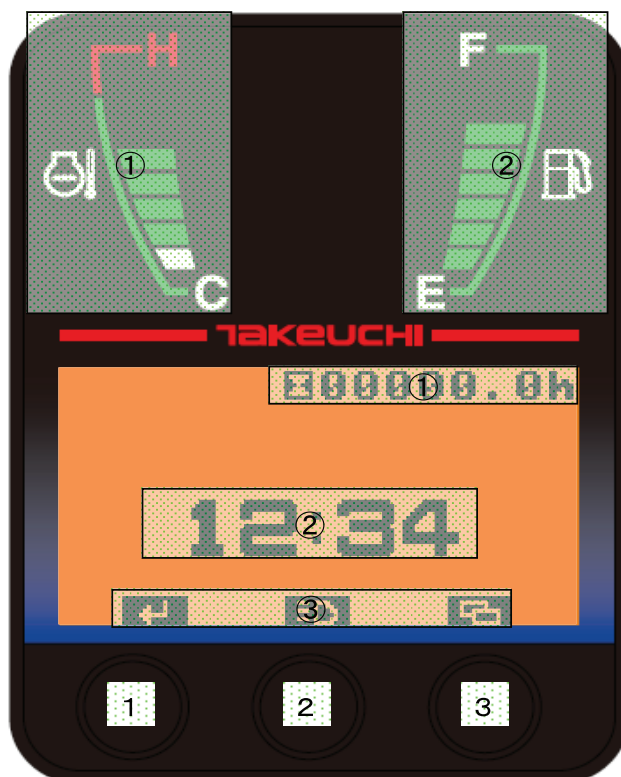
Monochrome LCD Cluster Panel Display and LCD Specifications (Without a CAN)

CONTENTS

- 1 Contents
- 2 Normal Panel Display/LCD Screen
- 3 Panel Display: Water Temperature Gauge
- 4 Panel Display: Fuel Gauge
- 5 Panel Display: Function/Warning Lamps
- 6 Normal Screen
- 7 Main Menu Screen
- 8 Data Selection Screen
- 9 Data Screen (TRIP METER)
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- 11 Settings Selection Screen
- 12 Setting Screen (CLOCK)
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- 15 Setting Screen (CONTRAST ADJ.)

NORMAL PANEL DISPLAY/LCD SCREEN

Off States for Function and
Warning Display Indicators



Panel Display

- ① Water temperature gauge
- ② Fuel gauge

LCD

- ① Hour meter
- ② Clock
- ③ Switch function display

On States for Function and
Warning Display Indicators



Panel Display

- ① Water temperature gauge
- ② Fuel gauge
- ③ Function/warning lamps
- Water temperature warning light
- Charge warning light
- 2nd speed travel light
- Engine oil warning light
- Glow light
- Low fuel level warning light
- System warning light

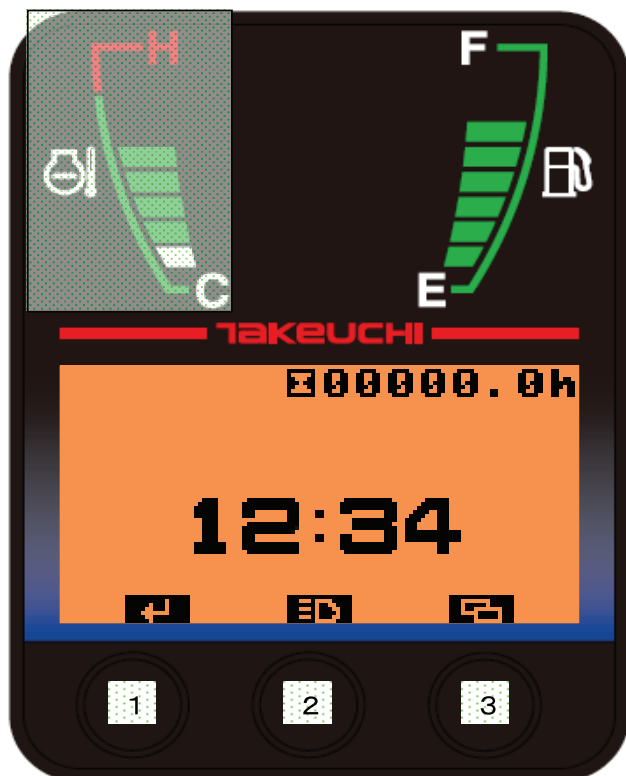
LCD

- ① Hour meter
- ② Clock
- ③ Switch function display
- ④ Function/warning display
- High-altitude mode light
- 3rd S pressure warning light
- Alarm light

* If there is no CAN present, the lights turn ON for 1.2 s in this state for a lamp check test. All lights on the LCD screen also turn ON for 1.2 s at this time. The alarm buzzer also sounds for 1.2 s.

The current time displays on the clock display during the lamp check. (The time does not display as 12:34, in other words, unless that happens to be the current time.)

PANEL DISPLAY: WATER TEMPERATURE GAUGE



Resistance characteristics

Temp. [°C (°F)]	Resistance [kΩ]
-30 (-22)	25.4
-20 (-4)	15.04
-10 (14)	9.16
0 (32)	5.74
5 (41)	4.72
10 (50)	3.7
20 (68)	2.45
30 (86)	1.66
40 (104)	1.15
50 (122)	0.811
60 (140)	0.584
70 (158)	0.428
80 (176)	0.318
90 (194)	0.24
95 (203)	0.2118
100 (212)	0.1836
105 (221)	0.1627
110 (230)	0.1417
120 (248)	0.1108


 $t < 50^{\circ}\text{C}$

 $50^{\circ}\text{C} \leq t < 60^{\circ}\text{C}$

 $60^{\circ}\text{C} \leq t < 70^{\circ}\text{C}$

 $70^{\circ}\text{C} \leq t < 80^{\circ}\text{C}$

 $80^{\circ}\text{C} \leq t < 95^{\circ}\text{C}$

 $95^{\circ}\text{C} \leq t < 105^{\circ}\text{C}$

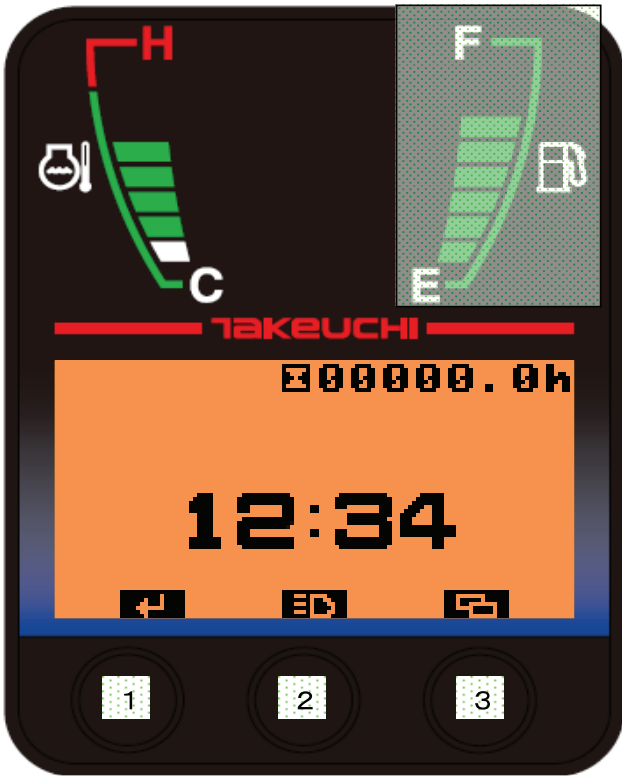
 $105^{\circ}\text{C} \leq t < 110^{\circ}\text{C}$

 $110^{\circ}\text{C} \leq t$

* Average values are used for the output values. (The average amount of movement over a span of 5 seconds measured in 100-ms intervals.)

* Allowable error: $\pm 5\%$ (Allowable error for the water temperature gauge sensor parts listed separately)

PANEL DISPLAY: FUEL GAUGE

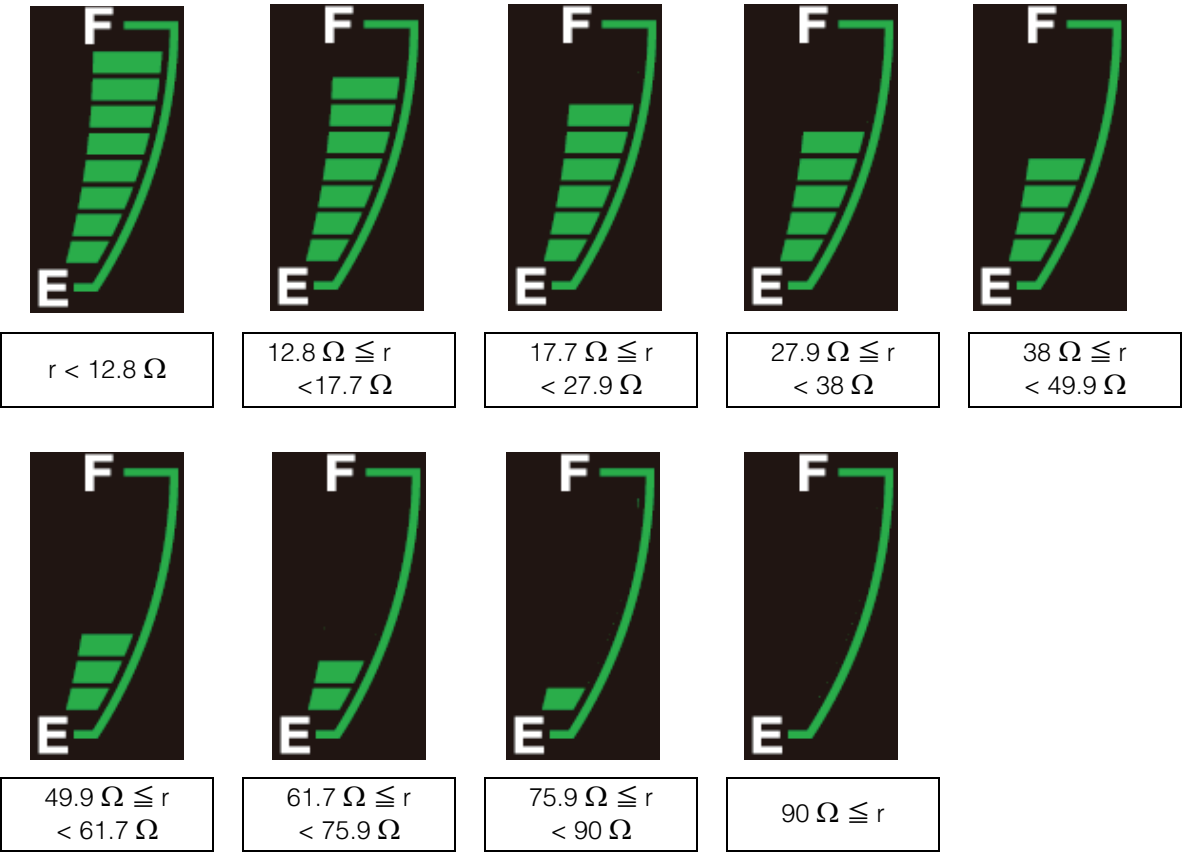


* Allowable error: ±5%
(Allowable error for the fuel gauge float parts listed separately)

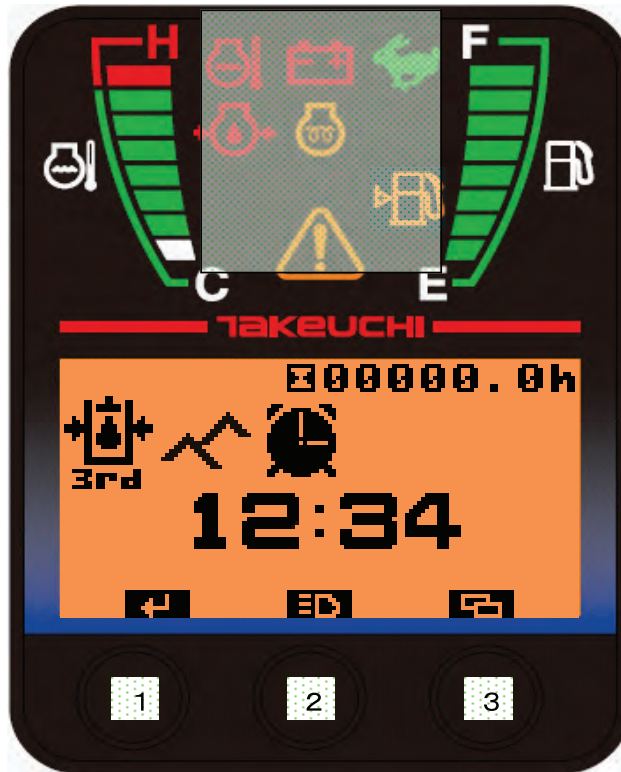
Resistance characteristics

Float position	FULL	3/4	1/2	1/4	EMPTY
Resistance (Ω)	10	17.7	(38)	61.7	90
Allowable error (Ω)	0 -4	-	-	-	+10 0

* Average values are used for the output values. (The average amount of movement over a span of 120 seconds measured in 100-ms intervals.)



PANEL DISPLAY: FUNCTION/WARNING LAMPS



Overheating warning light

Lamp ON conditions: Flashes when the temperature rises above 110°C (230°F)(Resistance: 0.1417 kΩ). Turns on solid for 0.5 s then goes out for 0.5 s and repeats in a flashing pattern.



Engine oil pressure warning light

Flashes when the oil pressure switch is ON (while set to LO). Turns on solid for 0.5 s then goes out for 0.5 s and repeats in a flashing pattern.



Charge warning light

Lamp ON conditions: Flashes when the voltage at the alternator input terminal is reading below +3 V. Turns on solid for 0.5 s then goes out for 0.5 s and repeats in a flashing pattern.



2nd speed travel light

Toggles from OFF to ON (or ON to OFF) along with the 2nd speed travel relay when the 2nd speed travel switch is turned from OFF to ON to OFF (by flip-flop operation). Chattering check: 20 ms



Glow lamp

Lamp ON conditions: Turns ON for 3 s when ACC is ON (Turns ON when the glow relay is ON; turns OFF if a Start signal is received within 3 s of being ON). (Turns ON when the glow relay is ON, OFF when the glow relay is OFF, and OFF if a Start signal is received within 3 s of being ON.)



Low fuel level warning light

Lamp ON conditions: Turns ON if the resistance increases to 75.9 Ω or higher.



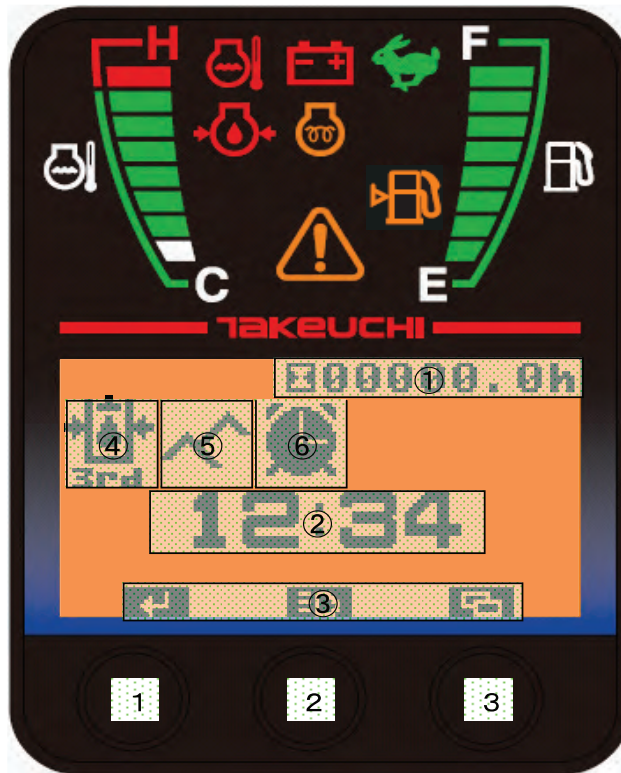
System warning light

Lamp ON conditions: Flashes when one of the Overheating, Engine oil warning, or Charge warning lights is turned ON. Turns on solid for 0.5 s then goes out for 0.5 s and repeats in a flashing pattern.

* If any one or more of the overheating warning light, engine oil pressure warning light, or charge warning light turns ON, chattering is determined to have occurred for 1.5 s. After 1.5 s passes, the warning light begins to flash and the buzzer to sound (ON for 0.5 s and then OFF for 0.5 s and so on in a repeating pattern). If the system is able to return to a normal state, the warning light and buzzer turn OFF after 1.5 s.

* If both the charge warning light and engine oil pressure warning light are in the abnormal state and the engine enters a shut-off state, the buzzer only will turn OFF after 10 s lapses, even if the abnormal state continues.

NORMAL SCREEN



① Hour meter

- The hour meter begins counting when the input terminal voltages of the alternator and trip meter rise above +3 V.
- Pressing and holding down Button [2] for 2 seconds switches the display to the trip meter.
(Toggles in order of Hour meter to Trip 1 to Trip 2 to Trip 3 to Hour meter.)

000000.0h → 000000.0h → 200000.0h → 300000.0h

- Pressing and holding down Button [3] for 3 seconds resets the trip meter while it is displayed.
- * The hour meter displays right after ACC is turned ON.

② Clock display

- The clock displays as a 24-hour clock.
- Refer to "Setting Screen (Clock)" for details on how to set the time.

③ Switch function display

- The takt switch functions are displayed.
- The display changes on the Normal screen, Setting screen, and Data screen.
- In Normal screen mode: Pressing Button [1] for a short while ⇒ No function, Pressing and holding down Button [1] for a long time ⇒ No function.
- In Normal screen mode: Pressing Button [2] for a short while ⇒ Turns on the work light, Pressing and holding down Button [2] for 2 seconds ⇒ Toggles the display to the trip meter.
- In Normal screen mode: Pressing Button [3] for a short while ⇒ Moves the display to the Main menu, Pressing and holding down Button [3] for 3 seconds ⇒ Resets the trip meter.

The work light toggles between ON and OFF with each quick press of Button [2]. The light relay also toggles ON/OFF at this time.

④ 3rd S pressure warning light

- The pressure switch turns OFF, and the icon displays when the 3rd S pressure drops (The switch turns ON and the icon OFF when the pressure goes up.)

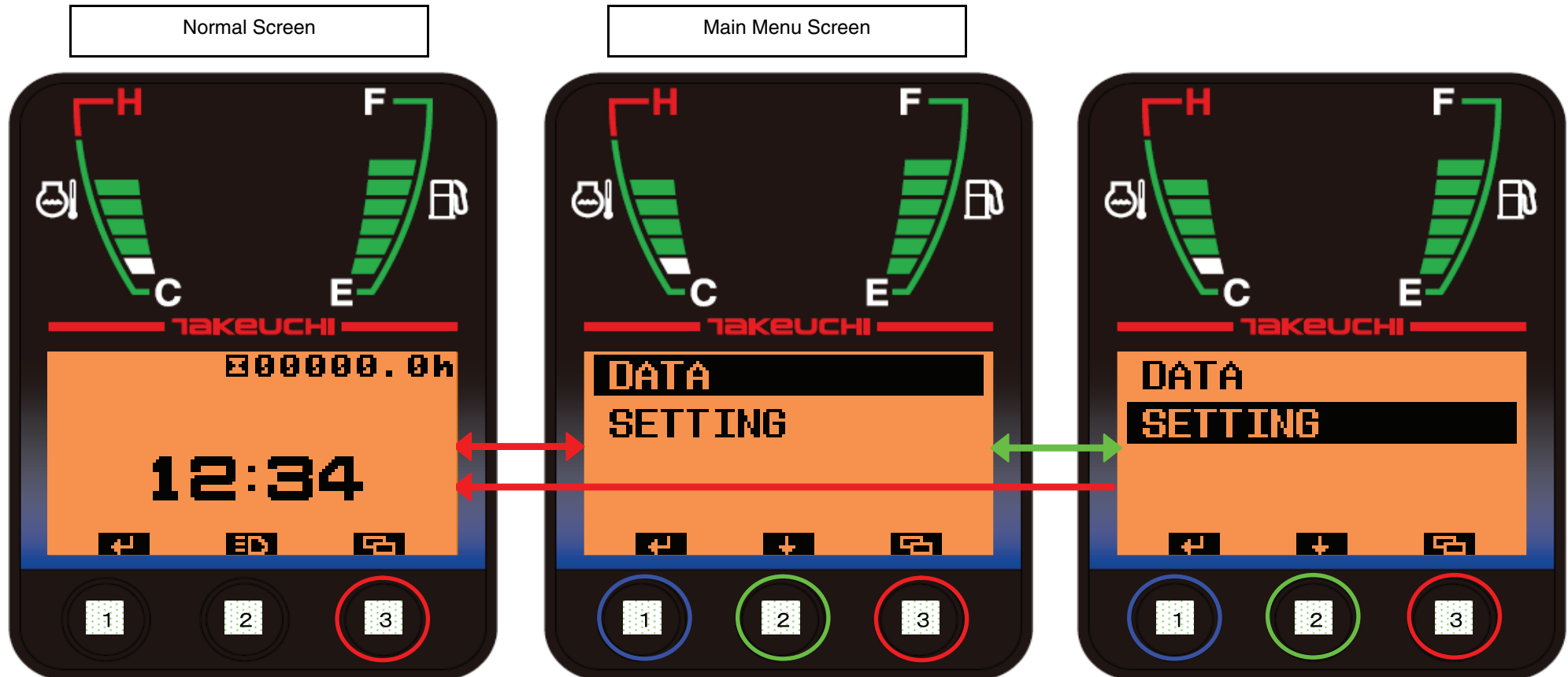
⑤ High-altitude mode light

- The icon displays when the high-altitude switch is turned ON.

⑥ Alarm light

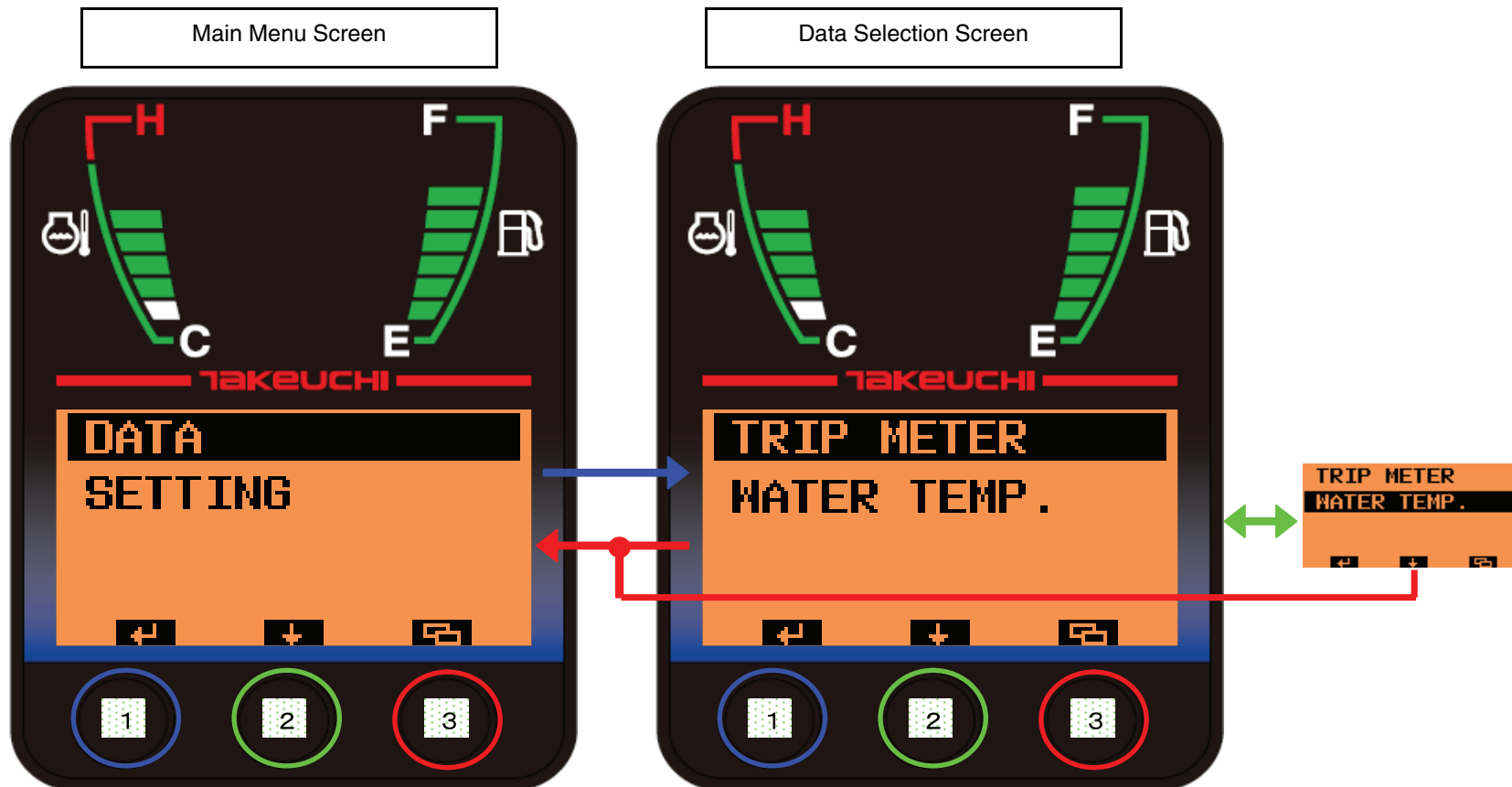
- The icon displays while the alarm function is turned ON.
- Refer to "Setting Screen (Alarm)" for details on how to set the alarm.
- A buzzer sounds for 30 s while the alarm is ON (During the first 15 s, the buzzer turns on and off repeatedly for 0.5 s each way; during the last 15 s, it turns on and off repeatedly for 0.3 s each way).
- The icon flashes (ON for 0.5 s, OFF for 0.5 s, and so on) while the buzzer is sounding.
- Pressing Button [1] for a short amount of time while the alarm is ON stops the buzzer.

MAIN MENU SCREEN



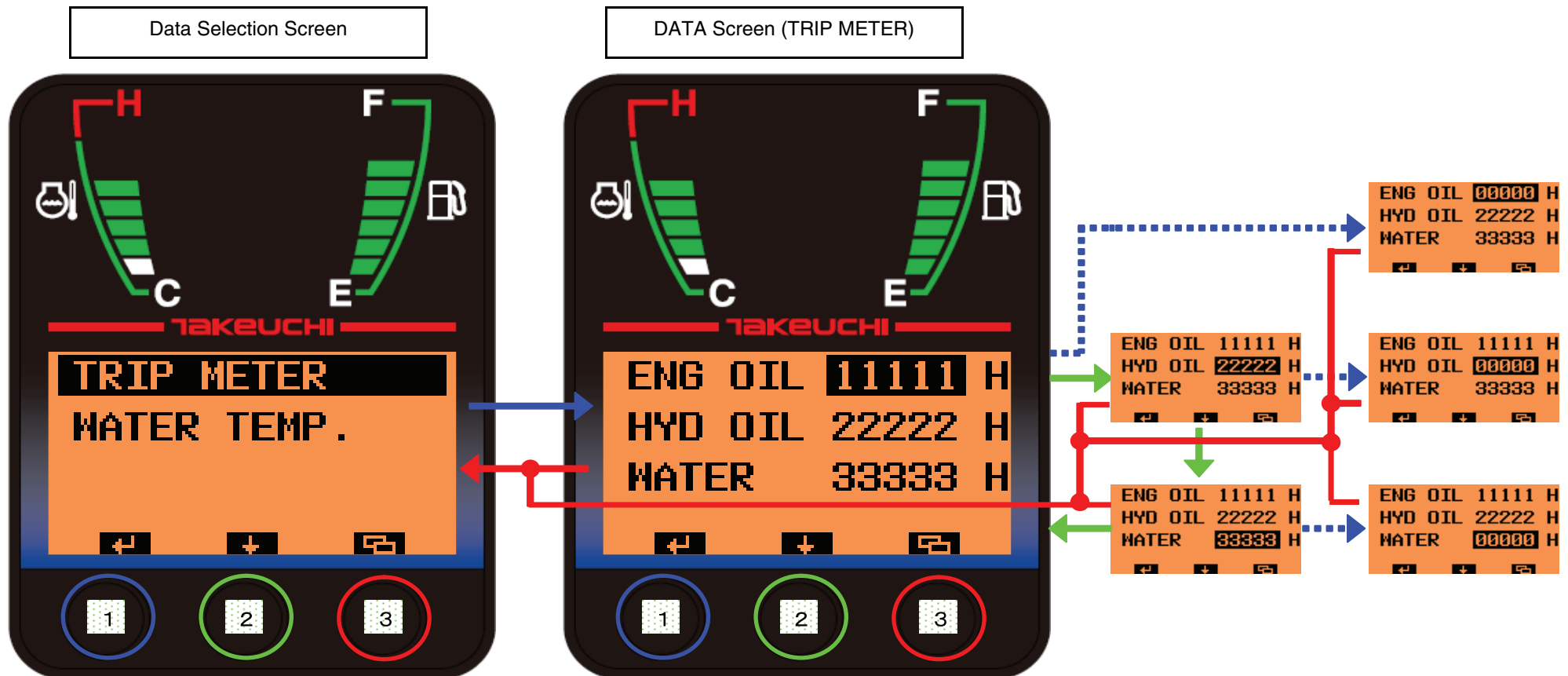
- Pressing Button [3] on the Normal screen for a short while moves the display to the Main Menu screen.
- Pressing Button [3] on the Main Menu screen for a short while moves the display to the Normal screen.
- Pressing Button [2] on the Main Menu screen for a short while moves the bar to the next option.
- Pressing Button [1] while [DATA] is highlighted moves the display to the Data Selection screen.
- Pressing Button [1] while [SETTING] is highlighted moves the display to the Settings Selection screen.

DATA SELECTION SCREEN



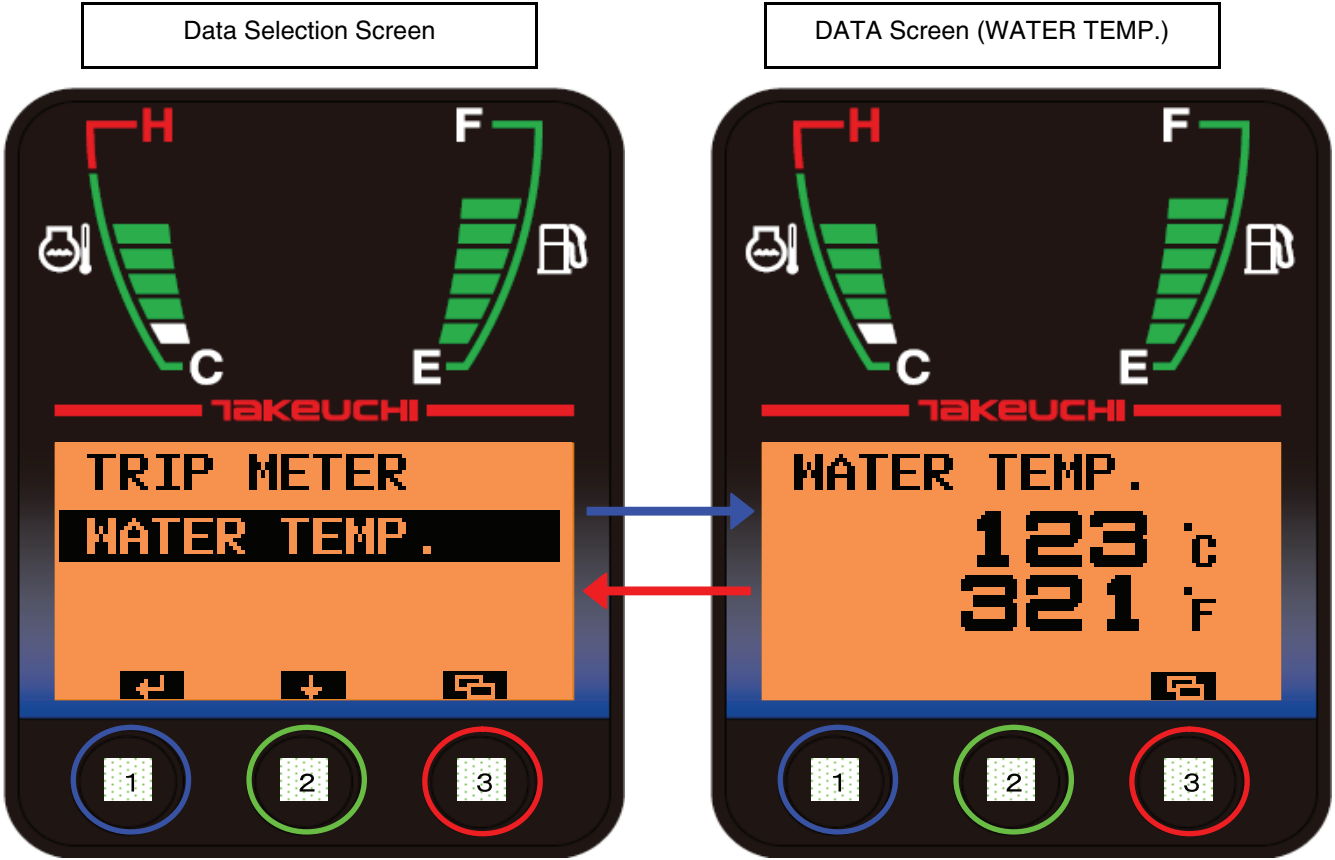
- Pressing Button [1] while [DATA] is highlighted moves the display to the Data Selection screen.
- Pressing Button [3] on the Data Selection screen for a short while moves the display to the Main Menu screen.
- Pressing Button [2] on the Data Selection screen for a short while moves the bar to the next option.
- Pressing Button [1] on the Data Selection screen for a short while moves the display to the Data screen for the highlighted option.

DATA SCREEN (TRIP METER)



- Pressing Button [1] for a short amount of time while [TRIP METER] is highlighted moves the display to the DATA screen (TRIP METER).
- The screen displays the trip meter values. (0 to 99999)
- If there is no CAN, the count for the trip meter begins when the input terminal voltage of the alternator rises above +3 V, as in the case of the hour meter.
- Pressing Button [2] on the DATA screen (TRIP METER) for a short while moves the bar to the next option. The setting value for the highlighted option flashes.
- Pressing and holding down Button [1] on the DATA screen (TRIP METER) for 5 seconds resets the value of the highlighted trip meter back to 0.
- The reset is confirmed when the value is reset. No particular changes occur with the displayed screen or position of the highlighting bar, which remain as is.
- The data is saved to the EEPROM when the value is reset. (Data is saved when ACC is turned OFF.)
- Pressing Button [3] on the DATA screen for a short while moves the display to the Data Selection screen.

DATA SCREEN (WATER TEMP.)

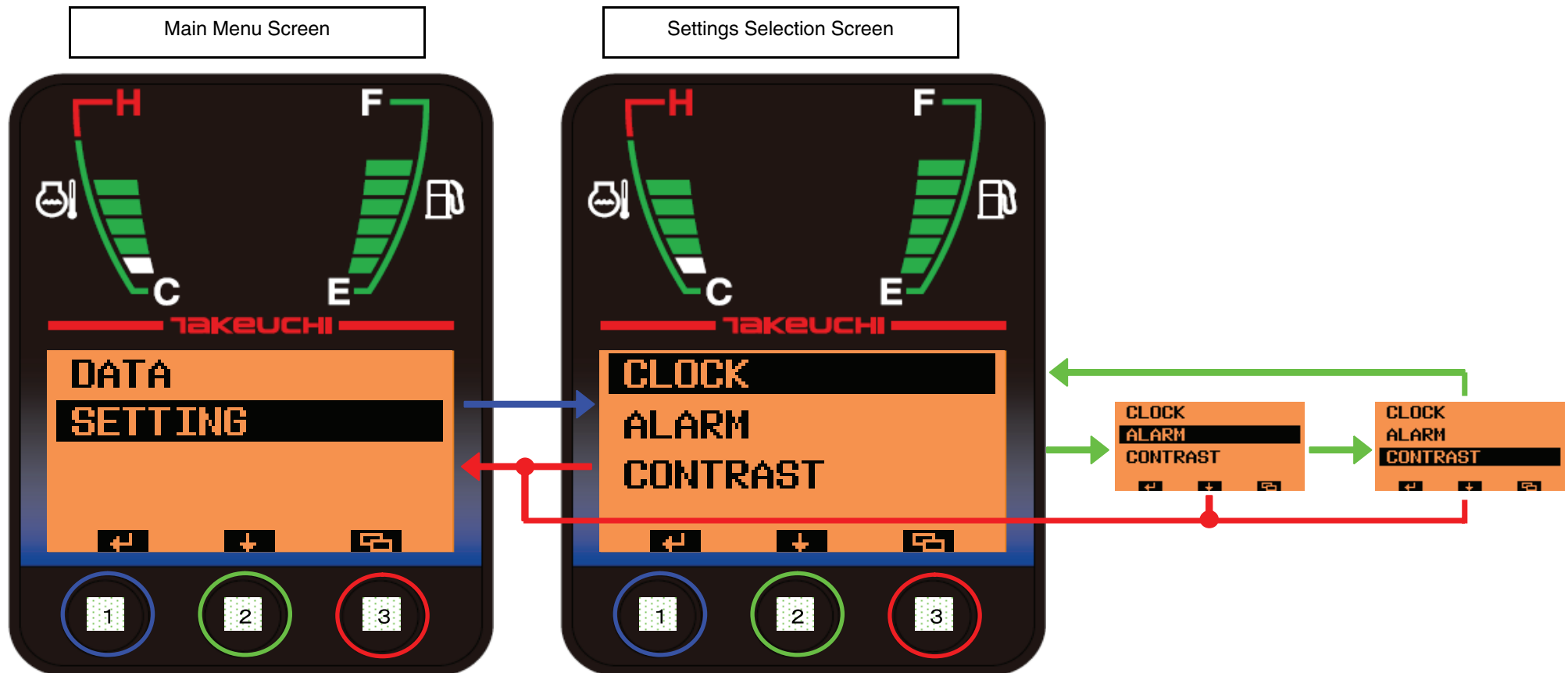


Resistance characteristics

Temp. [°C (°F)]	Resistance [kΩ]
-30 (-22)	25.4
-20 (-4)	15.04
-10 (14)	9.16
0 (32)	5.74
10 (50)	3.7
20 (68)	2.45
30 (86)	1.66
40 (104)	1.15
50 (122)	0.811
60 (140)	0.584
70 (158)	0.428
80 (176)	0.318
90 (194)	0.24
100 (212)	0.1836
110 (230)	0.1417
120 (248)	0.1108

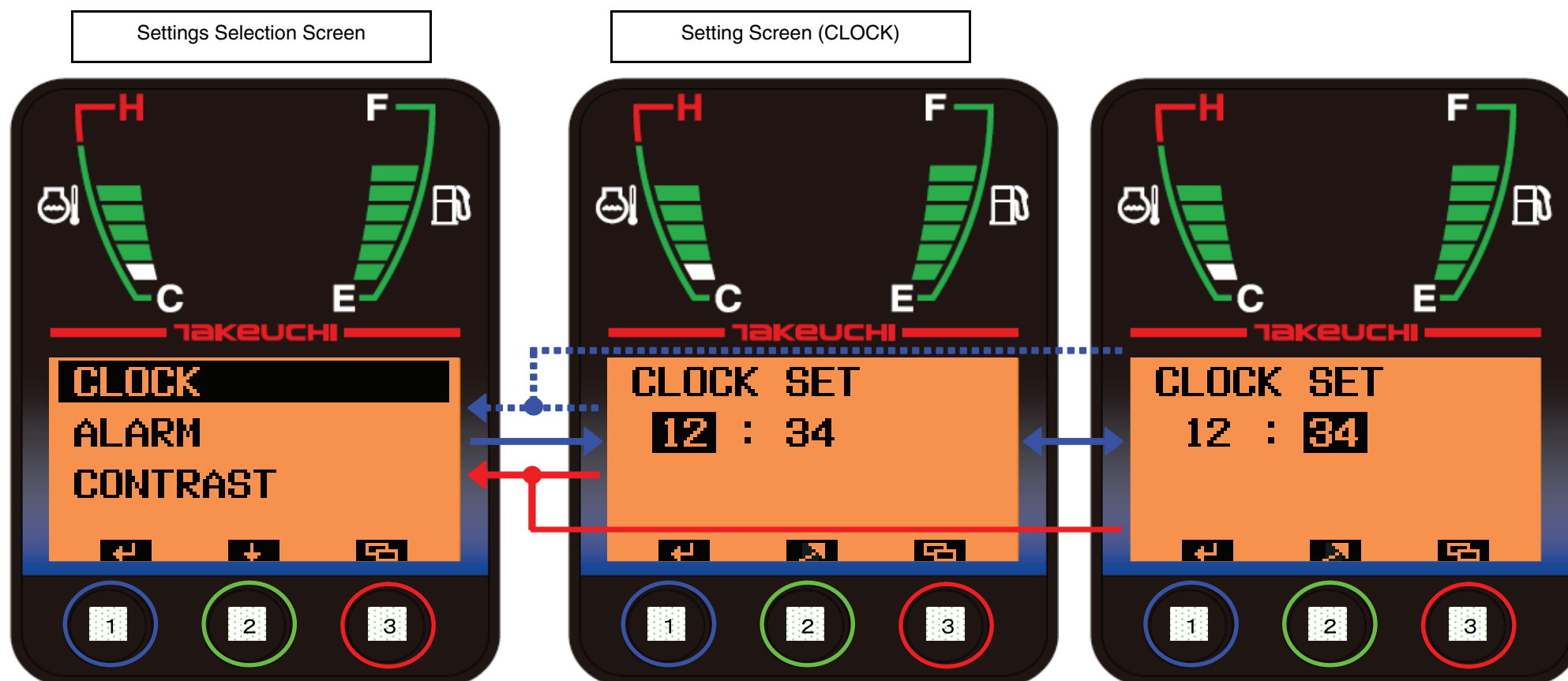
- Pressing Button [1] while [WATER TEMP.] is highlighted moves the display to the DATA screen (WATER TEMP.).
- Pressing Button [3] on the Data screen for a short while moves the display to the Data Selection screen.
- If there is no CAN present, the water temperature starts being calculated using resistance values arising when a voltage is applied.
- The water temperature is displayed in both degrees Celsius and degrees Fahrenheit.

SETTINGS SELECTION SCREEN



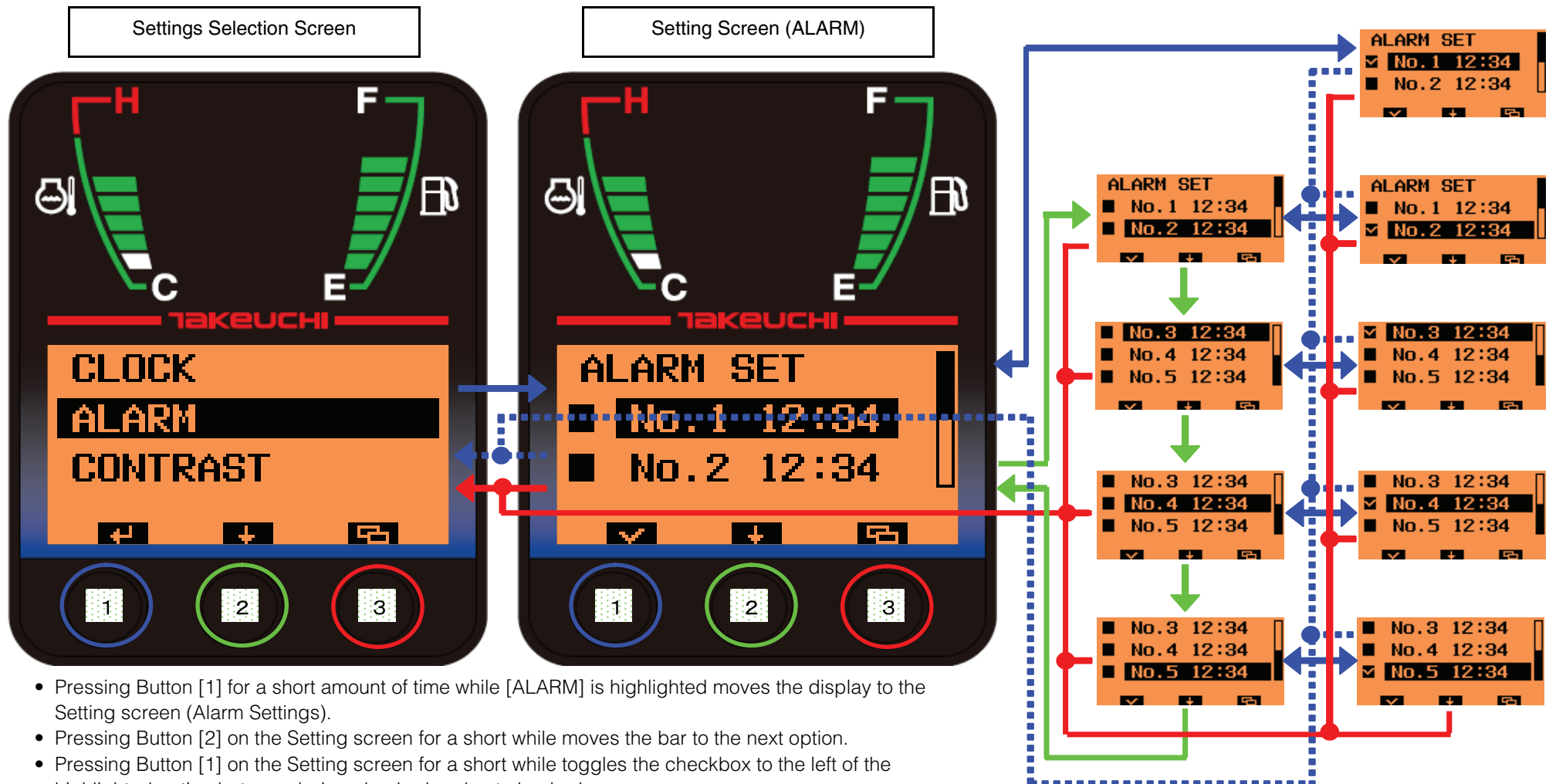
- Pressing Button [1] while [SETTING] is highlighted moves the display to the Settings Selection screen.
- Pressing Button [3] on the Settings Selection screen for a short while moves the display to the Main Menu screen.
- Pressing Button [2] on the Settings Selection screen for a short while moves the bar to the next option.
- Pressing Button [1] on the Data Selection screen for a short while moves the display to the Setting screen for the highlighted option.

SETTING SCREEN (CLOCK)



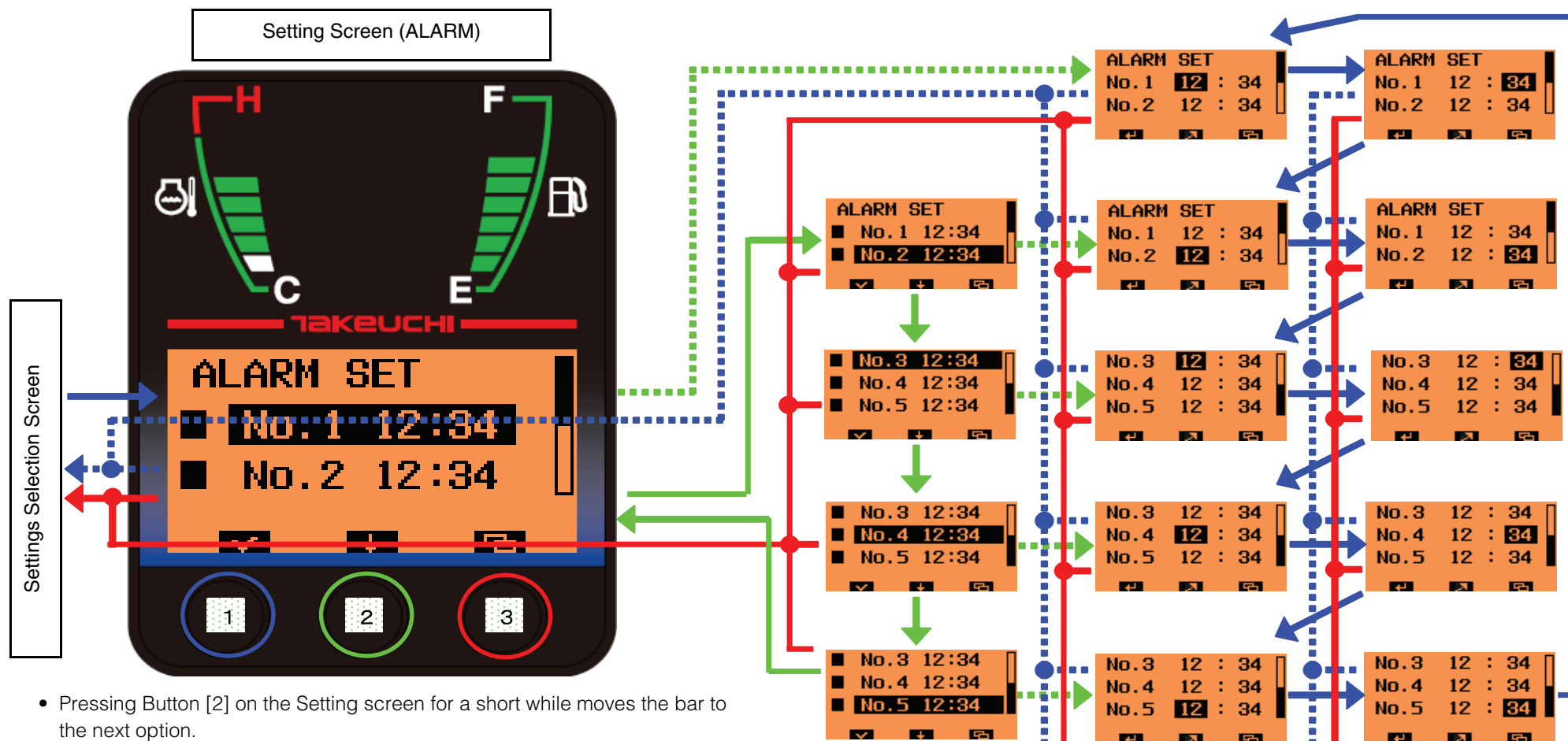
- Pressing Button [1] for a short amount of time while [CLOCK] is highlighted moves the display to the Setting screen (Clock Settings).
- Pressing Button [1] on the Setting screen for a short while moves the bar to the next option. The setting value for the highlighted option flashes. (Displaying in the normal color for 0.5 s and then in the inverted color for 0.5 s and so on.)
- Pressing Button [2] on the Setting screen for a short while causes the setting value of the highlighted option to increase. Pressing and holding down Button [2] for 1 second causes the setting value of the highlighted option to increase at high speed.
- Setting range for hours: 1 to 24 (Toggles from 1 to 2 to...24 and back to 1, where it starts start over). Setting range for minutes: 00 to 59 (Toggles from 00 to 01 to...59 and back to 00, and back to 1, where it starts over)
- Pressing Button [3] on the Setting screen for a short while moves the display to the Settings Selection screen. (Any changes made to the settings will be canceled.)
- Pressing and holding down Button [1] on the Setting screen for 2 seconds confirms the setting changes and moves the display to the Settings Selection screen.

SETTING SCREEN (ALARM)-1



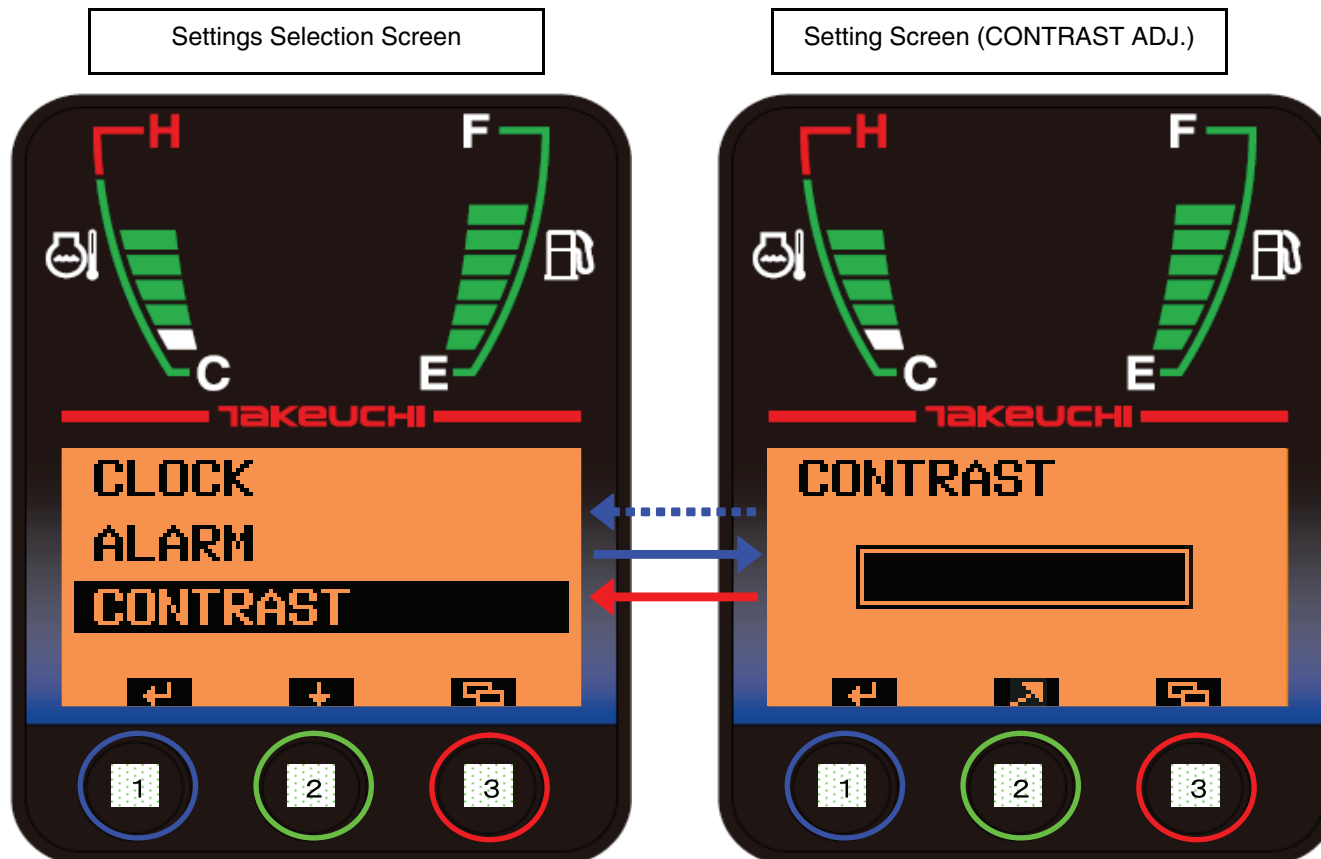
- Pressing Button [1] for a short amount of time while [ALARM] is highlighted moves the display to the Setting screen (Alarm Settings).
- Pressing Button [2] on the Setting screen for a short while moves the bar to the next option.
- Pressing Button [1] on the Setting screen for a short while toggles the checkbox to the left of the highlighted option between being checked and not checked.
- Pressing and holding down Button [1] on the Setting screen for 2 seconds completes configuration of the alarm and moves the display to the Settings Selection screen. The ALARM icon on the Normal screen (p. 1) turns ON.
- Pressing Button [3] on the Setting screen for a short while moves the display to the Settings Selection screen. (Any changes made to the settings will be canceled.)
- Once the alarm has been turned ON (the checkbox has been checked), it will remain enabled until the checkbox is unchecked.
- The alarm configuration settings (including the time) save to memory when ACC is turned OFF, and the stored settings are then loaded the next time that ACC is turned ON.

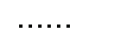
SETTING SCREEN (ALARM)-2



- Pressing Button [2] on the Setting screen for a short while moves the bar to the next option.
- Pressing and holding down Button [2] on the Setting screen for 3 seconds moves the bar to the ALARM TIME screen. Pressing Button [2] on that screen for a short while causes the numerical value for the highlighted option to increase. Pressing and holding down Button [2] for 1 second causes the setting value of the highlighted option to increase at high speed.
- Setting range for hours: 1 to 24 (Toggles from 1 to 2 to...24 and back to 1, where it starts start over). Setting range for minutes: 00 to 59 (Toggles from 00 to 01 to...59 and back to 00, and back to 1, where it starts over)
- Pressing Button [1] for a short while under the time settings option for ALARM moves the bar to the next option. The setting value for the highlighted option flashes.
- Pressing and holding down Button [1] for 2 seconds completes configuration of the alarm and moves the display to the Settings Selection screen.
- Pressing Button [3] on the Setting screen for a short while moves the display to the Settings Selection screen. (Any changes made to the settings will be canceled.)

SETTING SCREEN (CONTRAST ADJ.)



- Pressing Button [1] for a short amount of time while [CONTRAST] is highlighted moves the display to the Setting screen (CONTRAST ADJ.).
- Pressing Button [2] on the Setting screen for a short while increases the setting value of the highlighted option. Pressing and holding down Button [2] for 1 second causes the setting value of the highlighted option to increase at high speed.
-  → →  → →  →  → →  →
- The contrast changes as the setting value of the bar increases.
- The contrast can be set to any of the 40 different setting levels available.
- Pressing Button [3] on the Setting screen for a short while moves the display to the Settings Selection screen. (Any changes made to the settings will be canceled.)
- Pressing and holding down Button [1] on the Setting screen for 3 seconds confirms the setting changes and moves the display to the Settings Selection screen.
- The confirmed setting values are saved to the EEPROM when the ACC is turned OFF and enabled until the next time the contrast is adjusted.