Vol. No. T077E-01

TECHNICAL MANUAL

LX70-7
LX80-7

Applicable S/No. LX70-7:05101～
LX80-7:02101～

(L16-3 and LX80-7 with steel cab)

Unit: mm [in.]

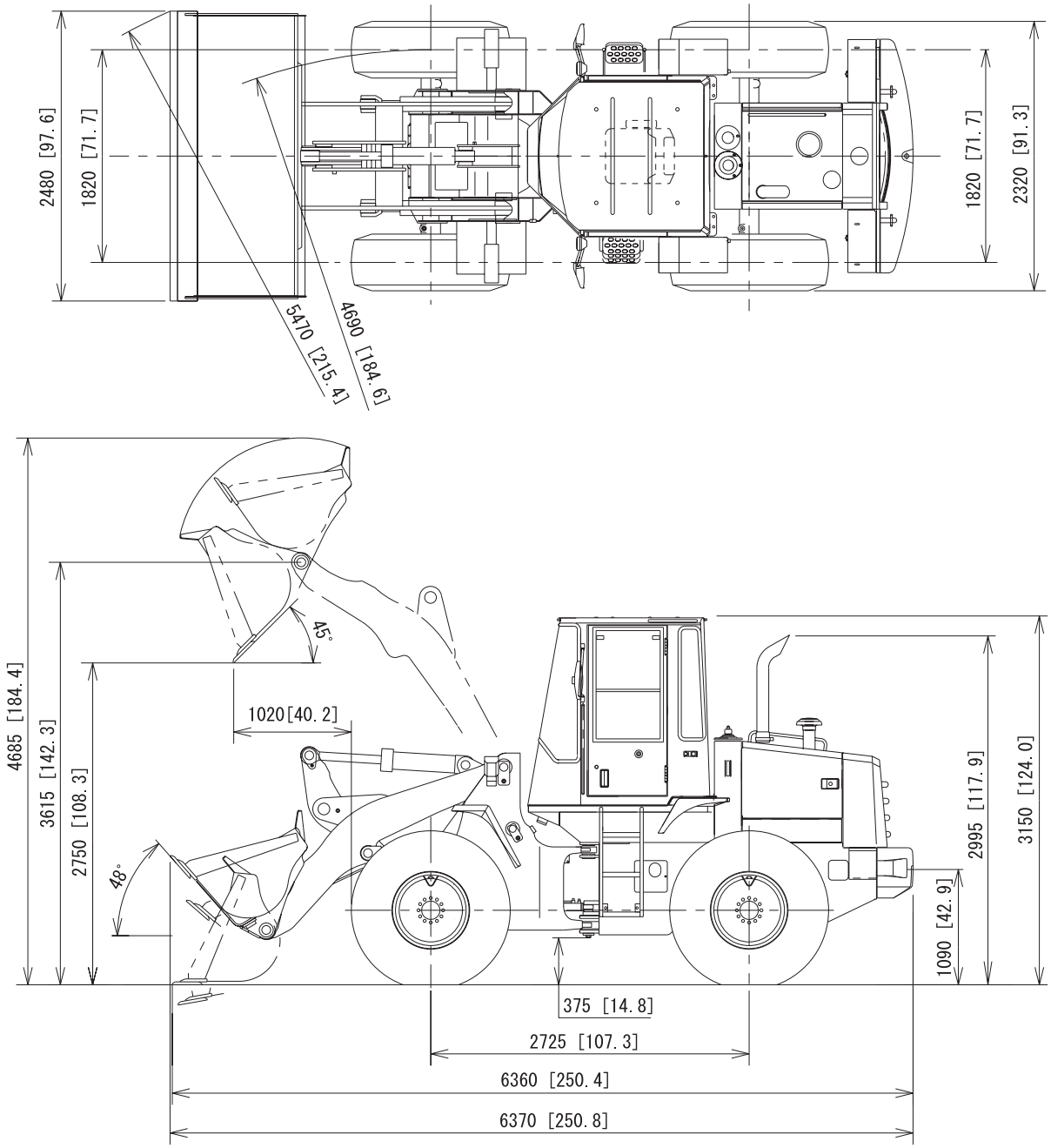
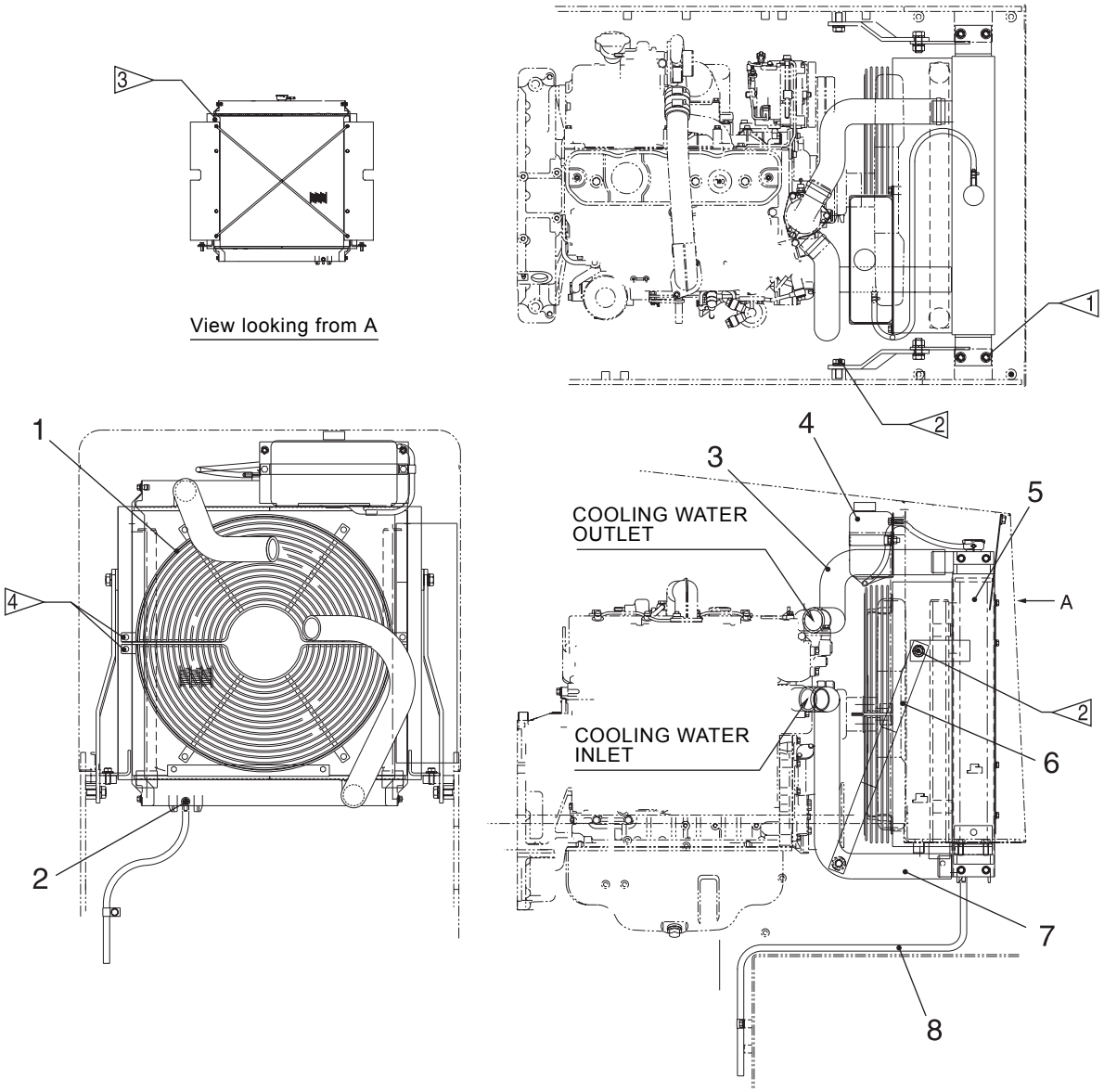


Fig. 0.3 Outer Views (L16-3 and LX80-7 with steel cab)



Note: ▷1 90 N-m {9 kgf-m} [65 lbf-ft]
▷2 230 N-m {24 kgf-m} [174 lbf-ft]
▷3 20 N-m {2 kgf-m} [15 lbf-ft]
▷4 40 N-m {4 kgf-m} [29 lbf-ft]

1. FAN GUARD
2. DRAIN COCK
3. UPPER HOSE, RADIATOR
4. RESERVOIR TANK
5. RADIATOR
6. PLATE
7. LOWER HOSE, RADIATOR
8. HOSE

Fig. 1.5 Engine Cooling System

2. POWER TRAIN

The power train consists of the HST unit, transmission, propeller shafts, front axle, rear axle, and tires.

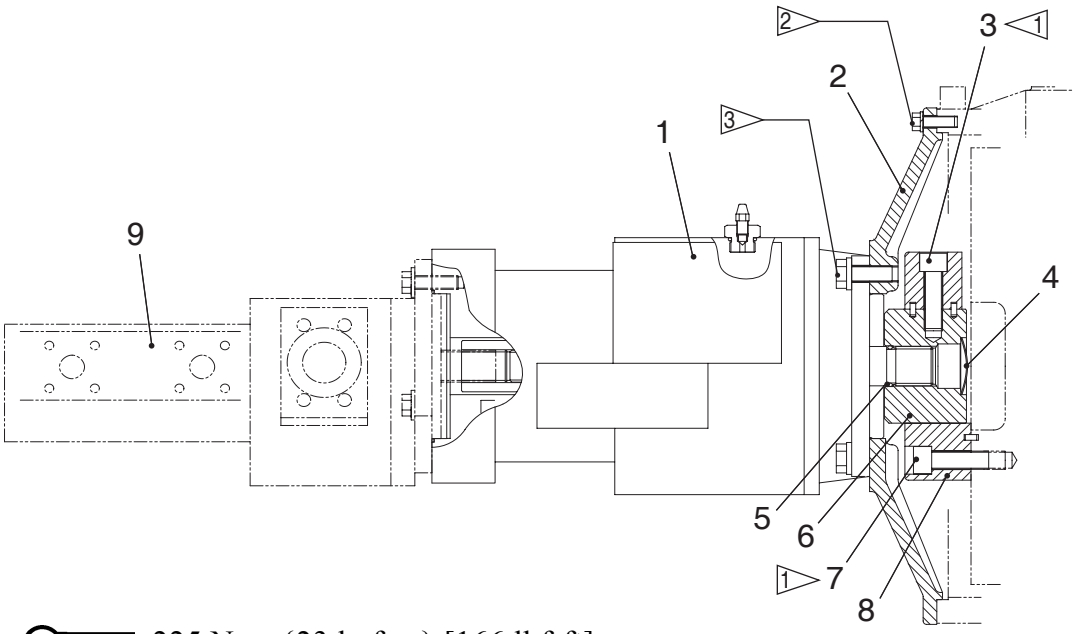
Power from the engine is transmitted through the HST unit to the transmission where the rotational speed is converted, and delivered, passing through the propeller shafts, to the front and rear axles.

The power transmitted to each axle is further sent through the wheel to the tire so that the loader moves.

2.2 HST PUMP

	L13-3, LX70-7	L16-3, LX80-7
Model	PV22-741	PV22-742
Type	Viable delivery piston	←
Driving	Directly connected to engine crankshaft	←
Discharge	0 to 69.8 cc/rev	←
Max. working pressure	38.7 MPa {395 kgf/ cm^2} [5618 psi]	39.2 MPa {400 kgf/ cm^2} [5689 psi]
(Relief valve pressure) [Pressure differential]	39.2 MPa {400 kgf/ cm^2} [5689 psi]	←
Control	Automotive regulator control	←
Weight	93 kg [205 lbs]	←
HST charging pump	Gear type	←

Note: For the specifications of the HST charging pump, refer to "6.2 PUMP."



Note: 1 225 N-m {23 kgf-m} [166 lbf-ft]
2 50 N-m {5 kgf-m} [36 lbf-ft]
3 137 N-m {14 kgf-m} [101 lbf-ft]

1. HST PUMP
2. FLYWHEEL COVER
3. SOCKET BOLT
4. PLUG
5. "O"-RING
6. HUB
7. BOLT
8. COUPLING
9. (HST CHARGING PUMP)

Fig. 2.13 HST Pump

⑦ The pump's torque is controlled at a value slightly higher than the rated torque of the engine by the return moment mechanism (see below) of the HST pump.

⑧ When a load greater than the engine torque acts on the HST pump, the engine speed slightly drops. Since the regulator controls the tilt-rolling operation of the pump in proportion to the engine speed, the regulator quickly reduces the tilt-rolling of the pump to match the pump's input torque to the engine's rated torque (because a better operating feel is obtained by controlling the tilt-rolling operation of the pump when the engine speed drops slightly).

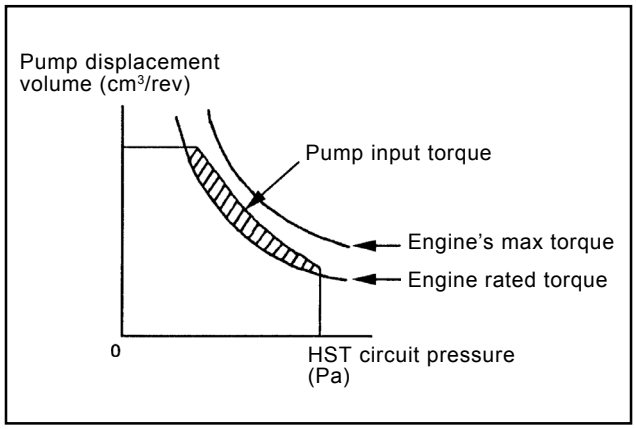


Fig. 2.23

⑨ When the load on the main steering pump increases enough to make the engine torque in an overloaded state, the engine speed drops. But, as the engine speed drops, the tilt-rolling operation of the HST pump is reduced by the regulator so that the HST pump's input torque becomes smaller. When the sum of the HST pump's input torque and the main steering pump's input torque matches the engine rated torque, the engine speed stops dropping to prevent the engine from stalling (due to the anti-stall function).

Return moment mechanism

① The pressure oil is delivered through the valve plate to the plunger in areas α and β with a condition of $\alpha < \beta$.

② When a load is applied on the HST motor, the oil pressure in the circuit leading from the HST pump to the HST motor rises to act on the inside of the plunger of the HST pump.

③ Since there is a difference between the area α and area β at the high-pressure side port of the valve plate, the pressure of the oil which acts on the plunger through the area β is greater than the pressure of the oil which acts on the plunger through the area α. The force of the area differential ($\beta - \alpha$) x circuit pressure pushes the bottom of the swash plate as a moment using the center of the tilt-rolling as an axis, thus moving the swash plate to the neutral direction (return moment).

④ The movement (angle) of the swash plate is proportional to the pressure of the HST circuit (between the HST pump and the HST motor). When the circuit pressure is low, the angle is also small. As the circuit pressure rises, the angle also becomes greater.

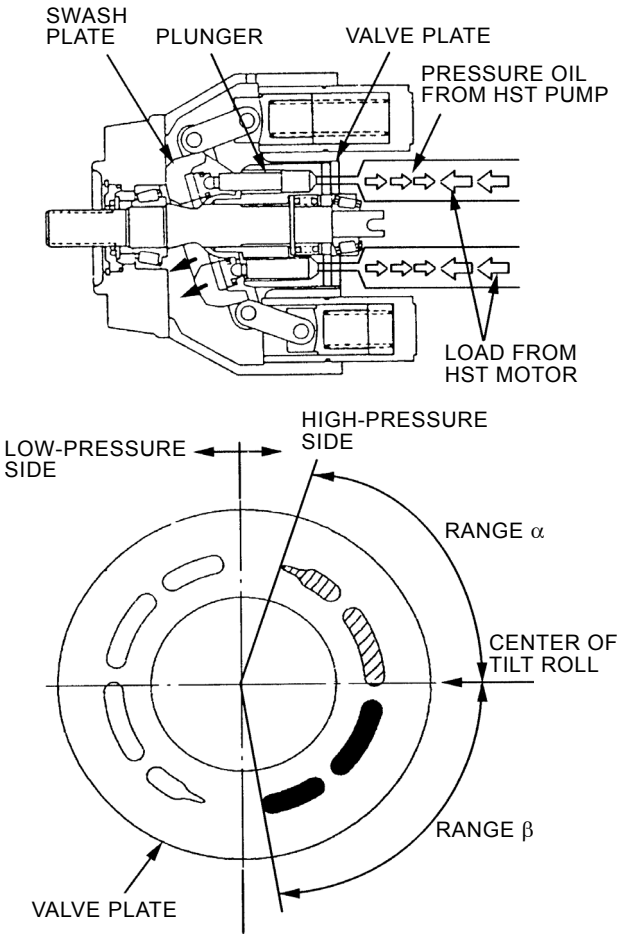
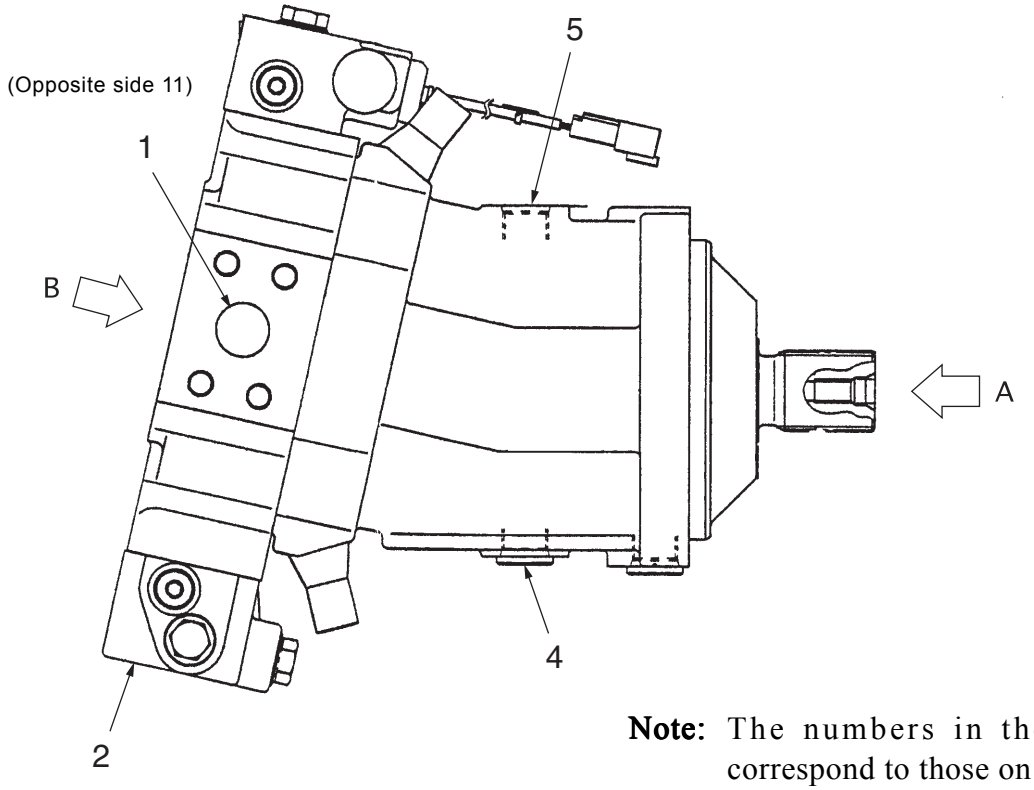


Fig. 2.24

(HST motor)



Note: The numbers in the figures correspond to those on page 52.

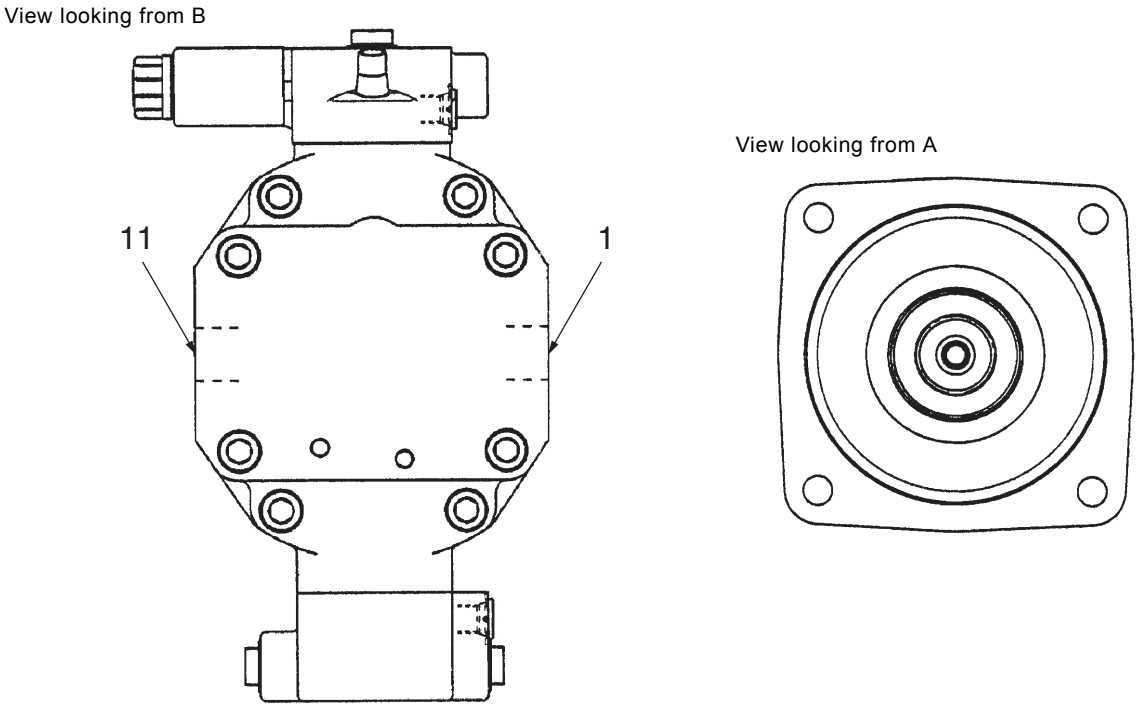
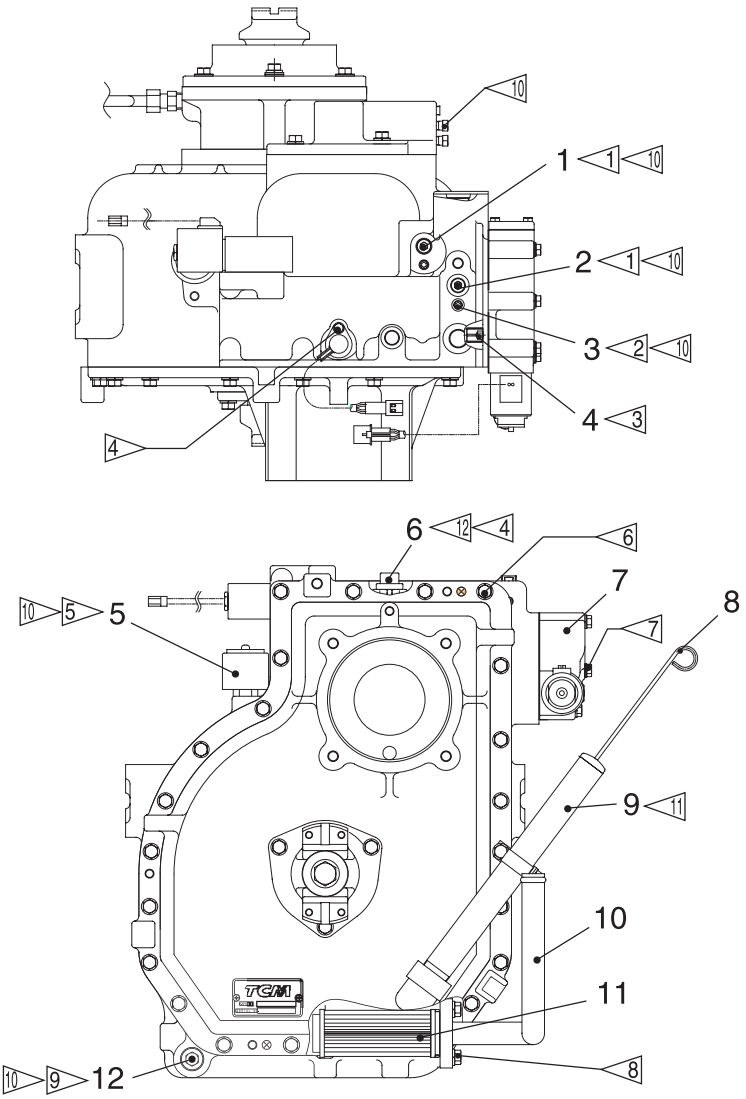


Fig. 2.36 HST Motor (2)



1. PLUG
2. PLUG
3. PLUG
4. CHOKE
5. BREATHER
6. SPEED SENSOR
7. CONTROL VALVE
8. OIL LEVEL DIPSTICK
9. PIPE
10. SUCTION TUBE
11. STRAINER
12. PLUG

Note:
1. 25.4 ± 3.9 N-m {3.0 ± 0.4 kgf-m} [21.7 ± 2.9 lbf-ft]
2. 9.8 ± 2.0 N-m {1.0 ± 0.2 kgf-m} [7.2 ± 1.4 lbf-ft]
3. 15 to 20 N-m {1.5 to 2.0 kgf-m} [10.8 to 14.5 lbf-ft]
4. 10.6 N-m {1.08 kgf-m} [7.8 lbf-ft]
5. 14.7 ± 2.0 N-m {1.5 ± 0.2 kgf-m} [10.8 ± 1.4 lbf-ft]
6. 52.1 N-m {5.32 kgf-m} [37.8 lbf-ft]
7. 26.1 N-m {2.66 kgf-m} [19.2 lbf-ft]
8. 18.8 N-m {1.92 kgf-m} [13.9 lbf-ft]
9. 58 to 74 N-m {5.9 to 7.5 kgf-m} [42.7 to 54.2 lbf-ft]
10. Threaded area: LOCTITE#572
11. Threaded area: Degrease and then apply LOCTITE#271
12. On L13-3 or LX70-7, install the speed sensor directly without using shims.
    On L16-3 or LX80-7, install the speed sensor using two shims.

Fig. 2.46 Transmission (1)

2.4.4 QUICK SHIFT SWITCH (QSS)

When operating the truck, the operator's hands are usually full, with his left hand grabbing the steering wheel and his right hand controlling the load handling lever. The quick shift switch, located on the grip of the load handling lever, allows the operator to switch over the loader's traveling speed modes (Hi and Lo) easily and smoothly at a touch of the switch.

Operation

① The controller always detects the loader's traveling speed through the transmission rotation sensor as well as the On-Off status of the QSS and Hi-Lo switch.

② When the following conditions are satisfied, you can switch over the transmission speed mode from Hi to Lo using the QSS.

- The Hi-Lo switch on the dashboard: Hi position
- The loader's traveling speed: less than 5 km/h [3.1 mph]
- QSS: Pressed. (The earth circuit from the controller to the QSS is completed so that the controller recognizes the depression of the QSS as the signal.) (The QSS is a momentary type switch.)
  The controller allows the current from the #9 fuse to flow to the Hi-Lo selector solenoid valve to turn it on, thus switching over the transmission to Lo.

Note: When the loader's traveling speed is more than 5 km/h [3.1 mph], you cannot switch over the transmission speed mode from Hi to Lo. Even if the QSS signal is sent to the controller, the controller judges that the condition for mode change is not satisfied and thus disables the signal from the QSS.

③ When the following conditions are satisfied, you can switch over the transmission speed mode from Lo to Hi using the QSS.

- The Hi-Lo switch on the dashboard: Hi position
- The loader's traveling speed: less than maximum speed (12.5 km/h) [7.8 mph] at Lo range
- QSS: Pressed. (The earth circuit from the controller to the QSS is completed so that the controller recognizes the depression of the QSS as the signal.) (The QSS is a momentary type switch.)
  The controller shut off the electric current flowing to the Hi-Lo solenoid valve to turn, the Hi-Lo solenoid valve off.

④ The QSS function is canceled when the engine is shut off. If the engine is shut off after the transmission is switched over to Lo by the QSS function, the transmission speed mode is put in Hi when the engine is restarted.

Note: The wiring for selection of the transmission controller models is connected only for the L16-3 or LX80-7.

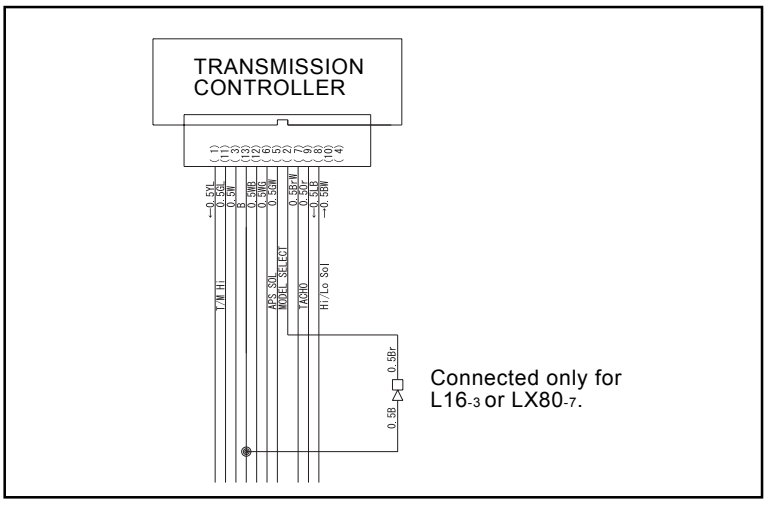
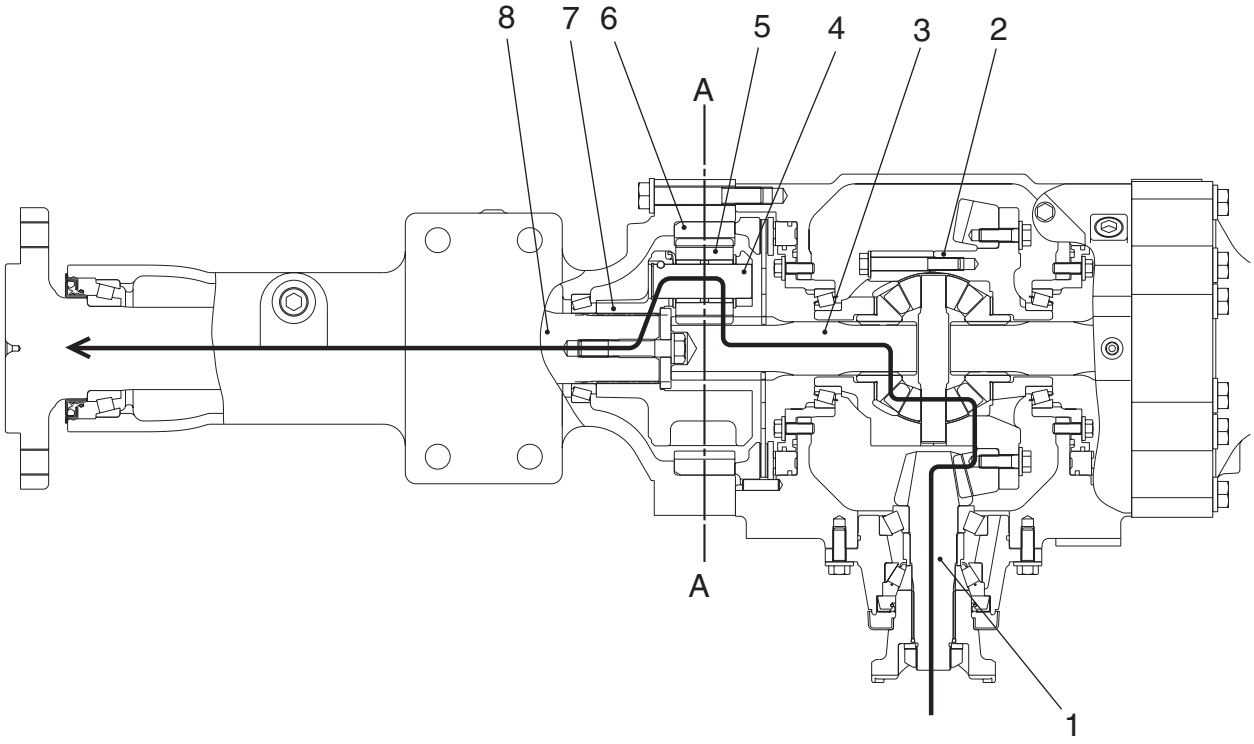


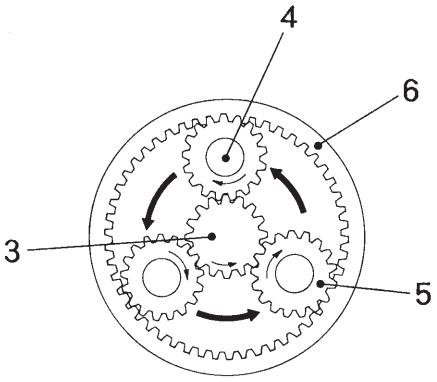
Fig. 2.58

2.6.3 FINAL REDUCTION GEAR

The final reduction gear assembly is a planetary type and provides final speed reduction of the power from the engine in the power transmission line.

The power from the differential gear rotates the shaft and the three planet gears inside the ring gear. The rotation of the planet gears is transmitted to the planet carrier and then to the axle shaft.





Sectional view A-A
(Planet gear operation)

: Power flow

1. DRIVE PINION
2. DIFFERENTIAL
3. GEAR & SHAFT ASSEMBLY
4. PLANET SHAFT
5. PLANET GEAR
6. RING GEAR (FIXED)
7. PLANET CARRIER
8. AXLE SHAFT

Fig. 2.67 Power Flow

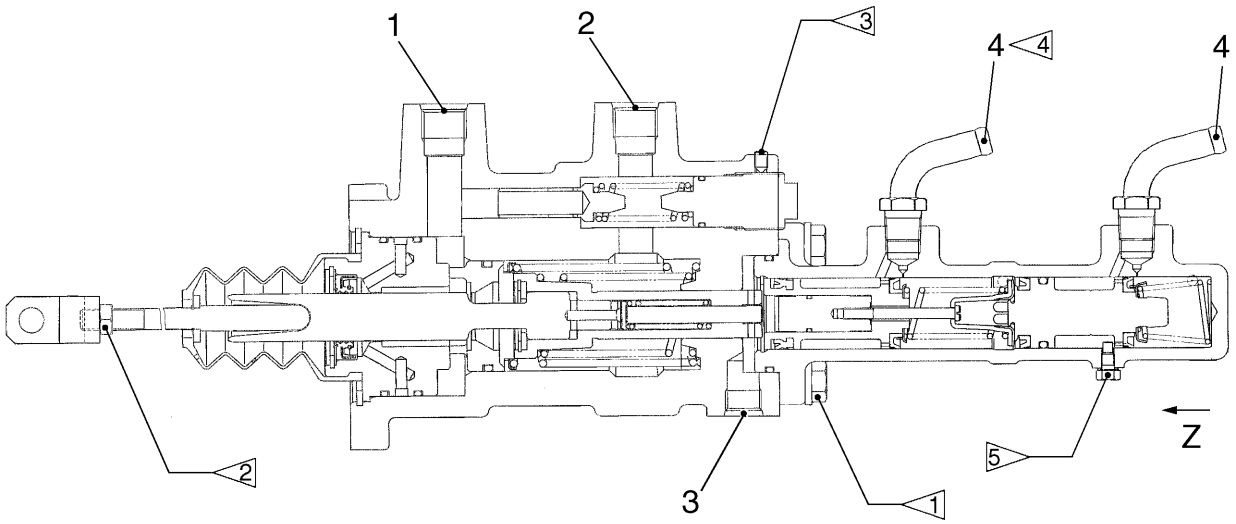
3.1.2 BRAKE VALVE

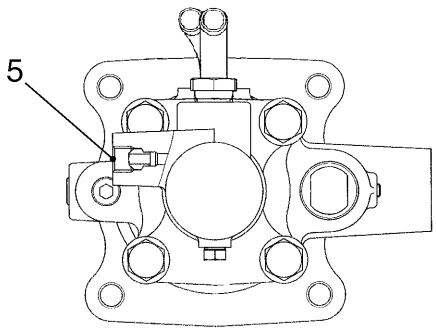
The brake valve is an oil-over booster which boosts the master cylinder oil pressure in proportion to the brake pedal effort, using the oil discharged from the oil pump as a boosting source.

The brake valve, consisting of a booster (power cylinder) and a tandem master cylinder, operates as follows: When the brake pedal is pressed, the spool connected to the brake pedal narrows the variable orifice to deliver boosted oil pressure to the power piston of the booster, thus activating the tandem master cylinder.

The feel of operation is obtained by a combination of the pedal stroke following the stroke of the tandem master cylinder piston and the reaction force produced by feeding back the brake oil pressure generated in the tandem master cylinder from the reaction piston. This provides fine brake control.

Even if the pump fails to operate normally for any reason, the brake pedal effort is applied directly to the tandem master cylinder to achieve the braking force in proportion to the pedal effort (fail-safe mechanism).





View looking from Z

Note: 1 29.4 to 34.3 N-m {3.0 to 3.5 kgf-m} [21.7 to 25.3 lbf-ft]

2 24.5 to 37.3 N-m {2.5 to 3.8 kgf-m} [18.1 to 27.5 lbf-ft]

3 9.8 to 14.7 N-m {1.0 to 1.5 kgf-m} [7.2 to 10.8 lbf-ft]

4 13.7 to 39.2 N-m {1.4 to 4.0 kgf-m} [10.1 to 28.9 lbf-ft]

Threaded area: LOCTITE#262

5 8.82 to 12.7 N-m {0.9 to 1.3 kgf-m} [6.5 to 9.4 lbf-ft]

1. INLET PORT
2. OUTLET PORT
3. DRAIN PORT
4. TANK PORT
5. BRAKE PORT (2)

Fig. 3.5 Brake Valve

(1) Parking brake switch in OFF

After the engine has been started:

1. When the parking brake switch is turned to the OFF (1) position, the parking brake relay (2) is activated to allow the power from the battery relay to flow to the parking brake relay (1), thus actuating the parking brake solenoid valve to release the parking brake.
2. The parking brake relay (2) holds the parking brake release power.

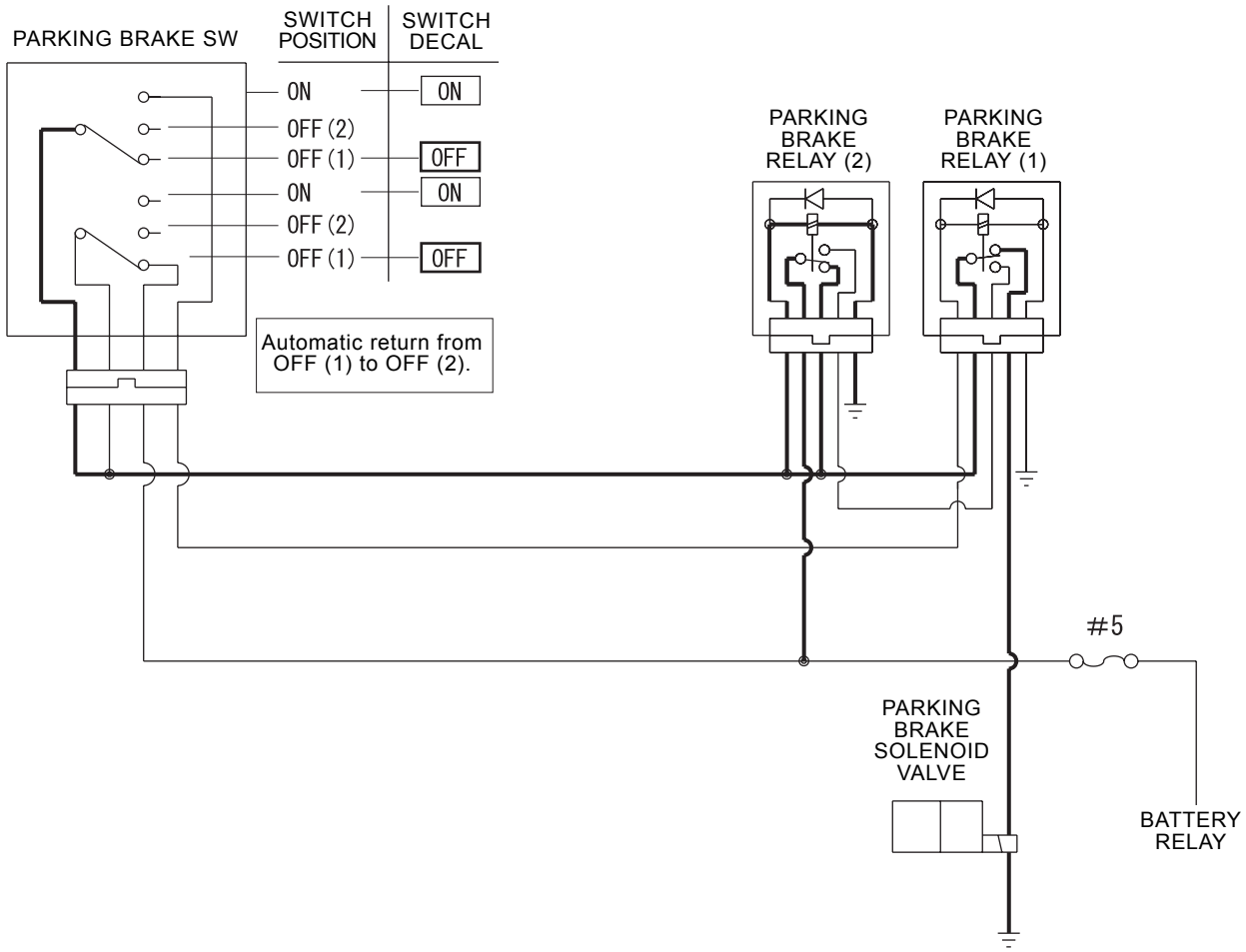


Fig. 3.16 Parking Brake in OFF

ORBITROL OPERATION

(1) Steering Wheel in Neutral

The oil from P port flows into the cavity between the spool (2) and drive shaft (3) through the small openings of the sleeve (1) and the spool (2). The oil in the cavity flows out from the T port through the upper part of the drive shaft, and notch groove of the spool and sleeve. The R and L ports (cylinder ports) are closed by the spool.

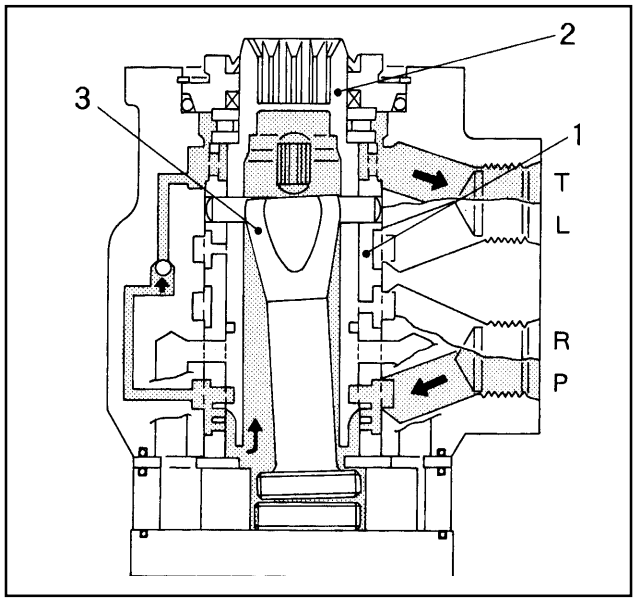


Fig. 4.7 Neutral State

(2) Turning Steering Wheel Counterclockwise

When the steering wheel is turned, counterclockwise, the spool (2) is rotated with respect to the sleeve (1) to close the neutral flow passage (small openings).

The oil from the P port passes through the changed over sleeve openings, spool groove and sleeve openings and is sent to the rotor set section through the oil passage of the housing (4) to rotate the rotor (5).

The oil discharged by rotation of the rotor is sent to the control valve section and then flows from the L port into the steering cylinder through the sleeve and spool.

The oil discharged from the steering cylinder returns to the R port and flows out from the T port through the sleeve and spool.

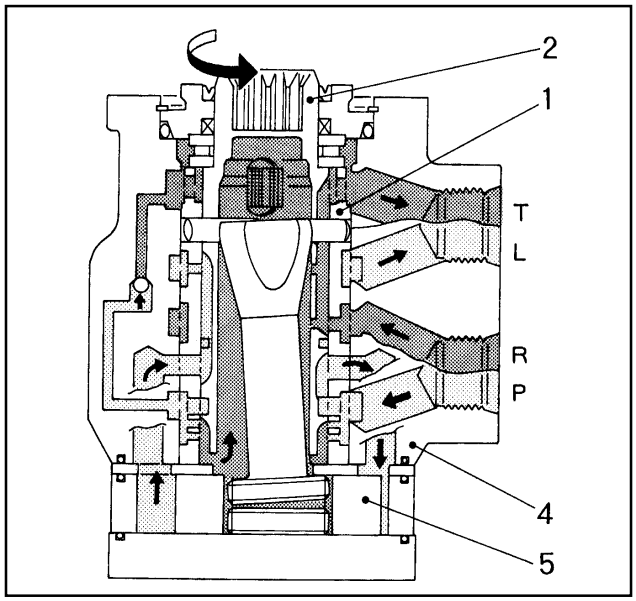


Fig. 4.8 Counterclockwise Rotation

Note: When the rotor rotates, the drive shaft and the sleeve rotate together. Namely, if the steering wheel is turned to rotate the spool, the sleeve is also rotated equally, thereby nullifying spool displacement. Consequently, the rotor is rotated, corresponding to the rotation angle of the steering wheel, and the oil displaced by the rotor is sent to the steering cylinder. In actual steering the following motion of rotor to steering wheel is executed continuously.

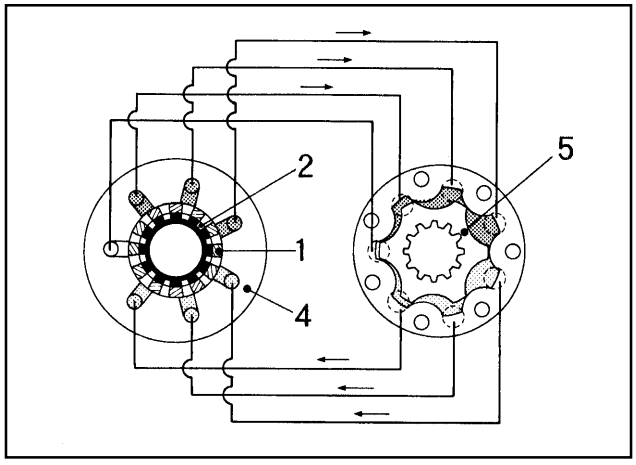


Fig. 4.9 Rotor Set Section in Operation

5. FRAME AND COCKPIT

5.1 FRAME

The frame is a steel-plate welded type and divided into two parts: front and rear frames. The cockpit and operator's seat are mounted on the rear frame.

⚠ Do not try to modify the ROPS (Roll-over protection structure), if mounted, without prior permission from the manufacturer. If the ROPS should get damaged or deformed due to turning over or collision, it is advisable to replace it with a new one, because a damaged or deformed ROPS has a low structural strength.

6.2 PUMP

	L13-3, LX70-7	L16-3, LX80-7
Main pump		
Model	56 · 20 · 11R680	60 · 20 · 11R681
Type	Gear type	←
Drive	(installed on HST pump)	←
Discharge	122 L [28.57 U.S. gal.]/min (2300 rpm, 1.47 MPa {15 kgf/ cm^2} [213 psi])	141 L [37.25 U.S. gal.]/min (2450 rpm, 1.47 MPa {15 kgf/ cm^2} [213 psi])
Weight	19.5 kg [43.00 lbs] (including HST charging pump and T/M charging pump)	20.8 kg [45.86 lbs] (including HST charging pump and T/M charging pump)
Steering pump	Used in common with main pump	←
HST charging pump		
Type	Gear type	←
Drive	Connected to the rear of main pump	←
Discharge	44 L [11.62 U.S. gal.]/min (2300 rpm, 3.9 MPa {40 kgf/ cm^2} [569 psi])	47 L [12.42 U.S. gal.]/min (2450 rpm, 3.9 MPa {40 kgf/ cm^2} [569 psi])
Transmission charging pump (Brake assist)		
Type	Gear type	←
Drive	Connected to the rear of HST charging pump	←
Discharge	24 L [6.34 U.S. gal.]/min (2300 rpm, 1.77 MPa {18 kgf/ cm^2} [256 psi])	26 L [6.87 U.S. gal.]/min (2450 rpm, 1.77 MPa {18 kgf/ cm^2} [256 psi])

4. Detent operation

(1) Boom side

① When the control lever is pushed down fully to the "Float" position, the boom spool (1) is pulled out fully. Due to this, the detent pin (2) fitted to the spool end is also pulled out, and the detent balls (3) fall into the groove of detent sleeve (4).

② Since the detent balls are pushed by the detent spring (5), the boom spool holds its position, and the detent becomes operative.

③ To release the detent, pull the control lever to disengage the detent ball.

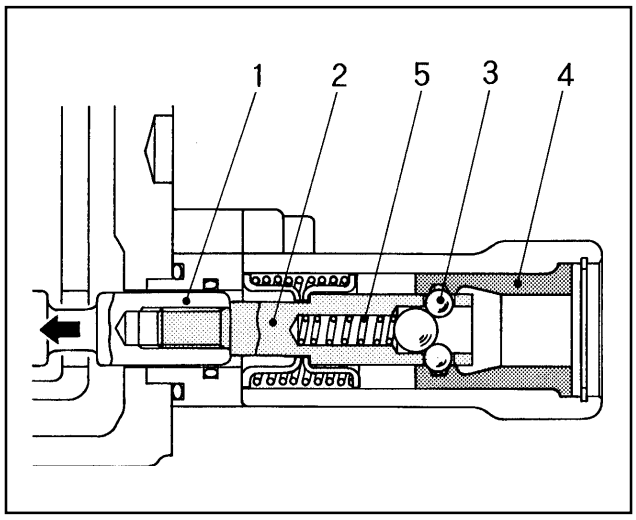


Fig. 6.11 Boom Side Detent in Operation

(2) Bucket Side

① The electromagnetic detent is used at the bucket side. The electrical circuit is connected from the battery to the proximity switch of the bucket leveler through the coil assembly of the bucket spool section.

② When the bucket is tilted forward, the proximity switch is kept closed so that the coil assembly (4) is excited.

③ When the control lever is pulled out fully to the "Roll-back" position, the bucket spool (1) is fully pushed in, and the pin (2) fitted to the spool end is also pushed in, so that the plate (3) contacts the coil (4). As a result the bucket spool holds its position, and the detent becomes operative.

④ To release the detent, open the proximity switch to de-energize the coil assembly or operate the control lever by hand.

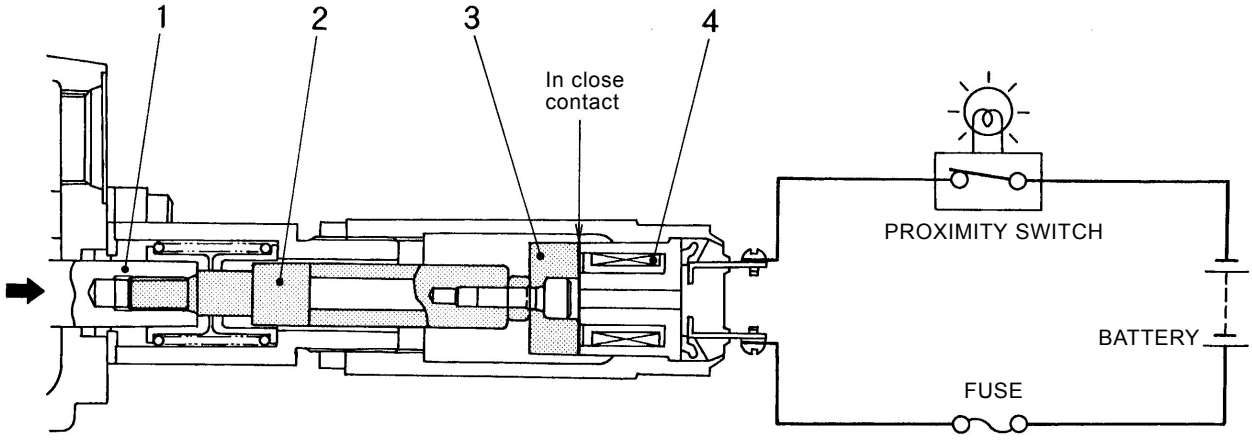
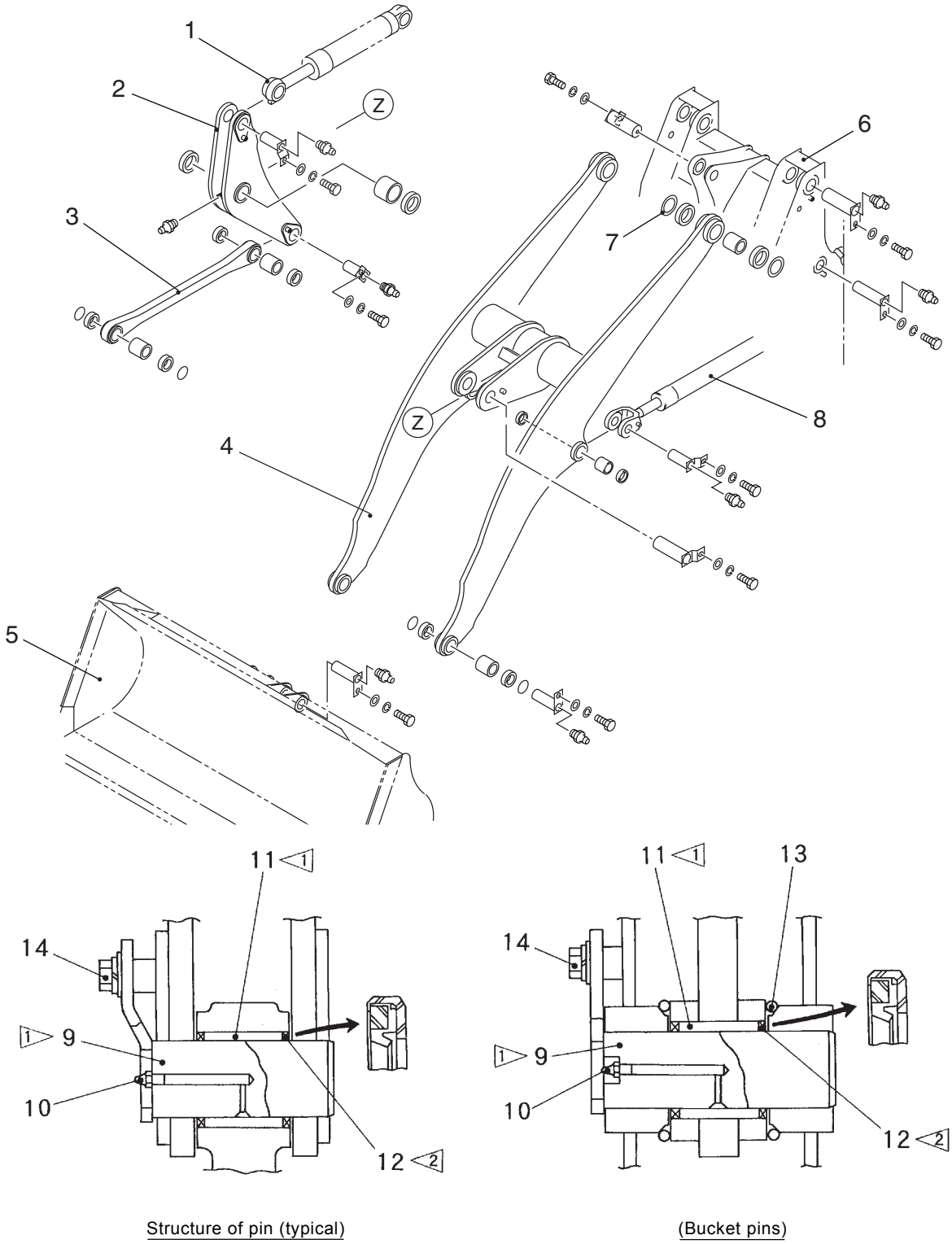


Fig. 6.12 Bucket Side Detent in Operation



Structure of pin (typical)

(Bucket pins)

Note: 1 All pins, bushings and bosses: Grease (apply before installing pins)

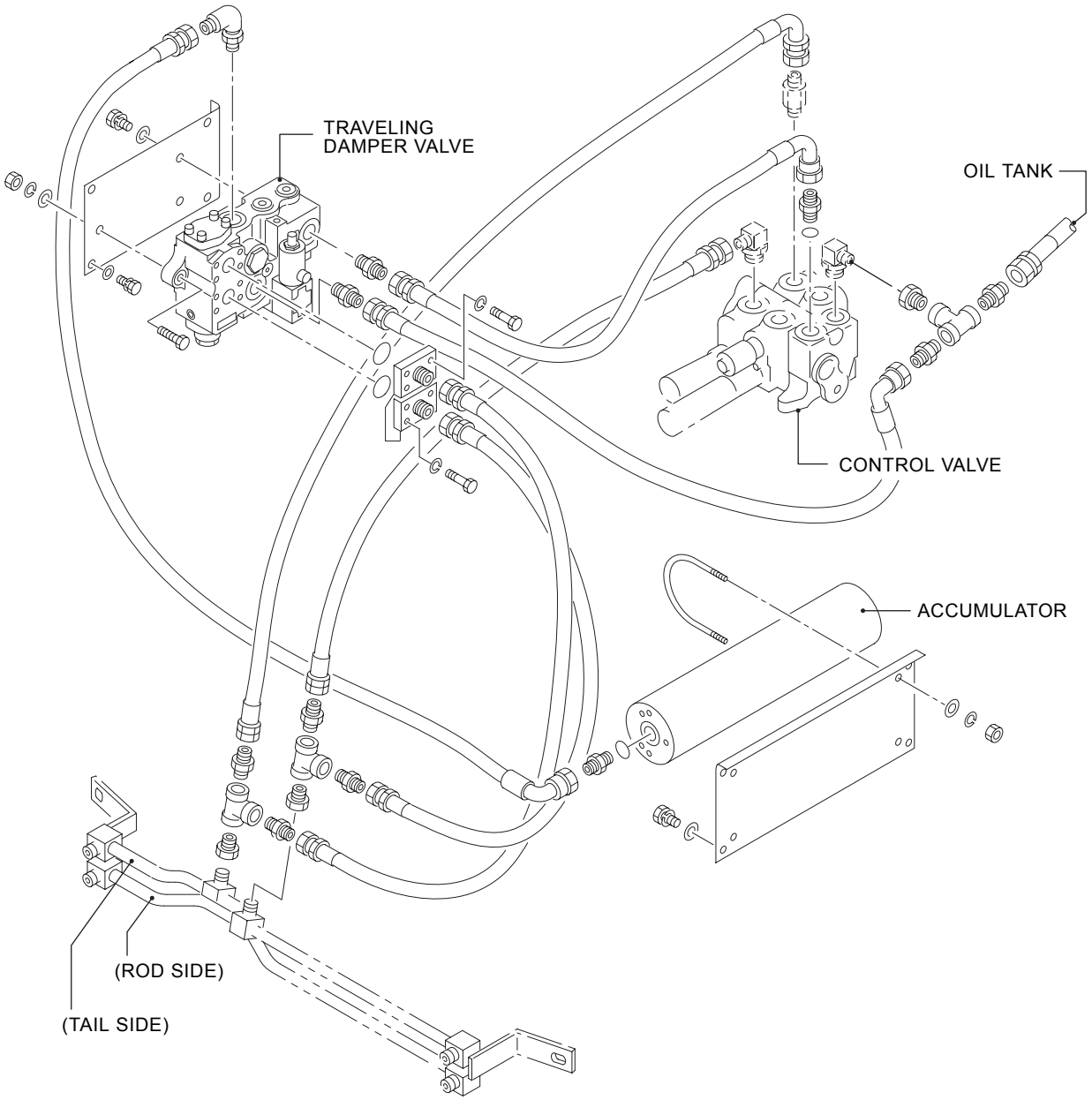
2 Dust seals must be installed with lip facing outward.

Fig. 7.2 Boom, Bellcrank, and Bucket (1)

7.3 ANTI-PITCHING SYSTEM (APS) [OPTION]

When traveling at high speed on bad roads, pitching or bouncing might occur and usually there is need to slow down.

The APS suppresses pitching and bouncing of the loader body to make it possible to travel in a safe and stable manner.



Note: The sketch shows the APS for the L13-3, LX70-7. The APS for the L16-3, LX80-7 is the same as above.

Fig. 7.11 Anti-pitching System (APS)