TTLA-0488-LX

HITACHI

Training Text

LX130-7/160-7/190-7/230-7

Operational Principle

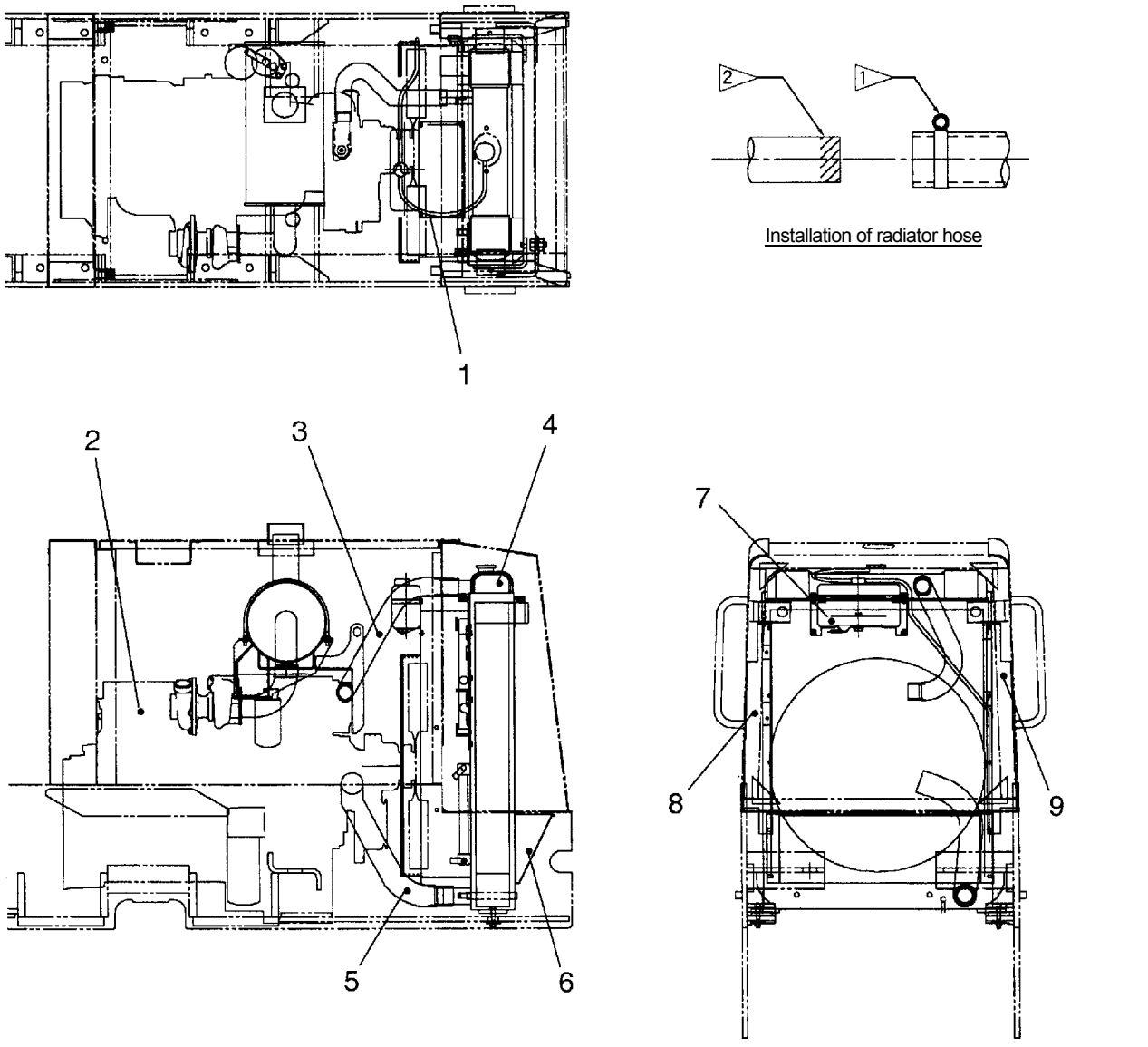
Hitachi Construction Machinery Co., Ltd.
Technical Training Center

ENGINE AND RELATED COMPONENTS

ENGINE

General Description

The engine mounted on this loader is a 4-cycle, water-cooled, in-line direct-injection type diesel engine. Each engine is equipped with a turbocharger.
The engine is mounted at the rear of the loader and its power is transmitted through the flywheel, coupling gear, and the torque converter, into the transmission.
In a Model LX130-7, the flywheel and torque converter are connected through the input plate instead of the coupling gear.



NOTE: This sketch shows the cooling system of the LX130-7.

NOTE: 1. *5.9 N-m {0.6 kg-m} [4.3 lbf-ft]*

2. *Tube end: Sealing agent (Japan Hermetic Co., Ltd. Herme-seal SS-80); it should not be applied to the inner side of the hose.*

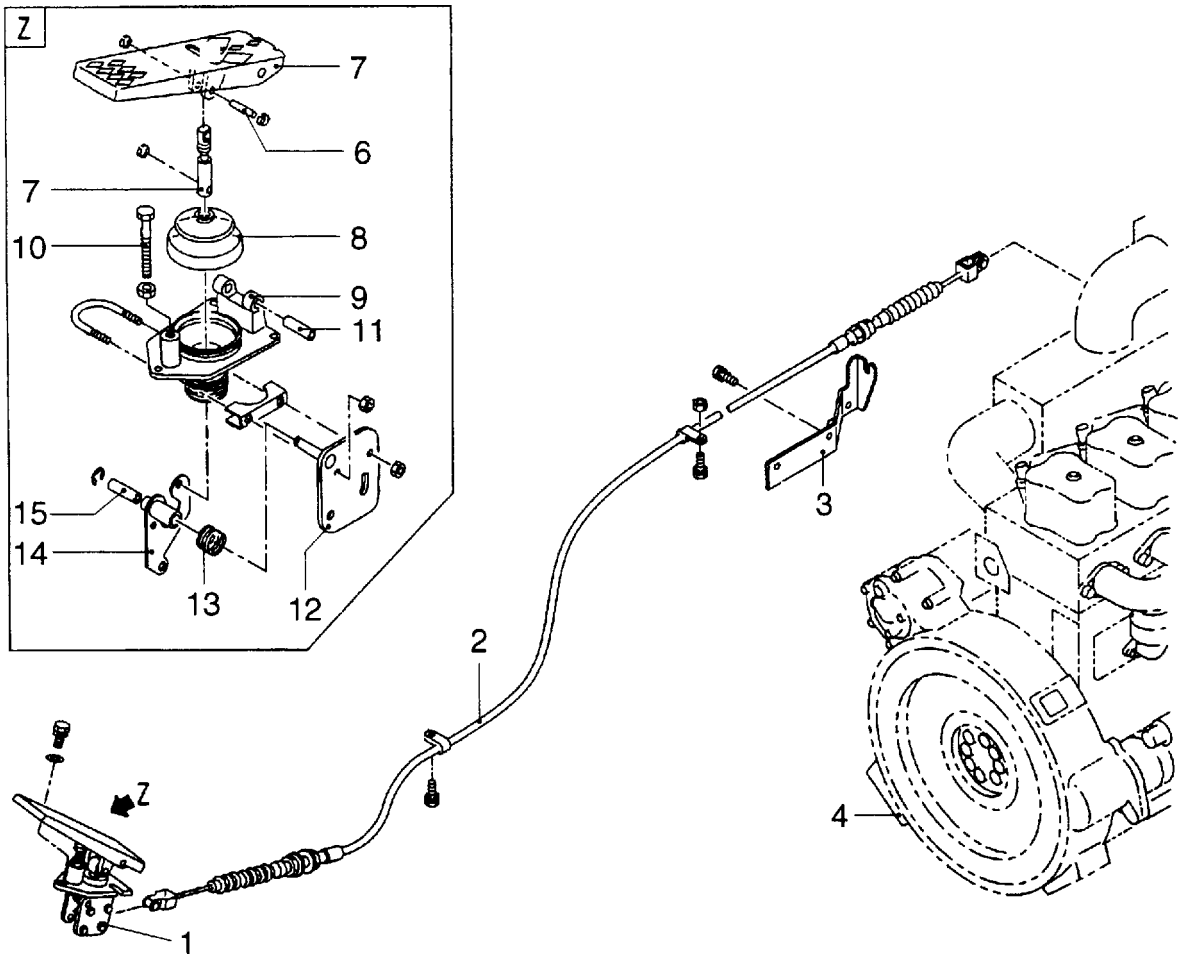
1- Hose
2- Engine
3- Radiator Upper Hose
4- Radiator
5- Radiator Lower Hose
6- Shroud
7- Reservoir Tank
8- Shroud
9- Shroud

Fig. 1.6 Engine Cooling System

ENGINE CONTROL UNIT

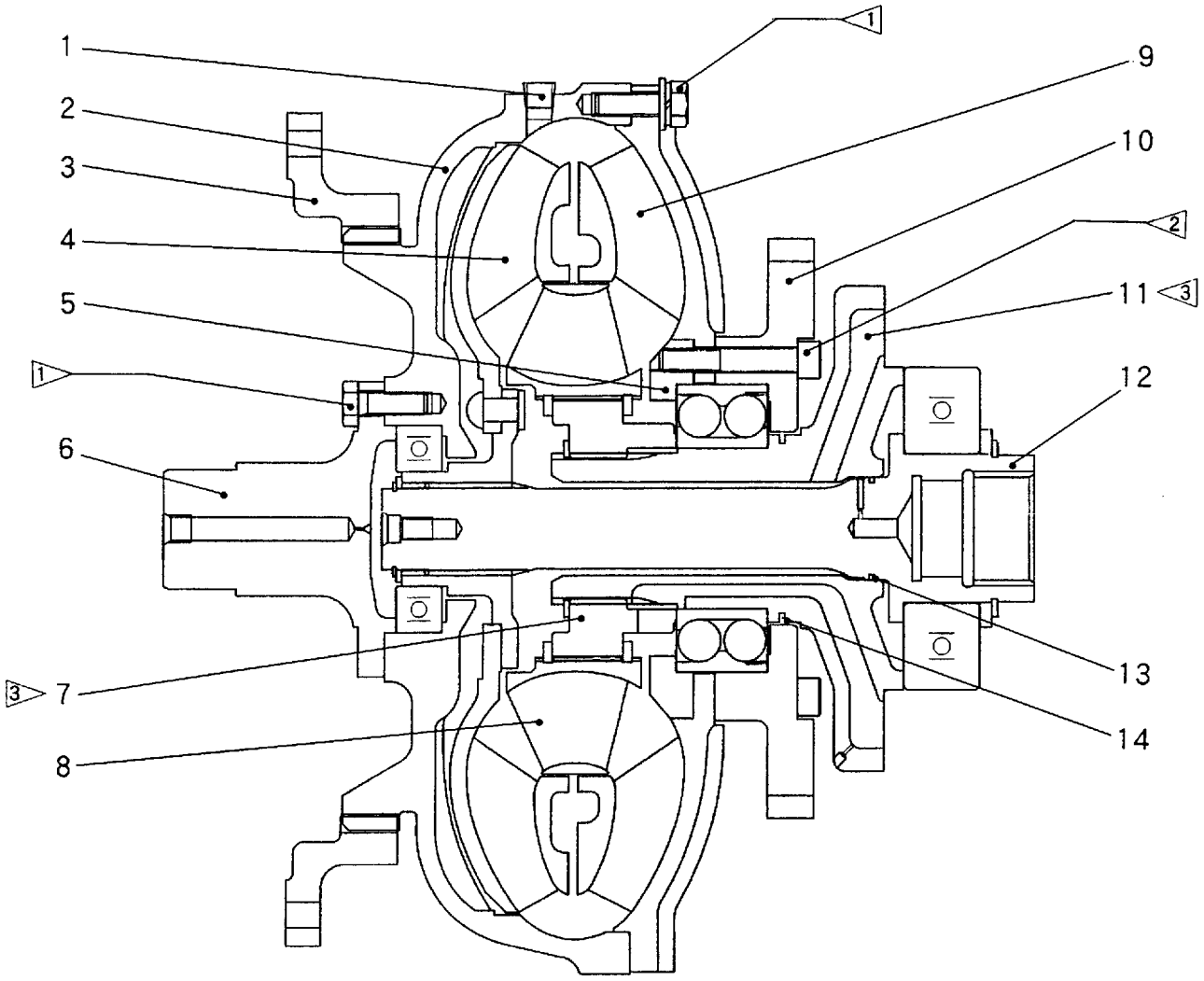
Accelerator Pedal

The engine speed is controlled by operating the accelerator pedal.
When the accelerator pedal is pressed, the governor control lever of the engine is actuated through the control cable so that an engine speed most suited to the working condition is obtained.



1- Accelerator Pedal Assembly	6- Pin	11- Pin
2- Cable	7- Push Rod	12- Hanger Plate
3- Bracket	8- Bellows	13- Return Spring
4- (Engine)	9- Body	14- Lever
5- Pedal	10- Stopper Bolt	15- Bearing

Fig. 1.15 Accelerator Pedal



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NOTE: 1. 39 – 45 N-m {4.0 – 4.6 kgf-m} [29 – 33 lbf-ft]

2. 51 – 58 N-m {5.2 – 6.0 kgf-m} [38 – 43 lbf-ft]

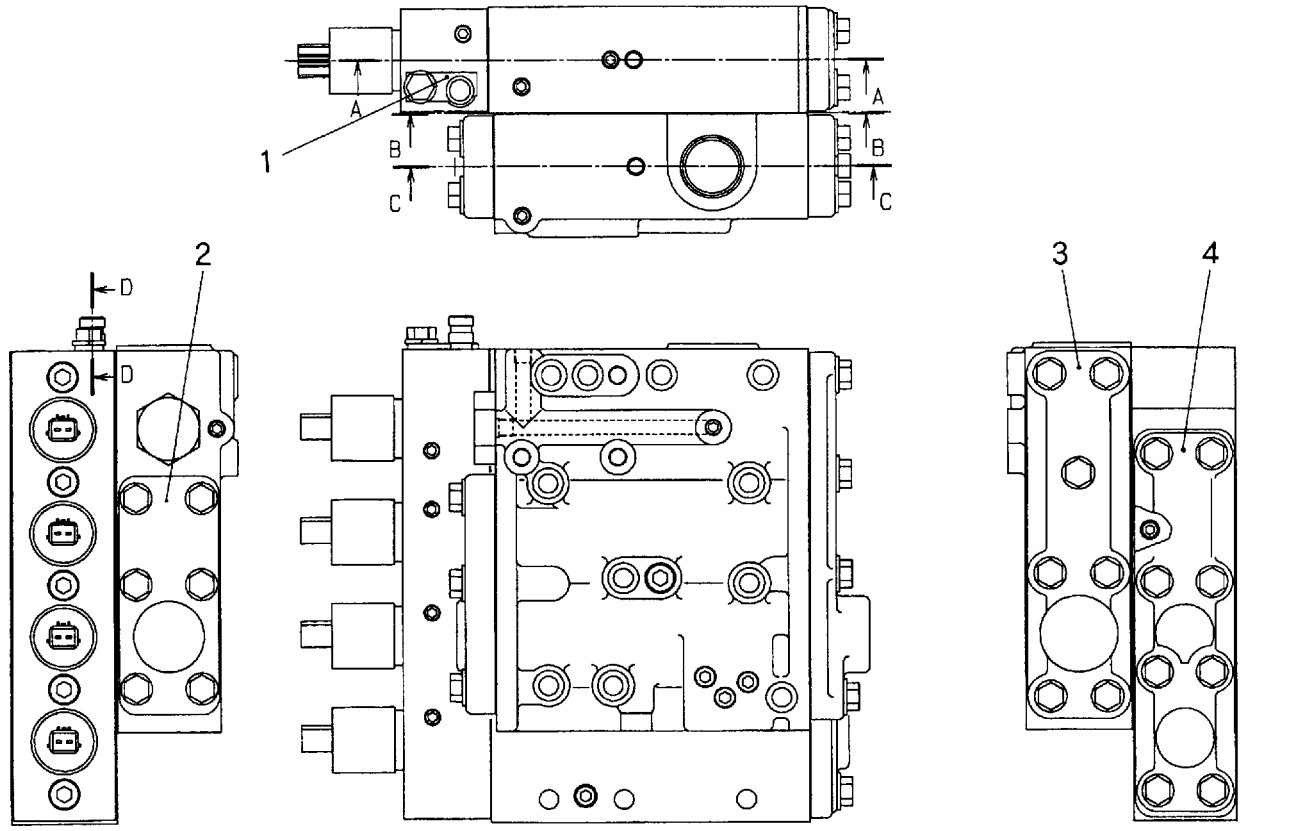
3. Align the arrows of the oil outlet grooves in the stator holder and stator hub.

1- Taper Plug
2- Cover Wheel
3- Coupling Gear (Drive Ring)
4- Turbine Wheel
5- Impeller Hub
6- Input Guide
7- Stator Hub
8- Stator Wheel
9- Impeller Wheel
10- Pump Drive Gear
11- Stator Holder
12- Turbine Shaft
13- Oil Seal Ring
14- Oil Seal Ring

Fig. 2.8 Converter Wheel Assembly (LX160-7)

TRANSMISSION CONTROL VALVE

The transmission control valve selectively sends oil to each clutch so as to change over the directions and speeds of the loader.
The control valve consists of a valve body and 4 solenoid valves. The solenoid valves are engaged and disengaged by the transmission control switch (shift lever), to shift the spool in the valve to control the clutch lock-up oil.
The control valve also has a modulation mechanism which operates differently according to the speed ranges. It is possible to operate the control valve manually if the electric system fails to operate normally.



1- Plate (For Manual Operation)
2- Cover
3- Cover
4- Cover
5- Solenoid Valve
6- Adapter
7- Valve Body (Lower)
8- F/R Selector Spool
9- Adapter
10- Spring
11- Spool A
12- Selector Spring
13- Spool B
14- Selector Spring
15- Orifice, 0.8 mm [0.031 in.] dia. (For Solenoid Valve)
16- Orifice (W)*
17- Orifice (Z)*
18- Orifice (Y)*
19- Orifice (X)*
20- Valve Body (Upper)
21- Spring
22- Flow Sensing Spool
23- Spring
24- Pin
25- Rod
26- Spring, Inner
27- Spring, Center
28- Spring, Outer
29- Load Piston H
30- Regulator Spool
31- Piston

* See Note

Fig. 2.18 Transmission Control Valve (1)

5. Fwd And 2nd Speed Clutches In Engagement (Point E In Fig. 2.21)

5.1 Since The Solenoids A And B Are In The ON State, The Speed Spools A And B Move To The Right In The Figure.

5.2 The Oil Which Entered Circuit (8) Flows Into Circuit (23). It Then Passes Through The Drilled Holes In The Spool, To Circuit (24) ,From Which Some Of The Oil Passes Orifice (X) Into The Load Piston Chamber (20).

5.3 At The Same Time, The Other Flows From Circuit (24) Into Circuit (27) Of The Spool B. The Oil Leaving The Circuit (27) Flows Through The Circuit (28) And Orifice (Y) If Circuit (29), Into The Load Piston Chamber (20).

5.4 In Other Words, When The Shift Lever Is Put In 2nd Speed, The Oil Flows Through Orifices (X, Y), So That The Time Needed For The Clutch Oil Pressure To Build Up Is Shorter Than When The 1st Speed Clutch (The Oil Passes Through Orifice (X) Alone) Is Selected.

1. General Description
The ATC (Automatic Transmission Controller) controls the transmission automatically based on the loader traveling speed and engine rpm.
The ATC has the following features:

1.1 The transmission shifts into the 2nd speed gear when the engine is started. The 2nd speed gear is selected for digging and loading; the 3rd speed gear for load & carry operation; the 4th speed gear for traveling and moving. (The speed range is automatically selected depending upon the shift lever position.)

1.2 It is possible to shift into a suitable gear position using the DSS (Down Shift Switch) and USS (Up Shift Switch).

1.3 The kick-down function quickens shifting down when climbing an uphill.

1.4 The transmission does not shift up when descending an downhill with the engine at low rpm, because the engine brake is used.

1.5 The over-run function protects the clutch assembly.

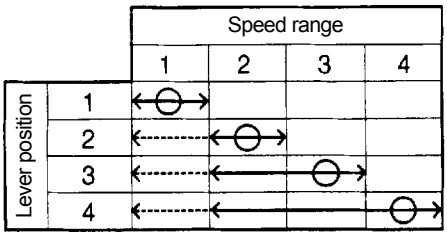
1.6 To protect the clutch assembly, the direction of travel is switched over (from forward to reverse or vice versa) after changing over the speed gears properly. (See 4. F-R selection pattern.)

NOTE: When the Auto/Manual switch is in Manual, the operator shifts the gears using the transmission shift lever. (Automatic gearshifting function is not available.)

ATC operates as follows when the key switch is turned on.

- When the key switch is turned on, the ATC checks the operation of the transmission solenoid valves.
- During this checking process, the loader won't move in either direction even if the shift lever is placed in forward or reverse.
- The ATC checks the operation of the forward and reverse solenoid valves, respectively, when the shift lever is placed in forward or reverse.

2. Relationship between shift lever positions and gearshift pattern

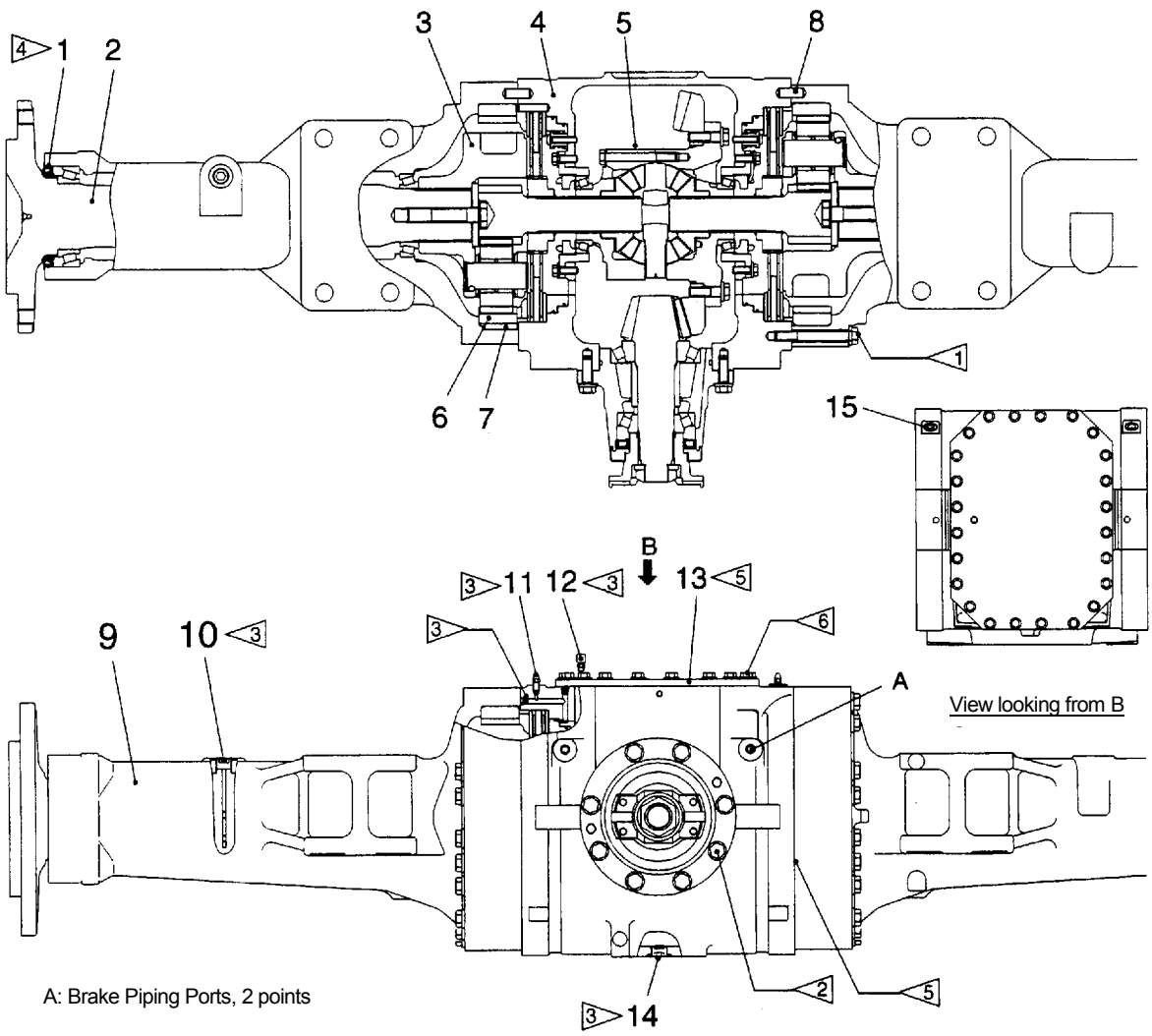


○: Fixed speed range in manual mode

When the DSS is pressed with the gears in the 4th speed, the transmission shifts from the 4th speed to the 3rd speed. (Press DSS once)
When the DSS is pressed with the gears in the 3rd speed, the transmission shifts from the 3rd speed to the 2nd speed. (Press DSS once)
When the DSS is pressed and held down with the gears in the 4th speed, the transmission shifts from the 4th speed to the 3rd speed and then to the 2nd speed.
(For the 1st speed, release the DSS switch and then press it once.)

When the USS is pressed with the gears in the 2nd speed, the transmission shifts from the 2nd speed to the 3rd speed. (When the shift lever is in "3" or "4", press the USS once.)
When the USS is pressed with the gears in the 3rd speed, the transmission shifts from the 3rd speed to the 4th speed. (When the shift lever is in "4", press the USS once.)
The transmission shifted into the 1st speed by the DSS, will shift into the 2nd speed when the USS is pressed.

NOTE: The transmission won't shift up, or from the 2nd speed to 3rd speed and to the 4th speed even if the USS is pressed and held down.



NOTE: 1. *225 N-m {23 kgf-m} [170 lbf-ft]*
2. *LX130-7: 98 N-m {10 kgf-m} [72 lbf-ft], LX160-7 – LX230-7: 225 N-m {23 kgf-m} [170 lbf-ft]*
3. *Threaded area: LOCTITE#572*
4. *Lip: Grease*
5. *Mating surface: LOCTITE FMD-127*
6. *LX130-7: 49 N-m {5 kgf-m} [36 lbf-ft], LX160-7 – LX230-7: 98 N-m {10 kgf-m} [72 lbf-ft]*

1- Oil Seal
2- Axle Shaft
3- Final Assembly
4- Differential Body
5- Differential
6- Ring Gear
7- Pin
8- Pin
9- Axle Tube
10- Level Gauge
11- Bleeder
12- Breather
13- Cover
14- Drain Plug
15- Plug (Checking Port)

NOTE: Threaded area not specified: LOCTITE#262
This sketch shows the front axle of the model LX160-7. On the other models, the construction of the front axle is the same.

Fig. 2.42 Front Axle

NOTE

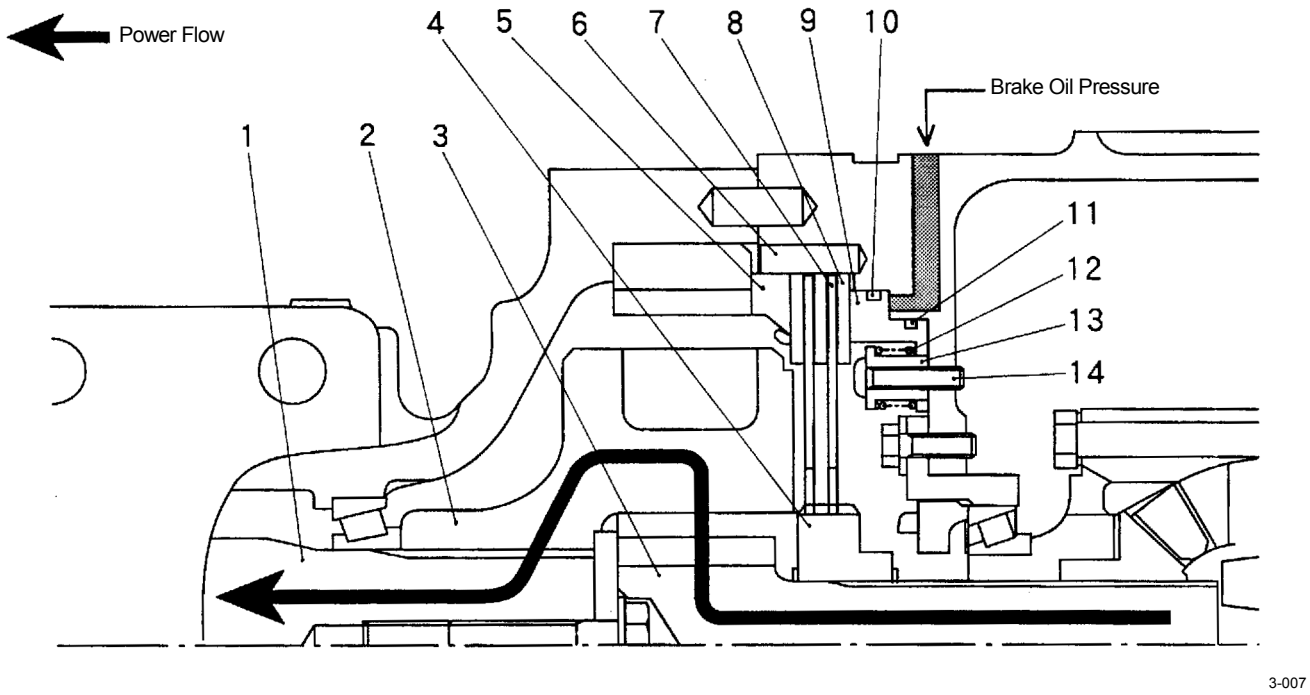
DISK BRAKE

The disk brake is wet multiple-plate disk brake and built in the differential body of the drive axle. On the loader, four disk brake units are installed on the 4 wheels, one for each.
For the structure of the disk brake, refer to “2.6 DRIVE AXLE.”

Operation

1. Brake in operation
   The brake oil pressure acts on the back of the brake piston, moves the brake piston and locks up the brake disks with the brake rings.
   The inner periphery of each brake disk is splined through the disk hub to the shaft in the power transmission line. The outer peripheries of the brake rings are secured to the differential body by pins so that the locked-up brake disks stop rotating to brake the loader.

2. Brake released
   When the brake oil pressure acting on the brake piston is released, the brake piston returned a little by the return spring to make the brake disks free, thus releasing the braking force.

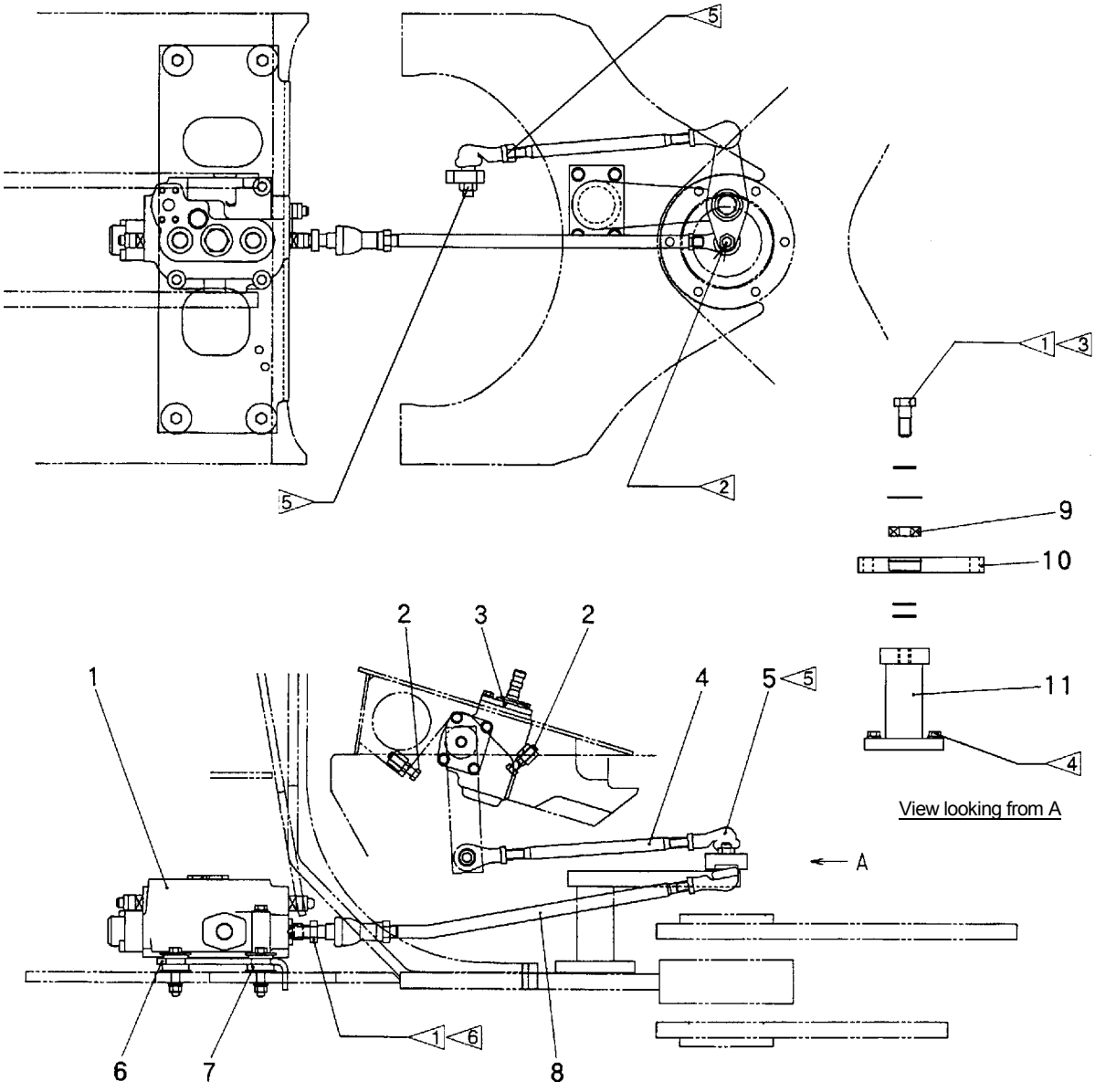


1- Axle Shaft
2- Planet Carrier
3- Gear & Shaft
4- Disk Hub
5- End Plate
6- Pin
7- Brake Disk
8- Brake Ring
9- Piston
10- D-Ring
11- D-Ring
12- Return Spring
13- Adapter
14- Bolt

Fig. 3.7 Disk Brake Operation

NOTE

CONTROL LINKAGE

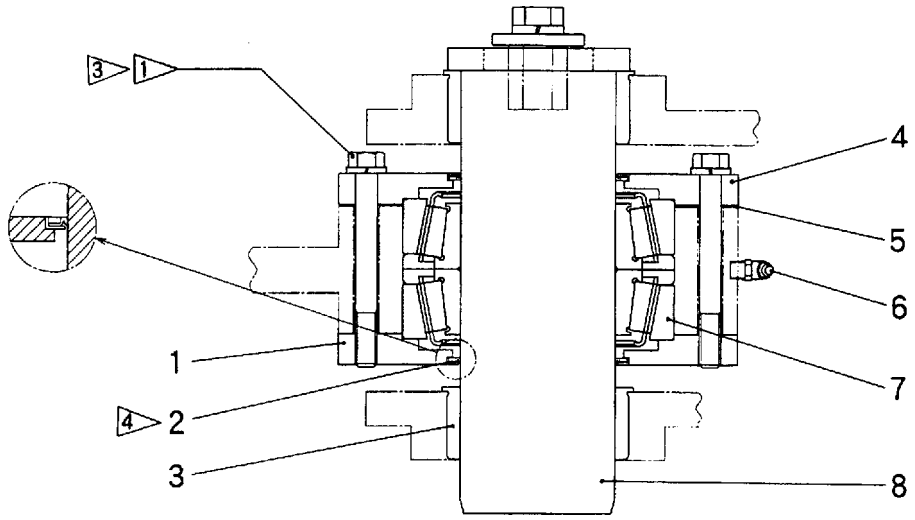


NOTE: 1. Threaded area: LOCTITE#262
2. Align with the center of the center hinge pin
3. 246.0 N-m {25.1 kgf-m} [181 lbf-ft]
4. 34.3 N-m {3.5 kgf-m} [25.3 lbf-ft]
5. 87.2 N-m {8.9 kgf-m} [64.3 lbf-ft]
6. 149.9 N-m {15.3 kgf-m} [111 lbf-ft]

1- Steering Valve
2- Stopper
3- (Steering Gear)
4- Rod
5- Ball Joint
6- Plate
7- Mounting Rubber
8- Rod
9- Bearing
10- Link
11- Pivot

Fig. 4.8 Control Linkage

(Upper hinge)



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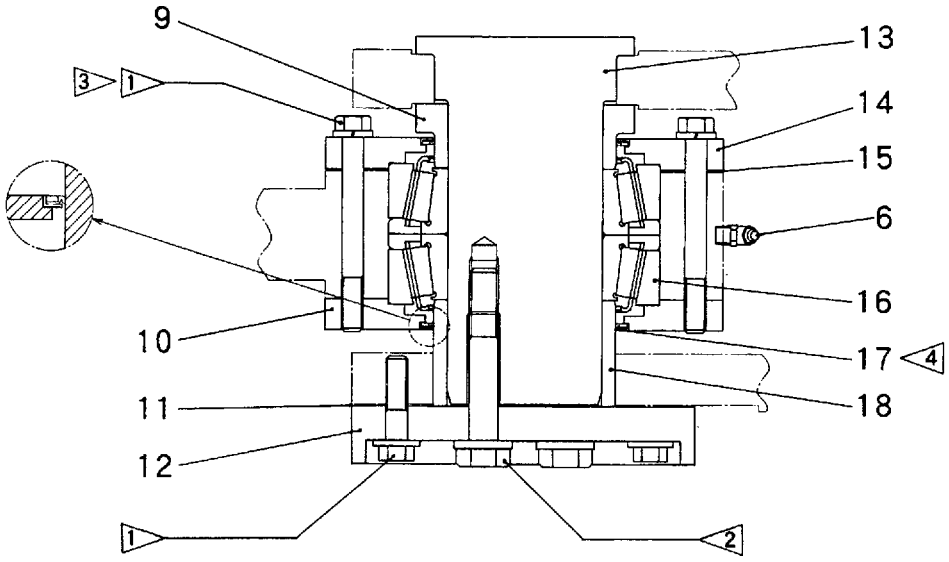
(Lower hinge)



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NOTE: 1. *88 N-m {9.0 kgf-m} [65 lbf-ft]*
2. *224 N-m {22.8 kgf-m} [165 lbf-ft]*
3. *Threaded area: LOCTITE#262*
4. *Outer ring area: LOCTITE#262*

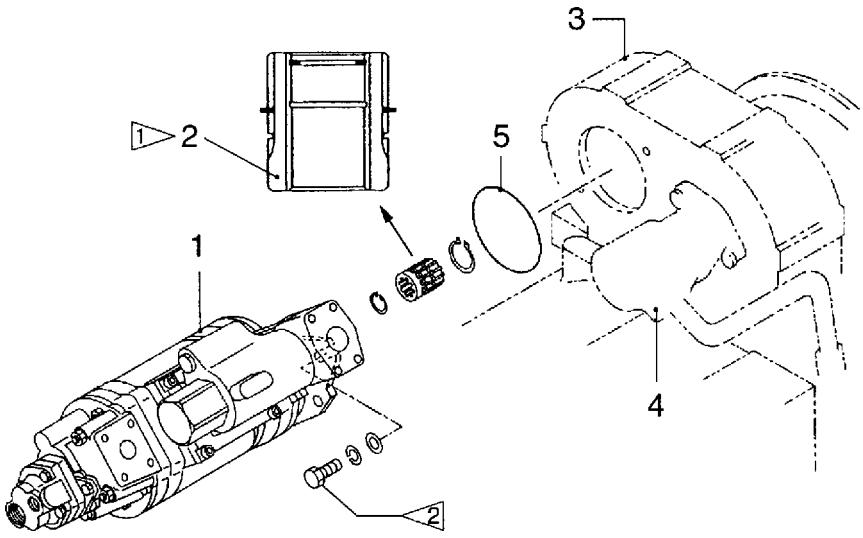
1- Cap
2- Dust Seal
3- Bushing
4- Cap
5- Shim
6- Grease Fitting
7- Bearing
8- Pin
9- Bushing
10- Cap
11- Shim
12- Washer
13- Pin
14- Cap
15- Shim
16- Bearing
17- Dust Seal
18- Bushing

Fig. 5.4 Center Hinge (LX130-7, LX160-7)

All pumps are installed in the converter housing and driven with the pump drive of the torque converter. Therefore, each pump always rotates with engine running. For the installation of the charging pump, refer to “2.1 DRIVE UNIT.”

(LX130-7)

1- Pump
2- Drive Sleeve
3- (Torque Converter)
4- (Charging Pump)
5- “O”-Ring



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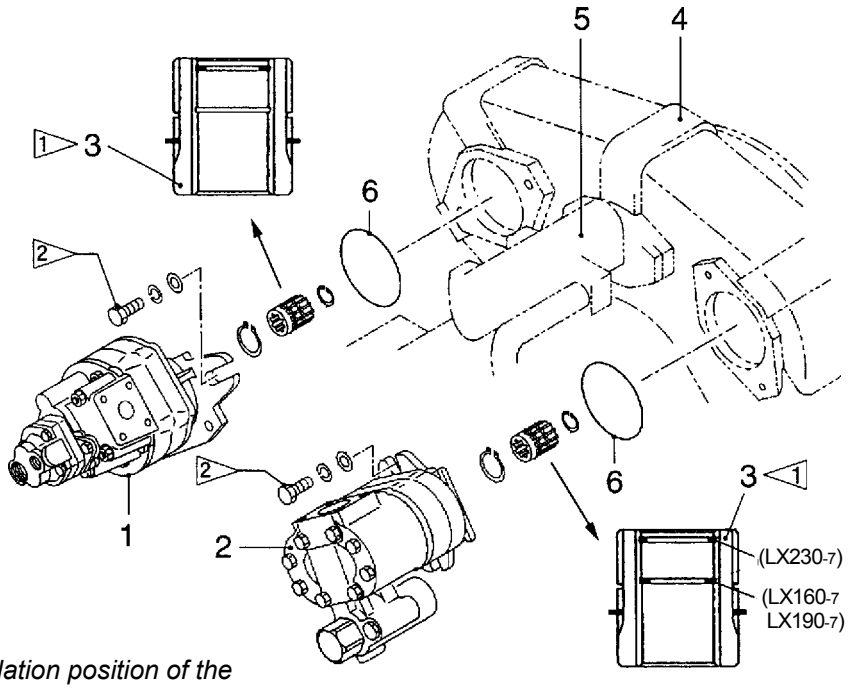
NOTE: 1. Pay attention to the installation position of the snap ring.

2. 88 N-m {9.0 kgf-m} [65.1 lbf-ft]

(LX160-7, LX190-7, LX230-7)

1- Steering Pump, Brake & Assist Pump
2- Main Pump
3- Drive Sleeve
4- (Torque Converter)
5- (Charging Pump)
6- “O”-Ring



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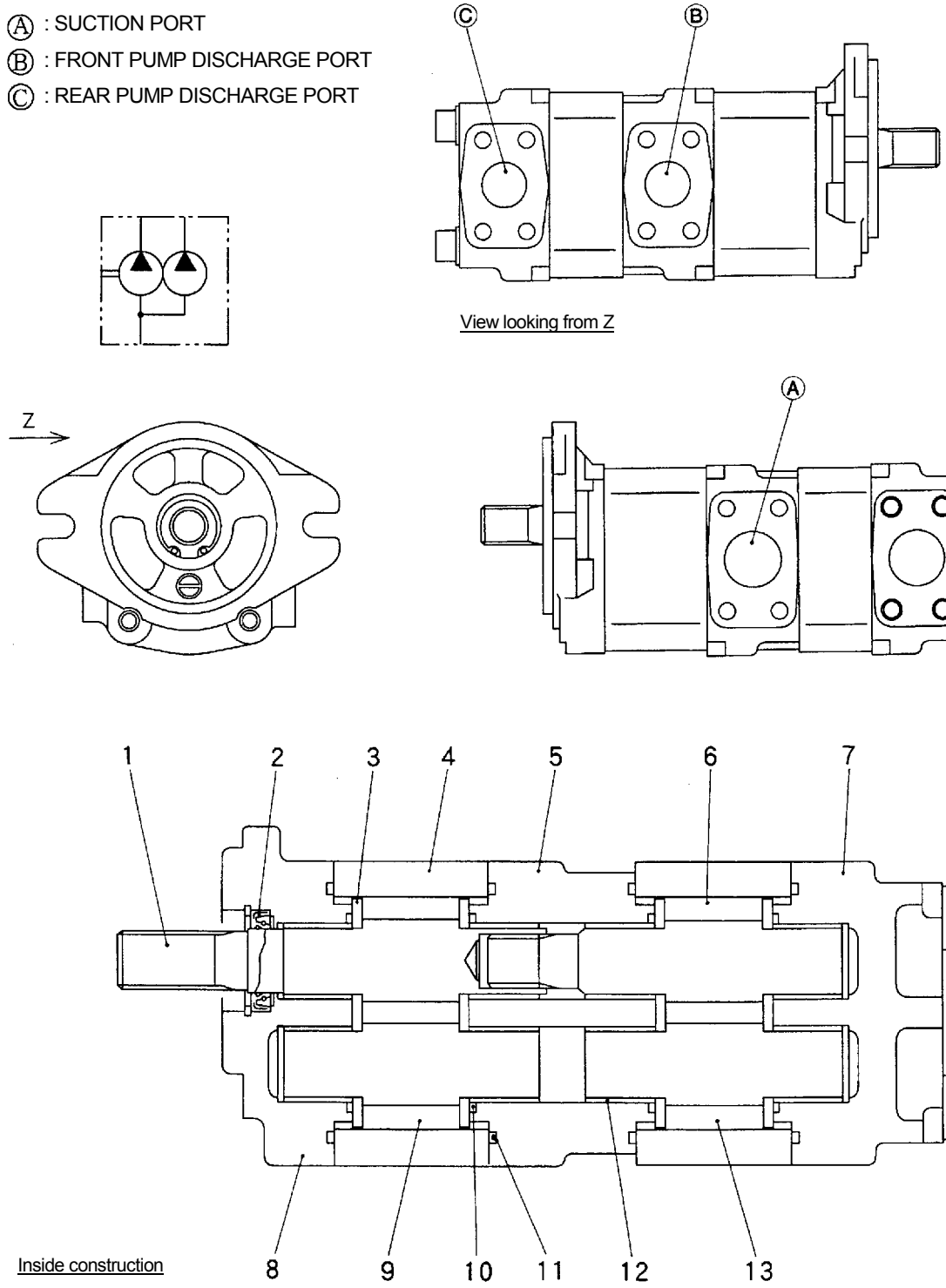
NOTE: 1. Pay attention to the installation position of the snap ring.

2. 224 N-m {22.8 kgf-m} [165 lbf-ft]

Fig. 6.5 Pumps Installed on Converter Housing

Ⓐ : SUCTION PORT
Ⓑ : FRONT PUMP DISCHARGE PORT
Ⓒ : REAR PUMP DISCHARGE PORT

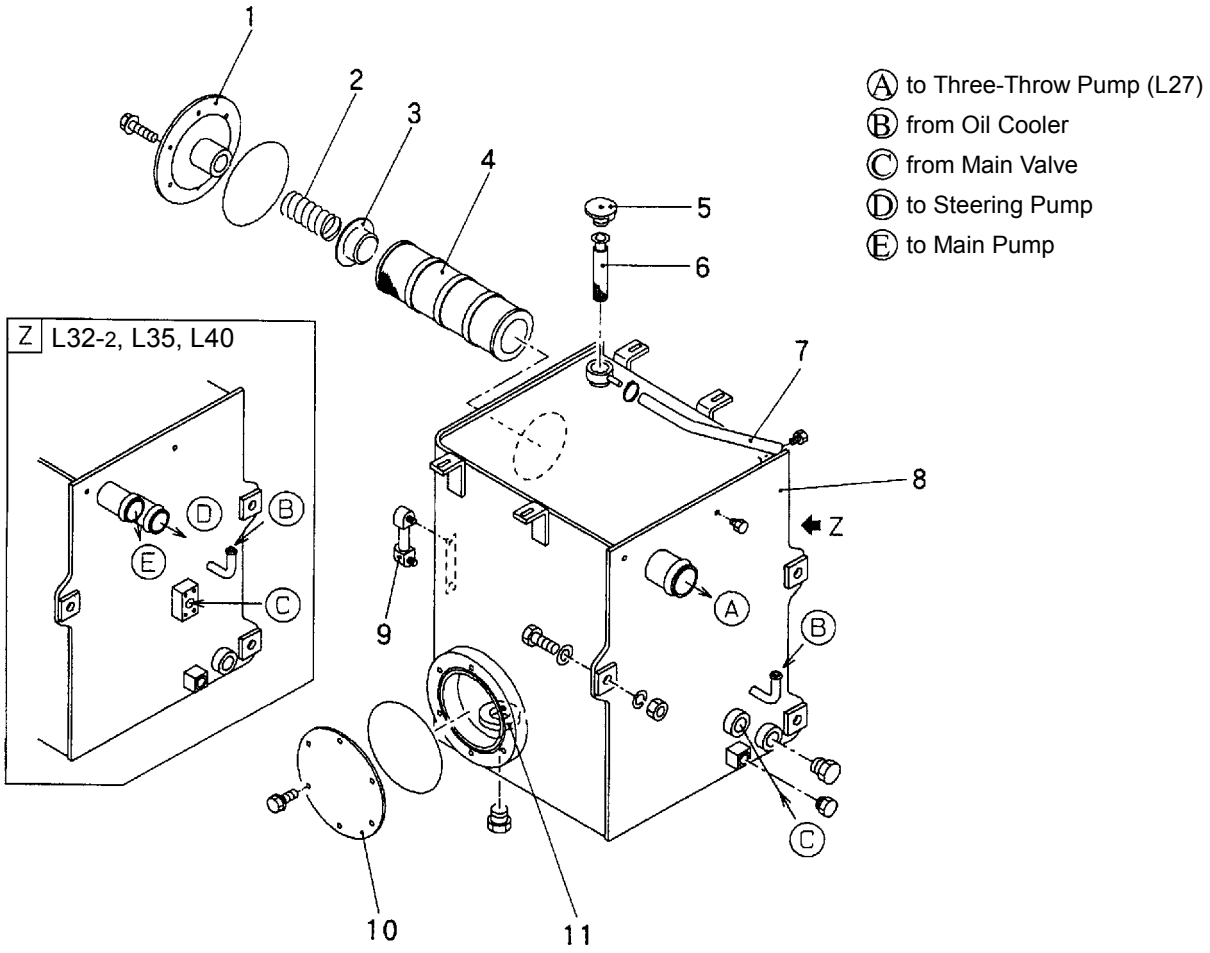


1- Drive Gear
2- Oil Seal
3- Side Plate
4- Body
5- Adapter Plate
6- Drive Gear
7- Rear Cover
8- Front Cover
9- Driven Gear
10- Back-Up Strip
11- Gasket
12- Bushing
13- Driven Gear

Fig. 6.14 Charging Pump (LX160-7, LX190-7, LX230-7)

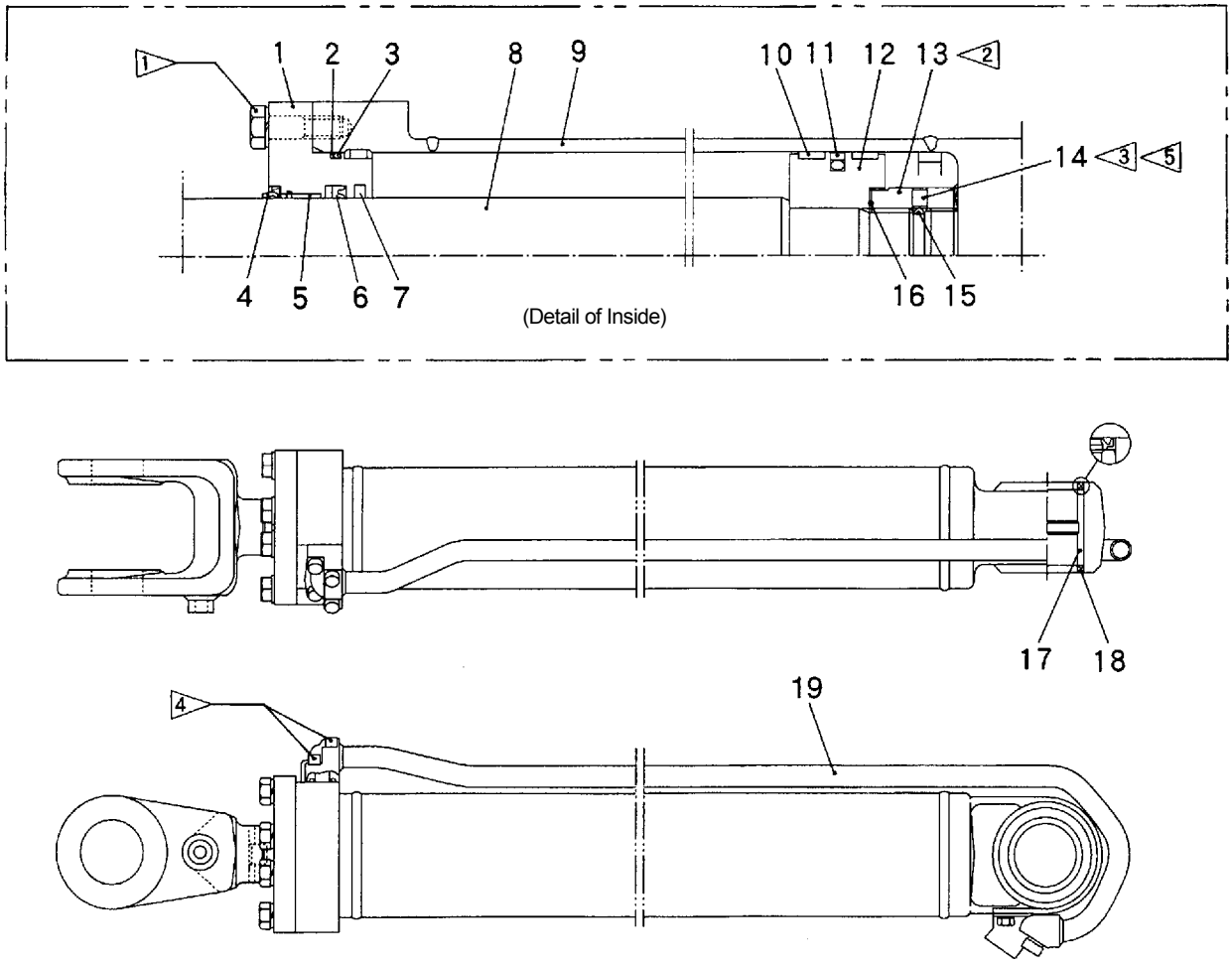
OIL TANK

	LX130-7	LX160-7	LX190-7, LX230-7
Type	Pressurized, enclosed type	←	←
Cap operating pressure	Positive pressure: 44.1 – 53.9 kPa {0.45 – 0.55 kgf/cm^2} [6.4 – 7.8 psi]	←	←
	Negative pressure: 3.9 – 4.9 kPa {0.04 – 0.05 kgf/cm^2} [0.57 – 0.71 psi]	←	←
Return filter	1pc., 15 m	←	←
Tank capacity	80 L [21.1 US gal]	97 L [25.6 US gal]	124 L [32.8 US gal]
Tank weight (dry)	141 kg [311 lbs]	161 kg [355 lbs]	178 kg [392 lbs]



1- Support Plate
2- Spring
3- Retainer
4- Filter
5- Cap
6- Filter
7- Hose
8- Oil Tank
9- Level Gauge
10- Cover
11- Magnet

Fig. 6.22 Oil Tank



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NOTE: *N-m {kgf-m} [lbf-ft]*

	LX130-7	LX160-7	LX190-7	LX230-7
1.	442 {45.1} [326]	442 {45.1} [326]	442 {45.1} [326]	603 {61.5} [445]
2.	3450 {352} [2540]	3450 {352} [2540]	3550 {362} [2620]	5710 {582} [4210]
3.	56.9 {5.8} [42]	56.9 {5.8} [42]	56.9 {5.8} [42]	56.9 {5.8} [42]
4.	{5.22} [37.8]	51.2 {5.22} [37.8]	51.2 {5.22} [37.8]	51.2 {5.22} [37.8]

5. After tightening, calk 2 parts around the bolt.

1- Cylinder Head
2- Back-up Ring
3- "O"-Ring
4- Wiper Ring
5- Bushing
6- "U"-Ring & Back-up Ring
7- Buffering
8- Piston Rod
9- Cylinder Tube
10- Slide Ring
11- Seal Ring, "O"-Ring
12- Piston
13- Nut
14- Set Screw
15- Steel Ball
16- Shim
17- Pin Bushing
18- Wiper Ring
19- Pipe

NOTE: The above sketches show the boom cylinder of the LX160-7. The boom cylinders of the other models have the same construction.

Fig. 7.7 Boom Cylinder