



Service Manual

6D16 Diesel Engine

FD80	F32B-00011-up
FD90	F32B-50001-up
FD100	F15C-50001-up
FD115	F15C-50001-up
FD135	F15C-50001-up
FD150A	F24A-50011-up

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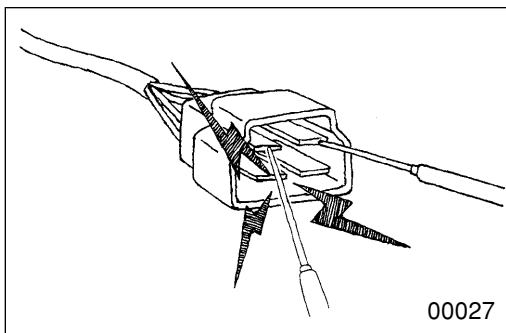
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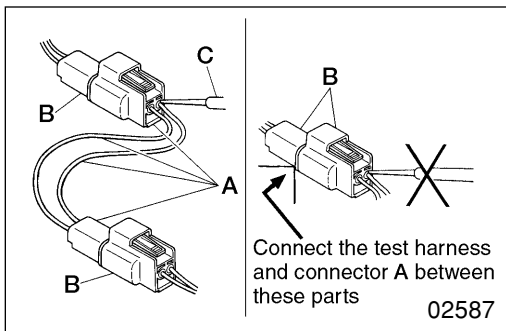
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PRECAUTIONS FOR MAINTENANCE OPERATION



When using testers or the like for continuity tests, be careful not to allow test probes to touch the wrong terminals.

Measurement Procedures Using Connectors

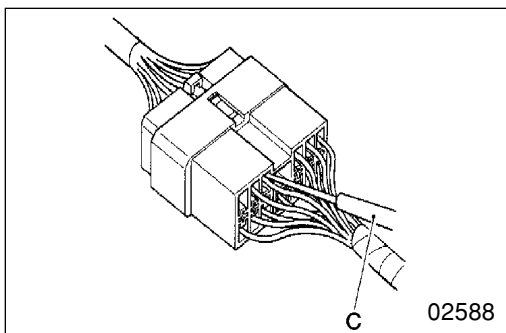


Test with connectors engaged (continuity through circuit obtained)

<Waterproof connector>

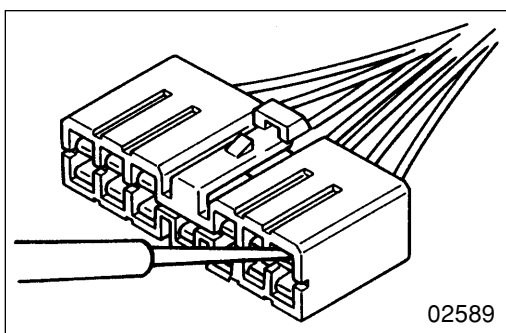
Prepare a test harness and connectors A, then connect it between the two parts of harness B that is to be tested. Check the circuit by touching test probe C to the test connector.

Never insert the test probe from the harness side of the waterproof connection, or waterproof performance might be diminished causing corrosion of the connector.



<Non-waterproof connector>

Insert test probe C from the harness side of the connector. Where control units, etc. have connectors that are too small to accept the test probe, do not force the test probe into them.



Test with connectors disengaged

Using female pins

Insert a test probe into a terminal. However, do not force the probe into the terminal, or it will cause a poor contact.

ON-VEHICLE INSPECTION AND ADJUSTMENT

2. Inspecting and Adjusting Valve Clearances

Service standards

Unit: mm (in.)

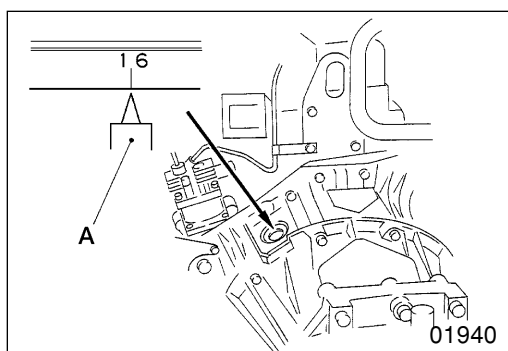
Location	Maintenance item	Standard value	Limit	Remedy
–	Valve clearance (when cold)	0.4 (0.0158)	–	Adjust

ⓘ Tightening torques

Unit: N·m (kgf·m) [lbf·ft]

Location	Parts to be tightened	Tightening torque	Remarks
2, 3	Rocker arm adjusting screw lock nut	34 (3.5) [25.1]	–

Valve clearances should be checked and adjusted when the engine is cold.

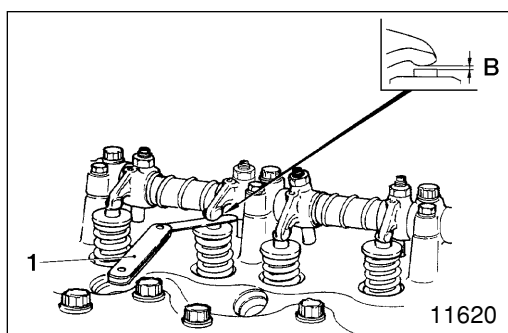


[Inspection]

- Bring piston No. 1 or piston No. 6 to the top-dead-centre (TDC) position of its compression stroke. To do this, crank the engine until the “1.6” mark inscribed on the flywheel is aligned with the pointer A in the flywheel housing inspection window.

NOTE

Pistons whose push rods are not pushing up their rockers are at top-dead-centre (TDC) of their compression strokes.



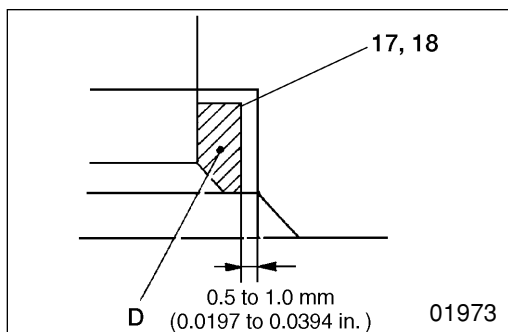
- When piston No. 1 or piston No. 6 is at the TDC position of its compression stroke, measure the clearance B of every valve marked “○” in the following table.

Piston No.	1		2		3		4		5		6	
Valve arrangement	In.	Ex.	In.	Ex.	In.	Ex.	In.	Ex.	In.	Ex.	In.	Ex.
No. 1 piston at TDC of compression stroke	○	○	○	×	×	○	○	×	×	○	×	×
No. 6 piston at TDC of compression stroke	×	×	×	○	○	×	×	○	○	×	○	○

NOTE

To measure the clearance, insert a feeler gauge 1. The gauge should be able to move in the gap, albeit not loosely. Accurate measurements cannot be taken if the gauge moves loosely in the gap.

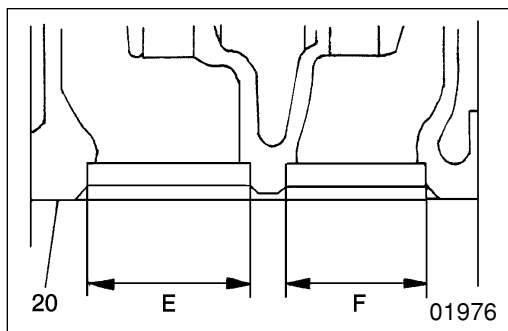
CYLINDER HEAD AND VALVE MECHANISM



[Removal]

Valve seats 17, 18 are installed by expansion fitting. To remove a valve seat, grind the inside surface to reduce its thickness, then remove the valve seat at room temperature.

D: Material to remove

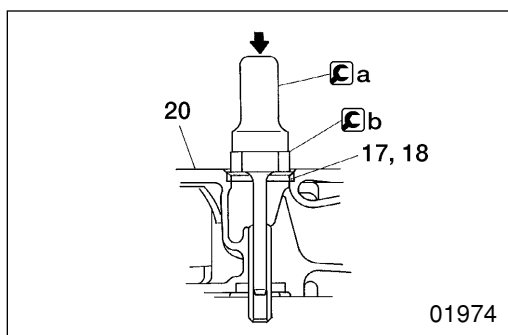


[Installation]

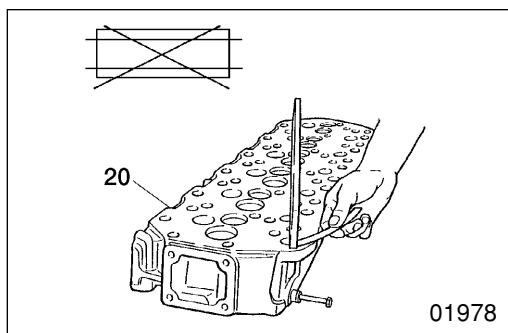
- Check that the valve seat hole diameters E, F in the cylinder head 20 conform with the values shown below.

Unit: mm (in.)

	6D16	6D16-TLE
Inlet valve seat hole (E)	$\phi 51^{+0.03}_0$ ($\phi 2.01^{+0.0012}_0$)	$\phi 49^{+0.025}_0$ ($\phi 1.93^{+0.00098}_0$)
Exhaust valve seat hole (F)	$\phi 44^{+0.025}_0$ ($\phi 1.73^{+0.00098}_0$)	$\phi 42^{+0.025}_0$ ($\phi 1.65^{+0.00098}_0$)



- Cool the valve seats 17, 18 by immersing it in liquid nitrogen.
- Install the valve seats 17, 18 in the cylinder head 20 using the a Caulking Tool Body and b Installer Ring.
- After installing the valve seats 17, 18, lap the valve seats and valves 7, 8. P.11-26

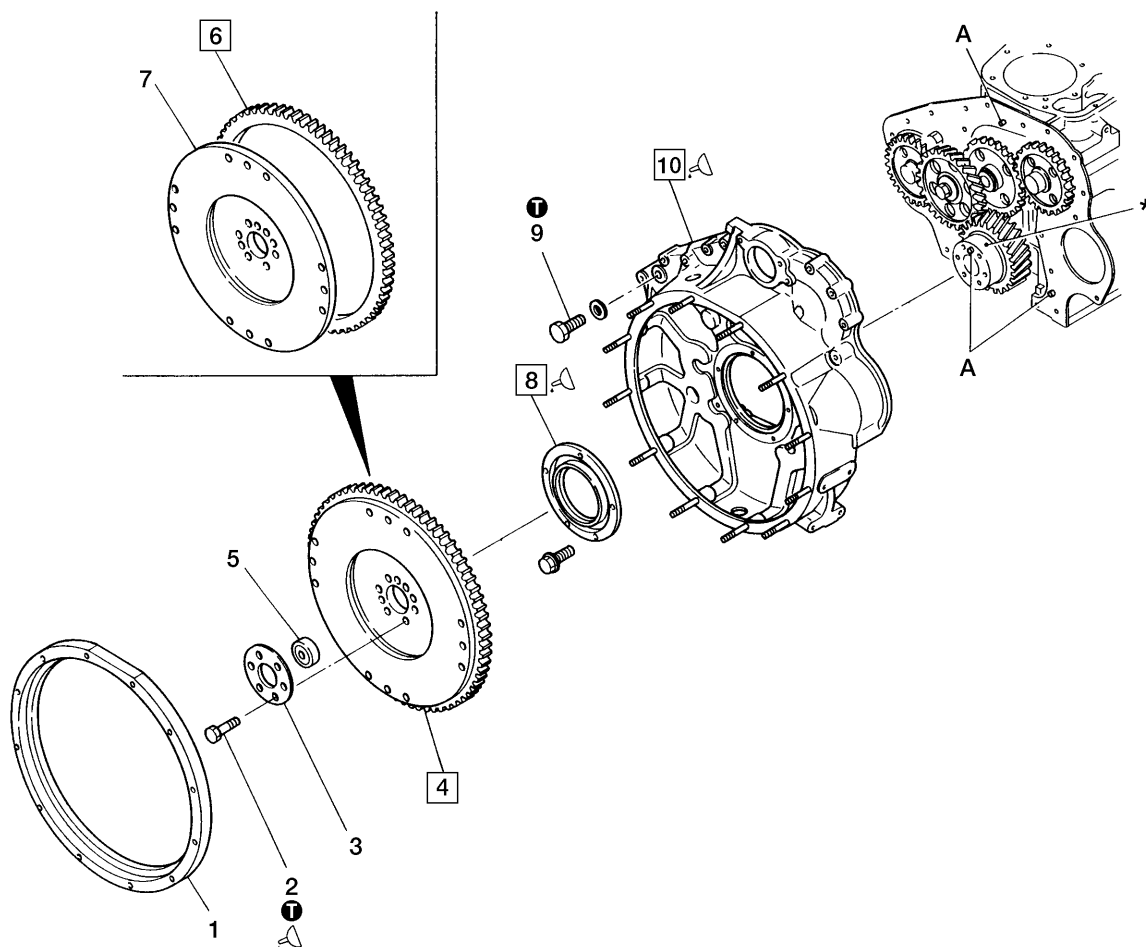


20 Inspecting cylinder head

- Measure the extent of distortion in the cylinder head's bottom surface.
- If the degree of distortion exceeds the specified limit, rectify the distortion with a surface grinder.

CAUTION

Ensure that grinding does not cause the cylinder head's top surface-to-bottom surface distance to fall below the specified limit.



16923

● Disassembly sequence

- 1 Spacer
- 2 Bolt
- 3 Washer plate
- 4 Flywheel assembly
- 5 Pilot bearing
- 6 Ring gear
- 7 Flywheel

- 8 Rear oil seal
- 9 Plug
- 10 Flywheel housing

*: Crankcase P.11-66

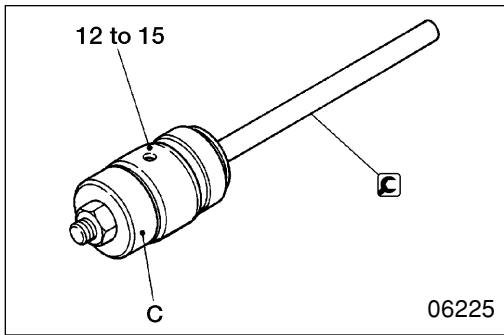
A: Locating pin

⊗: Non-reusable part

● Assembly sequence

Reverse the order of disassembly.

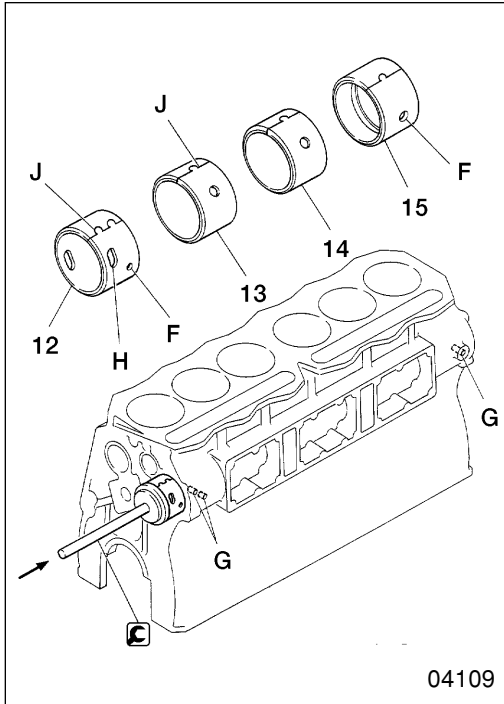
CAMSHAFT



- Install the bushings 12 to 15 by using all components of the  Camshaft Bushing Installer and Extractor (rod A, camshaft bushing adapter B, guide piece C and nut D).
- Install the camshaft bushings 12 to 15 in the following order: No. 3, No. 4, No. 2 and No. 1.

NOTE

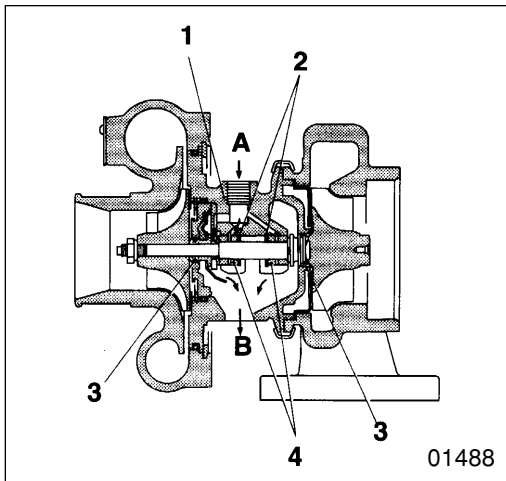
Install the No. 3 and No. 4 camshaft bushings 12, 13 from the rear of the engine. Install the No. 1 and No. 2 camshaft bushings 14, 15 from the front of the engine.



- Ensure that the oil holes F in the No. 1 and No. 4 camshaft bushings 15, 12 are aligned with the oil holes G in the crankcase. With the No. 4 camshaft bushing, ensure also that the longer oil hole H is toward the rear of the engine.

J: Bushing clinch joint

 : Camshaft Bushing Installer and Extractor



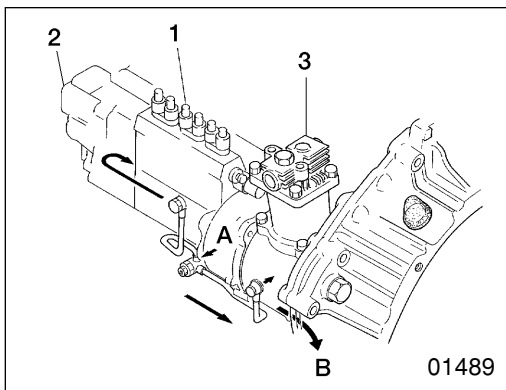
● Turbocharger <6D16-TLE>

- 1 Bearing housing
- 2 Snap ring
- 3 Piston ring
- 4 Bearing

A: From main oil gallery

B: To oil pan

Via an oil pipe, engine oil is delivered from the main oil gallery to the bearing housing 1 to lubricate the inside of the bearing housing. At each end of the turbine wheel shaft, piston ring 3 acts as an oil seal.



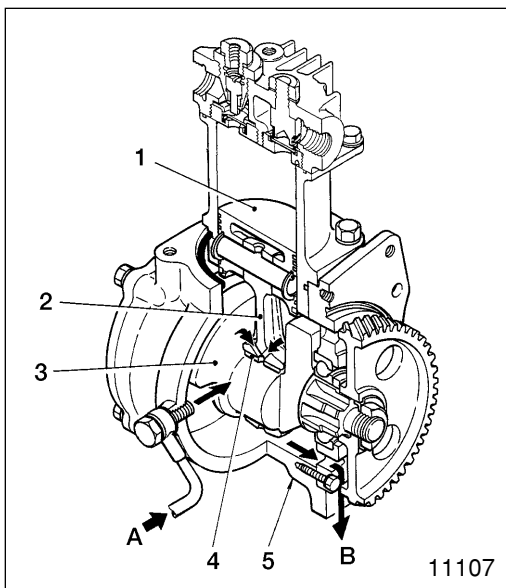
● Injection pump

- 1 Injection pump
- 2 Governor
- 3 Air compressor (or injection pump drive)

A: From main oil gallery

B: To oil pan

Engine oil that has lubricated injection pump 1 and governor 2 returns to the oil pan via the timer case, air compressor 3 (or injection pump drive), and timing gear train.



● Air compressor

- 1 Piston
- 2 Connecting rod
- 3 Crankshaft
- 4 Connecting rod bushing
- 5 Crankcase

A: From main oil gallery

B: To oil pan

Engine oil from the main oil gallery splashes onto connecting rod 2 and lubricates connecting rod bushing 4. Piston 1 and the connecting rod's small end are lubricated by oil that is splashed onto them by the rotation of the crankshaft 3.

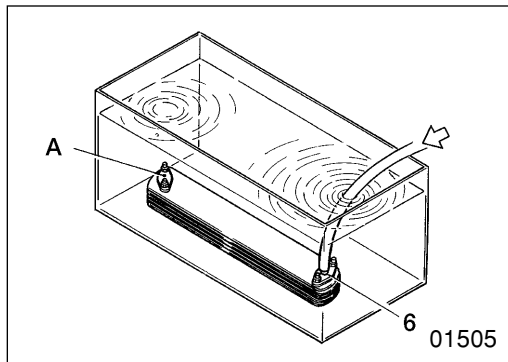
Lubricant and/or sealant

Location	Points of application	Specified lubricant and/or sealant	Quantity
2, 4, 11	Apply to O-rings	Engine oil	As required
13, 14	Wrap around thread of engine oil pressure gauge unit and engine oil pressure switch	Teflon tape	3 1/2 turns

◆ Service procedure

● Cleaning

- Check whether carbon deposits or sludge have accumulated in the oil passages of oil cooler element 6 and oil cooler cover 8 or in the oil cooler's bypass arrangement. Remove any deposits with cleaning sealant.
- Clean out any water scale or fur that has accumulated in the oil cooler element 6 or oil cooler cover 8.  Gr 14

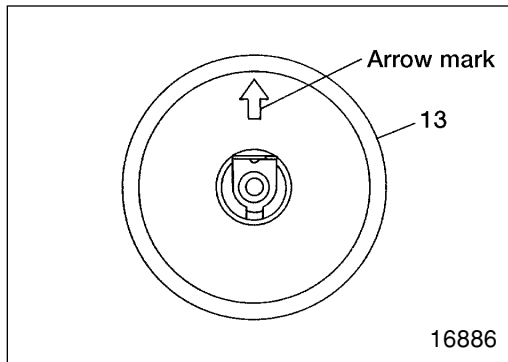


6 Inspection of oil cooler element

Plug outlet A of oil cooler element 6 and connect a hose to the oil inlet. Then, immerse the oil cooler element in a tank of water.

Apply the specified air pressure via the hose and check that no air leaks from the oil cooler element.

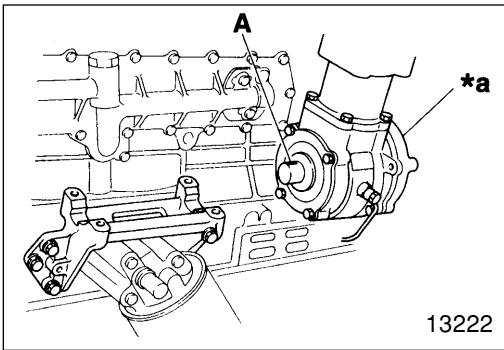
If any air leaks, replace the oil cooler element.



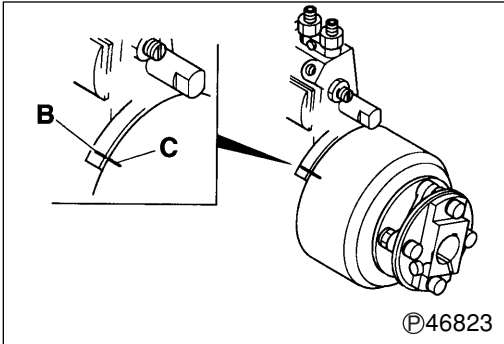
13 Engine oil pressure gauge unit

If the engine oil pressure gauge unit 13 is installed horizontally, it must be fitted with its arrow pointing upward.

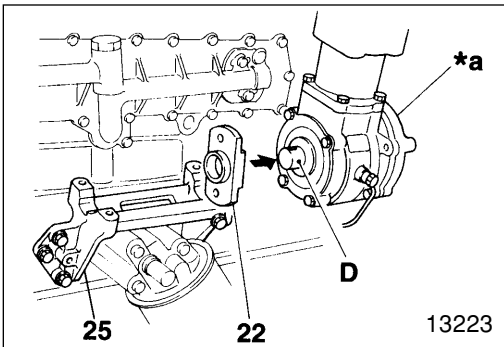
M E M O



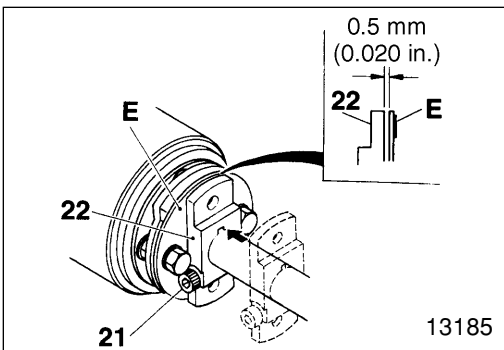
- Ensure that the key way A on the injection pump drive or air compressor (*a) crankshaft is facing upwards.
- If key way A is not facing upwards, rotate the engine crankshaft by one turn.



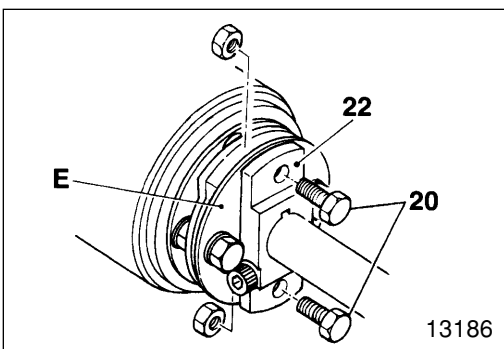
- Align line B inscribed on the injection pump and line C inscribed on the automatic timer.



- Fit driving coupling 22 to the injection pump drive or air compressor *a crankshaft D. Push the driving coupling against the injection pump drive or air compressor crankshaft D.
- Fit injection pump assembly 23 to injection pump bracket 25.



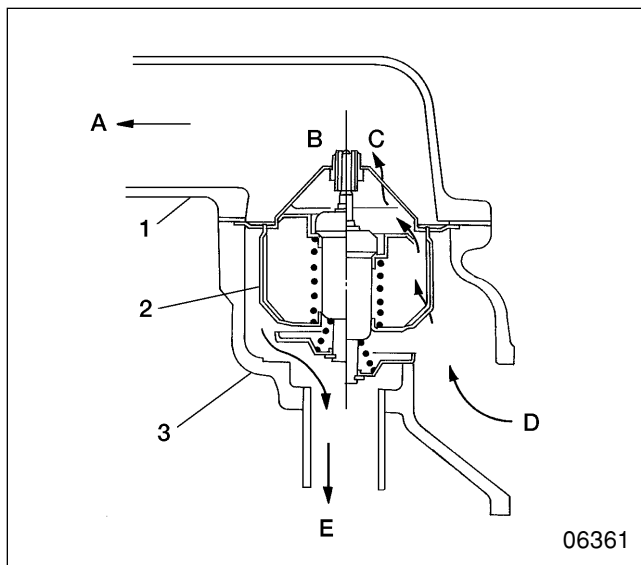
- Set driving coupling 22 apart from coupling plate E by 0.5 mm (0.020 in.) as shown in the illustration. Tighten cotter bolt 21 to the specified torque.



- Using bolts 20, fit driving coupling 22 and coupling plate E.

STRUCTURE AND OPERATION

3. Thermostat



- 1 Thermostat cover
- 2 Thermostat
- 3 Thermostat case

- A: To radiator
- B: With low coolant temperature
- C: With high coolant temperature
- D: From cylinder head
- E: To water pump

Thermostat 2 is a bottom bypass type that uses wax-charged pellets as its regulating element. As the wax changes from solid to liquid in line with temperature increases, the total wax volume changes. As a result, the position of the valve, changed by the coolant temperature, regulates the flow of coolant to the radiator and water pump (bypass side) and controls the coolant temperature.

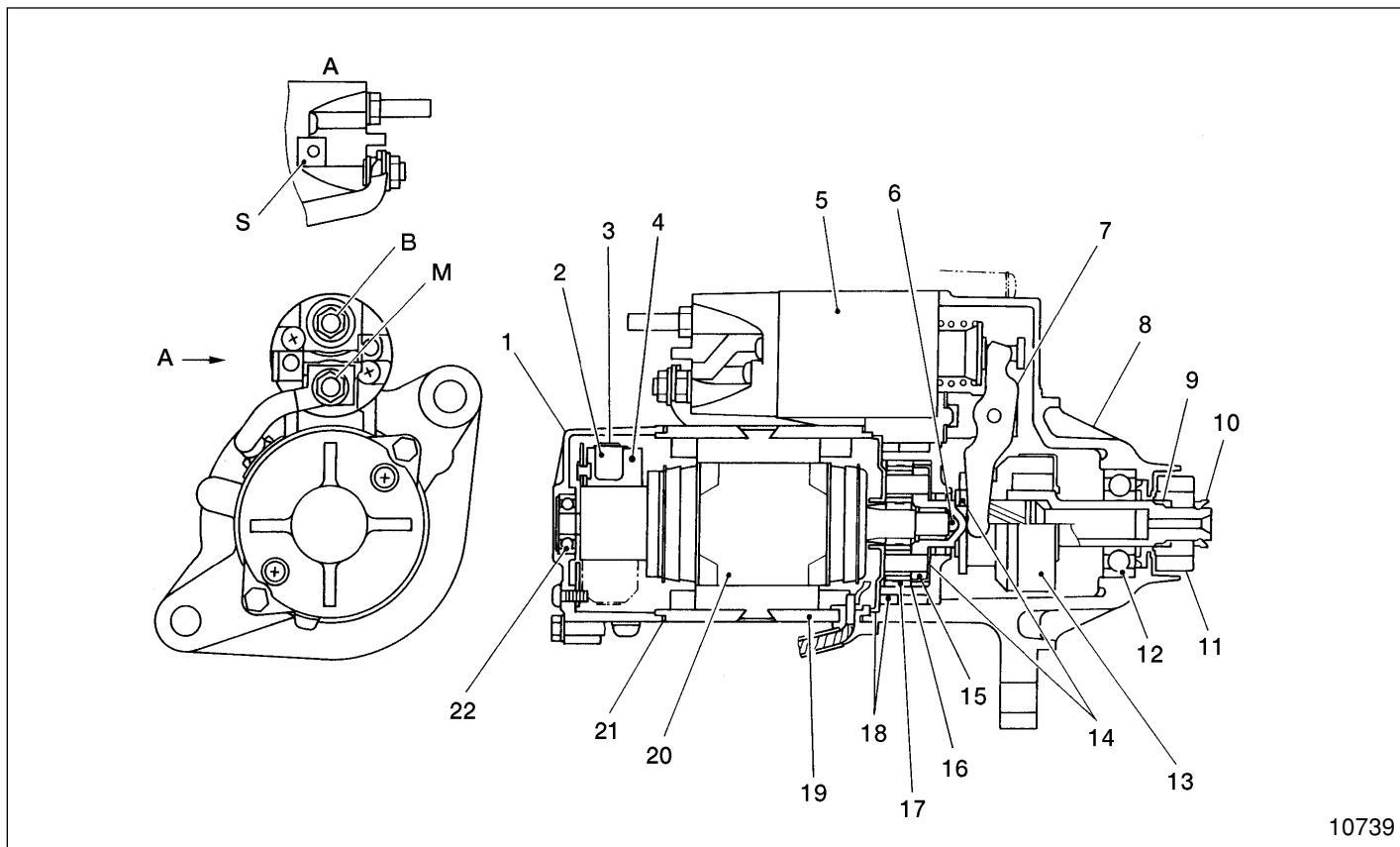
MEMO

M E M O

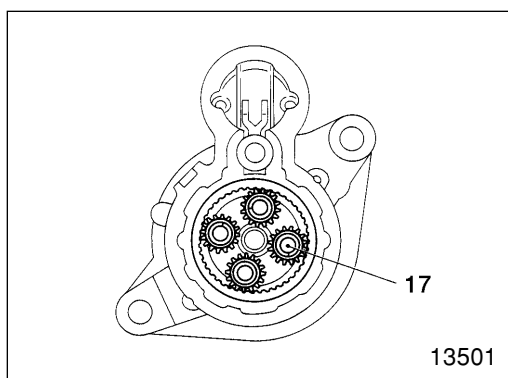
STRUCTURE AND OPERATION

4. Starter

<24V–5kW (6.7 HP)>



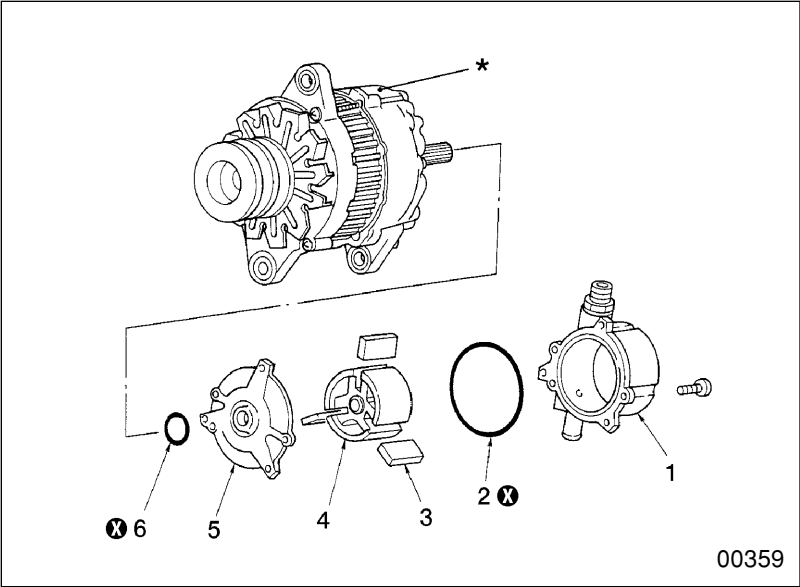
- | | | |
|-------------------------|---------------------------|----------------------|
| 1 Rear bracket | 10 Pinion stopper | 19 Yoke assembly |
| 2 Brush | 11 Pinion | 20 Armature assembly |
| 3 Brush spring | 12 Front bearing | 21 Packing |
| 4 Brush holder assembly | 13 Overrunning clutch | 22 Rear bearing |
| 5 Magnet switch | 14 Washer | |
| 6 Ball | 15 Gear shaft assembly | B: Terminal B |
| 7 Lever | 16 Internal gear assembly | M: Terminal M |
| 8 Front bracket | 17 Planetary gear | S: Terminal S |
| 9 Spring | 18 Packing | |



This starter uses planetary gear 17 in the reduction gear mechanism.

ALTERNATOR <24V-40A (with vacuum pump)>

Vacuum Pump Assembly



● Disassembly sequence

- 1 Vacuum housing
- 2 O-ring
- 3 Vane
- 4 Rotor
- 5 Plate
- 6 O-ring

*: Alternator P.54-26

ⓧ : Non-reusable part

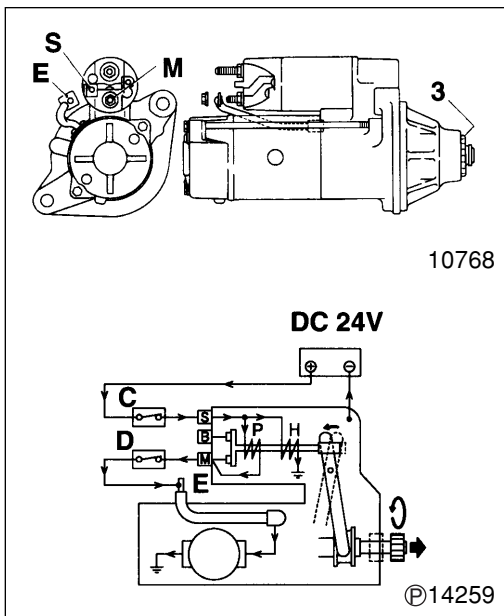
● Reassembly sequence

Reverse the order of removal.

Service standards

Location	Maintenance item	Standard value	Limit	Remedy
–	Attainable vacuum pressure (when alternator speed is 1500 rpm)	93 kPa (0.95 kgf/cm ²) [13 psi]	–	–

STARTER <24V-5kW>



(2) Pinion gap

[Inspection]

- Wire the starter as shown.

C: Switch

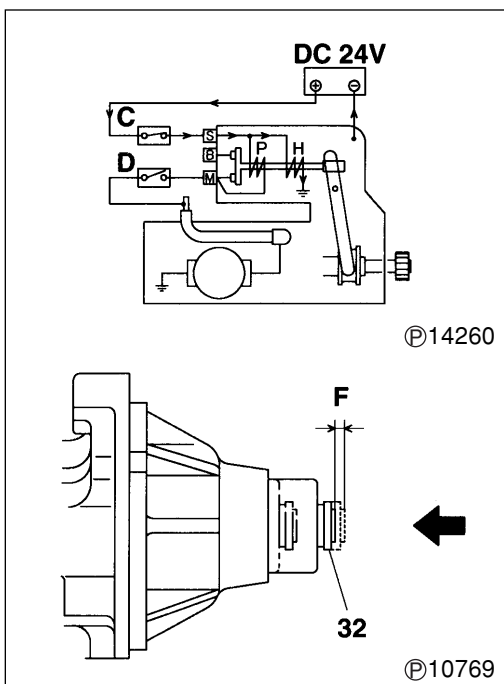
D: Switch

E: Cable

M: Starter terminal M

S: Starter terminal S

- The following operations are performed by supplying current to the starter. It is therefore necessary that the series of operations up to completion of measurement of the pinion gap is completed in less than 30 seconds.
 - Set the switch C and switch D to ON to supply current to the starter. At the time, the pinion 3 will spring out and rotate.



- Immediately (in less than 5 seconds) after the pinion has started rotation, set the switch D to OFF stop rotation of the pinion.

CAUTION

When the switch C and switch D are set to ON, current is supplied to both the pull-in coil P and holding coil H. Since wiring is such that no voltage is applied to terminal B of the starter, current flows to the pull-in coil during rotation of the pinion 3.

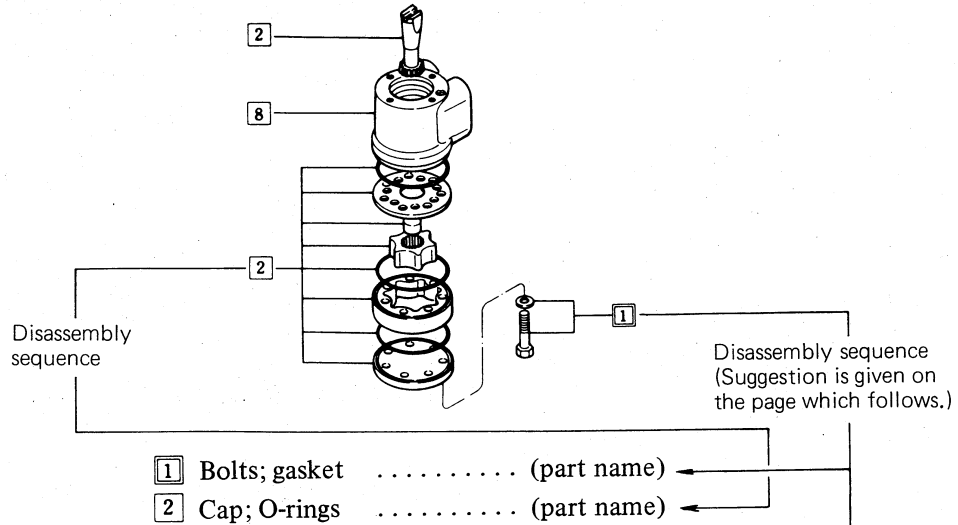
To prevent baking the pull-in coil, therefore, it is necessary that the switch E is set to OFF immediately (in less than 5 seconds) after the pinion has started rotating.

- Pull out the overrunning clutch 32 by hand, then push back its end lightly and measure the amount F the clutch moves in the axial direction (pinion gap).
- Set the switch C to OFF to stop supplying current to the starter.
- If the reading is out of the standard value, replace the lever assembly 33.

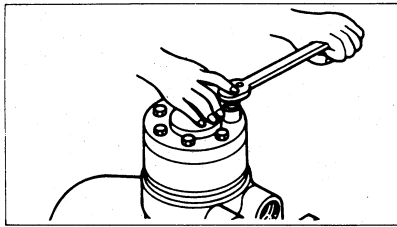
MEMO

IDENTIFICATION SYMBOLS

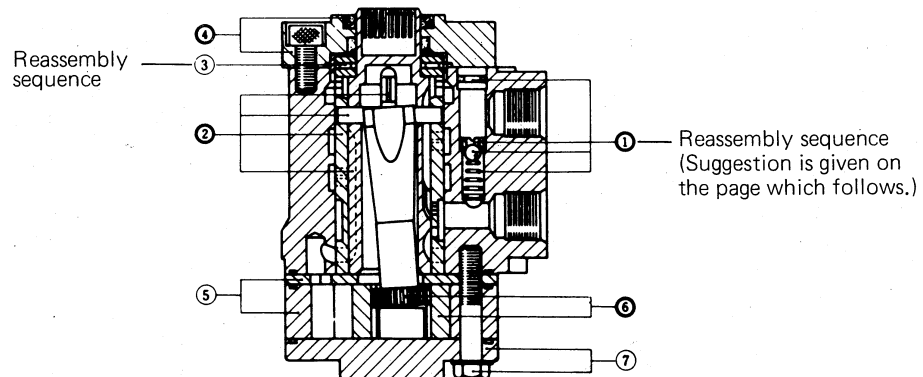
■ Disassembly



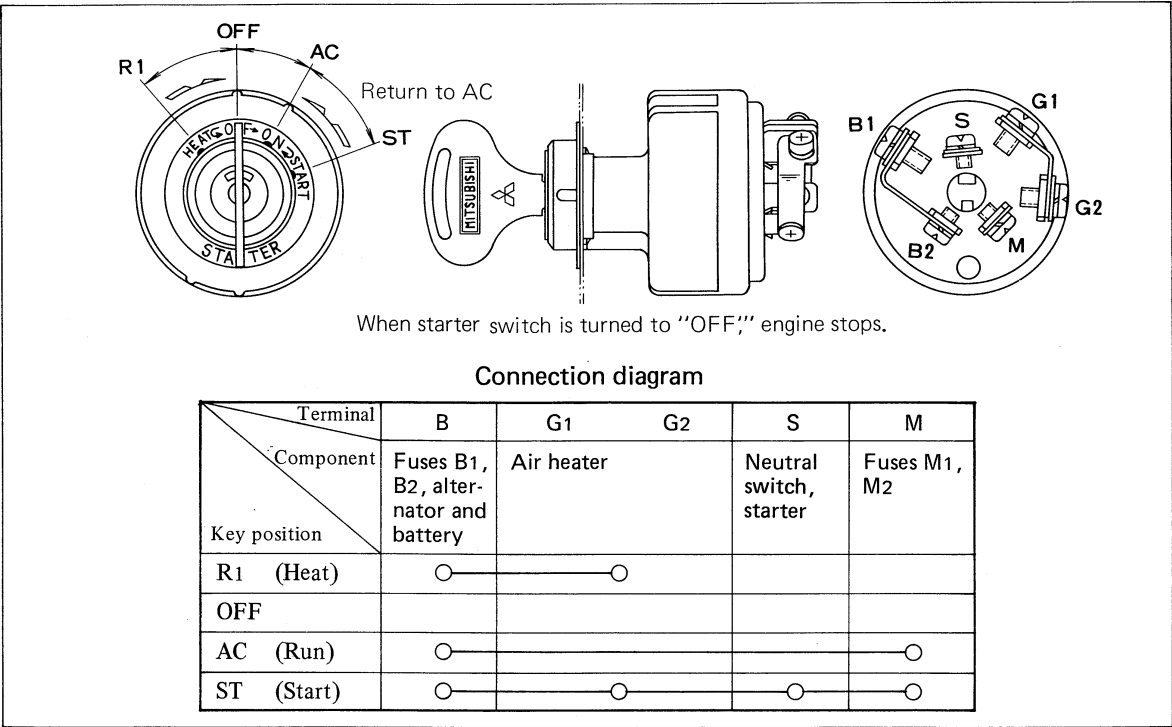
1 Cap mounting bolt removal



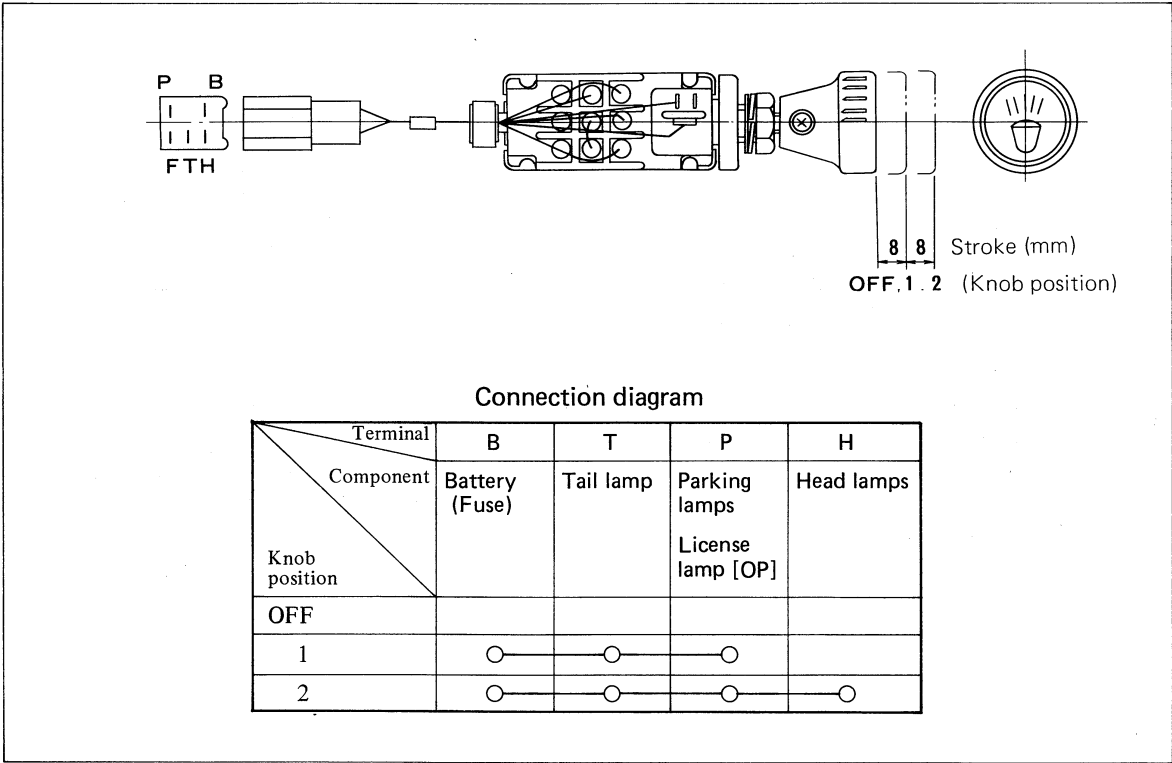
■ Reassembly



Starter switch

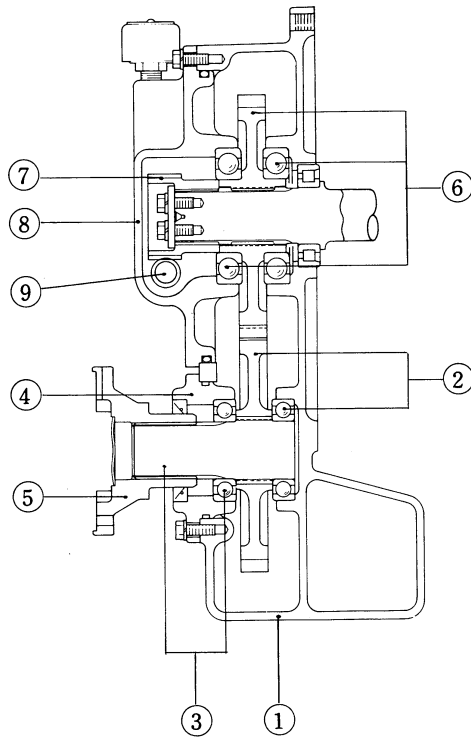


Lighting switch



TORQUE CONVERTER & TRANSMISSION

■ Reassembly



- | | |
|--|---|
| ① Transfer case
[Ball bearing] | ⑥ Input gear
[Ball bearing] |
| ② Output gear
[Ball bearing] | ⑦ Speedometer worm gear
[Spacer; lock plate; bolt] |
| ③ Output gear shaft
[Ball bearing] | ⑧ Speedometer cover
[Bolt; O-ring] |
| ④ Output cover
[O-ring; oil seal; bolt] | ⑨ Speedometer drive gear and lock plate
[Pin; speedometer bushing; O-ring; oil seal] |
| ⑤ Output flange | |
-

REDUCTION DIFFERENTIAL & FRONT AXLE

Drive from the engine is transmitted to the front wheels through the front axle. Two stages of speed reduction by gearing are involved in this drive, first in the reduction gearing and next in the planetary gearing — final reduction gearing — in the wheel hub.

The front axle is of full-floating type. Its two live axle shafts serve only to transmit drive to the wheels and do not take any part in imparting dead load to the wheels. The front-end load, including that of the mast assembly, is transmitted by the dead axle portions to the front wheels. The dead axle comprises the banjo-type housing of all-weld construction, integral with two sleeve structures extending to both sides, each surrounding the live axle shaft and rigidly connected to the chassis by means of a supporting bracket.

The reduction pinion, meshed with the reduction gear in the axle housing, is supported at its shank by two tapered roller bearings and at its forward end by a roller bearing. The reduction gear is bolted to the differential case, in which four differential pinions mounted on a cross spider are meshed with two differential gears splined to the inboard ends of the two live axle shafts.

The outboard end of each live axle shaft carries a sun gear, which is surrounded by three

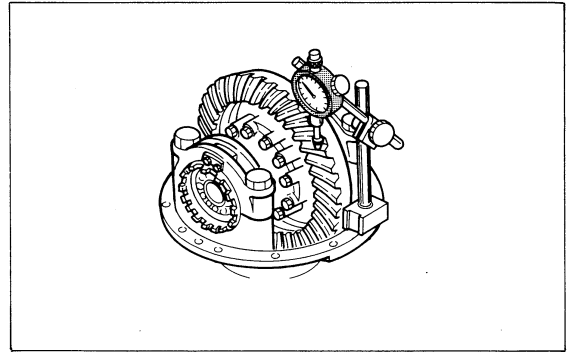
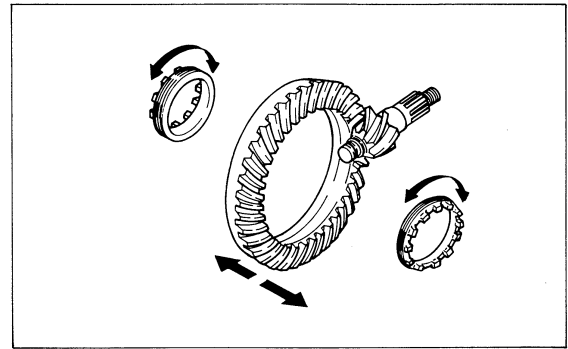
planet gears. Each planet gear runs on its shaft or pin; the pin is locked by means of a steel ball to the planet carrier bolted to the end face of the wheel hub. In other words, the planet carrier is integral with the hub, on which wheel rims are mounted rigidly.

The three planet gears are meshed with the teeth (internal) of the ring gear, the inboard end of which is splined to the dead axle. The ring gear is therefore stationary and forms an extension of the dead axle sleeve. Since the planet gears are around the sun gear and are surrounded by the ring gear, they “roll” along the teeth of the ring gear when they are driven by the sun gear; by this “rolling,” the planet carrier is forced to rotate. In short, the planet carrier and hub receive the drive from the live axle through the sun gear and planet gears. Here in the planetary gearing, the second or final reduction takes place.

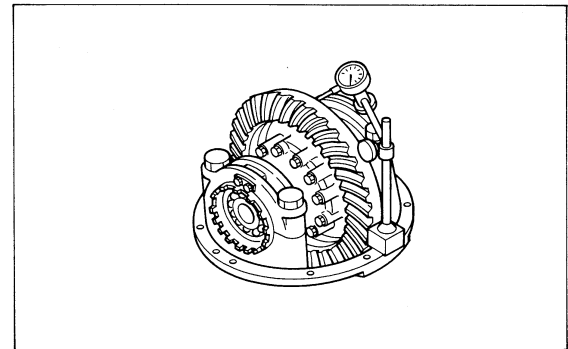
The shaft or pin, on which the planet gear is mounted through bushings, has internal oilways, through which oil flows into the oil grooves provided on the bore of each bushing. Thus, good lubrication is assured of the planet gear rotating on the pin. A cover is provided next to the planet carrier to contain the oil inside.

REDUCTION DIFFERENTIAL & FRONT AXLE

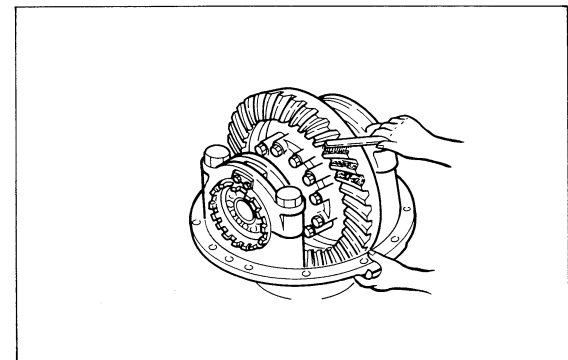
- (2) Measure backlash of reduction gear and pinion. To measure it, rig up a dial gauge with its spindle pointing squarely to heel of reduction gear. With the pinion held, move the gear back and forth to read the gauge pointer. To adjust the backlash, adjusting screws, right and left, must be equally unscrewed or screwed so as not to disturb bearing preload.



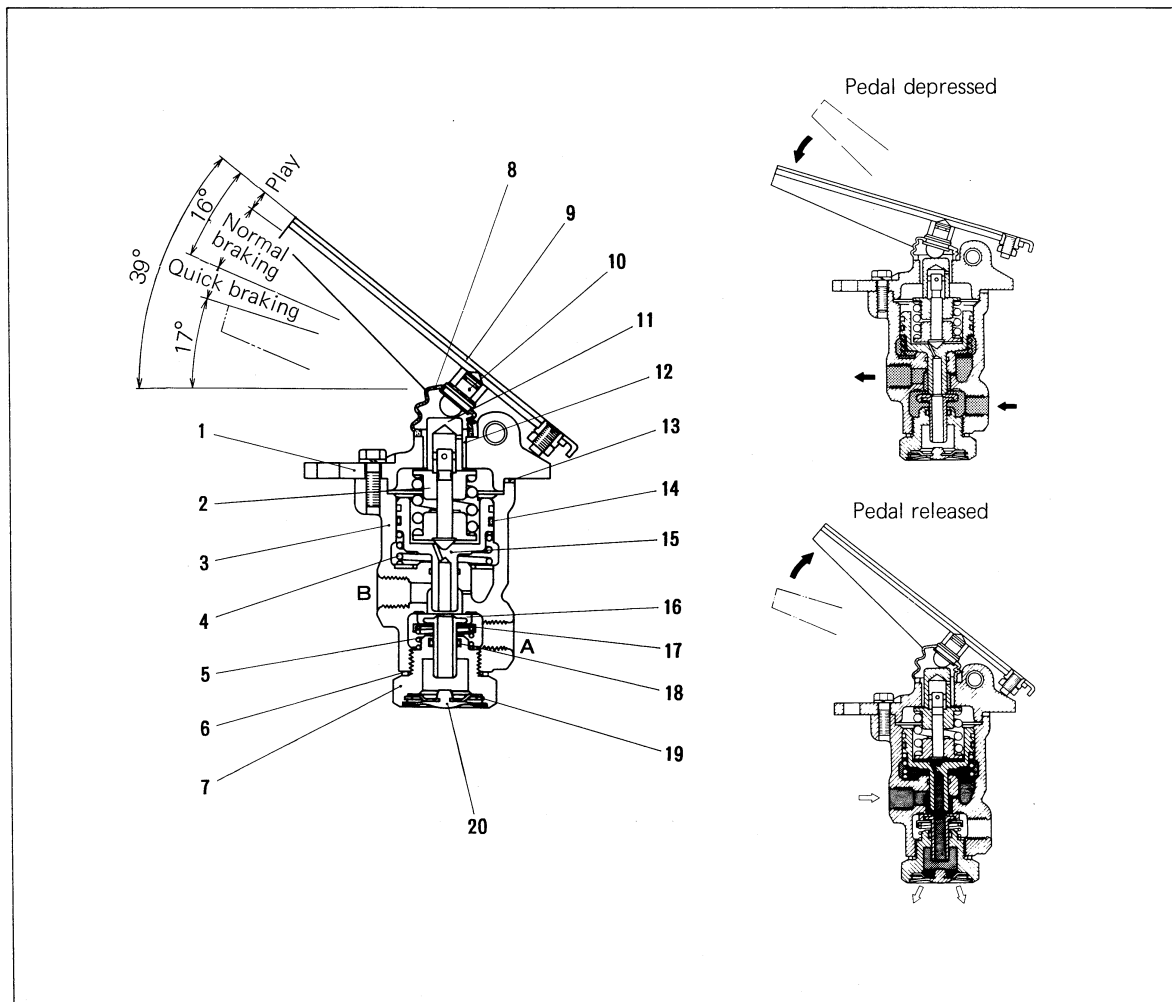
- (3) Using a dial gauge, check reduction gear for face runout at the maximum radius position in back of the gear. If this runout exceeds the limit, check reduction gear bolts for rightness, retightening them if necessary. Also check tapered roller bearings for condition, replacing and readjusting if necessary.



- (4) Check reduction gear tooth contact. To check, apply a thin coat of red lead to several reduction gear teeth on both drive and coast sides. Press forward on reduction pinion, and rotate reduction gear backward and forward until a contact pattern is noted on both concave and convex faces of gear teeth. To adjust tooth contact, refer to the following chart:



■ Brake control valve



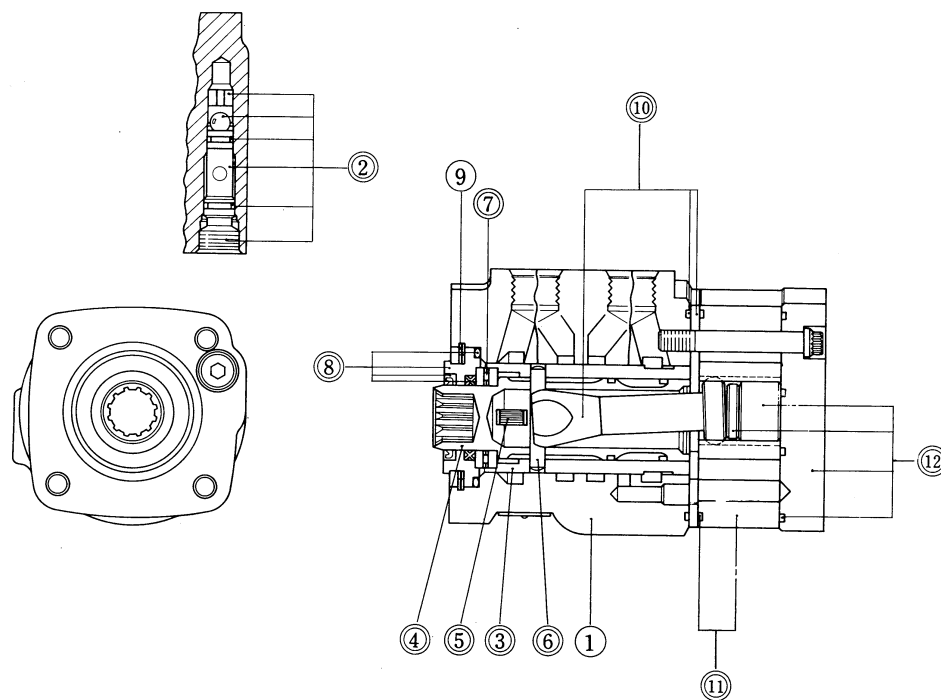
- | | |
|------------------------|------------------------|
| 1-Valve cover | 13-Packing |
| 2-Main spring assembly | 14-O-ring |
| 3-Valve case | 15-Piston |
| 4-Return spring | 16-Feed valve assembly |
| 5-Spring | 17-Spring seat |
| 6-Packing | 18-O-ring |
| 7-Cap | 19-C-ring |
| 8-Boot | 20-Dust seal |
| 9-Pedal | |
| 10-Push button | A-Air tank side port |
| 11-Plunger | B-Air master side port |
| 12-Plunger guide | |

The brake control valve is constructed as shown. Depressing the brake pedal causes this valve to open to introduce the air, proportional to the brake pedal position, into the line leading

to the air master. As the pedal is released, it lets out the air to the atmosphere.

- (2) Both ends of adjusting screw and ends of shoe webs to be fitted to slots of adjusting screw
 - (3) Threads and ends of adjusting screw
 - (4) Support plate (6 places)
3. Install chamshaft lever with marks aligned.

■ Reassembly



- | | |
|--|---|
| ① Long housing | ⑦ Thrust needle roller bearing |
| ② Check valve
[Check ball retainer; ball; O-ring; check seat;
set screw] | ⑧ Seal gland bushing
[Oil seal; dust seal; O-ring] |
| ③ Control sleeve | ⑨ Retaining ring |
| ④ Control spool | ⑩ Drive shaft
[Spacer plate; O-ring] |
| ⑤ Centering spring | ⑪ Metering rotor set
[O-ring] |
| ⑥ Pin | ⑫ End cap
[O-ring; spacer; bolt] |

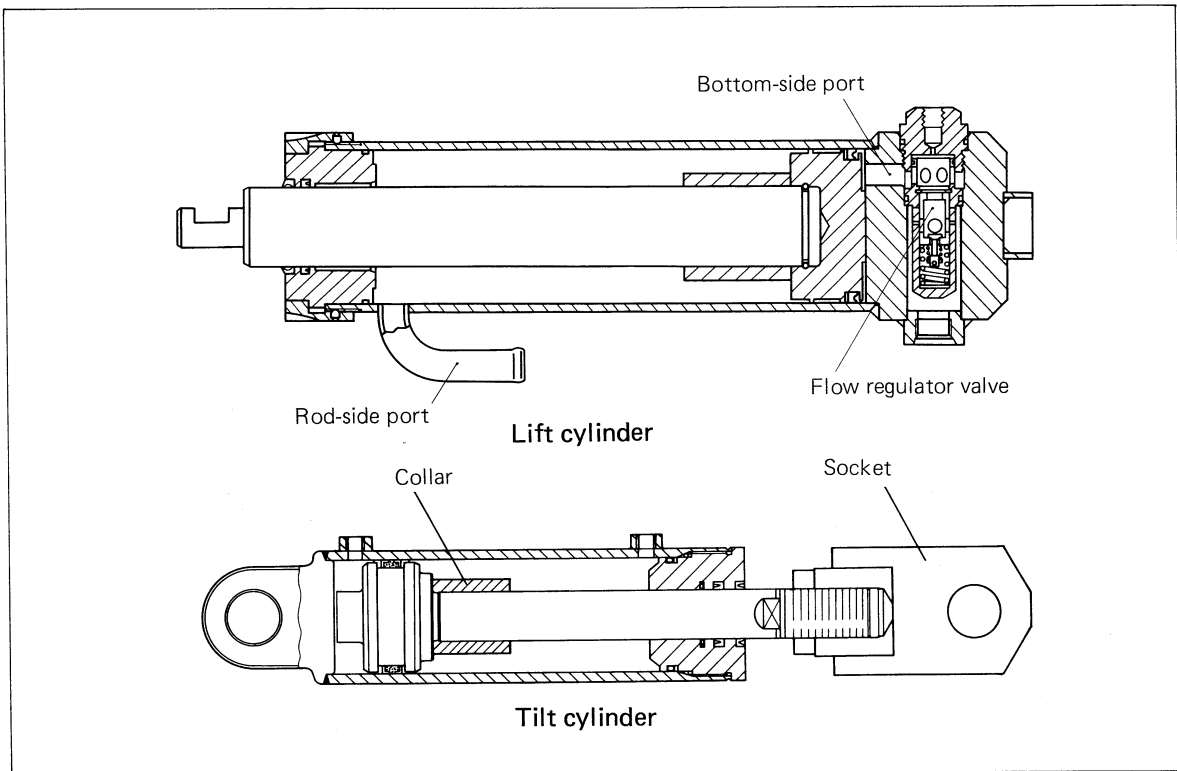
NOTE

Before reassembling, service as follows:

- Replace defective parts.
- Wash all metal parts and air dry.
- Replace O-rings and seals.
- Apply a coat of grease to O-rings.

HYDRAULIC SYSTEM

Lift and tilt cylinders



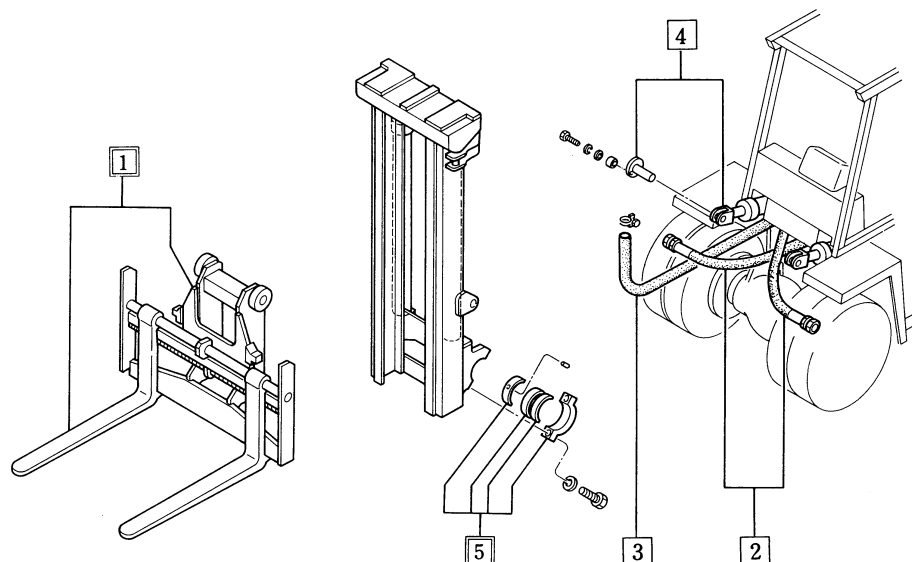
The lift cylinders right and left, are of single-acting type. The bottom-side port is equipped with a flow regulator valve. A return pipe is tied into its rod-side port in order to admit hydraulic oil from the oil tank when the piston goes down. By this feature, the top portion of cylinder bore wall is protected against rusting.

The tilt cylinders, right and left, are of double-acting type. The piston rod carries a screw-on “eye” piece. This piece, or socket, is to be repositioned by turning, as necessary, when the cylinder is connected to the outer mast. By this feature, the two tilt cylinders can be made to act on the mast in unison.

The tilt angle can be increased or decreased by means of collar and socket of each cylinder.

REMOVAL AND INSTALLATION

Mast & fork assembly



1 Forks; lift bracket

2 Lift cylinder high-pressure hose

3 Lift cylinder return hose

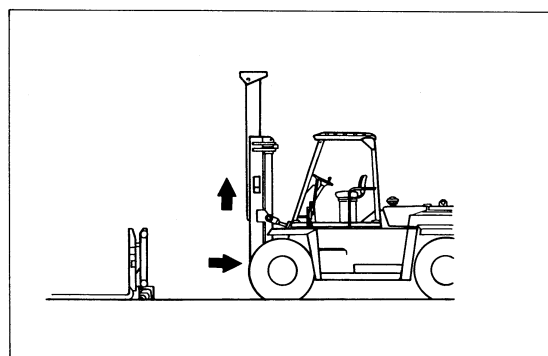
4 Tilt cylinder; cylinder pin

5 Mast support bearing cap
[Bushing; seal]

■ Tips for removal

1 Lift bracket removal

Raise inner mast to clear lift bracket, and back the truck away, leaving lift bracket standing on the floor.



BRAKE SYSTEM

Complaint		Possible cause	Remedy
Service brakes	Will not apply	a) Pressure too low in air tank b) Air circuit leaks c) Fluid circuit leaks or fluid level too low in reservoir d) Air trapped in hydraulic line e) Drum-to-lining clearance out of adjustment f) Air master or wheel cylinder piston cups worn, resulting in oil leaks	Increase pressure in air tank Repair or replace. Repair or add fluid. Bleed air out of air master and wheel cylinders. Readjust. Replace. Replace fluid with recommended type if cups are distorted.
	Brakes chatter	a) Linings worn to expose rivet heads b) Lining surface "glazed" c) Brake drum abnormally worn or loose d) Linings not seated on shoes	Replace. Replace. Replace or retighten. Replace linings.
	Will apply in one wheel	a) Wheel tires not inflated equally b) Brake shoe clearance out of adjustment c) Uneven contact of linings on drum d) Linings or drum wet with oil or grease e) Linings not equal in size and material f) Brake shoes loose or return springs broken g) Wheel cylinder faulty in one brake	Adjust tire pressure. Readjust. Repair or replace. Clean off oil or grease with solvent. Replace linings if necessary. Replace. Retighten or replace. Check cylinder piston and piston cups, and replace defective parts.
	Not enough brake pedal stroke	Brake valve defective	Readjust or replace.
	Brakes drag	a) Brake control valve leaks air into line leading to air master, causing air master to operate b) Brake pedal arm not returning properly	Repair or replace. Lubricate or repair arm shaft. Replace return spring if necessary.
	One brake drags	a) Drum-to-lining clearance too small in one brake b) Brake shoe return springs weak or broken c) Anchor pin seized, resulting in a failure of shoes to return d) Wheel cylinder piston and piston cup defective e) Brake pipe restricted at joint, resulting in a failure of fluid to return properly.	Readjust. Replace. Repair. Replace. Clean.

A-Assembly standard B-Repair or service limit

Reduction differential & front axle

Unit: mm (in.)

Truck model			FD100	FD115	FD135
Item					
Reduction differential	Gear backlash between differential pinions and differential gears (1)	A	0.2 ~ 0.28 (0.008 ~ 0.0110)		
		B	0.5 (0.020)		
	Thickness of thrust washers (2)	A	2.8 ± 0.025 (0.110 ± 0.00098)		
	Clearance between differential pinions and spiders (3)	A	0.034 ~ 0.084 (0.00134 ~ 0.00331)		
		B	0.35 (0.0138)		
	Preload for differential case tapered roller bearings (4) kg-cm (lb-ft) [Tangential pull applied to periphery of differential case] kg (lb)	A	25 ~ 35 (1.81 ~ 2.53) [2.4 ~ 3.3 (5.3 ~ 7.3)]		
	Face runout of reduction gear (5) at maximum radius	A	0.15 (0.0059), max		
	Backlash of reduction gear with reduction pinion (on output shaft) (6)	A	0.25 ~ 0.4 (0.0098 ~ 0.016)		
		B	0.6 (0.024)		
	Preload for reduction pinion bearing kg-cm (lb-in.) [Tangential pull applied to periphery of bearing retainer] kg (lb) (7)	A	25 ~ 35 (1.81 ~ 2.53) [3.7 ~ 4.2 (8.2 ~ 9.3)]		
	Axle shaft spline backlash (8)	A	0.16 ~ 0.20 (0.0063 ~ 0.0079)		
		B	0.5 (0.020)		
	Tightening torque kg-m (lb-ft)	Reduction gear mounting bolts (9)	A	30 (217.0)	
		Differential case mounting bolts (10)	A	20 (144.7)	
		Bearing cap mounting bolts (11)	A	45.5 (329.1)	
		Differential carrier mounting bolts (12)	A	9.8 (70.9)	
		Lock plate mounting bolts (13)	A	3.5 (25.3)	
		Reduction pinion bearing retainer mounting bolts (14)	A	12 (86.8)	
		Reduction pinion self locking nut (15)	A	55 ~ 75 (397.8 ~ 542.5)	

SERVICE DATA

○ : Check or clean ● : Change or adjust

Check points and items			What to do	Free warranty service intervals				Periodical service intervals				
				1 month	2 months	3 months	Daily	1 month	3 months	6 months	12 months	24 months
Hydraulic system	Hydraulic tank	Oil level and contamination of		○	○	○	○	○	○	○	●	●
		Strainer, condition of				○				○	○	○
		Return filter, condition of								●	●	●
	Pump	Oil leaks		○	○	○	○	○	○	○	○	○
	Priority valve	Oil leaks		○	○	○	○	○	○	○	○	○
		Hydraulic pressure in steering circuit							○	○	○	○
	Control valve	Oil leaks		○	○	○	○	○	○	○	○	○
		Main relief pressure		○	○	○	○		○	○	○	○
		Port relief pressure					○		○	○	○	○
		Lever; link, rattle of					○		○	○	○	○
	Lift cylinder	Cracks, distortion and other damage						○	○	○	○	○
		Function, wear and oil leaks		○	○	○	○	○	○	○	○	○
		Attaching bolts, tightness of		○	○	○	○	○	○	○	○	○
	Flow regulator valve	Oil leaks		○	○	○	○	○	○	○	○	○
		Lowering speed		○	○	○	○	○	○	○	○	○
	Tilt cylinders	Cracks, distortion and other damage						○	○	○	○	○
		Function, wear and oil leaks		○	○	○	○	○	○	○	○	○
		Installation		○	○	○	○	○	○	○	○	○
	Piping and tubing	Oil leaks		○	○	○	○	○	○	○	○	○
		Rubber hoses, damage to		○	○	○		○	○	○	○	○
Mast and forks	Mast and lift bracket	Cracks, distortion and other damage		○	○	○	○	○	○	○	○	○
		Mast support, rattle of		○	○	○			○	○	○	○
		Side rollers, rattle or damage to		○	○	○	○	○	○	○	○	○
	Lift chains and chain wheels	Lift chains, stretch and tension of		○	○	○	○	○	○	○	○	○
		Lift chains, damage, rust formation and distortion of		○	○	○	○	○	○	○	○	○
		Chain wheels, wear of or damage to							○	○	○	○

GROUP INDEX

GENERAL INFORMATION

REMOVAL AND INSTALLATION OF ACCESSORIES

ENGINE PROPER

INTAKE AND EXHAUST SYSTEMS

LUBRICATION SYSTEM

COOLING SYSTEM

FUEL SYSTEM

ELECTRICAL EQUIPMENT

AIR COMPRESSOR

DETERMINING TIME TO OVERHAUL

ENGINE TUNE-UP AND BREAK-IN OPERATION

SPECIAL TOOLS

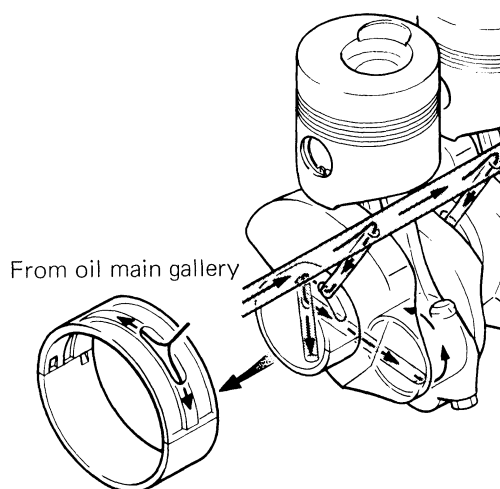
SERVICE DATA

(5) Lubrication of individual parts

The engine oil forced to the oil main gallery lubricates the individual parts as outlined below.

(a) Main bearing and connecting rod bearing

The oil delivered from the oil main gallery is forced through the oil hole of each crankshaft main bearing to lubricate the main bearings. Some of the engine oil of the main bearings is forced through the oil hole in the crankshaft to lubricate the connecting rod bearings.

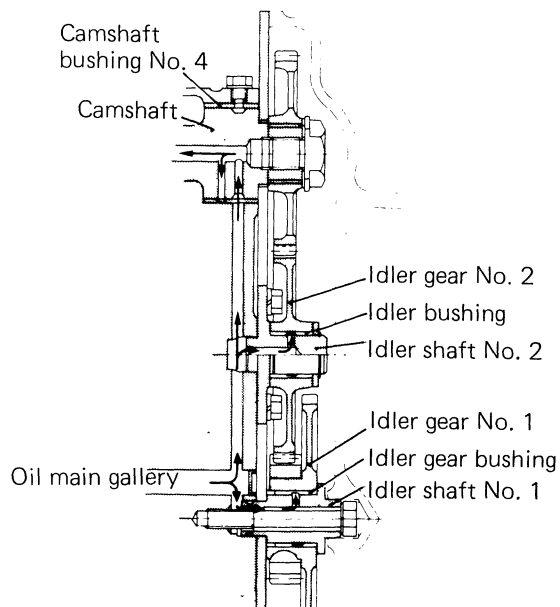
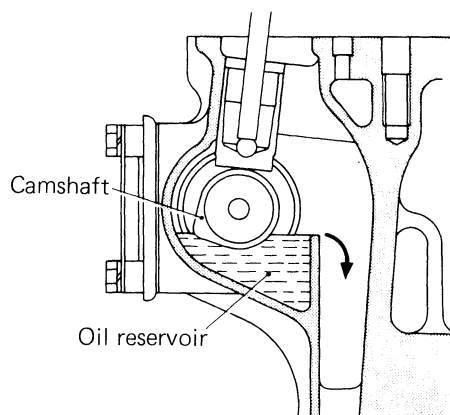


(b) Timing gear and camshaft

The timing gears are lubricated by the oil forced from the oil main gallery through the oil holes to the individual bushing as shown.

The camshaft bushings are lubricated by the engine oil coming from the oil main gallery. The oil lubricates camshaft bushing No. 4 and flows into the oil hole in the axial direction of the camshaft, then lubricating other camshaft bushings.

After lubrication of the rockers, camshaft bushings, etc., the engine oil enters the oil reservoir to lubricate the cam lobe of the camshaft.



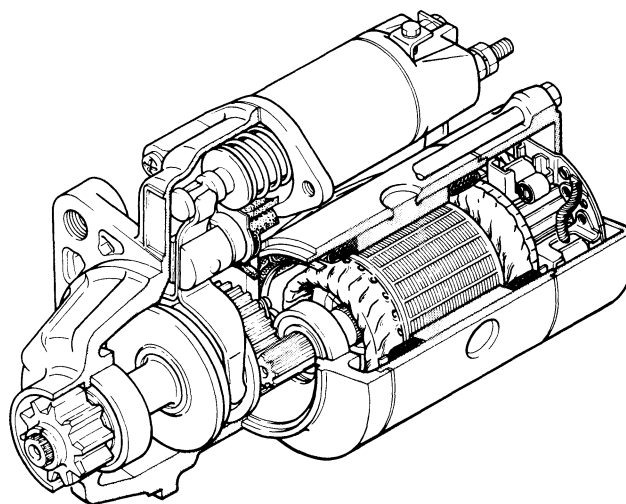
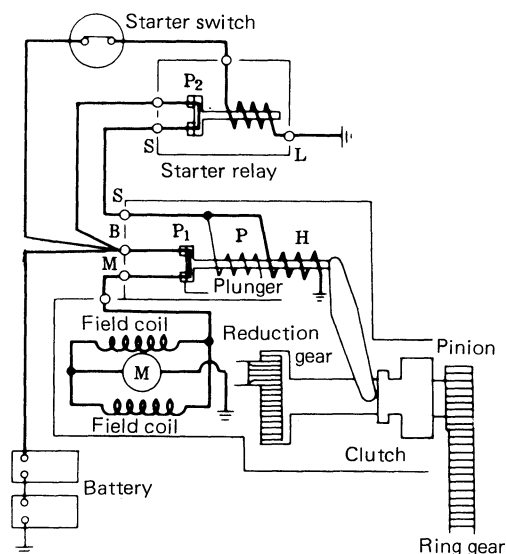
(1) Starter

The starter motor is an overhang type in which the contact surface of the pinion is not exposed to outside to seal out dust.

Also, the motor is small in size but a high-speed type. To compensate the decrease in torque resulting from the decrease in size, reduction gear is adopted; that is, a reduction starter is employed.

The starter consists mainly of the motor, overrunning clutch (which delivers the torque of the armature to crank the engine, and prevents the starter from overrunning after the engine has started), magnetic switch (which makes the pinion mesh with the ring gear, and transmits load current to the motor), and reduction gears (which reduces the armature speed and delivers the torque to the pinion).

When the pinion comes in mesh with the ring gear completely, contact points P_1 close, and current flows from the battery to the motor, thus turning the pinion. In this case, no current flows to the pull-in coil (P), and the plunger is held by the holding coil (H) alone.



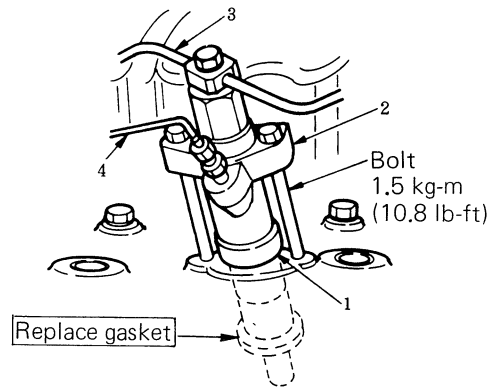
(2) Injection nozzles

(a) Install the following parts.

- 1 Dust seal
- 2 Injection nozzle
- 3 Leak-off pipe
- 4 Injection pipe

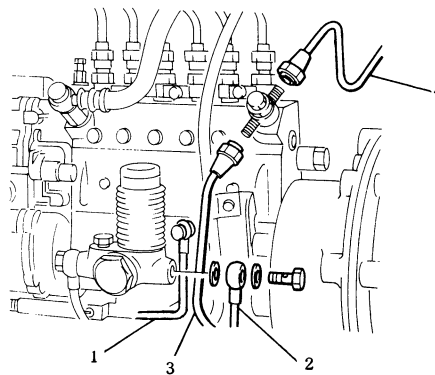
NOTE

The nozzle mounting bolts should be tightened alternately and in steps.



(b) Install the following parts.

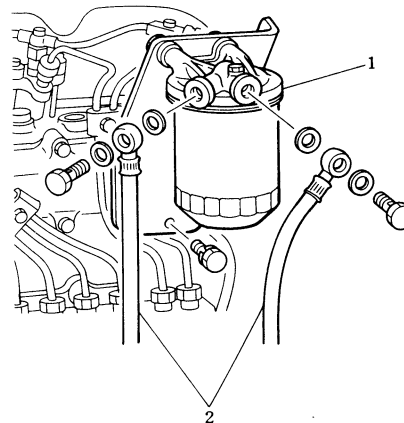
- 1 Oil pipe
- 2 Suction pipe
- 3 Return pipe
- 4 Leak-off pipe



(3) Fuel filter

Install the following parts.

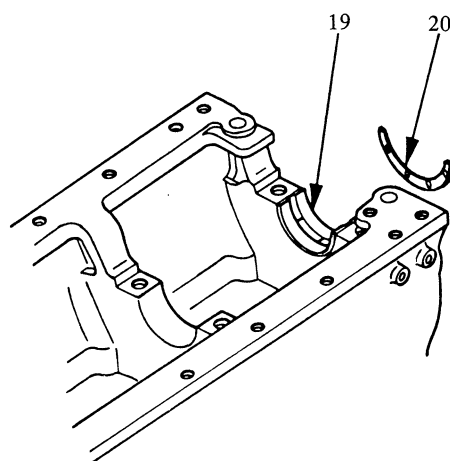
- 1 Fuel filter
- 2 Flexible hose



(11) Remove the following parts.

19 Main bearing

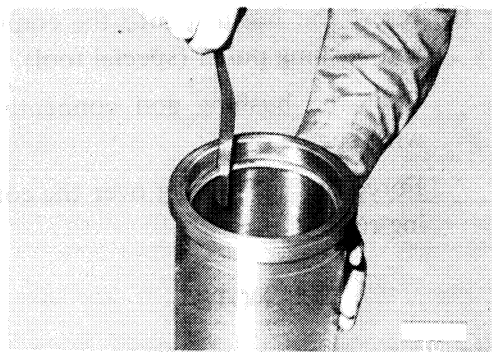
20 Thrust plate



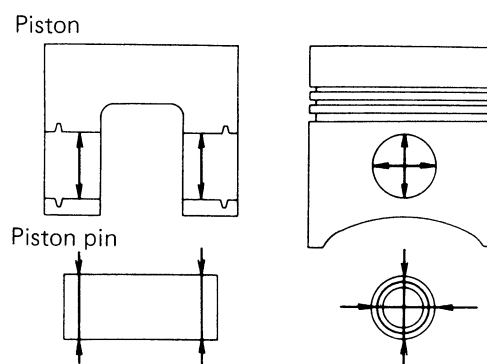
- (4) Place the piston ring in a standard gauge or new cylinder to measure the end gap.
If the service limit is exceeded, replace.
Standard gauge I.D. 113 ± 0 mm (4.45 ± 0 in.)

NOTE

For measurement, push the piston ring into the standard gauge with a piston to level its position.

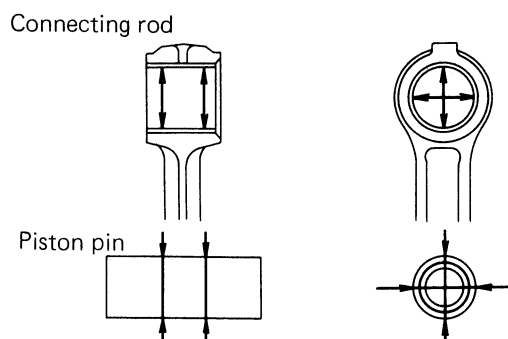


- (5) Calculate the clearance between the piston pin and its hole in piston by measuring their O.D. and I.D.
If the clearance is over the service limit, replace the piston pin or piston.

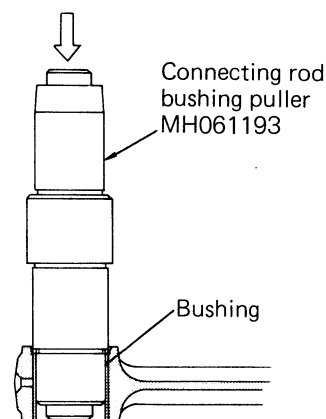


Connecting rods

- (1) Calculate the clearance between the piston pin and connecting rod end by measuring their O.D. and I.D.
If the repair limit is exceeded, replace the bushing in the connecting rod.

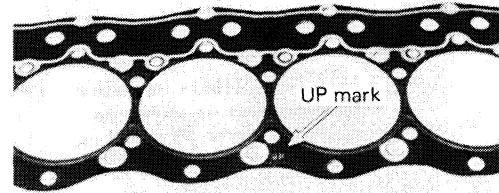


- (2) Replacement of connecting rod bushing
(a) Draw out a bushing with a special tool (connecting rod bushing puller).



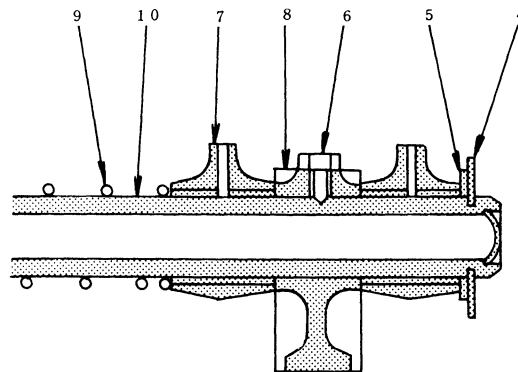
NOTE

Install the cylinder head gasket with the UP mark side facing toward the cylinder head.

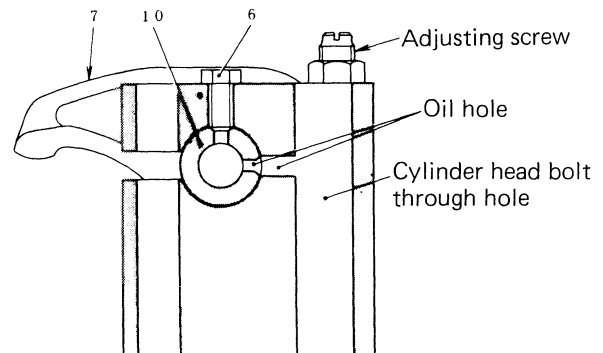


(6) Install the following parts to the rocker shaft 10.

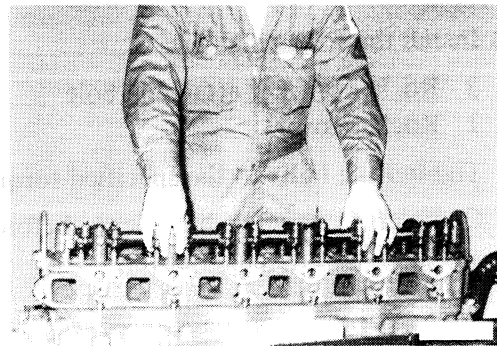
- 8 Rocker shaft bracket
- 6 Set screw
- 7 Rocker
- 9 Rocker shaft spring
- 5 Washer
- 4 Snap ring

**NOTE**

There is an oil hole in the rear rocker shaft bracket. Align this hole with the hole in the rocker shaft, and lock the shaft with the set screw.

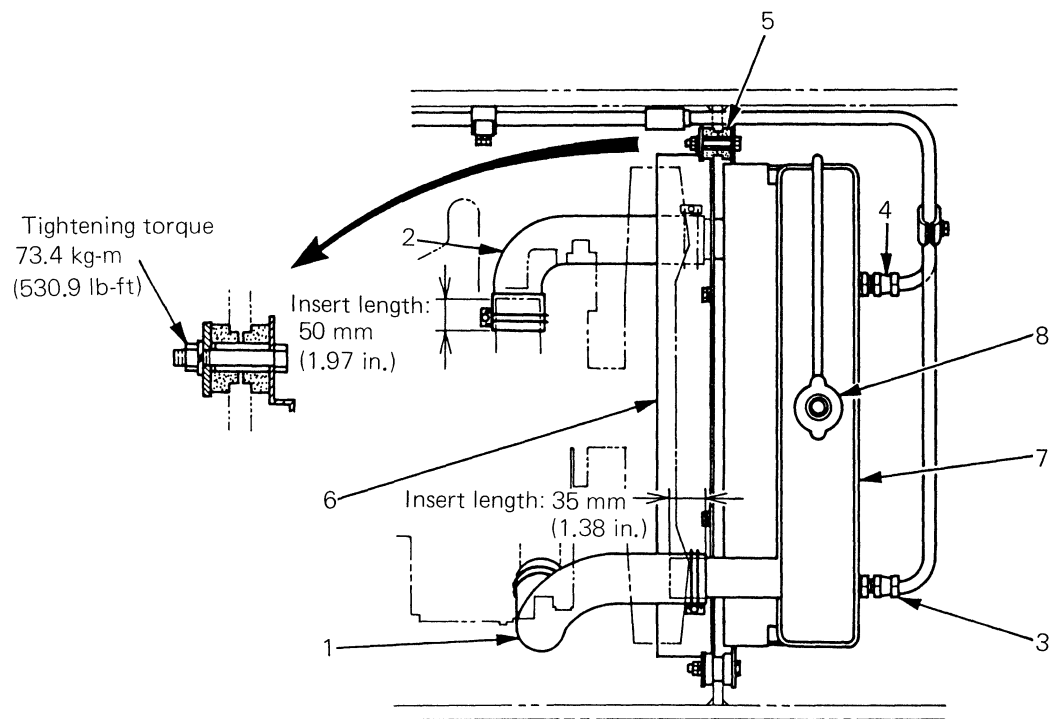


(7) Install the push rod 11 and rocker and bracket assembly.



COOLING SYSTEM

Installation



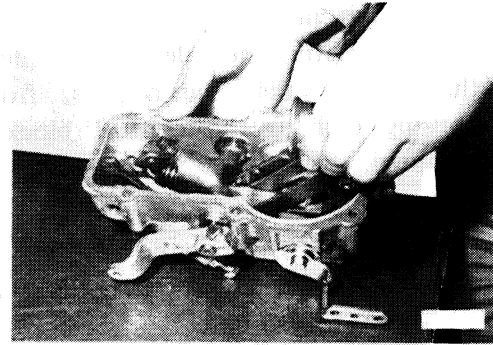
Installation order

Install in order of the following numbers.

8 → 7 → 6 → 5 → 4 → 3 → 2 → 1

(e) Remove the following parts:

- 8 Cap nut and lock nut
- 9 Full-load stopper
- 10 Cover
- 11 Adjusting lever
- 12 Supporting lever shaft
- 13 Control lever assembly
- 16 Control spring

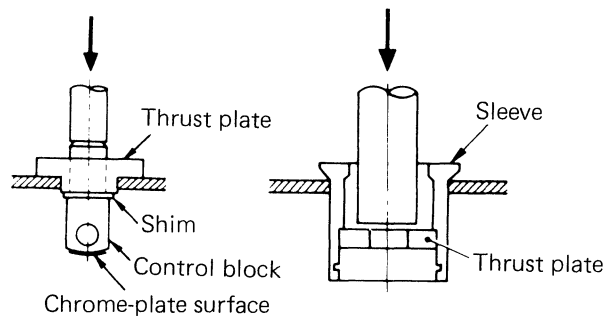


(f) Remove swivelling lever 22.

Remove snap ring 19 on the lever bushing, and remove each bushing 20 by tapping on swivelling lever shaft from the adjusting lever side, then remove the swivelling lever.

(g) Sleeve or control lever

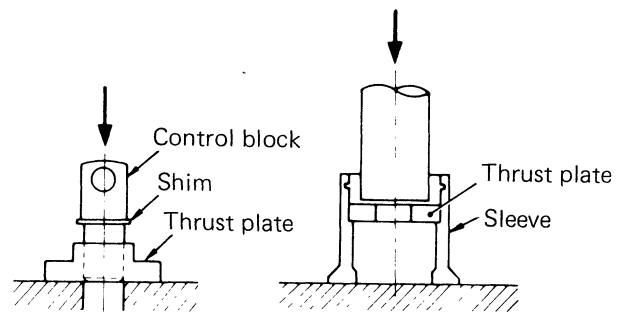
- (1) Remove the snap ring in the sleeve, and disconnect the sleeve from the guide lever control block.
- (2) Using a press, remove the thrust plate from the sleeve and control block.



- (3) Press-fit the thrust plate into each of the sleeve and control block.

NOTE

Never change the shim, since its thickness has been already determined as specified in (h) below.

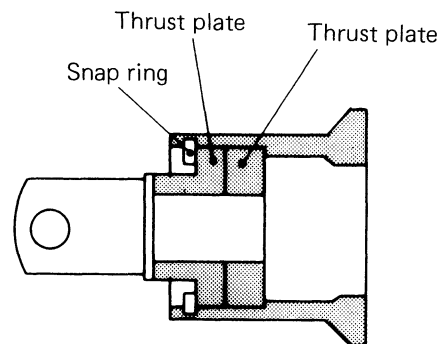


- (4) Press the sleeve and control block together so that the thrust plates are in full-faced contact, and fit the snap ring.

Check to see that the snap ring turns smoothly.

NOTE

Use care not to scratch the chrome-plated surface of the control block when removing or installing the thrust plate.



Reassembly

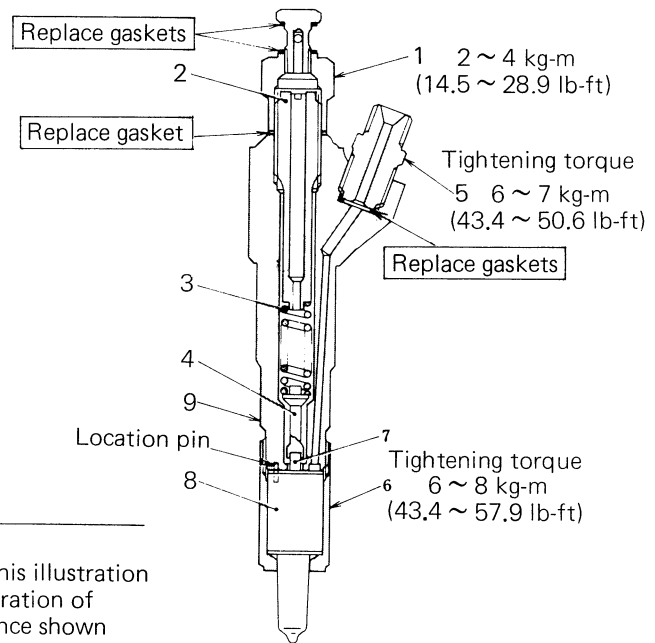
NOTE

1. Be careful not to touch the sliding surfaces of the needle valve by hand.
2. Tighten the nozzle nut to the specified torque, while centering it.

Reassembling order

Reassemble parts shown in this illustration and those shown in the illustration of Para. in the numbered sequence shown below.

9 → 7 → 8 → 6 → 5 → 4 → 3 → 2 → 1



Adjustments and tests

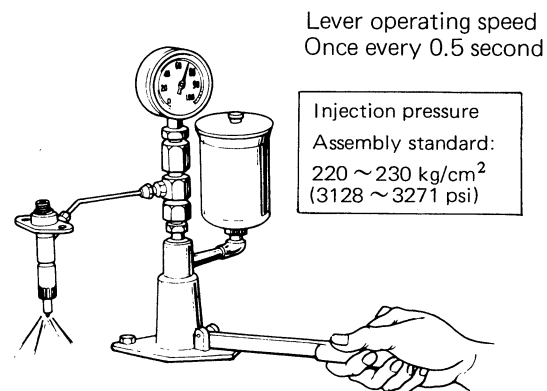
(1) Injection pressure

- (a) Remove the cap nut and mount it on a nozzle tester.
- (b) Loosen the adjusting screw, and let the nozzle spray two or three times for bleeding.
- (c) Operate the lever of the nozzle tester at the specified speed.

Adjust the injection pressure to the standard value with the adjusting screw.

NOTE

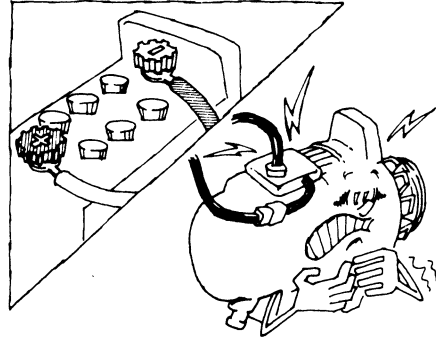
Be careful not to touch the spray injected from the nozzle.



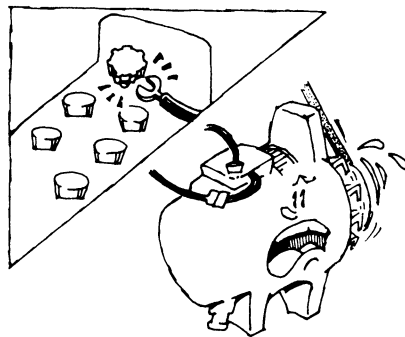
ALTERNATOR HANDLING NOTES

When servicing the alternator, take the following precautions:

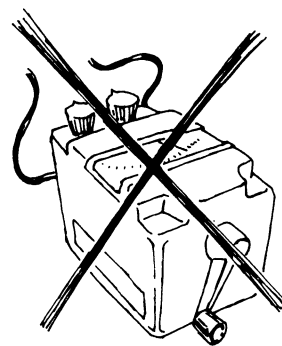
- (1) Should the battery polarity be reversed, surge current flows from the battery to the alternator, thus damaging diodes or IC regulator.



- (2) Use care not to disconnect leads from the battery terminals during operation. Surge voltage could damage diodes or IC regulator.

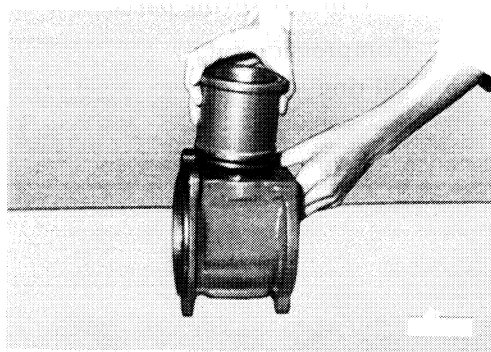


- (3) Never use a megger tester, or diode or IC regulator could be damaged.



AIR COMPRESSOR

- (9) Remove the cylinder liner 15 from the crankcase.



- (10) Disassembly of intake and exhaust valve sections

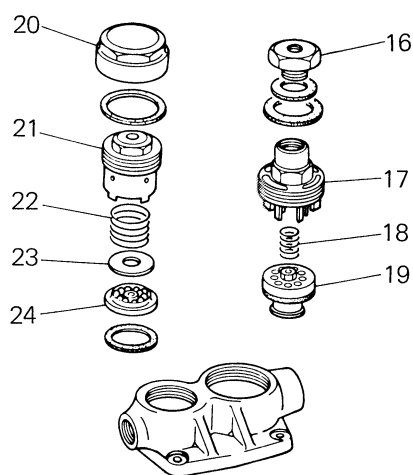
Remove the following parts.

- (a) Intake valve section

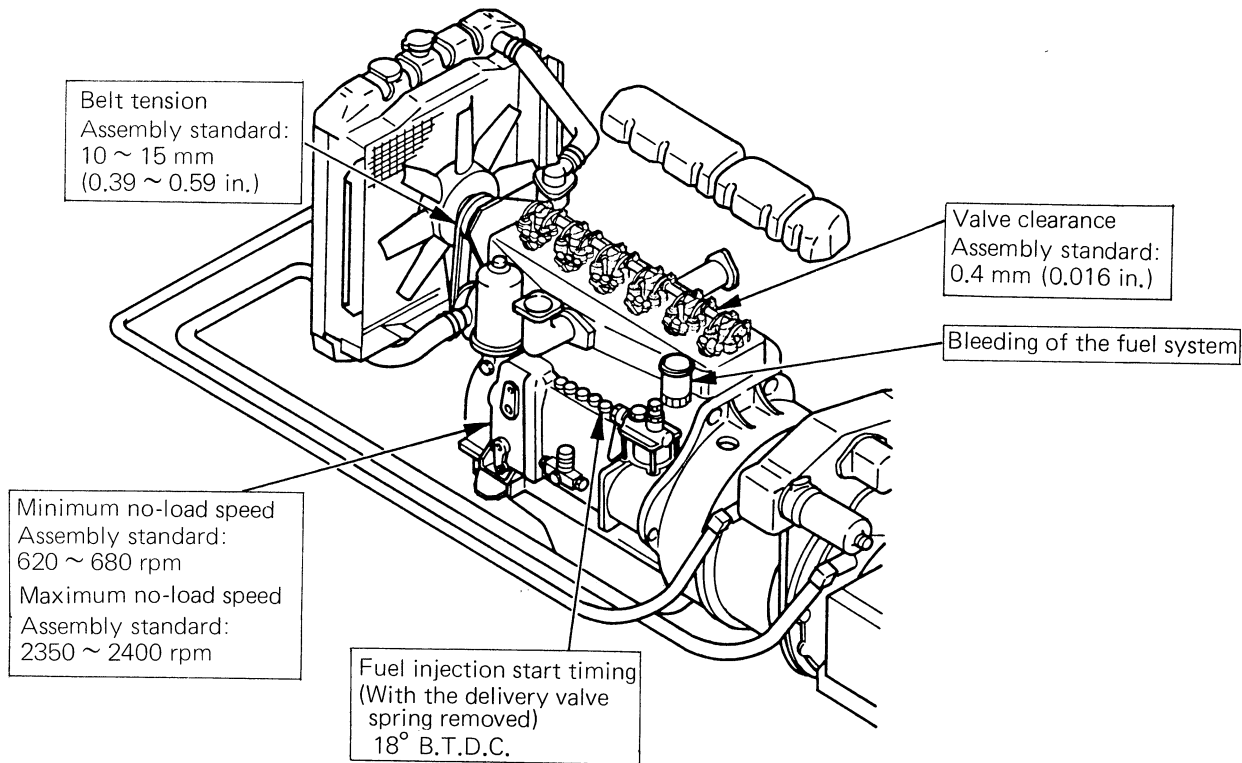
- 16 Connector
- 17 Intake fixing screw
- 18 Unloader valve spring
- 19 Intake valve assembly

- (b) Exhaust valve section

- 20 Fixing screw cap
- 21 Exhaust fixing screw
- 22 Valve spring
- 23 Valve plate
- 24 Exhaust valve seat



ENGINE TUNE-UP

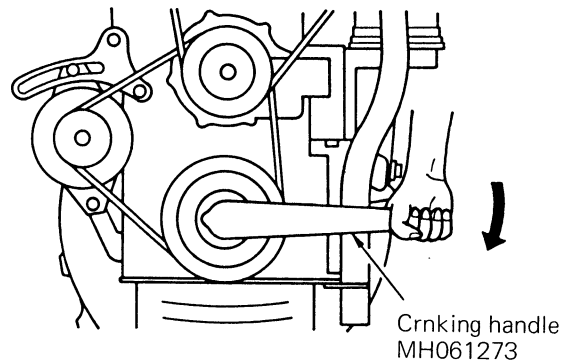


Inspection and adjustment of valve clearance

- (1) Slowly crank the engine until the piston of the No. 1 or No. 6 cylinder reaches the top dead center on the compression stroke.

NOTE

Check and adjust the valve clearance while the engine is cold.



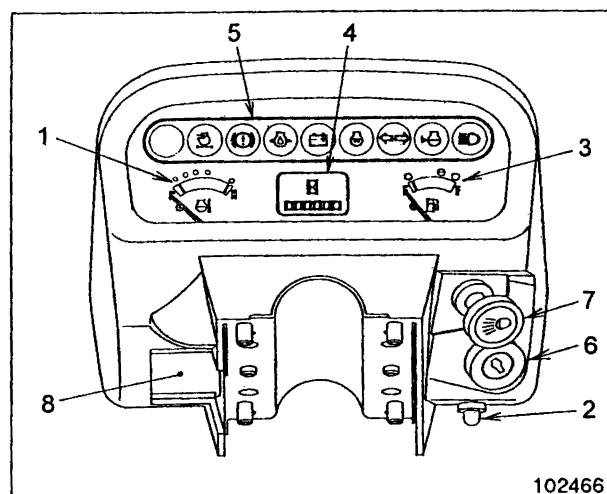
ENGINE TUNE-UP STANDARDS

Item			Standard
Valve timing	Intake valves	Open	35° BTDC
		Close	65° ABDC
	Exhaust valves	Open	65° BBDC
		Close	35° ATDC
Valve clearance (at cold)			0.4 mm (0.016 in.)
Injection timing			18° BTDC
No-load minimum engine speed			620 ~ 680 rpm
No-load maximum engine speed			2350 ~ 2400 rpm
Compression pressure (at engine speed of 200 rpm)	Assembly standard		26 kg/cm ² (370 psi)
	Repair limit		20 kg/cm ² (284 psi)
	Difference between cylinders		4 kg/cm ² (57 psi) or less
V-belt tension (When pushed inward with about 10 kg (22 lb) pressure exerted midway between pulleys.)			10 ~ 15 mm (0.39 ~ 0.59 in.)
Oil pressure [at 70 ~ 90°C (158 ~ 194°F)]	Idling speed	Standard	1.5 kg/cm ² (21.3 psi) or more
		Repair limit	0.5 kg/cm ² (7.1 psi) or less
	Maximum speed	Standard	3 ~ 5 kg/cm ² (43 ~ 71 psi)
		Repair limit	2 kg/cm ² (28 psi) or less

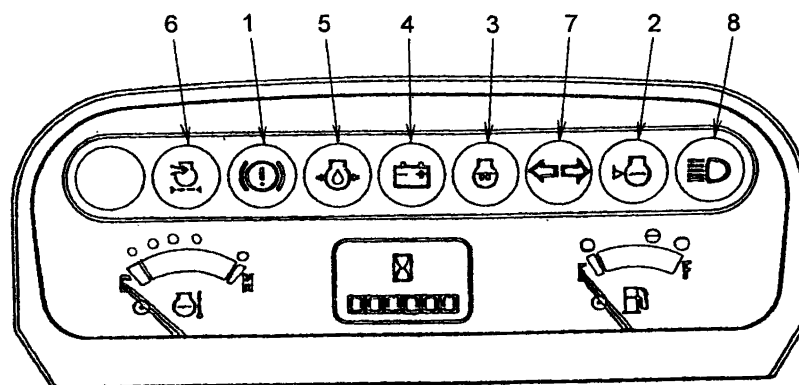
DESCRIPTION

Console Box

- 1 Engine coolant temperature gauge
- 2 Speed selector switch
- 3 Fuel gauge
- 4 Service hourmeter
- 5 OK monitor
- 6 Starter switch
- 7 Light switch
- 8 Fuse box



OK monitor



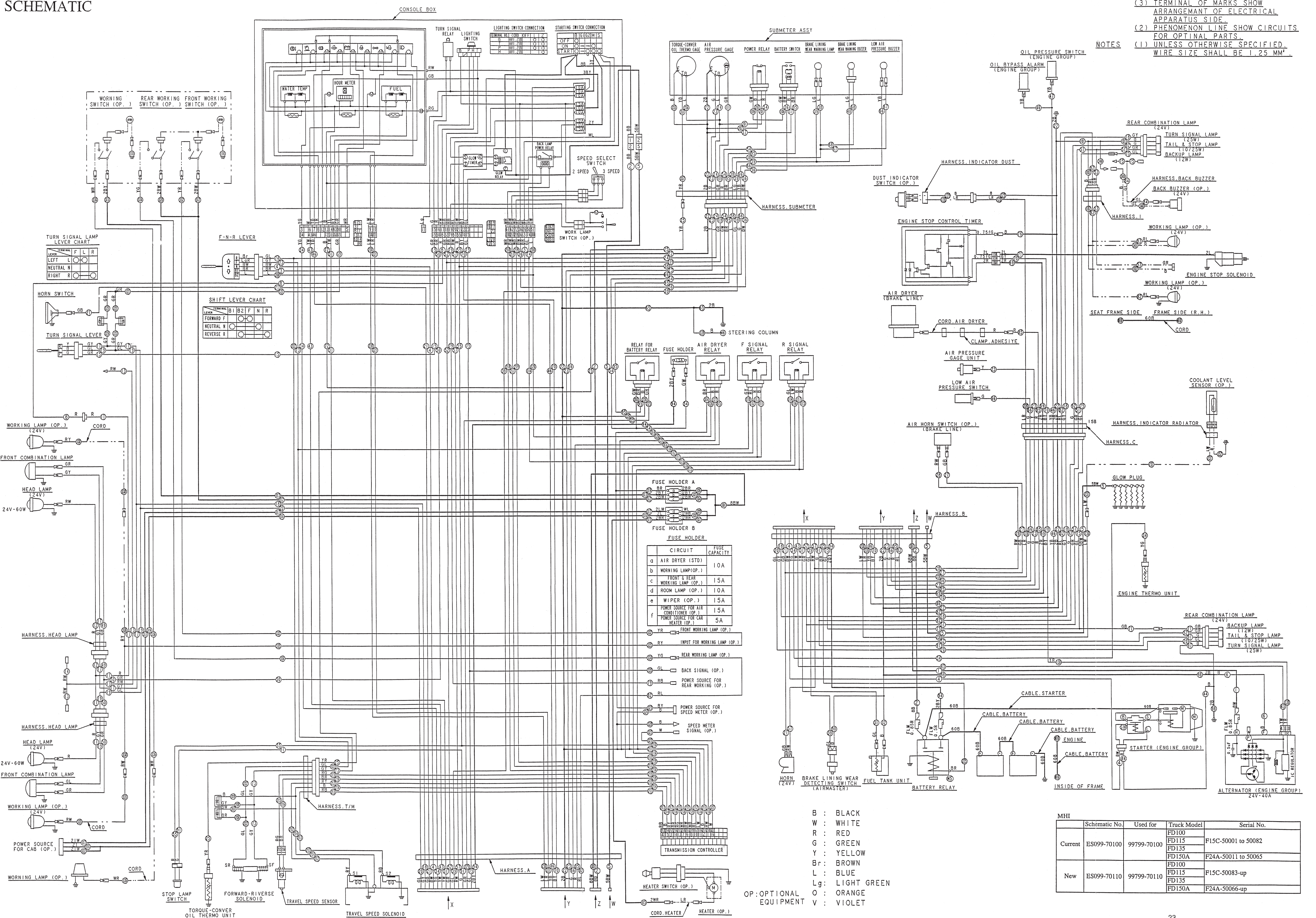
Function

No.	Indicator light	OFF	ON	Remarks
1	Brake fluid level indicator	Normal	Low	
2	Engine coolant level warning light	Normal	Low	Option
3	Glow plug indicator light	Heated	Heating	
4	Alternator not charging indicator light	Normal	Abnormal	
5	Engine oil pressure indicator light	Normal	Low	
6	Air cleaner element indicator light	Normal	Element clogged	Option
7	Turn signal indicator		Switch ON	
8	High-beam indicator light	Low beam	High beam	Option

How to check monitor indicator bulbs

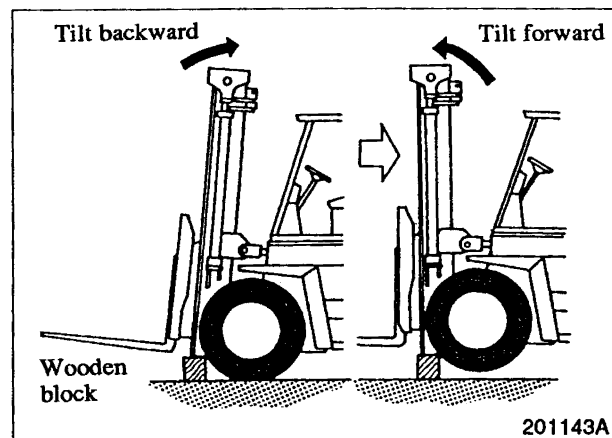
The bulbs are normal if the indicator lights 1, 2 and 6 come ON when the starter switch key is turned to I (ON) position. (The indicator lights will go OFF when the engine starts.)

SCHEMATIC



POWER TRAIN

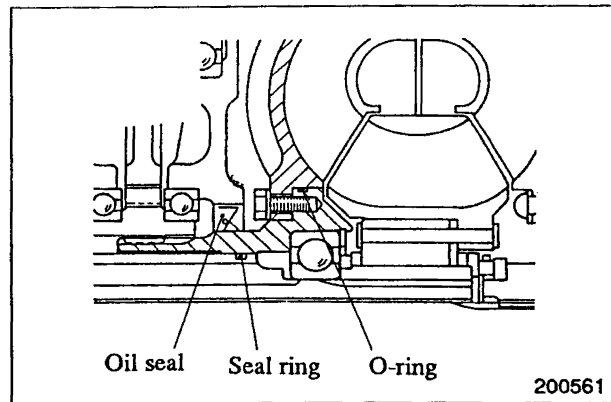
- (12) Make sure all wires and harnesses have been connected properly, then connect the negative (ground) battery cable.
- (13) Fill the radiator with coolant with 35% concentration of antifreeze.
- (14) Prime the engine fuel system. (Refer to OPERATION & MAINTENANCE MANUAL.)
- (15) Fill the brake fluid reservoir. Start the engine and bleed the brake lines. (Refer to BRAKE SYSTEM.)
- (16) After having checked the various parts, start the engine and check its operating condition. If the engine vibrates excessively, retighten the mounting bolts to see if this retightening has any effect. Operate the front end and steering to remove air from the hydraulic lines. Check the oil level in the hydraulic tank. Add oil if necessary. Check the engine oil coolant and transmission oil levels and add oil if necessary.
- (17) Test the transmission and as follows:
 - (a) Tilt the mast all the way backward. Position wooden blocks under the mast and tilt the mast forward to raise the front wheels until they clear the ground. After raising the wheels, support the frame by stand. Block the rear wheels.
 - (b) Start the engine and operate it at low idle. Move the direction lever to FORWARD position to make sure the front wheels rotate in the correct direction. Move the direction lever to REVERSE position and do the same step.
 - (c) Move the speed selector switch on the console box to each position to make sure the front wheels rotate at the correct speed in each position.



Inspection

Pump (impeller)

- (1) Check for cracks.
- (2) Check for oil leaks due to looseness of the bolts holding the boss to the pump, or defective O-ring.
- (3) Check the face of the pump boss in contact with the oil seal for wear
- (4) Check the face of the pump boss in contact with the seal ring.

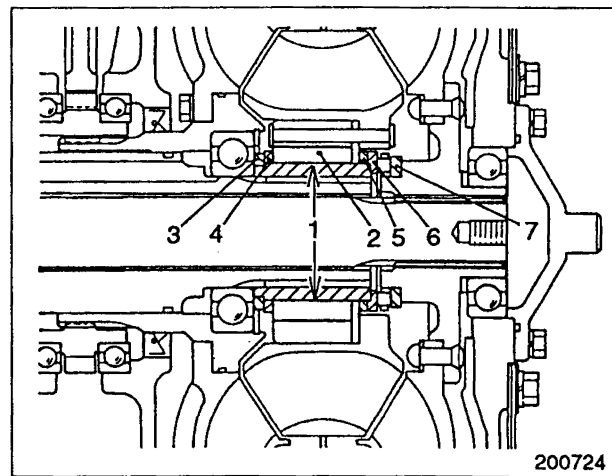


Stator

- (1) Check the blades for cracks. Also check the fit of the stator on the clutch cam.
- (2) Check the clutch hub and cam for wear or flaws.
- (3) Check the springs for damage. Also check the spring caps for wear or distortion.
- (4) Check the rollers for flaws, distortion or flat spots due to wear.
- (5) Check the clutch hub splines for defects.
- (6) Check the thrust washers for wear or other defects.

A = Assembly standard
B = Repair or service limit

Outside diameter of clutch hub 1, mm [in.]	A	67.97 to 67.951 [2.676 0 to 2.675 23]
	B	67.8 (2.669)
Diameter of clutch rollers 2, mm [in.]	A	10.185 to 10.2 [0.400 98 to 0.402]
	B	10.1 [0.398]
Thickness of thrust washer 3, mm [in.]	A	4.95 to 5 [0.194 9 to 0.197]
	B	4.8 [0.189]
Thickness of thrust washer 4, mm [in.]	A	3.95 to 4 [0.155 5 to 0.157]
	B	3.8 [0.150]
Thickness of thrust washer 5, mm [in.]	A	2.9 to 3 [0.114 to 0.118]
	B	2.8 [0.11]



Thickness of thrust washer 6, mm [in.]	A	4.9 to 5 [0.193 to 0.197]
	B	4.8 [0.189]
Thickness of thrust washer 7, mm [in.]	A	4.95 to 5 [0.194 9 to 0.197]
	B	4.8 [0.189]

Suggestions for assembly

(1) Piston installation

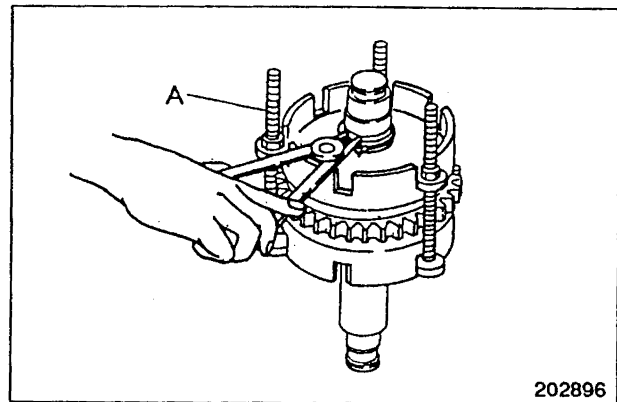
When putting pistons 3 in the clutch drum, apply ATF (automatic transmission fluid) to their seal ring contact surfaces.

(2) Return spring installation

Using Piston Tool A (special tool) or an arbor press, compress springs 4 and retainers 5, and install snap rings 6.

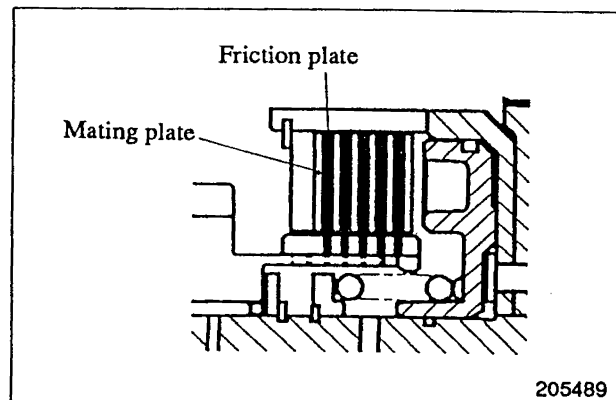
Special tool:

Piston tool 92267-00300



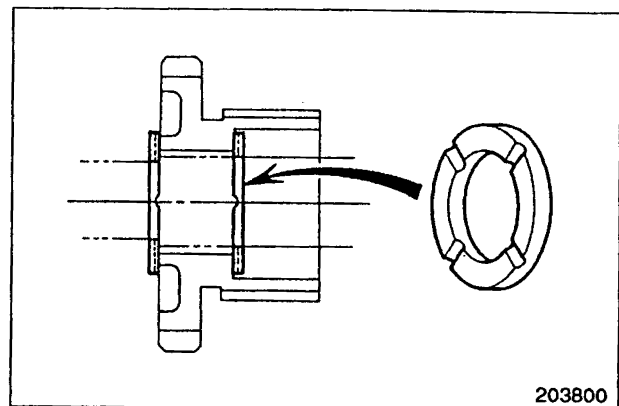
(3) Friction and mating plate installation

- (a) Make sure that the position and number of the plates are correct. Install the plates while applying ATF to them. When replacing the friction plates, replace the mating plates, too.



(b) Thrust washer installation

Install thrust washers 11, 14, 16 and 19 with the side that has oil grooves toward the gear.



(4) Piston testing

After having assembled the clutch, apply pressure air of approximately 690 kPa (7 kgf/cm²) [100 psi] to the oil hole to make sure that the piston move freely without any sign of air leaks.

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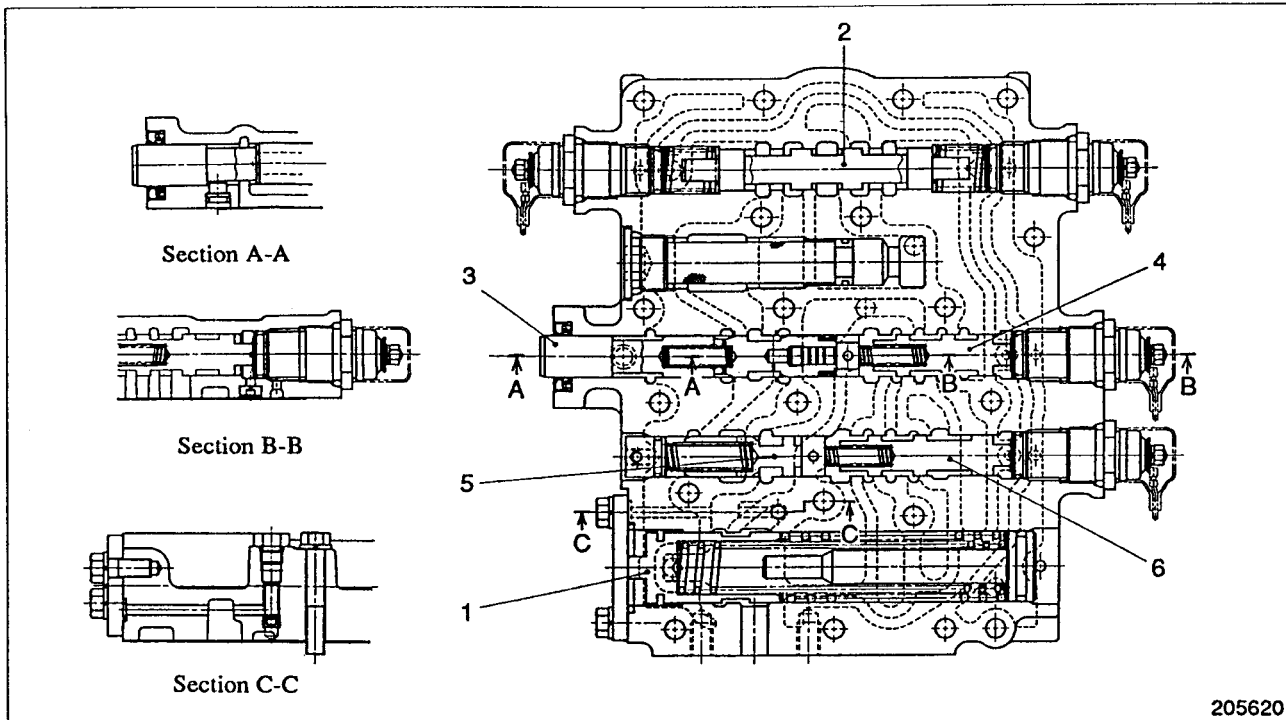
2-SPEED POWERSHIFT TRANSMISSION

Problem	Cause		Correction
No power flow	Transmission	e) Plug on input shaft loose or slipped off, resulting in oil leaks f) Clutch seized g) Shafts broken h) Clutch drum, particularly snap ring groove, defective i) Snap ring fitted to clutch drum broken j) Oil line to clutch piston clogged k) Shaft splines worn	Repair. Replace. Replace. Replace. Replace. Clean or replace. Replace shafts.
	Power train	Broken parts in reduction differential or front axle	Refer to each section.
Abnormal noise	Torque converter	a) Flexible plate broken b) Bearings damaged c) Rubbing blades of running members d) Bolts loose e) Splines worn f) Oil pump worn	Replace. Replace. Replace. Retighten or replace. Replace. Inspection or replace.
	Transmission	a) Clutch seized and dragging b) Bearings worn or seized c) Gears broken d) Bolts loose e) Splines worn	Replace clutch plate. Replace. Replace. Retighten or replace. Replace.
	Loud noise	a) Oil strainer clogged b) Main regulator valve spool defective c) Restriction in oil pipe d) Oil too viscous in cold weather e) Instruments out of order f) Wrong kind of oil used	Clean or replace. Wash or replace. Replace. Replace oil. * Replace. Replace oil. *
	Low noise	a) Oil strainer clogged b) Oil pump defective c) Excessive oil leaks <ul style="list-style-type: none"> • Main regulator valve spring defective • Main regulator valve spool defective d) Air being sucked in e) Oil level too low	Clean or replace. Replace. Replace. Repair or replace. Retighten or replace packing. Refill.

* (Refer to Recommended Brands of Lubricants.)

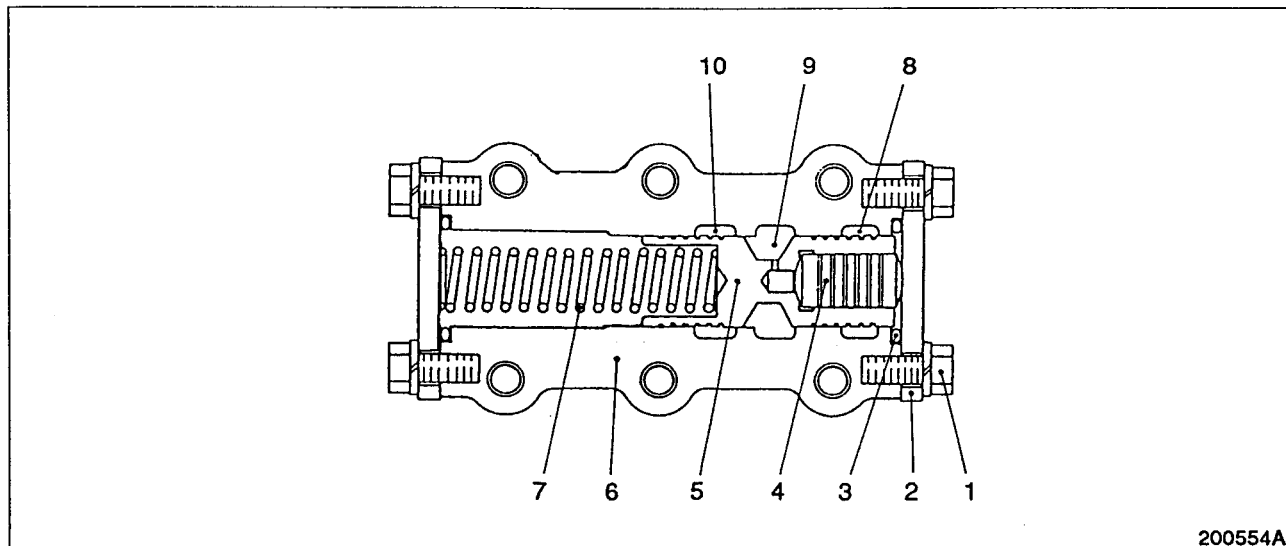
3-SPEED POWERSHIFT TRANSMISSION

Control Valve



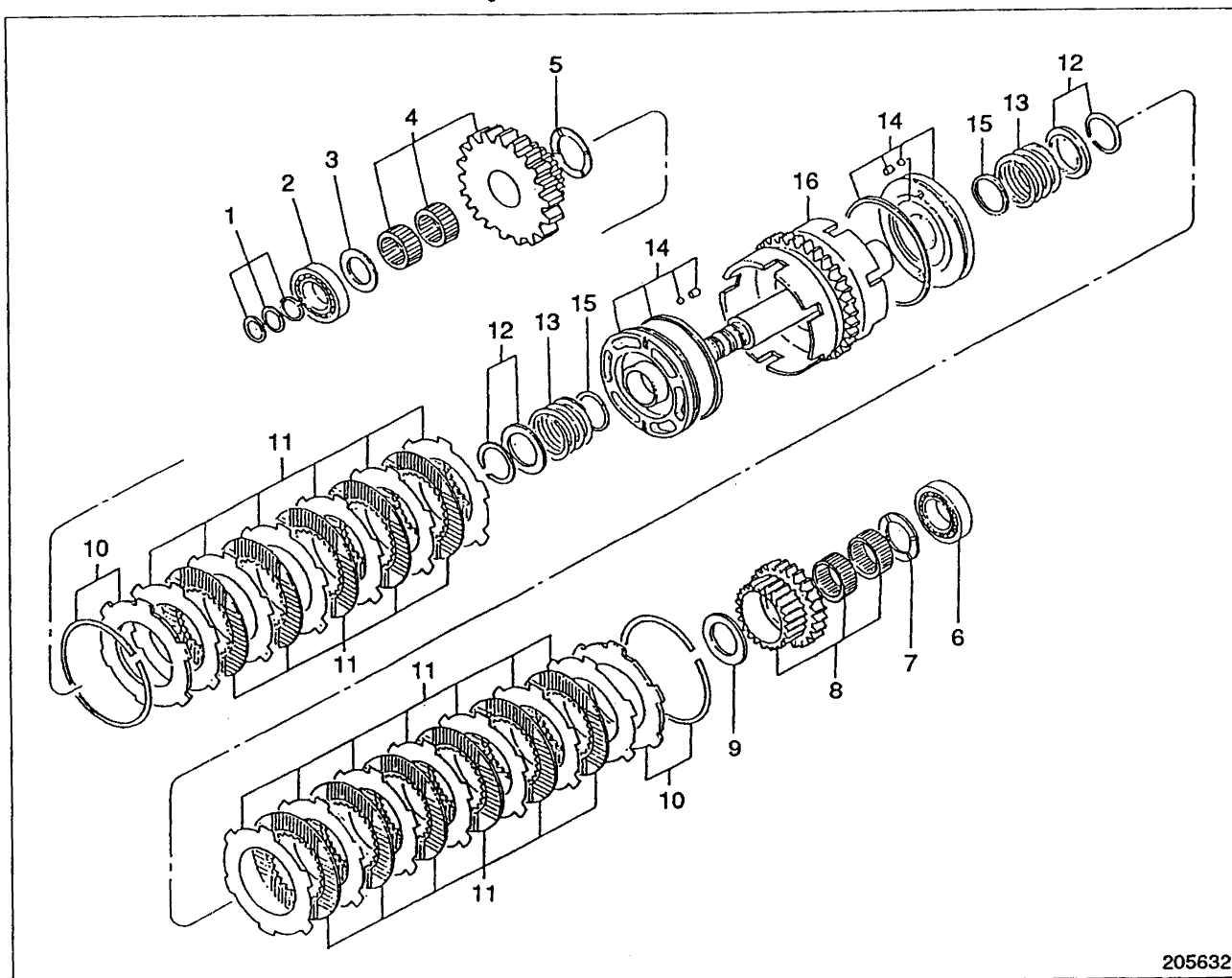
- | | |
|------------------------|-----------------------------|
| 1 Accumulator valve | 4 1st-speed valve |
| 2 Directional valve | 5 Differential valve |
| 3 Clutch valve plunger | 6 2nd-speed/3rd-speed valve |

Main Regulator Valve



- | | | |
|----------|--------------|---|
| 1 Bolts | 5 Spool | 9 Main pressure port |
| 2 Cover | 6 Body | 10 Torque converter inlet pressure port |
| 3 O-ring | 7 Spring | |
| 4 Slug | 8 Drain port | |

4. Forward clutch shaft subassembly



205632

Sequence

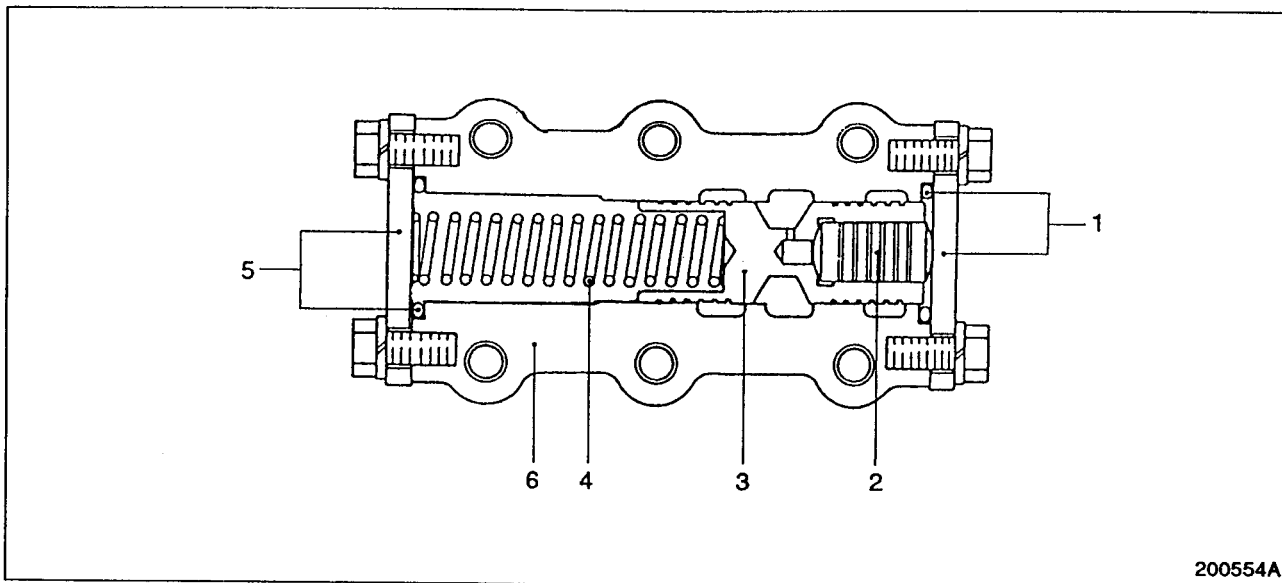
- | | |
|---|--|
| 1 Seal rings | 9 Thrust washer and snap ring |
| 2 Ball bearing | 10 Snap rings and pressure plates |
| 3 Thrust washer | 11 Friction plates and mating plates |
| 4 Gear (2nd-speed drive) and needle roller bearings | 12 Snap rings and retainers |
| 5 Thrust washer and snap ring | 13 Clutch springs |
| 6 Roller bearing | 14 Clutch pistons [Steel balls, screws and piston seals] |
| 7 Thrust washer | 15 Seal rings |
| 8 Gear (forward drive) and needle roller bearings | 16 Forward clutch shaft |

NOTE

Do not attempt to remove the screws from the forward clutch shaft. It is not necessary to disassemble clutch pistons 14 if the balls move freely in the pistons when the pistons are shaken.

MAIN REGULATOR VALVE

Disassembly



200554A

Sequence

- | | |
|--|---|
| 1 Cover [O-ring, bolts and washers]
2 Slug
3 Spool | 4 Spring
5 Cover [O-ring, bolts and washers]
6 Body |
|--|---|

Inspection

- (1) Check the oil holes in the valve body for restriction.
- (2) Check the valve spool for wear or damage. Make sure the spool moves freely.
- (3) Check the spring for damage. Measure the free length of the spring.

A = Assembly standard
 B = Repair or service limit

Free length of main regulator valve spring, mm [in.] { Spring rate: N/mm (kgf/mm) [lbf/in.]}	A	112 [4.41] { k = 4.989 (0.508 7) [28.486]}
	B	109 [4.29]

⚠ CAUTION

Loosen the bolts slowly so as not to cause the springs, spool and slug to fly out.

Assembly

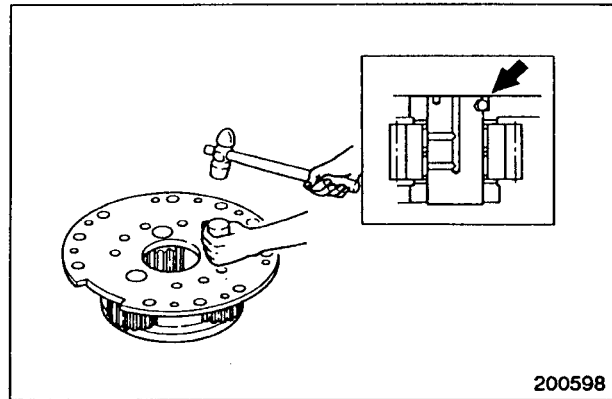
Follow the reverse of disassembly sequence.

Suggestion for assembly

Apply oil to the spool and slug when putting them in the body.

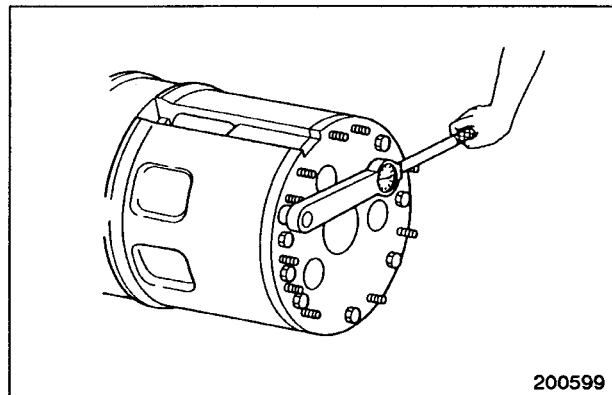
(3) Planet gear installation

- (a) Put the needle roller bearing in position in each planet gear. Put the thrust washers on both sides of the gear and install the gear with the pin in the carrier. Lock the gear in position with steel ball.



- (b) Install the planet carrier to the wheel hub and, after making sure the hub rotates freely, tighten its mounting bolts to the specified torque.

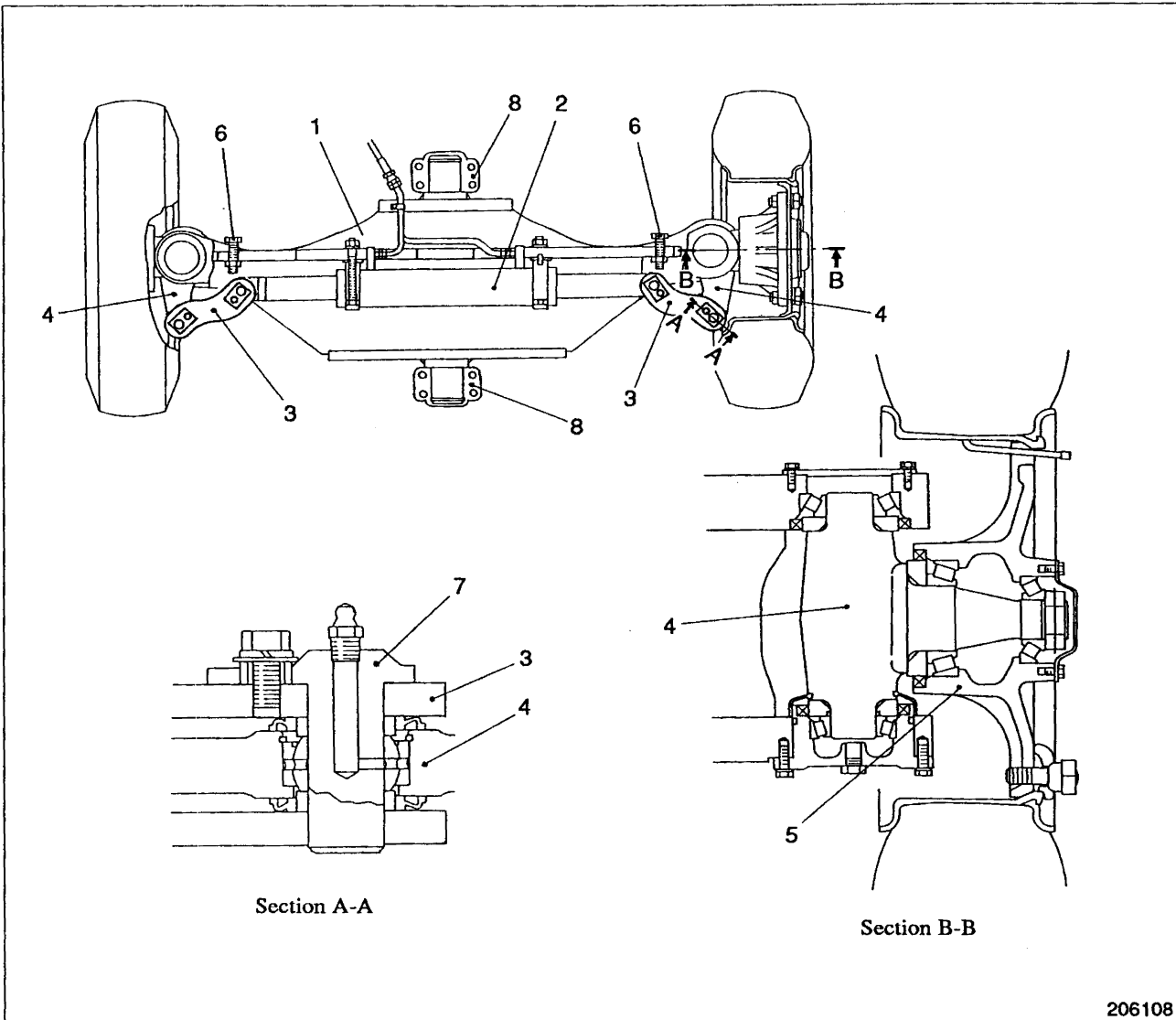
Tightening torque for planet carrier bolts	$93 \pm 10 \text{ N}\cdot\text{m}$ $(9.5 \pm 1.0 \text{ kgf}\cdot\text{m})$ $[69 \pm 7 \text{ lbf}\cdot\text{ft}]$
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REAR AXLE

DESCRIPTION

Rear Axle



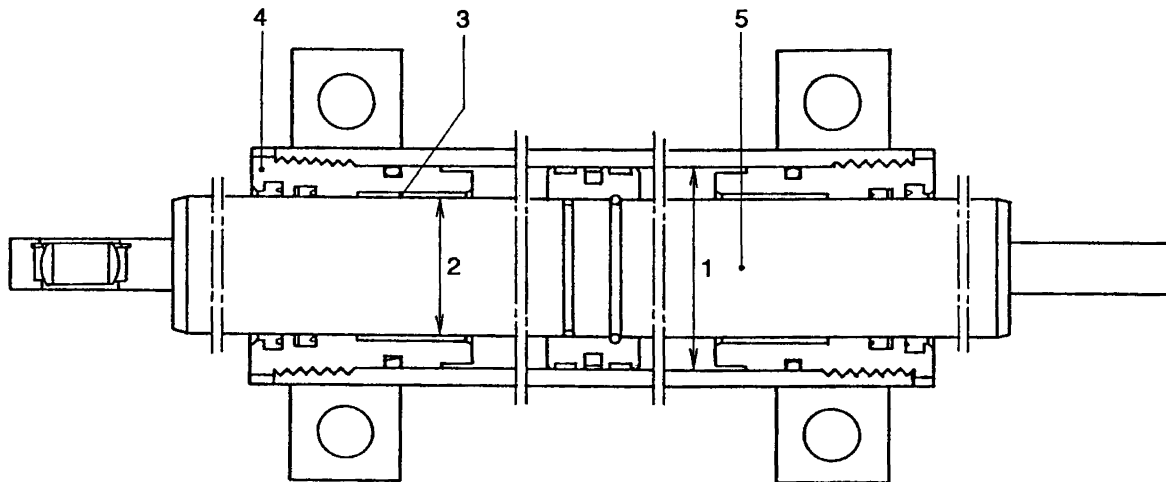
- 1 Rear axle housing
- 2 Power cylinder
- 3 Tie rods (left and right)
- 4 Steering knuckles (left and right)

- 5 Wheel hubs (left and right)
- 6 Stopper bolts (left and right)
- 7 Pin (two on each side)
- 8 Rear axle supports (front and rear)

REAR AXLE

A = Assembly standard B = Repair or service limit

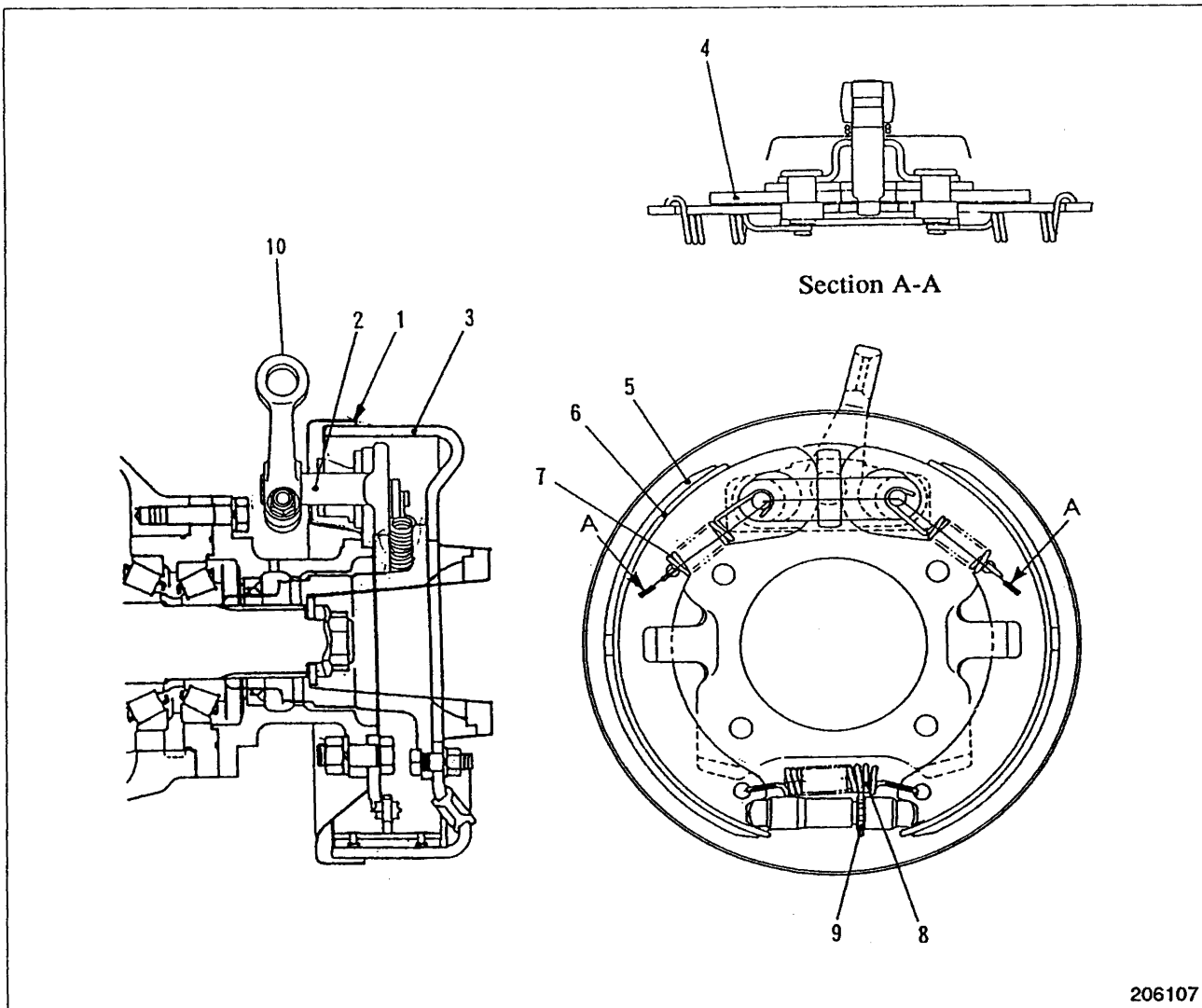
Item		Truck model	FD100	FD115	FD135	FD150A
Power cylinder	Inside diameter of cylinder tube 1, mm [in.]	A	115 [4.53]			
		B	115.15 [4.533 5]			
	Diameter of piston rod 2, mm [in.]	A	80 [3.15]			
	Clearance between piston rod and bushing 3, mm [in.]	A	0.1 [0.004]			
		B	0.2 [0.008]			
	Tightening torque for cylinder head 4, N·m (kgf·m) [lbf·ft]	A	539 ± 54 (55 ± 5.5) [398 ± 40]			
	Runout of piston rod 5, mm [in.]	B	0.3 [0.012]			



205425

BRAKE SYSTEM

Parking brake



- 1 Dust cover
- 2 Camshaft
- 3 Drum
- 4 Support plate
- 5 Lining

- 6 Shoe
- 7 Spring
- 8 Spring
- 9 Adjuster assembly
- 10 Lever

The shoes are expanded against the drum by the cam. The clearance between the drum and lining is automatically adjusted by means of the adjuster.

Valve body assembling

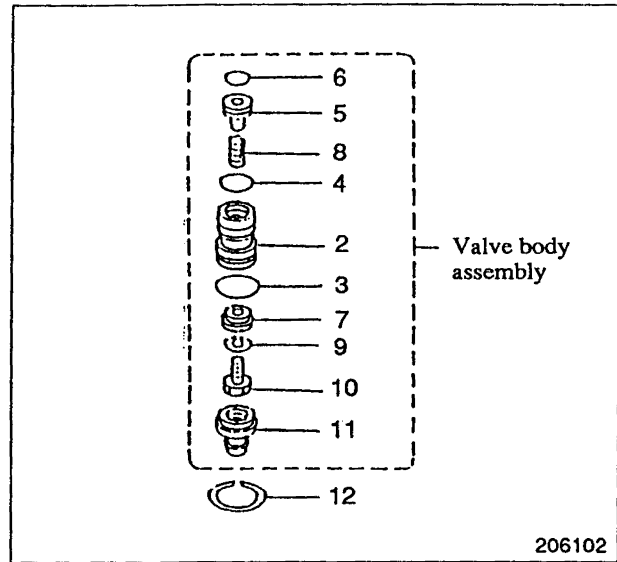
1. Apply grease to O-ring 6 for piston 5 and install the O-ring to the piston.
2. Apply grease to the piston sliding surface of valve body 2 and to the guide of piston 5. Put spring 8 and piston 5 in the valve body. With the piston held with 10 mm [0.39 in.] Allen wrench, put valve 7 in position and tighten bolt 10 to the specified torque.

Tightening torque for bolt 10	4 to 7 N·m (0.4 to 0.7 kgf·m) [3 to 5 lbf·ft]
-------------------------------	---

3. Apply grease to O-rings 3 and 4 for valve body 2 and install the O-rings to the valve body.
4. Install exhaust cover 11 to valve body 2 by tapping around the end face of the cover.
5. Apply grease to the O-ring seal for body 1 and install valve body parts 2 thru 11.
6. Install ring 12 with a ring pliers.

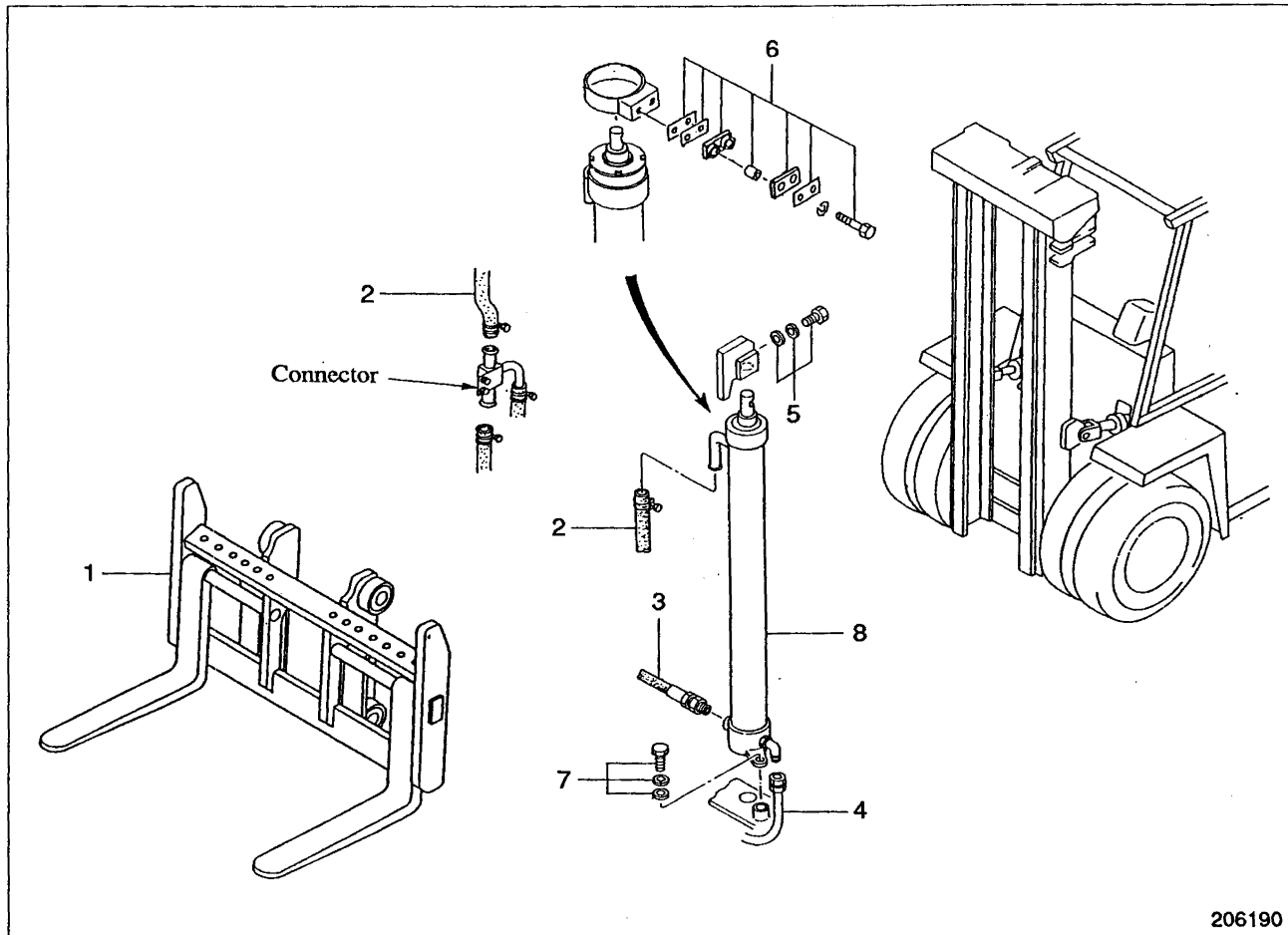
Inspection after assembly

1. Drain water from the pipes and air tank before installing the air dryer.
2. Start the engine and check the joints of the air lines for leaks.
3. Make sure that, after the system pressure has reached the maximum level limited by the air governor, the purge valve opens to exhaust moisture and oil mist to the atmosphere for about one minute.
4. About one week later, drain water from the air tank.
5. Make sure the amount of leakage from the exhaust port is less than 20 cc [1.2 cu in.]/min when the system pressure drops to the minimum level and the air compressor is loaded.



206102

Lift Cylinders



206190

Sequence

- | | |
|-----------------------------|--|
| 1 Lift bracket | 5 Stopper bolt [Washer and spring washer] |
| 2 Return hose [Clamp] | 6 Cylinder clamp [Cushion, collar and shims] |
| 3 High-pressure hose | 7 Stopper bolt |
| 4 Flow regulator valve hose | 8 Lift cylinder |

Suggestions

- (1) Remove return hoses as follows:

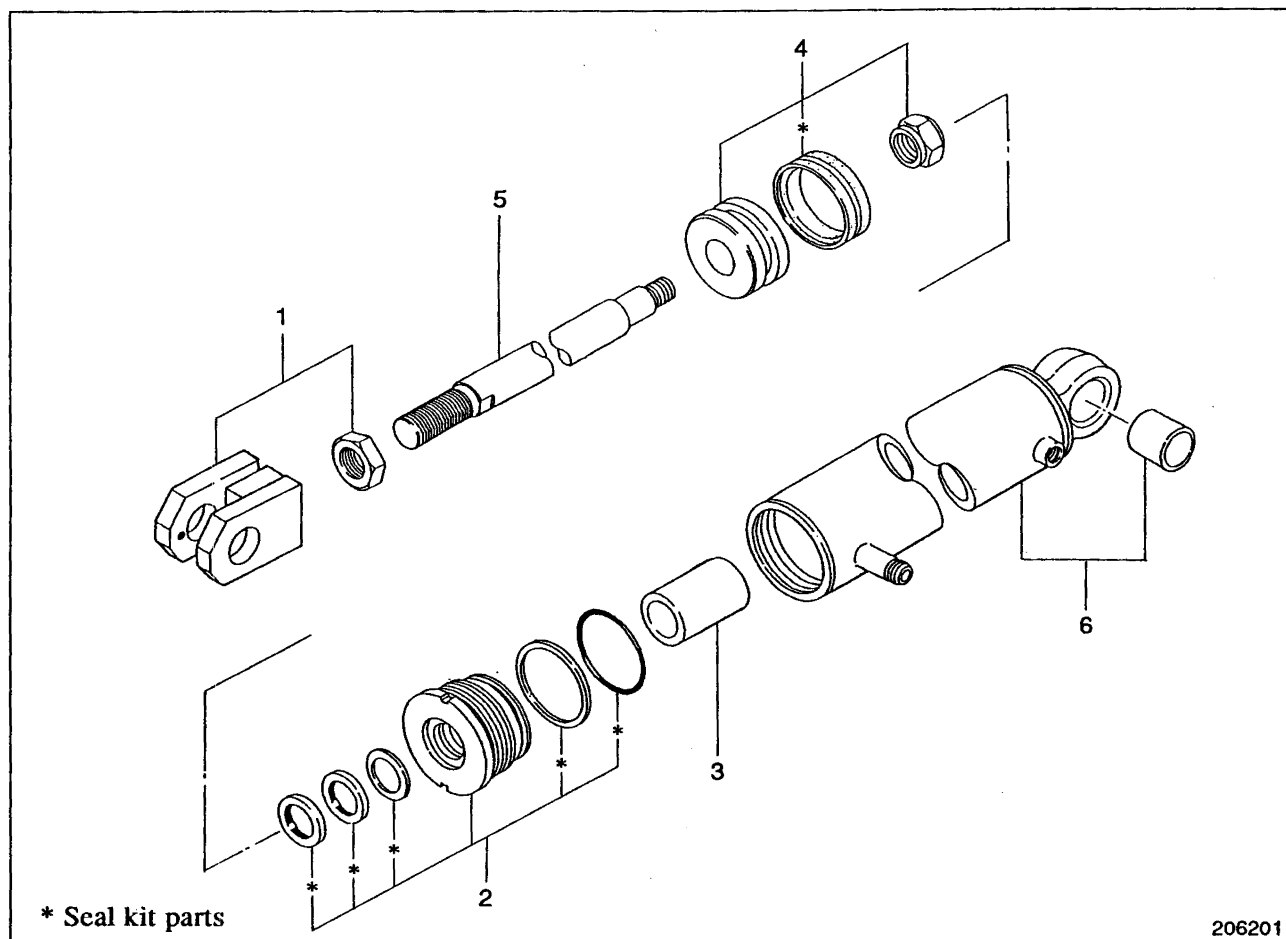
Start the engine. Raise the inner mast all the way and stop the engine. Disconnect the return hoses from the left and right lift cylinders at their connectors.



Be careful not to touch the lift control lever.

TILT CYLINDERS

Disassembly



Sequence

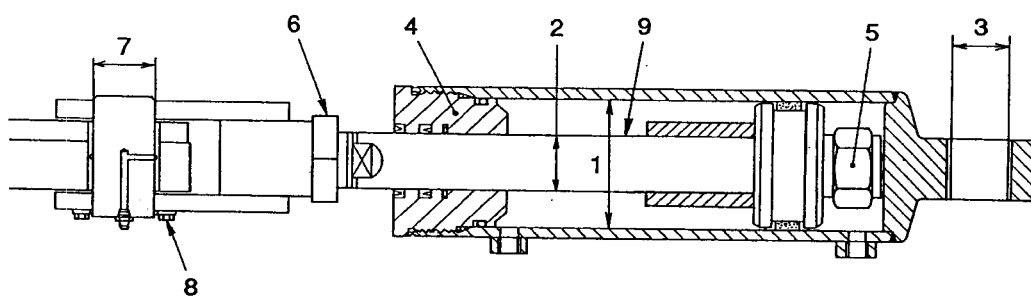
- | | |
|--|---|
| 1 Socket [Nut] | 4 Piton [Self-lock nut and piston seal] |
| 2 Guide bushing [Dust seal, packing, buffer ring, O-ring and back-up ring] | 5 Piston rod |
| 3 Collar | 6 Cylinder tube [Bushing] |

NOTE

Do not remove the bushing from cylinder tube 6 unless it is defective to require replacement.

HYDRAULIC SYSTEM

A = Assembly standard B = Repair or service limit

Item		Truck model	FD100	FD115	FD135	FD150A	
Tilt cylinders	Inside diameter of cylinder tube 1, mm [in.]	A	120 [4.72]		130 [5.12]		
		B	120.12 [4.729 1]		130.12 [5.122 8]		
	Diameter of piston rod (guide bushing side) 2, mm [in.]	A	55 [2.17]				
	Clearance between piston rod and guide bushing, mm [in.]	A	0.1 [0.004]				
		B	0.2 [0.008]				
	Inside diameter of bushing 3, mm [in.] (as installed)	A	60 ^{+0.100} _{+0.070} [2.36 ^{+0.003} _{+0.002} 94]				
		B	60.6 [2.386]				
	Tightening torque, N·m (kgf·m) [lbf·ft]	Guide bushing 4	A	637 ± 64 (65 ± 6.5) [470 ± 47]		696 ± 69 (71 ± 7) [514 ± 51]	
		Self-lock nut 5	A	1 275 ⁺⁴⁹ ₀ (130 ⁺⁵ ₀) [940 ⁺³⁶ ₀]		1 520 ⁺⁹⁸ ₀ (155 ⁺¹⁰ ₀) [1 121 ⁺⁷² ₀]	
		Socket nut 6	A	1 177 to 1 471 (120 to 150) [868 to 1 085]			
	Diameter of tilt pin 7, mm [in.]	A	60 ⁰ _{-0.046} [2.36 ⁰ _{-0.001} 81]				
		B	59 [2.32]				
	Tightening torque for tilt pin mounting bolts 8, N·m (kgf·m) [lbf·ft]	A	33 (3.4) [25]				
	Runout of piston rod 9, mm [in.]	B	0.5 [0.020]				
							

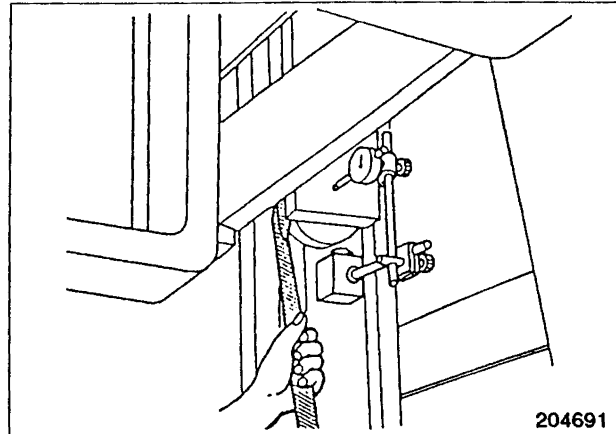
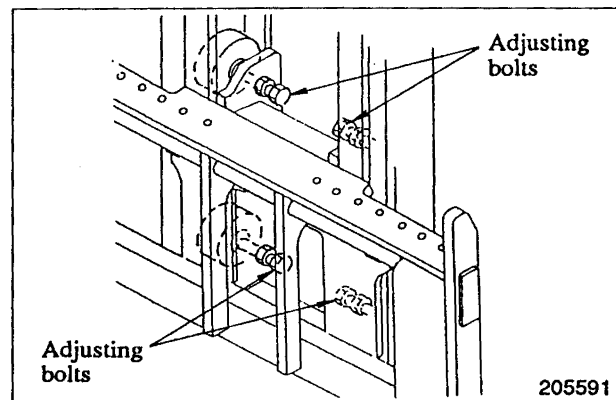
206208

206208

MASTS AND FORKS

(2) Longitudinal and lateral clearances between lift bracket and inner mast

- (a) Check these clearances and adjust them if necessary.
- (b) Check the longitudinal clearance with a feeler gauge.
- (c) Check the lateral clearance with a dial indicator. Set the dial indicator on the inside face of the inner mast, with its spindle put to the side face of lift bracket. Insert a bar into between the lift bracket and inner mast and pry the lift bracket laterally to check the clearance.
- (d) To adjust the clearance, remove the lift bracket and adjust the rollers.
- (e) If the longitudinal clearance of the main rollers exceeds the limit, replace the rollers with oversize main rollers.
- (f) If the lateral clearance of the side rollers is incorrect, make an adjustment.
 - To adjust the clearance N, loosen the lock nut for the side roller bracket adjusting bolt and turn the adjusting bolt.



Suggestions

- (1) Replace the seal kit parts.
- (2) Wash all parts clean, making sure that each part is free from any foreign particles.
- (3) Install O-ring 3 and back-up ring 2 as follows:
 - (a) Install O-ring 3 to piston 1.
 - (b) Install two back-up rings 2 to the piston, one ahead the O-ring and the other behind it, making sure the they face outside.
- (4) Put self-lock nut 5 on the piston and tighten it to the specified torque. The self-lock nut should be replaced after being used a maximum of 3 times.

Tightening torque for self-lock nut	196 N·m (20 kgf·m) [145 lbf·ft]
-------------------------------------	---------------------------------------

- (5) Install packing 11 to guide bushing 9 with main lip inside. Install dust seal 12 to the same bushing with main lip outside.
- (6) Tighten guide bushing 9 to the specified torque after it has been re-installed.

Tightening torque for guide bushing	245 N·m (25 kgf·m) [181 lbf·ft]
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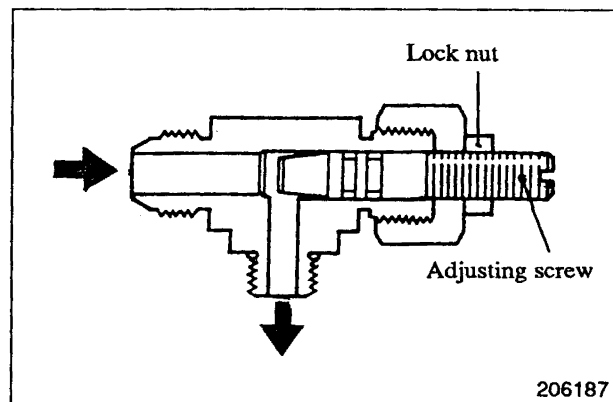
Testing

(1) Stroke

Check the strokes of the left and right forks to see if they are equal and correct.

(2) Shift speed

Shift the left and right forks to see if they move in unison from side to side. If not, make an adjustment by varying the setting of the flow regulator valve. To do this, loosen the lock nut and turn the adjusting screw in either direction with the engine running at 1,500 rpm. To decrease the speed, turn the adjusting screw in to decrease the flow of oil. To increase the speed, back the screw off to increase it.



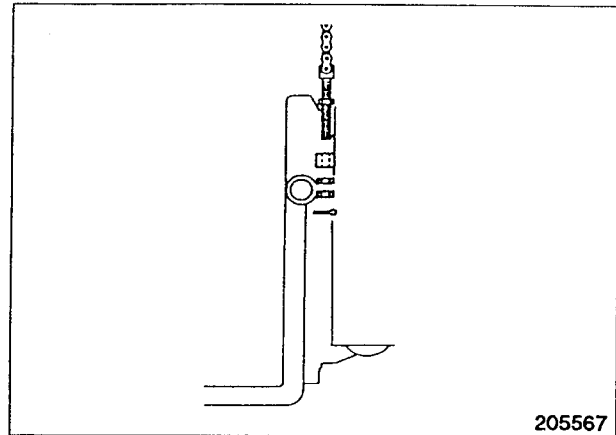
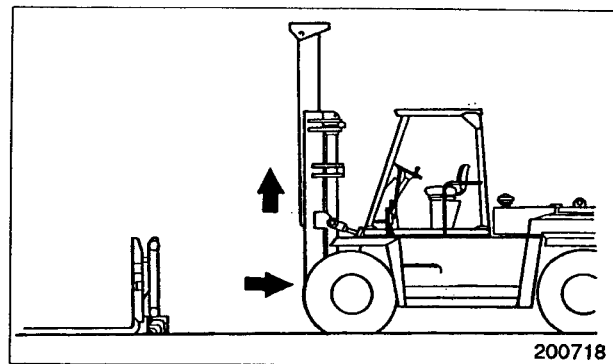
SERVICE DATA

<p>⑨</p> <p>G(PF)3/8-B</p> <p>G(PF)3/8-A</p> <p>R_P(PS)1/8-A</p> <p>203849</p>	<p>⑬</p> <p>Gear puller</p> <p>Puller</p> <p>Plate</p> <p>M10 x 1.25</p> <p>203541</p>
<p>⑩</p> <p>Flame hardened Hv > 500, depth: 2 mm [0.08 in.]</p> <p>203556</p>	<p>⑭</p> <p>205603A</p>
<p>⑪</p> <p>600328</p>	<p>⑮</p> <p>206997</p>
<p>⑫</p> <p>G-B1/2</p> <p>27</p> <p>206237</p>	<p>⑯</p> <p>S point</p> <p>A</p> <p>15°</p> <p>S point</p> <p>R</p> <p>View A</p> <p>206491</p>

Suggestions for removal

(1) Lift bracket removal

- (a) Pull the split pin and remove the anchor nut and lock nut from the lift chain on each side.
- (b) Fasten an approximate 3 meter [10 ft] long rope to the ends of the lift chains.
- (c) Start the engine and raise the inner mast by operating the lift control lever until the lift bracket main rollers are free, with the lift chains pulled down.
- (d) Move the machine backward to separate the lift bracket (fork positioner) from the machine.

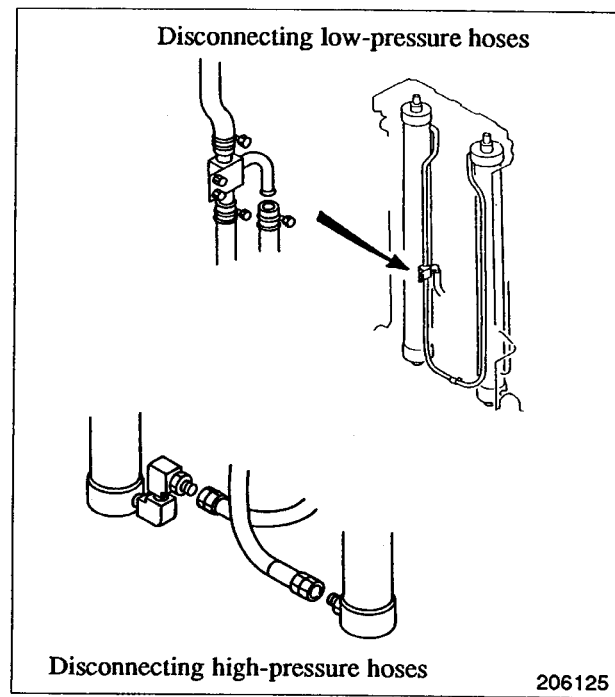


(2) Lift cylinder low-pressure (return) hose removal

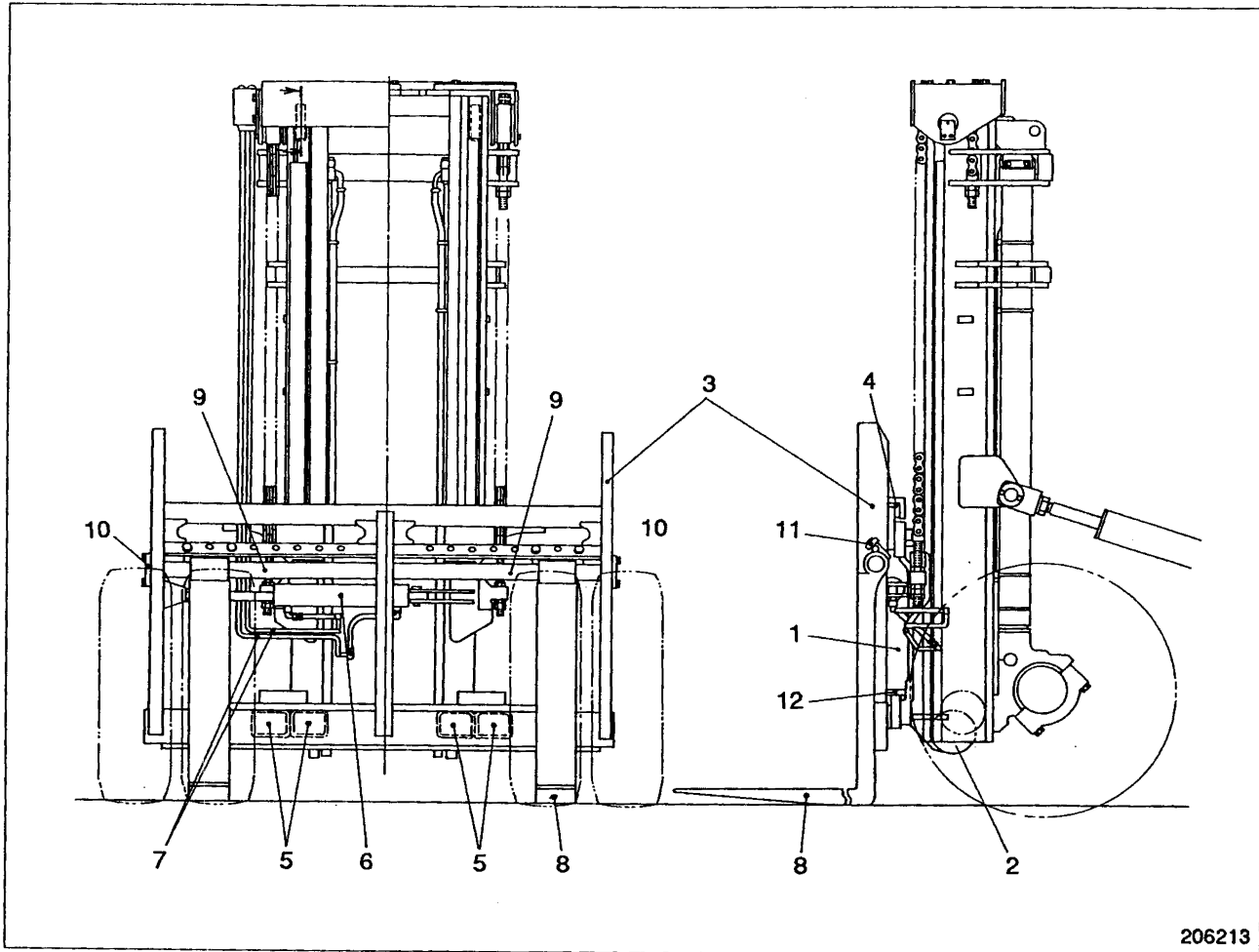
- (a) Start the engine and extend the mast all the way. Stop the engine and disconnect the hoses at the return connectors.
- (b) Lower the mast.

(3) Lift cylinder high-pressure hose removal

Relieve the pressure in the lift cylinder circuits by moving the lift control lever back and forth. Disconnect the high-pressure hoses from the lift cylinders.



DESCRIPTION



206213

- 1 Lift bracket
- 2 Cross roller
- 3 Fork carriage
- 4 Slider block
- 5 Slider block
- 6 Hydraulic cylinder

- 7 Pipes and hoses
- 8 Fork
- 9 Guide bar
- 10 Stopper plate
- 11 Retainer assembly
- 12 Support

With this attachment mounted on the truck, the operator merely approaches the point of pick-up or the stack, shifts the forks to the exact position required to handle the load, then, completes the job. No time is lost by the operator jockeying the truck back and forth.

The fork carriage, which is moved to either side of the center by the hydraulic cylinder, is combined with the lift bracket through plastic slider blocks attached on the top and front of

the bracket. On the lower side of the bracket are mounted the supports to guide the movement of the carriage.

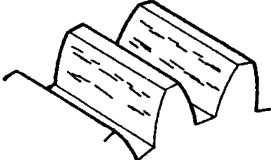
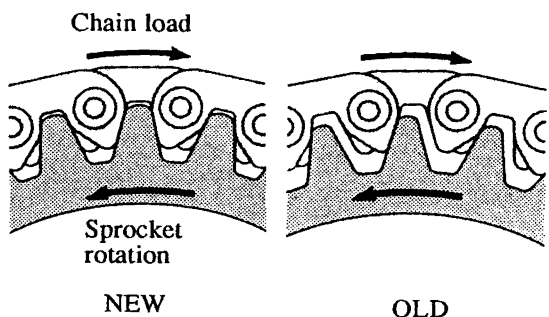
The hydraulic cylinder is pinned to the lift bracket at its cap end, its head end being pinned to the right side of the carriage.

The hoses are routed along the right-hand member of the mast.

SERVICE DATA

Item		How to check	Intervals					Service data			
			Daily (pre-start)	Every 50 hours or weekly	Every 200 hours or monthly	Every 1,200 hours or 6 months	Every 2,400 hours or 1 year	FD100	FD115	FD135	FD150A
Lift chains and chain wheels	Length of lift chains (20 links)	Scale					○	915 mm [36 in.], maximum		1,046 mm [41 in.], maximum	
	Tension (deflection) of lift chains	Scale	○	○	○	○	○	Both chains to be equal in tension			
	Chains — damage or rusting	Visual	○	○	○	○	○				
	Chain wheels — wear, distortion or other defects	Visual			○	○	○				
	Chain wheel bearings — rattle	Feel			○	○	○				
	Chain anchor bolts — distortion or damage	Visual			○	○	○				
Forks	Forks — wear and distortion	Visual/measure	○	○	○	○	○	69 mm [2.7 in.], minimum		79 mm [3.1 in.], minimum	
	Fork stopper pins — damage or distortion	Visual	○	○	○	○	○				
Lights	Operation	Test/visual	○	○	○	○	○				
Horn	Operation	Test/listen	○	○	○	○	○				
Turn signals	Operation	Test/visual	○	○	○	○	○				
Rear view mirrors	Rear vision	Visual	○	○	○	○	○				
Overhead guard	Installation and damage	Visual/wrench	○	○	○	○	○				
Chassis	Loosen bolts or nuts	Wrench/visual					○				
	Operator seat — damage and installation	Visual			○	○	○				
	Lubrication points	Lubricate			○	○	○	Lubricate mast supports weekly.			
	Oil change	Inspect			○	○	○				

SERVICE DATA

Check:	For (item or defect):	How
Gears	i) Corrosive wear 	Visually.
Keys and keyways	Wear on sides making parts not fit tightly	Examine by placing.
Oil seals	Damage to lip	Visually.
Roller chains and sprockets	a) Wear on pins, bushings, rollers and plates in each link tending to increase pitch b) Wear on sprocket teeth 	Visually.
Rubber parts	Hardening or softening, swelling, tackiness, tearing, and deterioration due to aging	Visually.

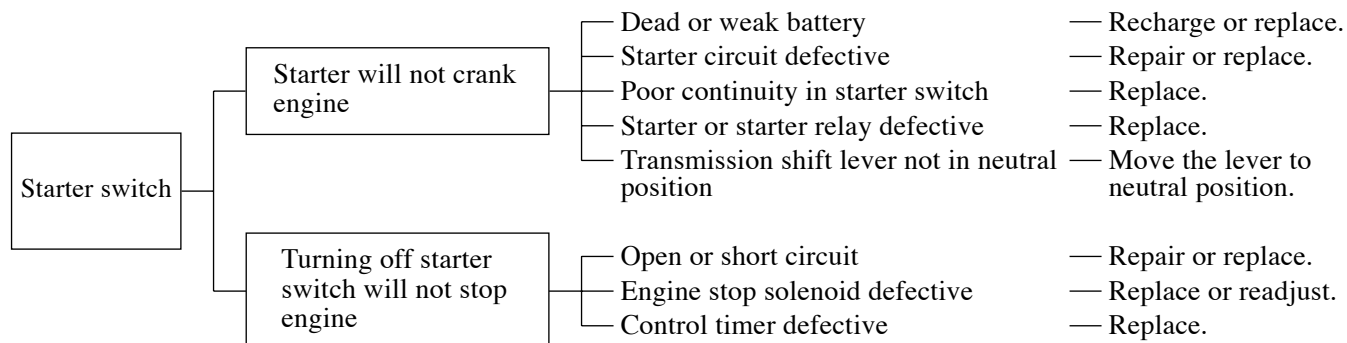
COOLING SYSTEM

Specifications	2 – 1
Description	2 – 2
Removal and Installation	2 – 3
Radiator and Intercooler	2 – 3
Troubleshooting	2 – 6

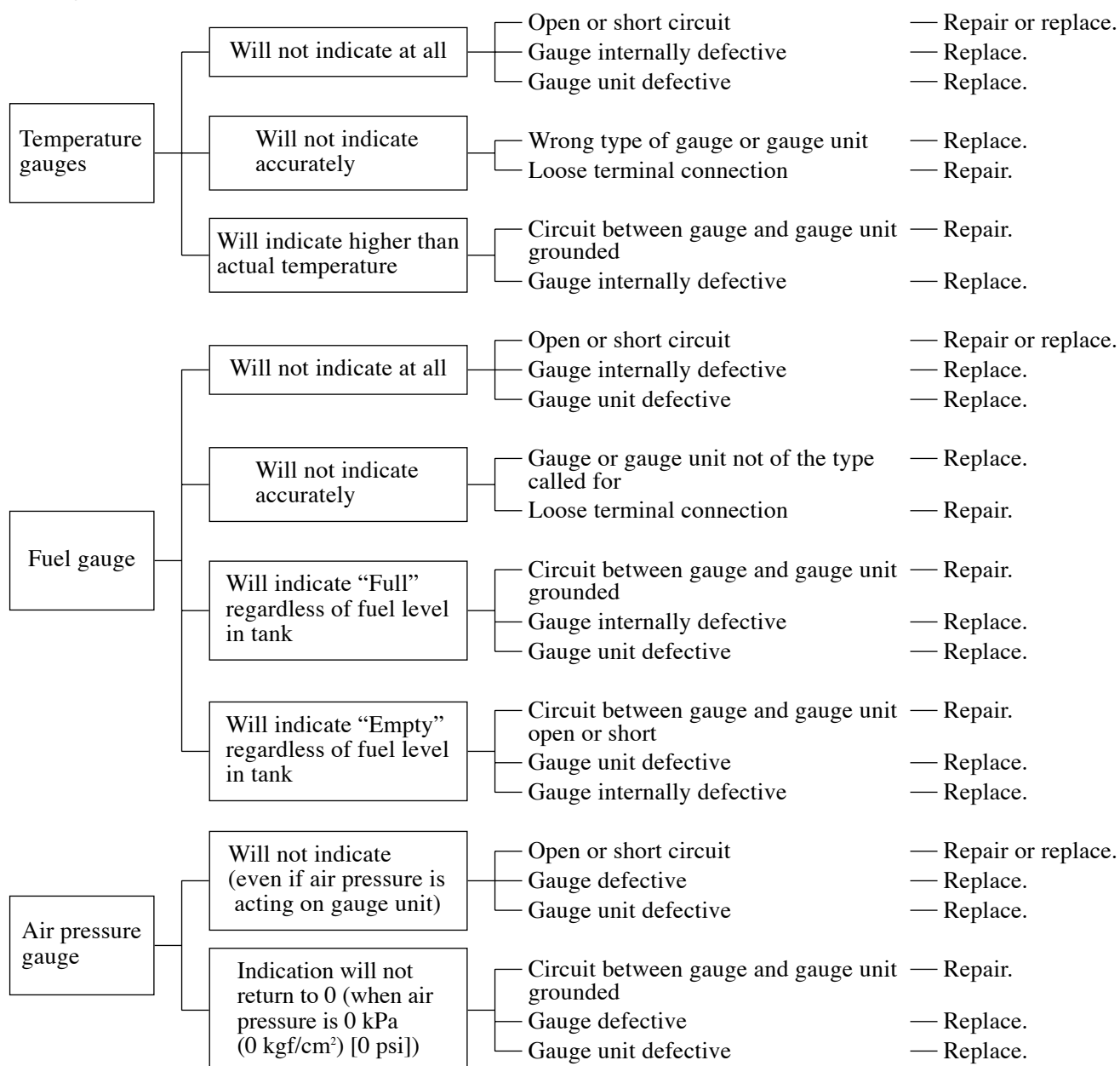
1. To harness A
2. To harness C
3. Glow plug
4. Electronic horn
5. Lining wear detection switch
6. Fuel tank unit
7. Battery relay
8. M5 terminal
9. Battery side terminal
10. Frame side terminal
11. Battery
12. Starter relay
13. Alternator
14. Engine coolant temperature gauge unit
15. Ground point
16. Earphone switch (option)

Troubleshooting

Starter System



Gauges



4. Electrical Parts Removal

Suggestions for Removal

(1) Harness B disconnecting points (see page 3-8.)

1. Glow plug terminal
2. Joint with harness C
3. Lining wear detection switch connector
4. Alternator connector
5. Engine coolant temperature gauge unit terminal

Note: Disconnect the harness B from the right-hand side of the truck. Then, unclip the harness at two mid-points and put it aside to the left-hand side of the truck.

(2) Harness C disconnecting points (see page 3-10.)

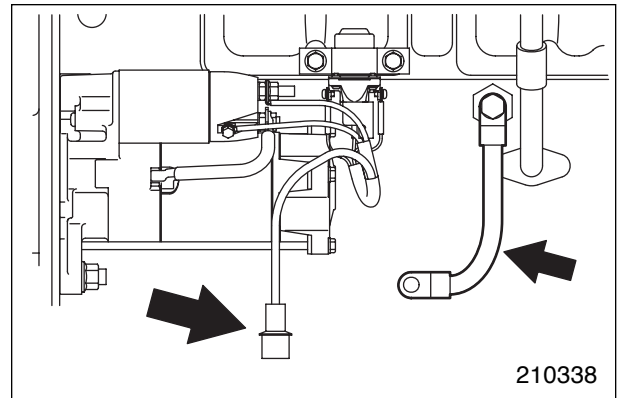
1. Engine stop solenoid connector
2. Oil bypass alarm switch terminal
3. Engine oil pressure switch terminal

(3) Starter cable

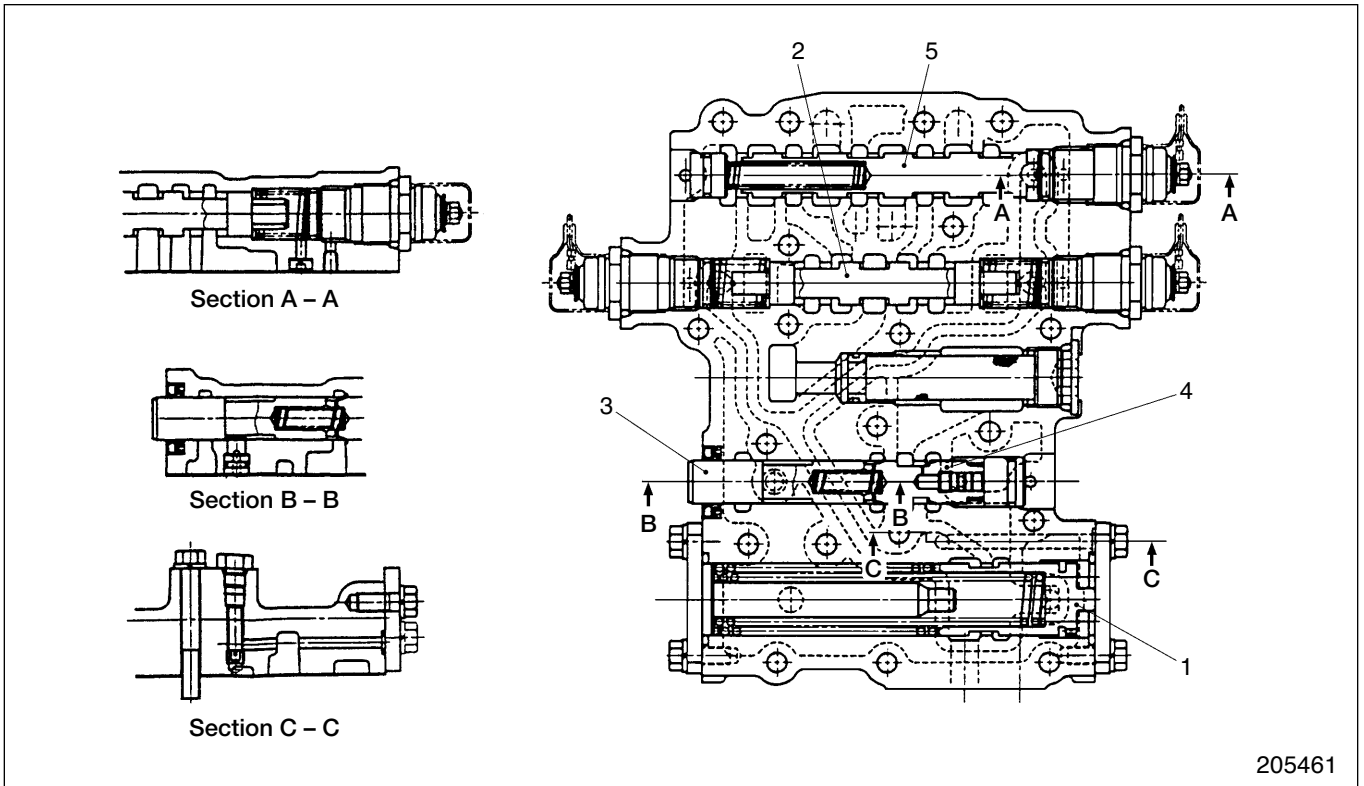
Disconnect the cable at the starter relay side connector.

(4) Engine grounding cable

Remove the bolt securing the cable to the frame.

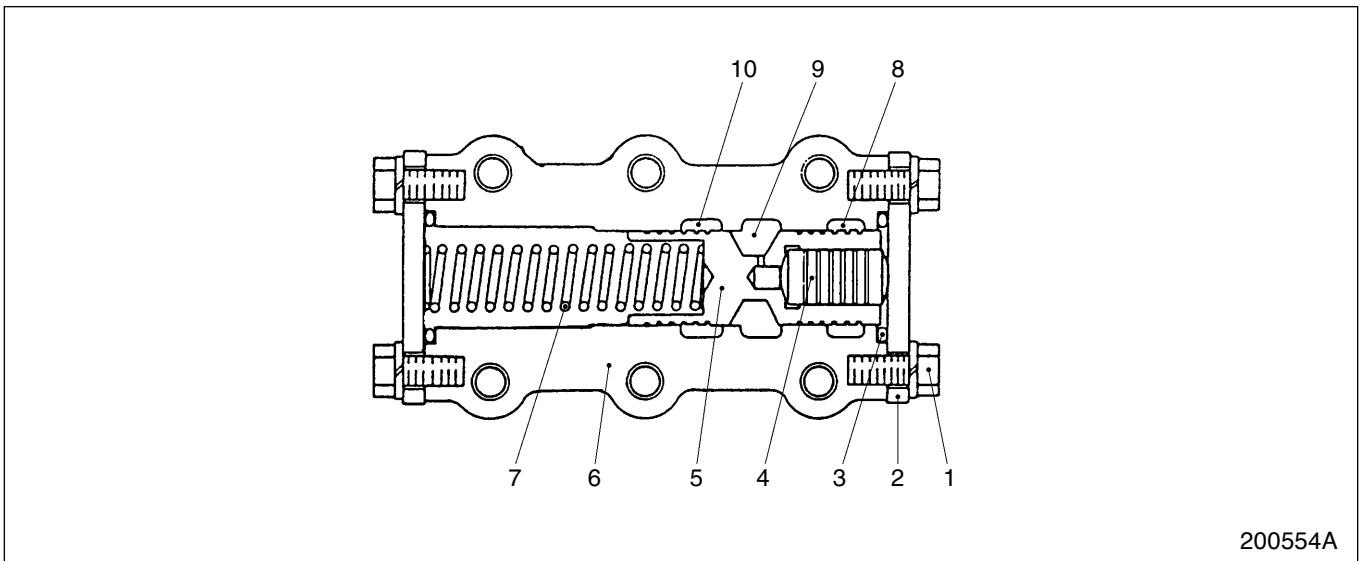


Control Valve



- | | | |
|----------------------|--------------------------|---------------------------------|
| 1. Accumulator valve | 3. Inching valve plunger | 5. Travel speed (1st/2nd) valve |
| 2. Direction valve | 4. Inching valve | |

Main Regulator Valve



- | | | |
|-----------|---------------|--|
| 1. Bolts | 5. Spool | 9. Main pressure port |
| 2. Cover | 6. Body | 10. Torque converter inlet pressure port |
| 3. O-ring | 7. Spring | |
| 4. Slug | 8. Drain port | |

5. Stator shaft 31 removal

Turn two Bolts (jack bolts) (special tool) in the M10 × 1.25 holes in one end of the shaft evenly or hit the other end by using a protective plate.

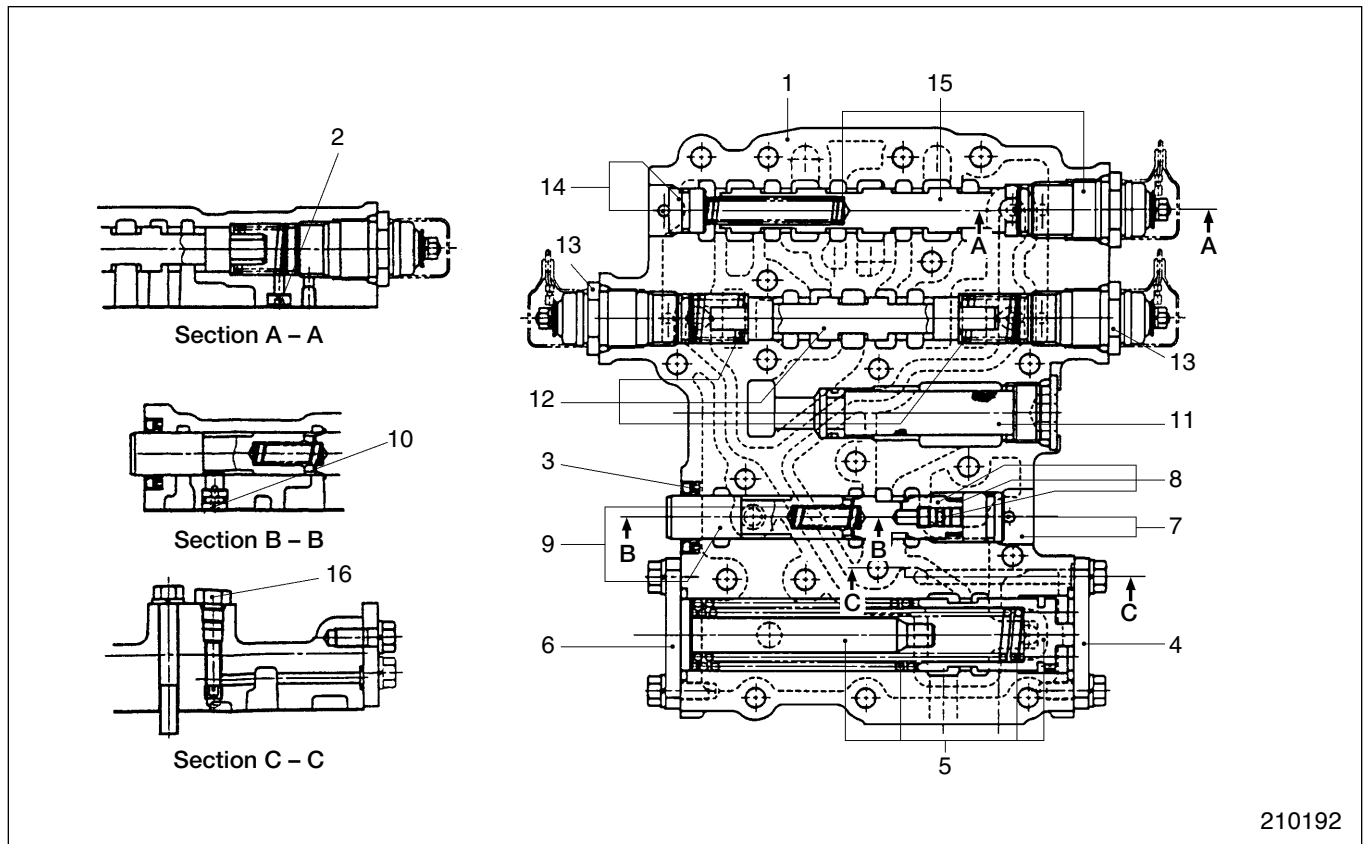
Special tool needed

Bolt	67284 - 15400
------	---------------

6. Roller bearing outer race removal

Do not remove the outer race of roller bearing **33** for idler gear **32** unless it has a defect.

Reassembly



210192

Sequence

- | | |
|--|--|
| 1. Valve body | 9. Spring, Inching valve plunger |
| 2. Oil filter | 10. Stopper pin, O-ring |
| 3. Oil seal | 11. Oil filter, O-ring |
| 4. Plate, O-ring | 12. Spring, Direction valve |
| 5. Accumulator piston, Springs (inner and outer),
Spring seat | 13. Solenoid valves |
| 6. Plate, O-ring | 14. Plug, O-ring, Roller bearing |
| 7. Plug, O-ring, Roller bearing | 15. Spring, Travel speed valve, Solenoid valve |
| 8. Inching valve, Spring, Slug | 16. Plug, O-ring |

Start by:

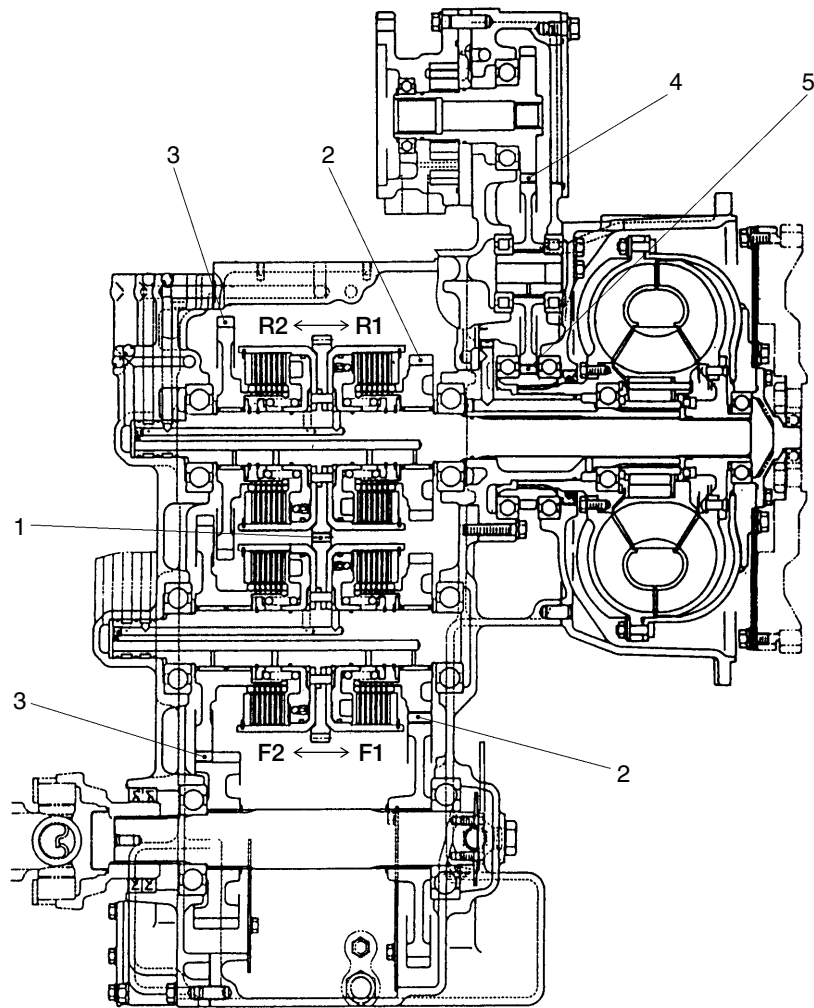
Clean the oil passages in the control valve thoroughly and make sure they are not restricted.

Suggestions for Reassembly

- (1) Replace oil seal 3 with a new one.
- (2) Apply ATF (automatic transmission fluid) to the valves and plungers when installing them in the valve body.

A: Standard value

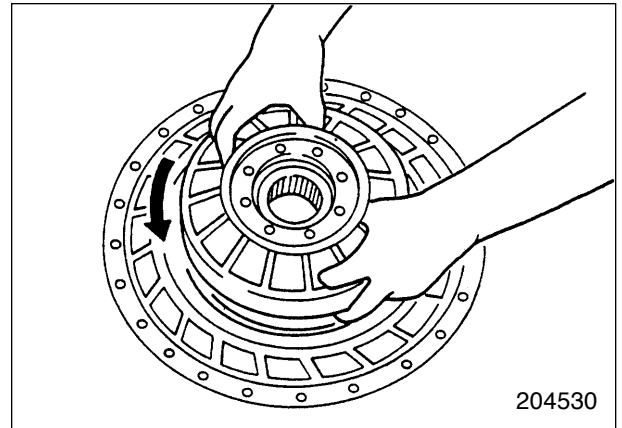
Unit: mm (in.)

Truck Model			FD100	FD115	FD135	FD150A
Item						
Backlash of gears	Input gear and counter gear 1	A	0.12 to 0.28 (0.0047 to 0.0110)			
	Forward 1st speed gear and reverse 1st speed gear 2	A	0.13 to 0.32 (0.0051 to 0.0126)			
	Forward 2nd speed gear and reverse 2nd speed gear 3	A				
	Pump drive gear and idler gear 4	A	0.12 to 0.26 (0.0047 to 0.0102)			
	PTO drive gear and idler gear 5	A				
						

210217

Suggestion for Disassembly

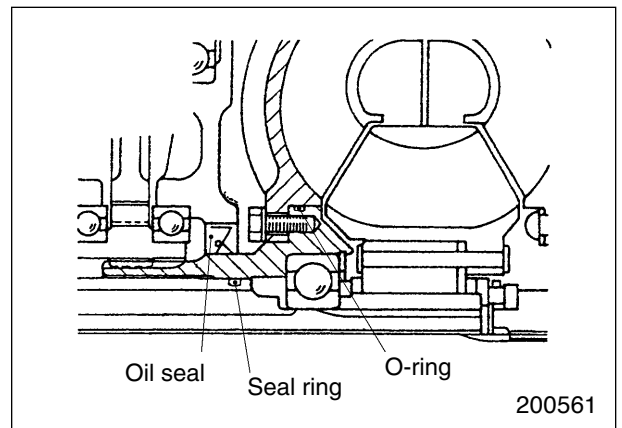
To remove the stator assembly, slightly force the stator just like turning it counterclockwise to prevent the rollers from falling and pull the stator together with the hub by sliding the splines.



Inspection

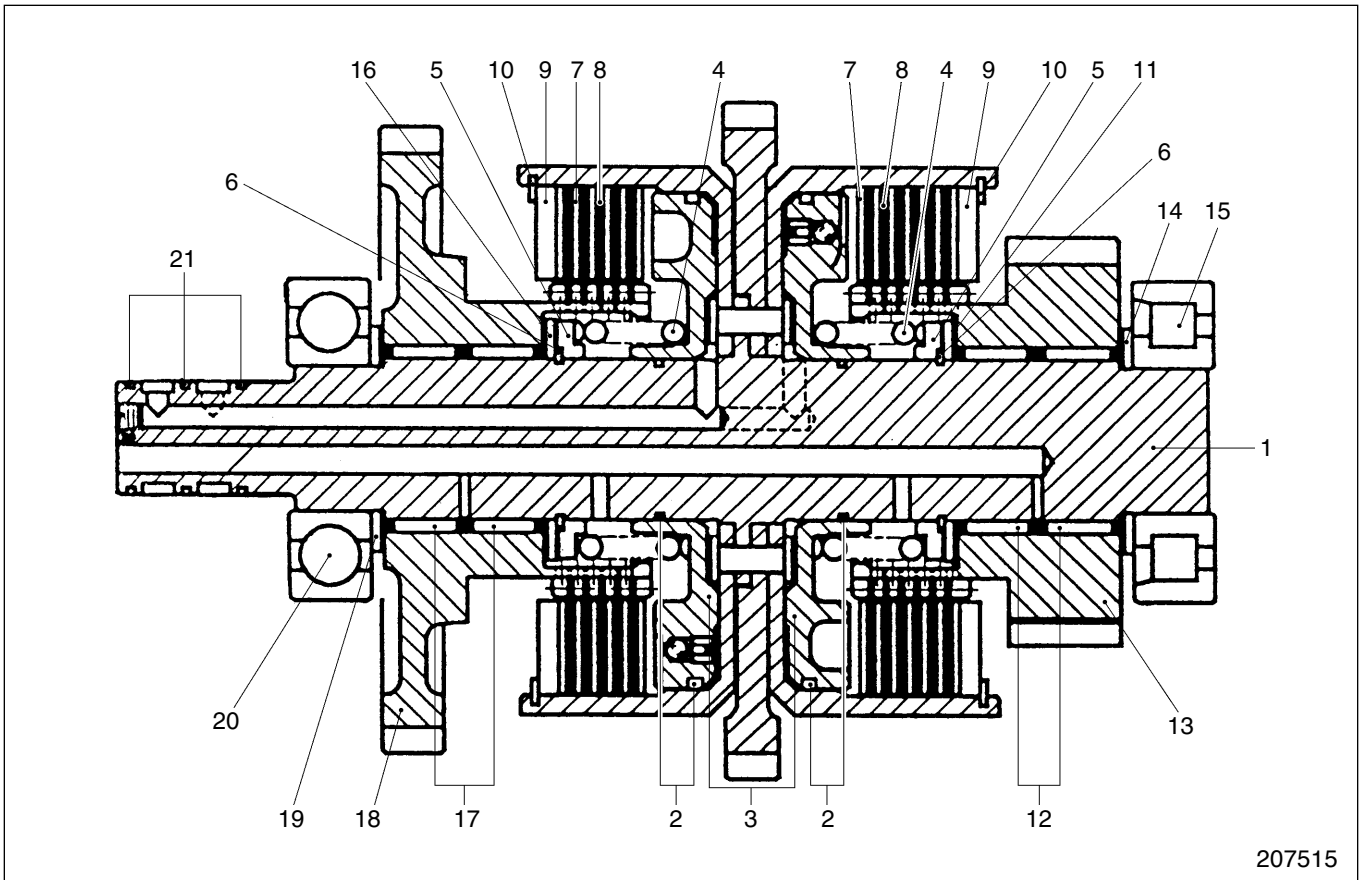
1. Pump (impeller)

- (1) Check for cracks.
- (2) Check for oil leaks due to looseness of the bolts holding the boss to the pump, or defective O-ring.
- (3) Check the face of the pump boss in contact with the oil seal for wear.
- (4) Check the face of the pump boss in contact with the seal ring.



Reassembly

1. Forward clutch shaft subassembly (1st-speed/3rd-speed clutch shaft subassembly/reverse clutch shaft subassembly)



Sequence

- | | |
|--|------------------------------|
| 1. Forward clutch shaft (1st-speed/3rd-speed clutch shaft or reverse clutch shaft) | 11. Thrust washer, Snap ring |
| 2. Sealing rings, Piston seals | 12. Needle roller bearings |
| 3. Pistons | 13. Gear (forward drive) |
| 4. Springs | 14. Thrust washer |
| 5. Retainers | 15. Roller bearing |
| 6. Snap rings | 16. Thrust washer |
| 7. Mating plates | 17. Needle roller bearings |
| 8. Friction plates | 18. Gear (2nd-speed drive) |
| 9. Pressure plates | 19. Thrust washer |
| 10. Snap rings | 20. Ball bearing |
| | 21. Seal rings |

NOTE

The reassembly sequence and suggestions for the reverse clutch shaft subassembly are similar to the forward clutch shaft subassembly as far as the clutch is concerned.

Travel Speed Select Switch

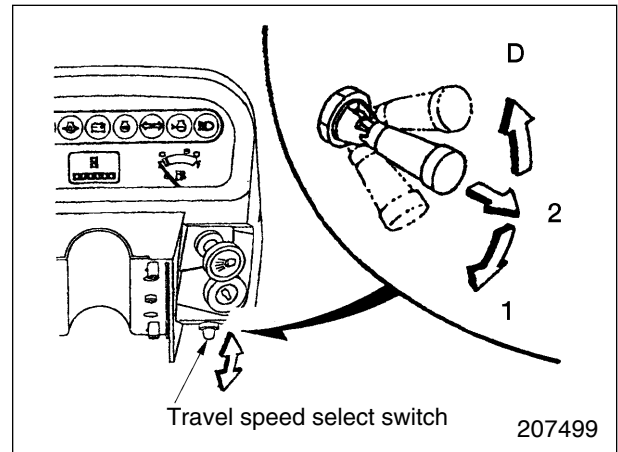
Move the travel speed select switch mounted on the console box to each position, and make sure that the speed selector system functions properly. Move the switch when the truck is at standstill.

FD100, FD115

- (1) In the “Fixed 1st speed” position, the truck runs at a maximum speed of 8 km/hr (5.0 mph) and a greater torque is available.
- (2) In the “Automatic 2-speed” position, the transmission automatically shifts from the 1st to the 2nd speed when the travel speed reaches 6.5 km/hr (4.0 mph) to allow the truck to run at a maximum speed of 18.5 km/hr (11.5 mph).
- (3) In the “Automatic 3-speed” position, the transmission automatically shifts from the 1st to the 2nd speed when the travel speed reaches 6.5 km/h (4.0 mph). It automatically shifts from the 2nd to the 3rd speed when the travel speed reaches 15 km/h (9.3 mph) to allow the truck to run at a maximum speed of 27 km/h (16.5 mph).

FD135, FD150A

- (1) In the “Fixed 1st speed” position, the truck runs at a maximum speed of 8.5 km/hr (5.3 mph) and a greater torque is available.
- (2) In the “Automatic 2-speed” position, the transmission automatically shifts from the 1st to the 2nd speed when the travel speed reaches 6.5 km/hr (4.0 mph) to allow the truck to run at a maximum speed of 19 km/hr (11.8 mph).
- (3) In the “Automatic 3-speed” position, the transmission automatically shifts from the 1st to the 2nd speed when the travel speed reaches 6 km/h (3.7 mph). It automatically shifts from the 2nd to the 3rd speed when the travel speed reaches 12.5 km/h (7.8 mph) to allow the truck to run at a maximum speed of 32 km/h (19.6 mph).



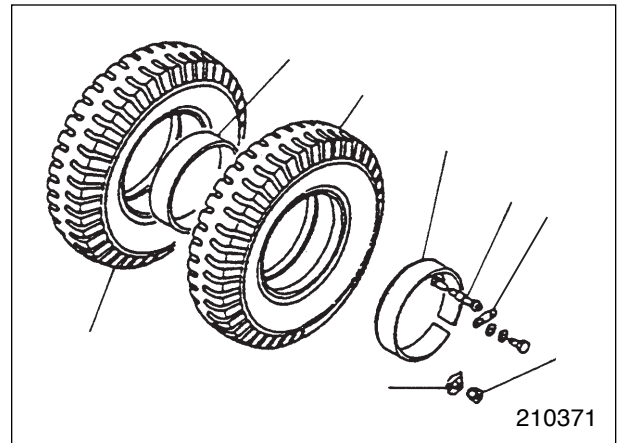
Removal and Installation

Front Wheels (Tires)

Removal

Sequence

1. Extension bracket
2. Wheel nuts
3. Clamp
4. Wedge band
5. Front wheel (Tire) (outer)
6. Spacer
7. Extension valve
8. Front wheel (Tire) (inner)



Start by:

Loosen the outer wheel nuts about two full turns, and block the rear wheels.

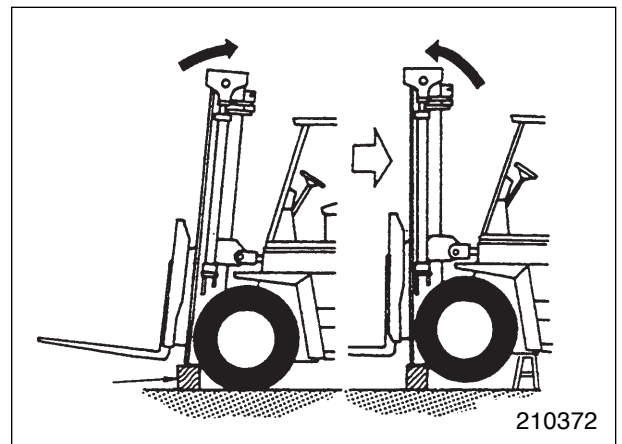
Truck lifting

- (1) Lifting with lift equipment

Tilt the mast fully backward, place wood blocks under the mast, and tilt the mast forward.

WARNING

After raising the front end of the truck, securely support the truck by putting wood blocks under the frame. Block the rear wheels.



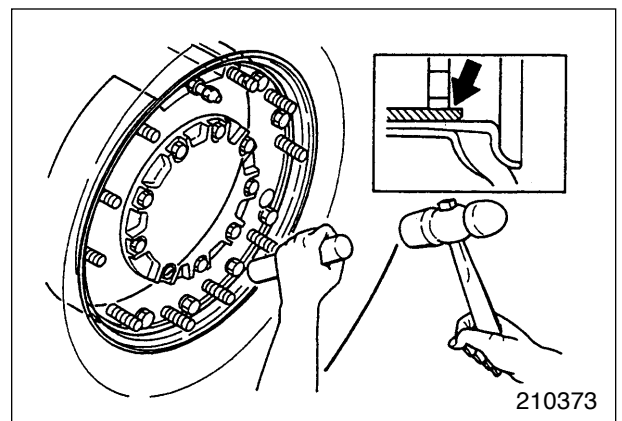
- (2) Tire removal

- (a) Position the extension valve at top center.
- (b) Release air from the tire.

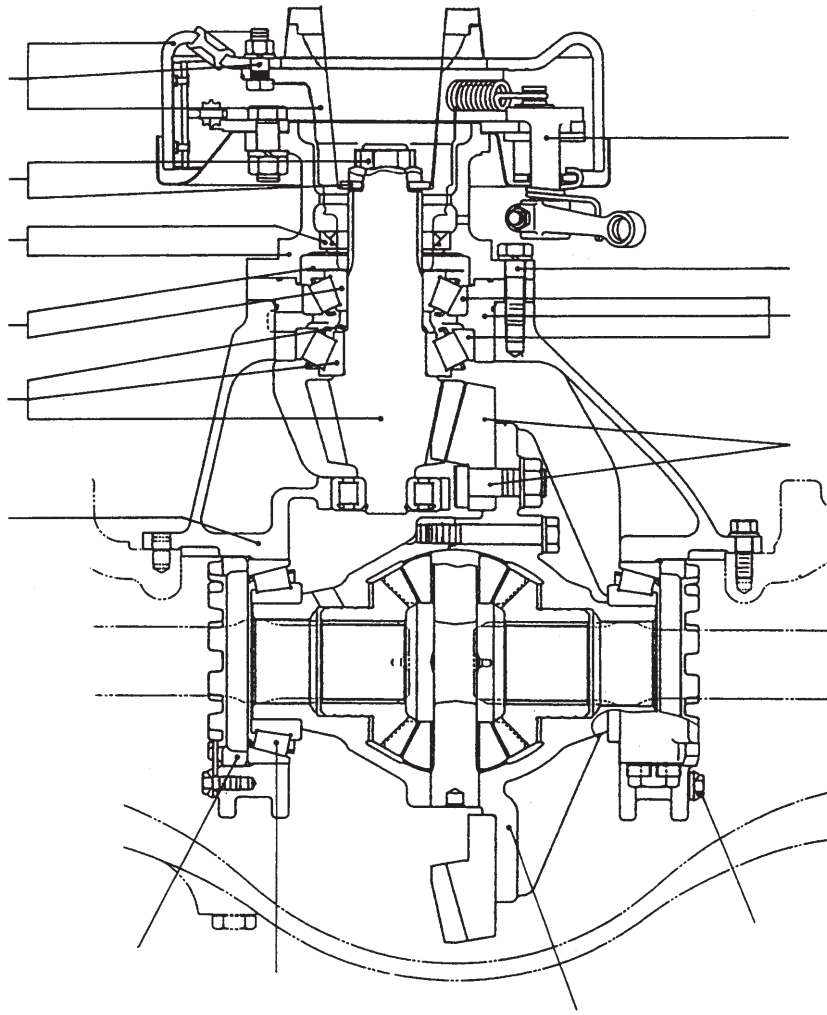
NOTE

Air is compressed. Keep your face away.

- (c) Hammer and remove the wedge band with a dolly bar applied to it.



Reassembly



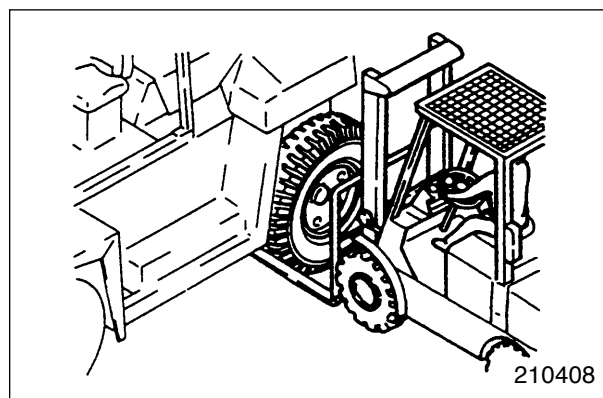
210393

Sequence

1. Differential case, Washers, Differential bevel gears, Differential bevel pinions, Pinion shafts, Washers , Bolts
2. Reduction bevel gear, Bolts, Nuts
3. Taper roller bearings
4. Differential carrier, Bearing caps, Lock washers, Bolts
5. Side bearing nuts
6. Reduction bevel pinion, Taper roller bearing (inner race), Collar
7. Bearing retainer, Taper roller bearing (outer race), O-ring, Shim(s)
8. Taper roller bearing (inner race), Oil separator
9. Parking brake bracket, Oil seal, O-ring, Bolts, Washers
10. Parking brake assembly, Bolts, Washers
11. Input flange, Parking brake drum, Reamer bolts, Washers, Nuts, Plug
12. Self-locking nut, Washers, O-ring
13. Lock plates, Bolts, Washers

- (e) Apply the forks of a forklift truck or tire handler under the tire. Then, remove wheel nuts and detach the tire.

Wheel weight	140 kg (310 lb)
--------------	-----------------



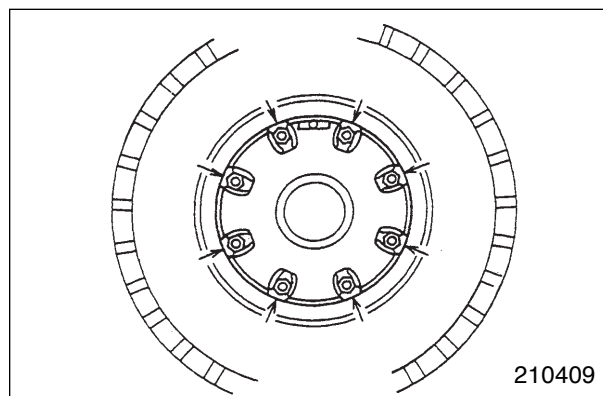
210408

Installation

Follow the reverse of removal sequence, and do the following steps.

- (1) Before installing the wheel onto the hub, make sure that the air valve set groove in the hub and the positioning boss on the rim meet at top position.
- (2) Snug up the wheel nuts evenly in the illustrated numerical order. Then, tighten them to the specified torque in the same sequence.

Tightening torque for wheel nuts	539±54 N·m (55±5.5 kgf·m) [398±40 lbf·ft]
----------------------------------	---



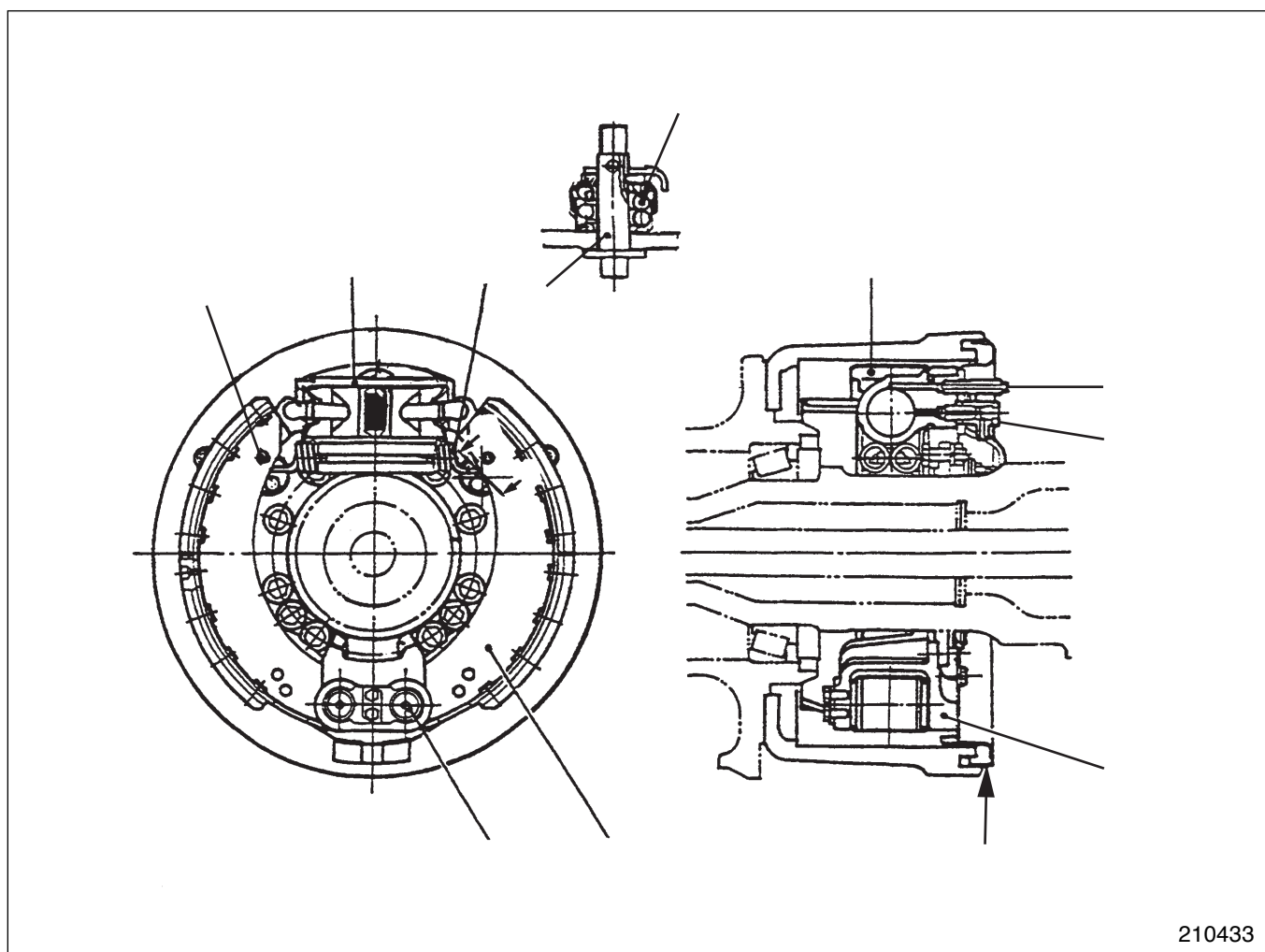
210409

- (3) After installing the tires, retighten wheel nuts. After about 10 minutes of advancing, reversing and braking, check that wheel nuts for the specific torque using a torque wrench.

Specifications

Truck Model		FD100	FD115	FD135	FD150A
Item					
Wheel brake	Type	Hydraulically actuated, internal-expanding, with leading and trailing shoes, effective on front wheels			
	Drum diameter mm (in.)	420 (16.54)			
	Lining dimensions (length × width × thickness) – number mm (in.)	200 × 190 × 16 (7.9 × 7.5 × 0.63) – 4			
	Wheel cylinder inside diameter mm (in.)	55.56 (2.187)			
	Brake booster	Air master (pneumatic booster)			
Parking brake	Type	Mechanically actuated, internal-expanding, effective on reduction bevel pinion			
	Drum diameter mm (in.)	304.8 (12.00)			
	Lining dimensions (length × width × thickness) – number mm (in.)	345 × 75 × 6.7 (13.6 × 3.0 × 0.26) – 2			

Reassembly



210433

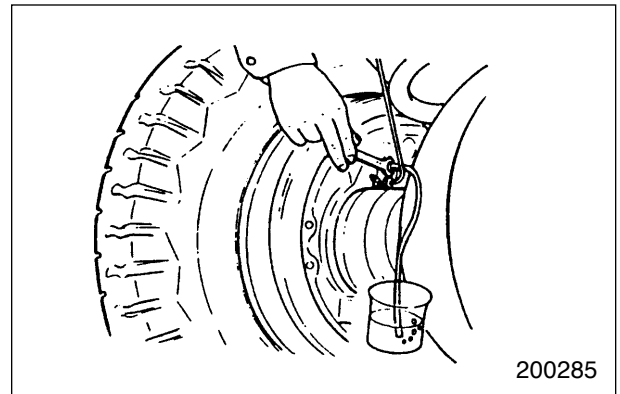
Sequence

- | | |
|--|---|
| 1. Anchor brackets | 7. Wheel cylinder, Cylinder plate, Bolts, Washers |
| 2. Adjusting cam | 8. Cylinder cover, Bolts, Washers |
| 3. Washer, Spring, Boot, Cover, Indicator, Pin | 9. Return spring |
| 4. Pins, E-rings | 10. Air bleeder |
| 5. Brake shoes | 11. Connector, Bolt |
| 6. Anchor pin, Bolt, Lock plate, Lock washer | 12. Dust cover, Bolts, Washers |

- (4) Do Step (3) until the fluid flows from the vinyl tube into the jar in a solid stream that is free of air bubbles, and tighten the bleeder screw.

2. Wheel cylinders

- (1) Start the engine and allow it to run at low idle.
- (2) Connect a transparent vinyl tube to the bleeder screw of the wheel cylinder with the free end of the tube put in a jar filled with brake fluid.
- (3) Have someone get into the truck and pump the brake pedal, allowing it to return slowly, then keep the pedal depressed and loosen the bleeder screw to allow the fluid to flow into the jar. Tighten the bleeder screw while the fluid is flowing into the jar.
- (4) Do Step (3) until the fluid free of air bubbles flows from the vinyl tube into the jar, and fill the reservoir with the fluid up to the specified level.



NOTE

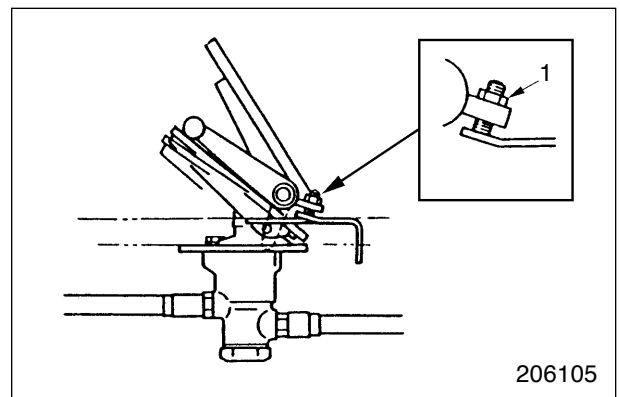
- (1) Maintain proper fluid level in the reservoir during bleeding operation.
- (2) Avoid mixing different types or brands of fluids.

Brake Pedal

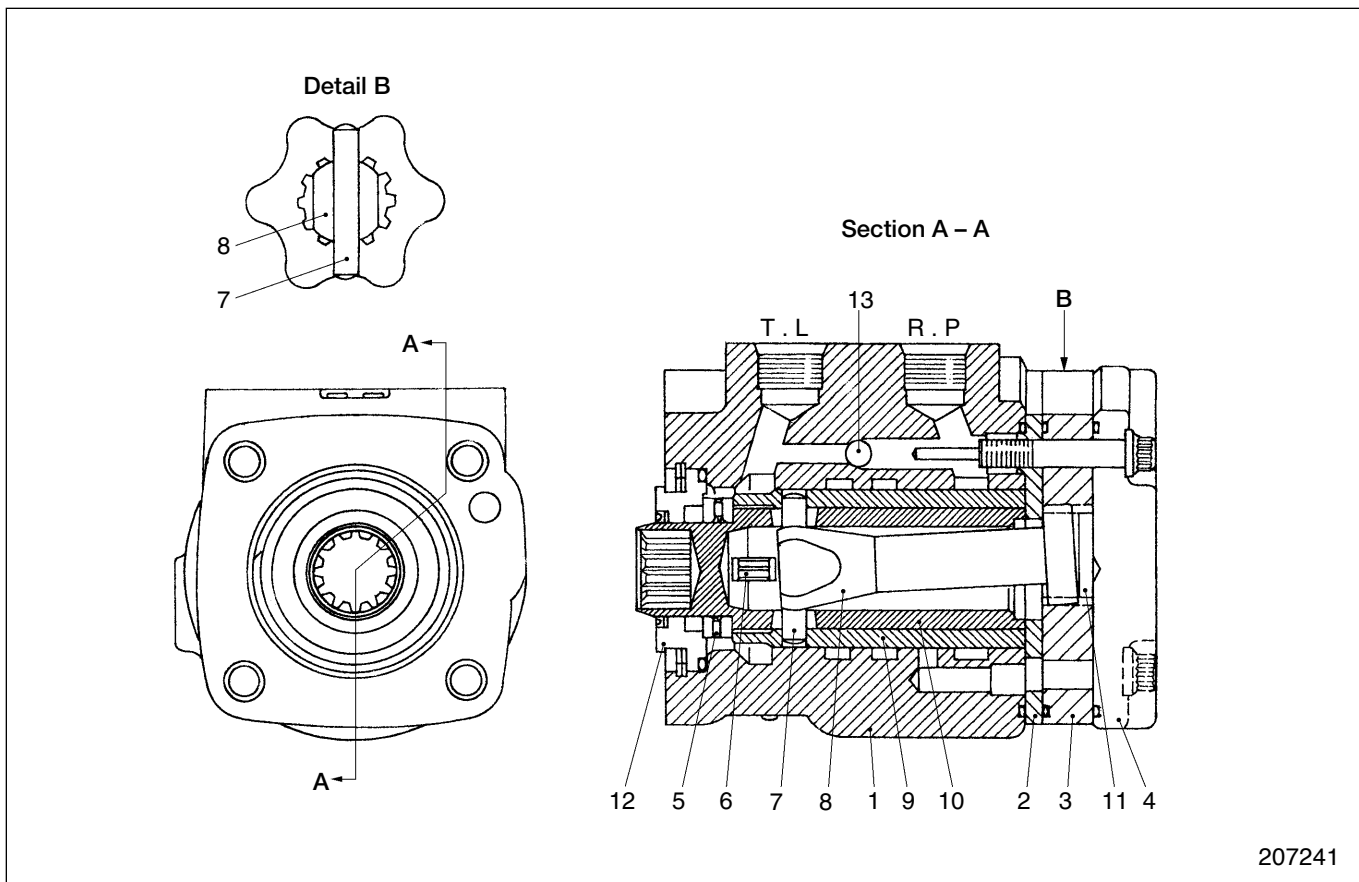
Set the brake pedal with bolt 1 so that the roller may come in contact with the brake control valve pedal.

NOTE

Do not tamper with the brake valve pedal set angle ($39 \pm 1.5^\circ$).



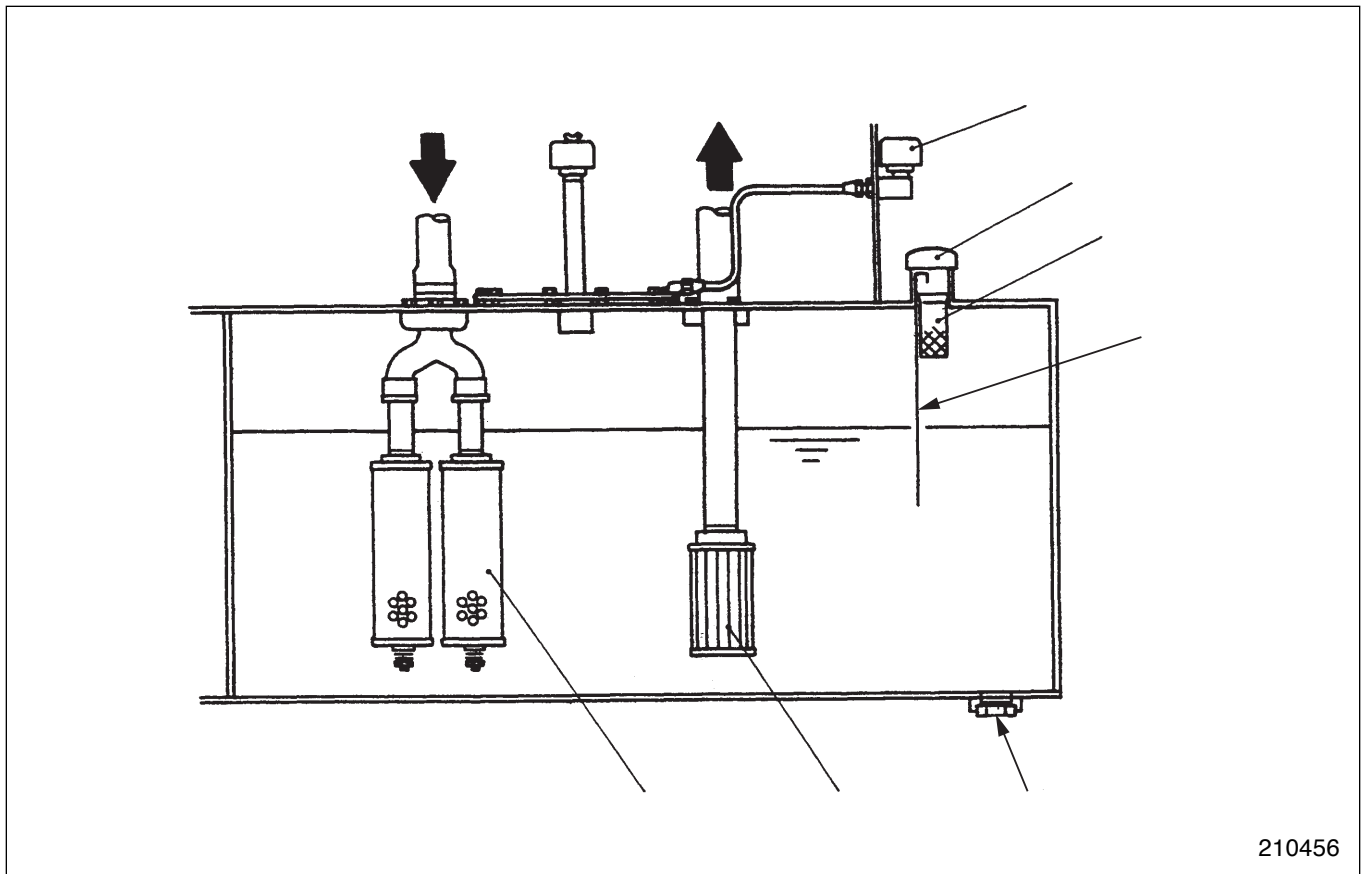
Steering Control Valve



207241

- | | | |
|--------------------------|---------------------------------|--------------------------|
| 1. Housing | 8. Drive | P: Pump port |
| 2. Wear plate | 9. Control sleeve | T: Tank port |
| 3. Gerotor set (Rotor) | 10. Control spool | L: Cylinder port (left) |
| 4. End cap | 11. Spacer | R: Cylinder port (right) |
| 5. Thrust needle bearing | 12. Seal gland bushing assembly | |
| 6. Centering spring | 13. Ball | |
| 7. Pin | | |

Hydraulic Tank



- | | |
|-------------------|---------------------|
| 1. Strainer | 5. Drain plug |
| 2. Breather | 6. Suction strainer |
| 3. Cap | 7. Return filter |
| 4. Oil level gage | |

The hydraulic tank is integral with the frame and contains an oil inlet strainer, a suction strainer and a return filter to keep the oil clean.

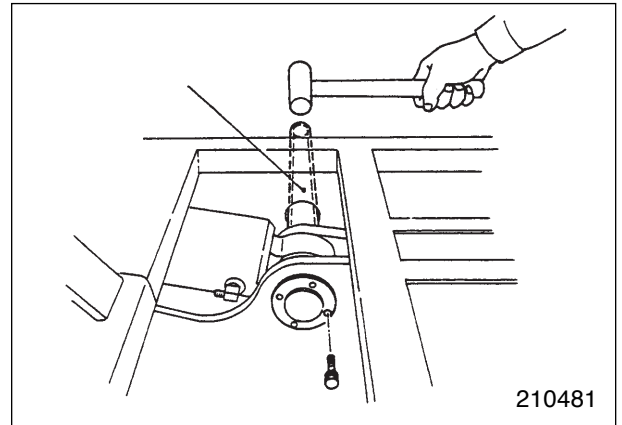
Oil is drawn from the tank through suction strainer (105 μ) by the gear pump. The oil returning from the lift cylinders joins the oil returning from the hydraulic and steering control valves, and returns to the tank through return filter (25 μ).

- (7) Remove the bolts that hold tilt cylinder pin 3. Remove tilt cylinder pin 3 with a hammer through the hole in the frame as shown. Use a hollow pipe tooling to prevent damage to the grease fitting of the pin.

NOTE

Have someone support the pin to prevent it from falling.

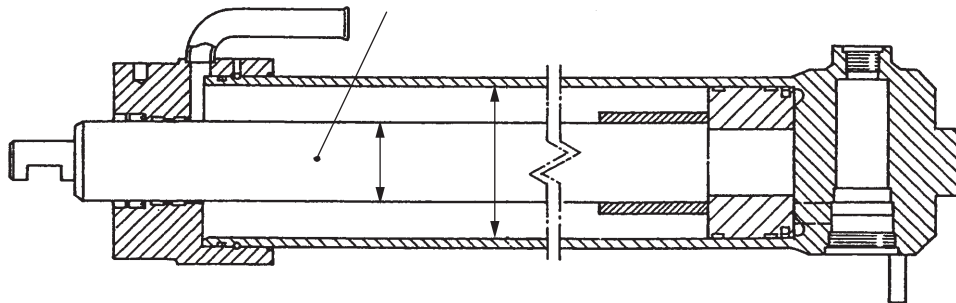
- (8) Remove the cylinder from the front side of the seat frame.



A: Standard value B: Repair or service limit

Unit: mm (in.)

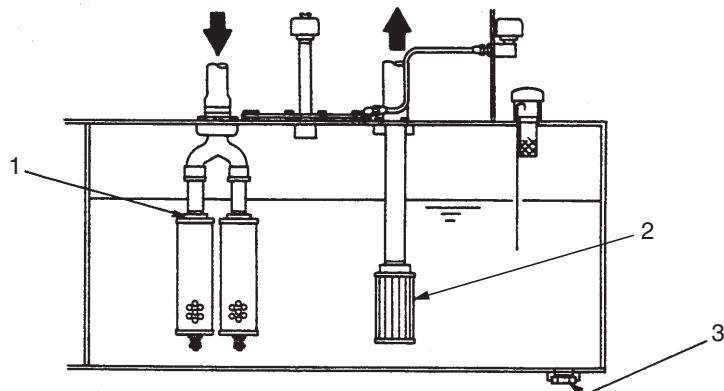
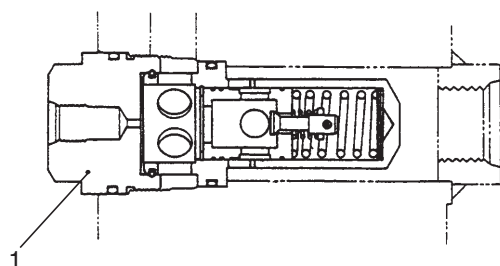
Truck Model		FD100	FD115	FD135	FD150A
Item					
Inside diameter of cylinder tube 1		A	115 (4.53)	125 (4.92)	
		B	115.14 (4.53331)	125.16 (4.9275)	
Deflection of piston rod 2 (1/2 of dial indicator reading)		B	0.5 (0.020)		
Diameter of piston rod 3	Lift height 3000 to 5000 (118 to 197)	A	60 (2.36)		
		B	59.84 (2.3559)		
	Lift height 5500 to 7000 (217 to 276)	A	75 (2.95)		
		B	74.84 (2.9465)		



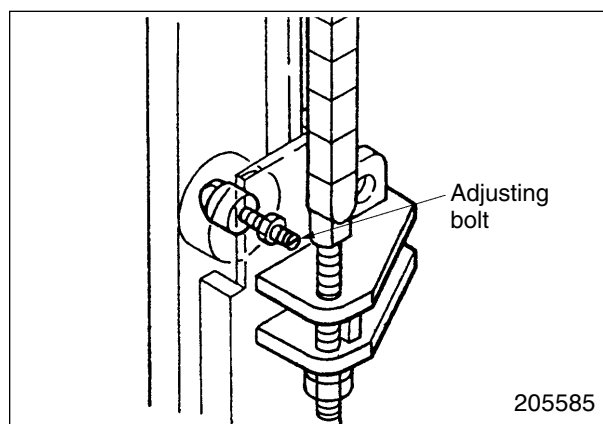
210633

A: Standard value

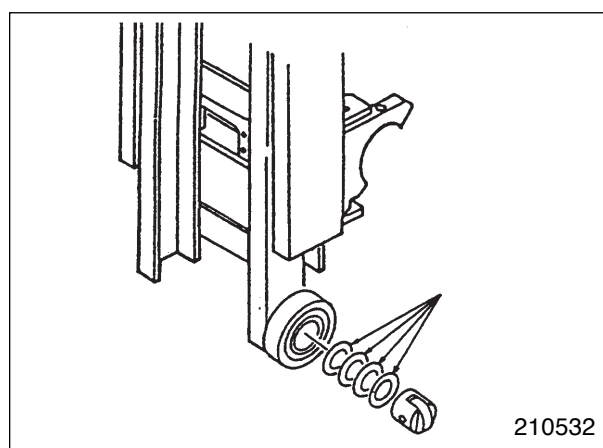
Unit: mm (in.)

Truck Model			FD100	FD115	FD135	FD150A
Item						
Hydraulic tank	Tightening torque for return filter 1 N·m (kgf·m) [lbf·ft]	A	49 (5) [36]			
	Tightening torque for suction strainer 2 N·m (kgf·m) [lbf·ft]	A	49 (5) [36]			
	Tightening torque for drain plug 3 N·m (kgf·m) [lbf·ft]	A	177 to 196 (18 to 20) [131 to 145]			
						
Flow regulator valve	Control flow (no load) liter [U.S. gal.]/min	A	150 (40)			
	Tightening torque for plug 1 N·m (kgf·m) [lbf·ft]	A	343 (35) [253]			
						

- To adjust the clearance K on the upper side of the mast, loosen the lock nut for the side roller bracket adjusting bolt and turn the adjusting bolt.



- To adjust the clearance K on the lower side of the mast, remove the side roller and increase or decrease the amount of the shims.

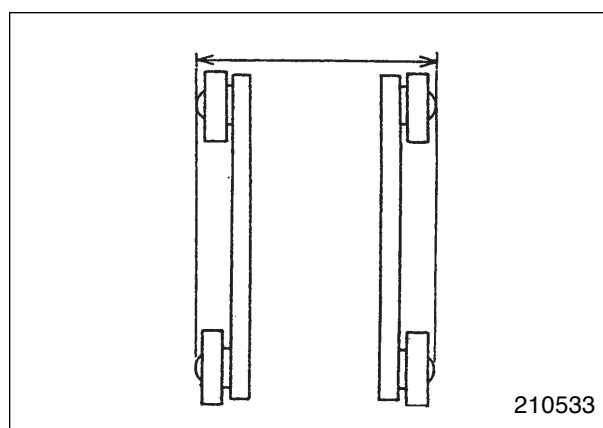


4. Lateral clearance between lift bracket and inner mast

- Measure the distance C between the side rollers.

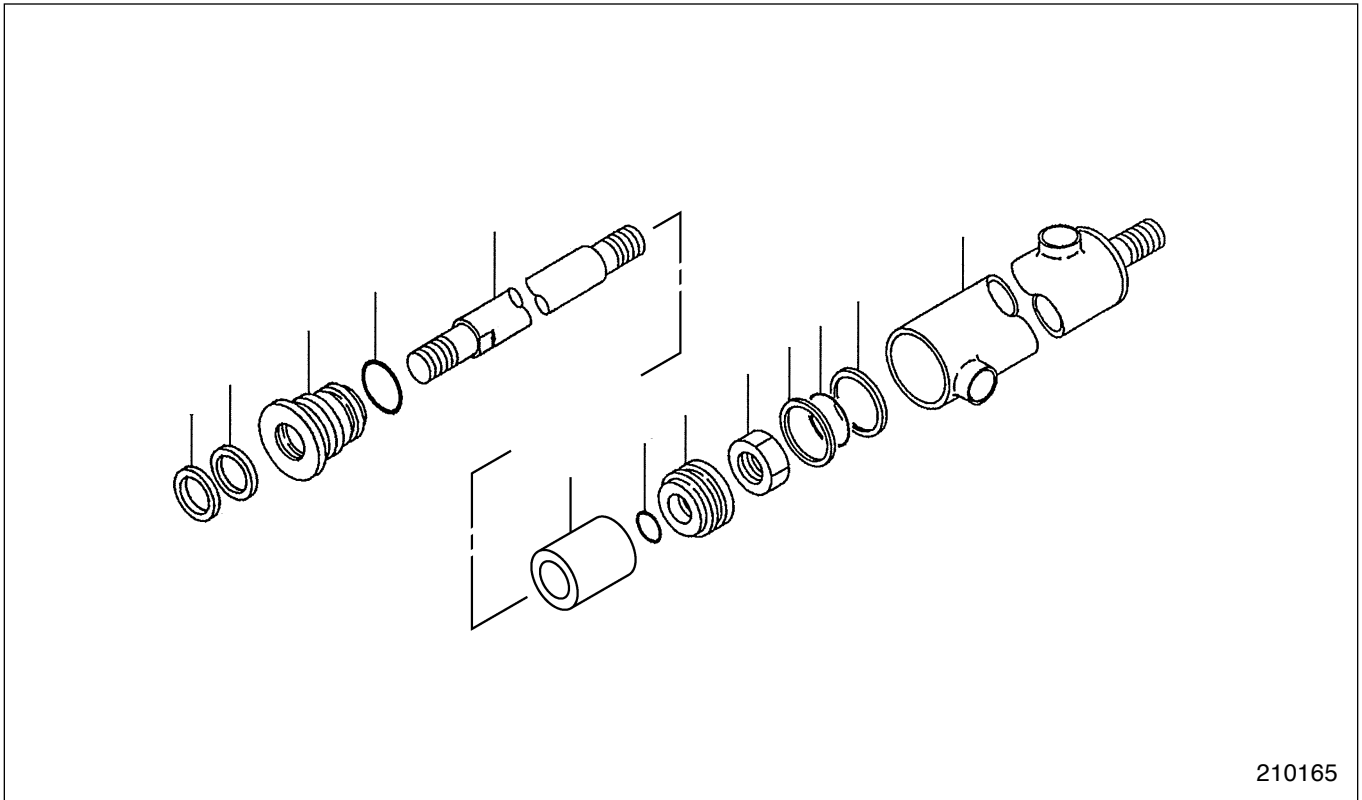
Unit: mm (in.)

Truck Model	FD100, FD115, FD135	FD150A
Item		
Distance C	704±0.5 (27.72±0.020)	692±0.5 (27.24±0.020)



Fork Positioner Cylinder

Disassembly



210165

Sequence

- | | |
|---------------------|-------------------|
| 1. Guide bushing | 7. Piston |
| 2. O-ring | 8. Backup ring |
| 3. Dust seal | 9. O-ring |
| 4. Rod packing | 10. O-ring |
| 5. Collar | 11. Piston rod |
| 6. Self-locking nut | 12. Cylinder tube |

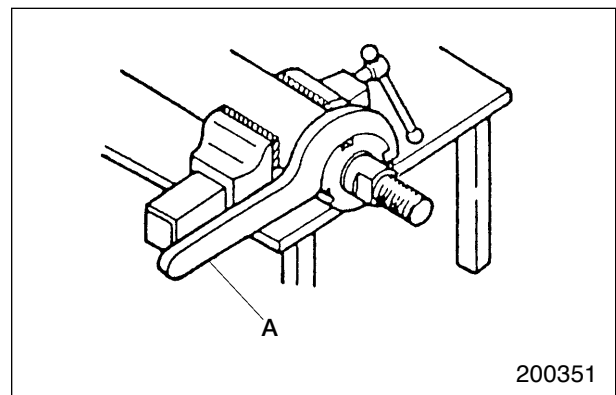
Suggestions for Disassembly

1. Removal of guide bushing

Wrap the cylinder tube with rag, and secure it onto the vise. Then, remove the guide bushing with a Hook Wrench (special tool).

Special tool needed

Hook wrench A	05312 - 20520
---------------	---------------



200351

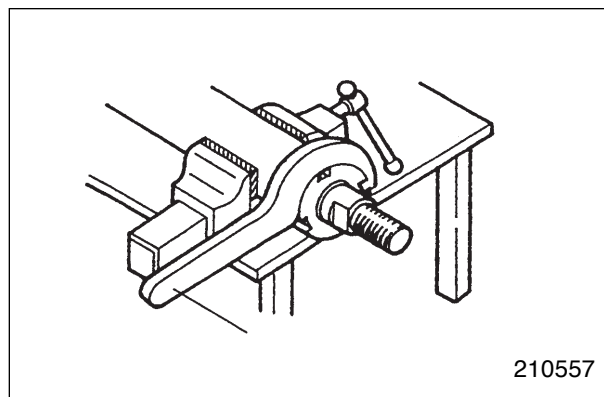
Suggestions for Disassembly

1. Removal of guide bushing

- (1) Wrap the cylinder tube with waste cloth, and secure it onto the vise. Then, remove the guide bushing with Hook Wrench A.

Special tool needed

Truck Model	FD100, FD115	FD135, FD150A
Tool Name		
Hook wrench A	05312 - 20980	05312 - 21100



Inspection and Correction

1. Cylinder tube

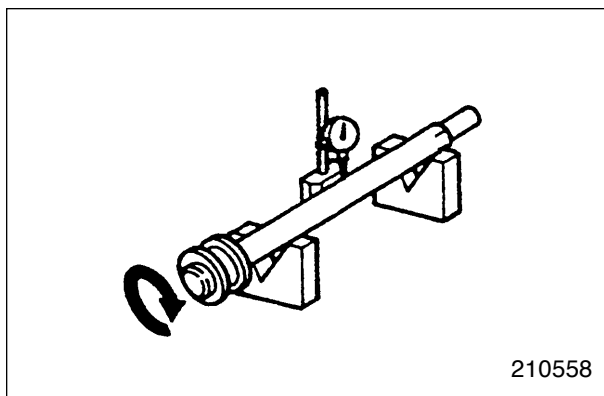
- (1) Check the inside surface of the cylinder for wear, damage and rust.
- (2) Check the welded part for cracks, damage and dent.

2. Piston rod

- (1) Check the piston rod for bend.
Support both ends of the piston rod with a V-shaped block, and measure bend by putting a dial gauge to the center of the piston rod.
Replace the piston rod if 1/2 of the gauge reading exceeds the service limit.

B: Repair or service limit
Unit: mm (in.)

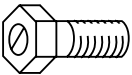
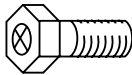
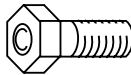
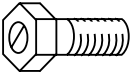
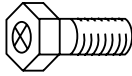
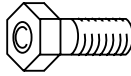
Deflection of piston rod (1/2 of dial indicator reading)	B	1.0 (0.039)
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- (2) Check the rod surface for rust, damage, sliding scratches and dent.
- (3) Replace the piston rod if excessive damage is found on the thread.

3. Rings and packing

Replace seal kit parts with new ones.

	Nominal size		Pitch		With spring washer									101656		
																
Metric coarse thread	mm	in.	mm	in.	N·m	kgf·m	lbf·ft	N·m	kgf·m	lbf·ft	N·m	kgf·m	lbf·ft			
	10	0.39	1.5	0.06	33.3	3.4	24.6	43.1	4.4	31.8	67.7	6.9	49.9			
	12	0.47	1.75	0.07	58.8	6.0	43.4	76.5	7.8	56.4	115.7	11.8	85.3			
	14	0.55	2	0.08	96.4	9.8	70.9	124.5	12.7	91.9	182.4	18.6	134.5			
	16	0.63	2	0.08	147.14	15.0	108.5	191.2	19.5	141.0	274.6	28.0	202.5			
	18	0.71	2.5	0.10	203.0	20.7	149.7	264.8	27.0	195.3	383.4	39.1	282.8			
	20	0.79	2.5	0.10	286.4	29.2	211.2	371.7	37.9	274.1	536.4	54.7	395.6			
	22	0.87	2.5	0.10	383.4	39.1	282.8	499.2	50.9	368.2	715.9	73.0	528.0			
	24	0.95	3	0.12	492.3	50.2	363.1	640.4	65.3	472.3	924.8	94.3	682.1			
	27	1.06	3	0.12	724.7	73.9	534.5	942.2	96.1	695.1	1350.4	137.7	996.0			
	30	1.18	3.5	0.14	969.9	98.9	715.3	1259.2	128.4	928.7	1843.7	188.0	1359.8			
	33	1.30	3.5	0.14	1328.8	135.5	980.1	1727.0	176.1	1273.7	2477.2	252.6	1827.1			
	36	1.42	4	0.16	1676.0	170.9	1236.1	2180.0	222.3	1607.9	3199.9	326.3	2360.1			
	39	1.54	4	0.16	2219.2	226.3	1636.8	2884.1	294.1	2127.2	4118.8	420.0	3037.9			
	42	1.65	4.5	0.18	2754.7	280.9	2031.8	3581.4	365.2	2641.5	5137.7	523.9	3789.4			
	Nominal size		Pitch		Without spring washer									101656		
																
	10	0.39	1.5	0.06	39.2	4.0	28.9	51.0	5.2	37.6	79.4	8.1	58.6			
	12	0.47	1.75	0.07	69.6	7.1	51.4	90.2	9.2	66.5	135.3	13.8	99.8			
	14	0.55	2	0.08	112.8	11.5	83.2	146.1	14.9	107.8	215.7	22.0	159.1			
	16	0.63	2	0.08	172.6	17.6	127.3	224.6	22.9	165.6	323.6	33.0	238.7			
	18	0.71	2.5	0.10	239.3	24.4	176.5	311.9	31.8	230.0	451.1	46.0	332.7			
	20	0.79	2.5	0.10	336.4	34.3	248.1	437.4	44.6	322.6	630.6	64.3	465.1			
	22	0.87	2.5	0.10	392.3	40.0	289.3	587.4	59.9	433.3	842.4	85.9	621.3			
	24	0.95	3	0.12	578.6	59.0	426.7	753.2	76.8	555.5	1088.5	111.0	802.9			
	27	1.06	3	0.12	852.2	86.9	628.5	1108.2	113.0	817.3	1588.7	162.0	1171.7			
	30	1.18	3.5	0.14	1140.5	116.3	841.2	1481.8	151.1	1092.9	2168.3	221.1	1599.2			
	33	1.30	3.5	0.14	1563.2	159.4	1153.0	2031.9	207.2	1498.7	2915.5	297.3	2150.4			
	36	1.42	4	0.16	1972.1	201.1	1454.6	2564.4	261.5	1891.4	3765.8	384.0	2777.5			
	39	1.54	4	0.16	2610.5	266.2	1925.4	3393.1	346.0	2502.6	4845.5	494.1	3573.8			
	42	1.65	4.5	0.18	3241.1	330.5	2390.5	4212.9	429.6	3107.3	6044.8	616.4	4458.4			

Remarks: 1. The tolerance on these torque is $\pm 10\%$.

2. These torques are for “dry” condition.

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