CAT® Lift Trucks

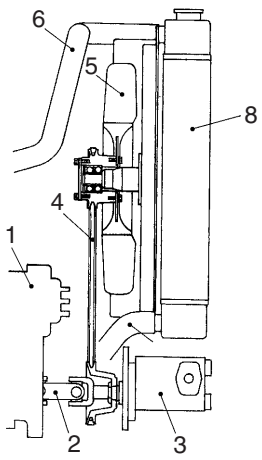
Service Manual

Chassis, Mast & Options

GP40K	**T29C-00011-up**	**DP40K**	**T19C-00011-up**
GP40KL	**T29C-50001-up**	**DP40KL**	**T19C-50001-up**
GP45K	**T29C-80001-up**	**DP45K**	**T19C-80001-up**
GP50K	**T33B-50001-up**	**DP50K**	**T28B-50001-up**

For use with S6S and TB45 Engine Service Manual. **99739-36130**

Structure



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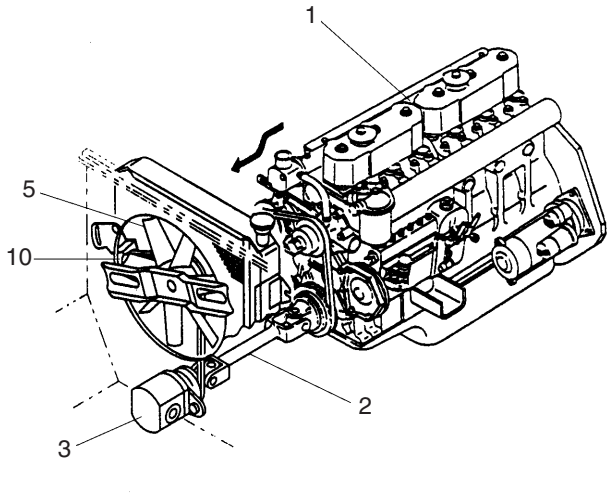

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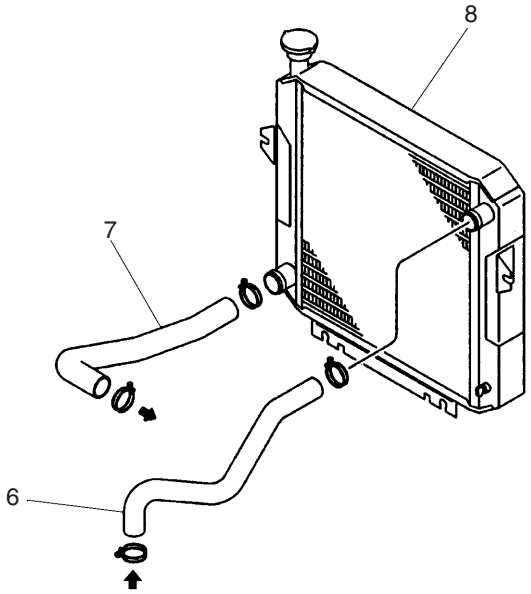

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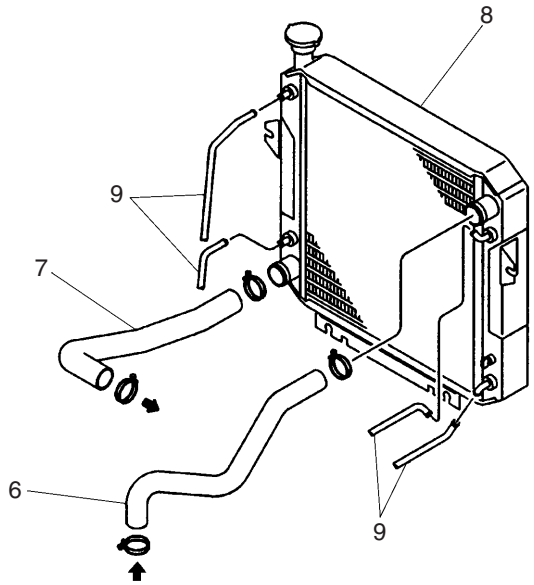

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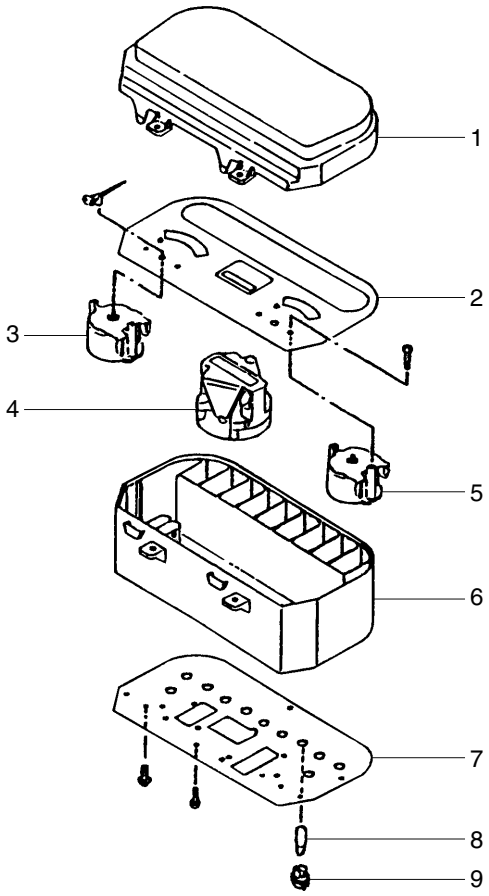
1 Engine
2 Universal joint
3 Gear pump
4 Fan belt
5 Cooling fan
6 Upper hose
7 Lower hose
8 Radiator
9 Oil cooler hoses
10 Tension pulley

Combination Meter

Disassembly



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Sequence

1 Instrument panel
2 Dial
3 Engine coolant temperature gauge
4 Service hourmeter
5 Fuel gauge
6 Meter case
7 Printed circuit plate
8 Bulb
9 Socket

⚠ CAUTION

Be careful not to damage the printed circuit plate when disassembling the combination meter.

Reassembly

To reassemble the combination meter, follow the reverse of disassembly procedure.

Bulb replacement

For bulb replacement, remove the socket from the printed circuit plate by turning it to the left. For configuration of the indicator lights, refer to the preceding section “OK Monitor.”

Suggestions for Installation

(1) For the following steps, refer to the preceding section "Removal of Engine and Power Train as an Assembled Unit."

(a) Engine mounting nut installation

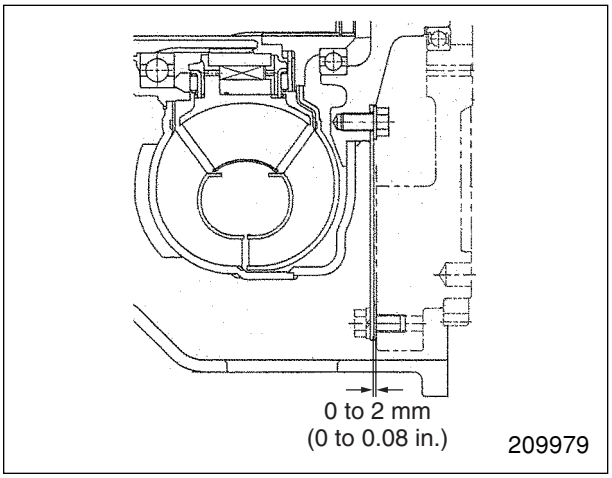
(b) Filling of radiator

(c) Filling of torque converter

(d) Inspection after starting

(2) Suggestions for engine installation on powershift transmission models

After coupling the engine to the torque converter, make sure that there is a clearance of 0 to 2 mm (0 to 0.08 in.) between the flywheel and flexible plate. If no clearance is found there, it is an indication that the torque converter and pump gear are improperly meshed. In such a case, reinstall the torque converter.



NOTE

After installing the rear plate and torque converter case, make sure that the flexible plate rotates freely.

3. Return spring

Measure the free length of the spring and replace the spring if the free length exceeds the service limit.

A: Standard value
Unit: mm (in.)

Free length of return spring	A	90 ± 2.5 (3.54 ± 0.1)

4. Piston cup, secondary cup and valve

Check each rubber part for damage or swelling.

A: Standard value
Unit: mm (in.)

Outside diameter of secondary cup	A	16.6 ± 0.2 (0.654 ± 0.008)
Outside diameter of piston cup	A	17.0 ± 0.2 (0.669 ± 0.008)

Reassembly

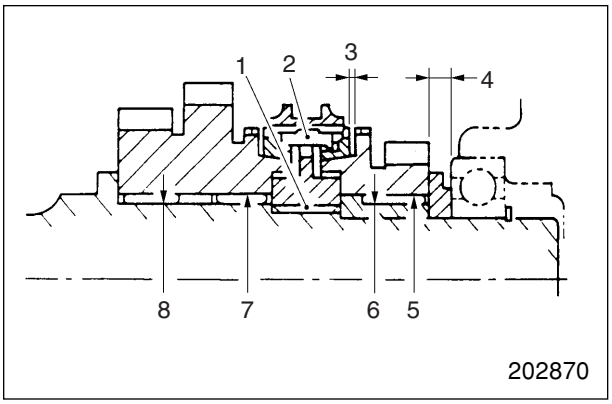
To reassemble, follow the reverse of disassembly sequence, and do the follwing steps:

(1) Wash all metal parts with volatile cleaning solvent, and blow off the solvent.

(2) Apply a thin coat of rubber grease (METAL RUBBER #20) or brake fliud to the inside surface of cylinder, piston cup and secondary cup.

Input Shaft (1st Shaft)

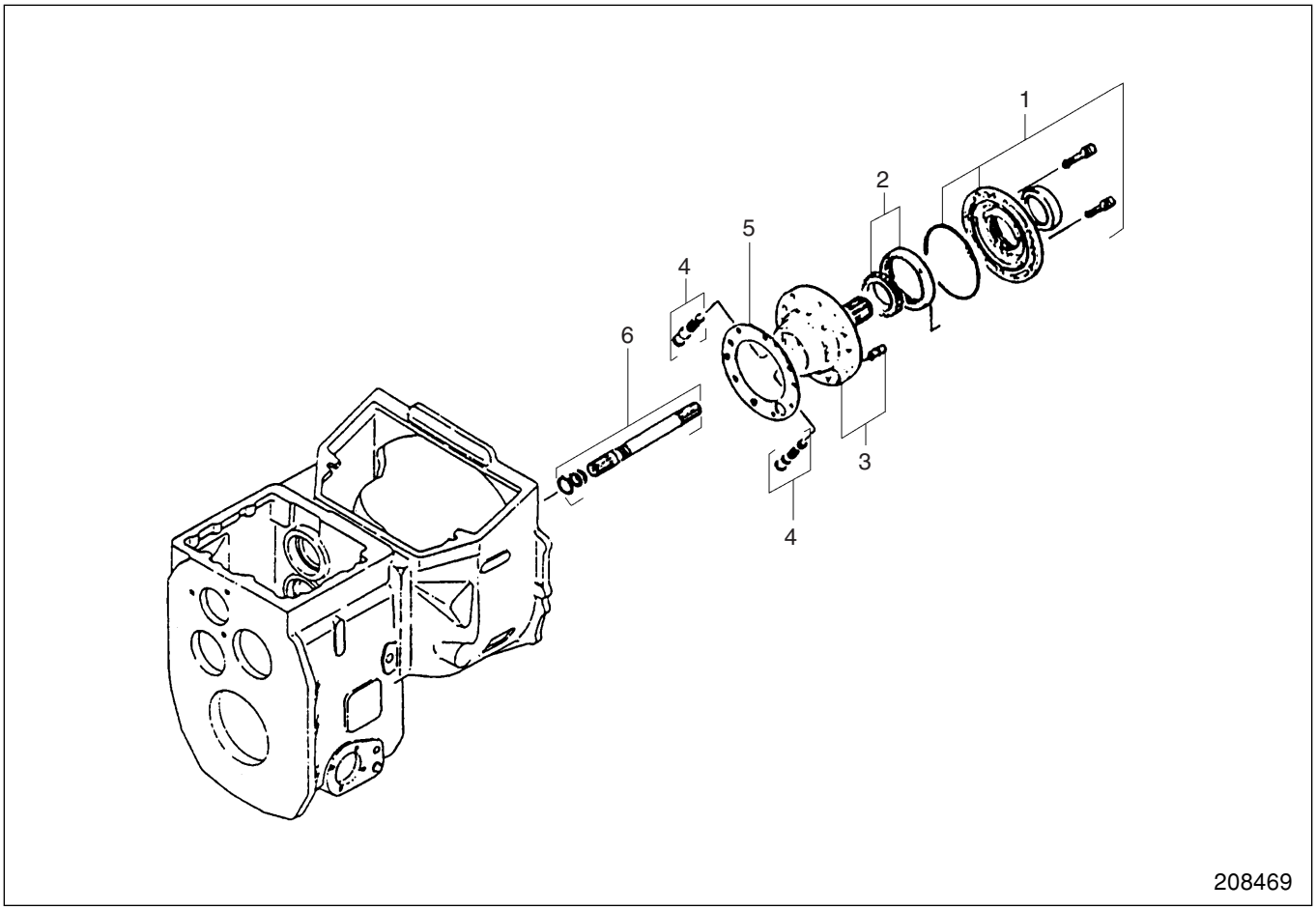
Check the clearance of synchronizer parts, thickness of thrust washer and diameters of gears.



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

Items \ Truck Model		DP40K, DP40KL, DP45K
Free movement of synchronizer hub 1 (looseness of mating splines)	A	0.016 to 0.176 (0.00063 to 0.00693)
	B	0.5 (0.020)
Clearance of synchronizer key in synchronizer hub groove 2	A	0.05 to 0.2 (0.0020 to 0.008)
	B	0.3 (0.012)
Axial clearance between synchronizer ring and gear 3	A	1.1 to 2.2 (0.043 to 0.087)
	B	0.2 (0.008) minimum
Thickness of thrust washer 4	A	$8\ ^{0}_{-0.1}$ ($0.31\ ^{0}_{-0.004}$)
	B	7.7 (0.303)
Inside diameter of low-range gear 5	A	$60\ ^{+0.029}_{+0.010}$ ($2.36\ ^{+0.00114}_{+0.00039}$)
	B	60.10 (2.3661)
Outside diameter of low-range gear sleeve 6	A	$55\ ^{-0.010}_{-0.023}$ ($2.17\ ^{-0.00039}_{-0.00091}$)
	B	54.90 (2.1614)
Inside diameter of high-range gear 7	A	$60\ ^{+0.029}_{+0.010}$ ($2.36\ ^{+0.00014}_{+0.00039}$)
	B	60.10 (2.3661)
Outside diameter of high-range gear portion of shaft 8	A	$55\ ^{-0.010}_{-0.023}$ ($2.17\ ^{-0.00039}_{-0.00091}$)
	B	54.90 (2.1614)

Pump Body Assembly



Sequence

1 Pump body, Oil seal, Bushing
2 Internal gear, Drive gear, O-ring
3 Stator shaft, Cap, Dowel pin
4 Valve, Spring, Washer, Snap ring
5 Gasket
6 Turbine shaft, Seal ring, Snap ring

NOTE

It is not necessary to remove the cap and dowel pin from the stator shaft or the bushing and oil seal from the pump body unless they are defective.

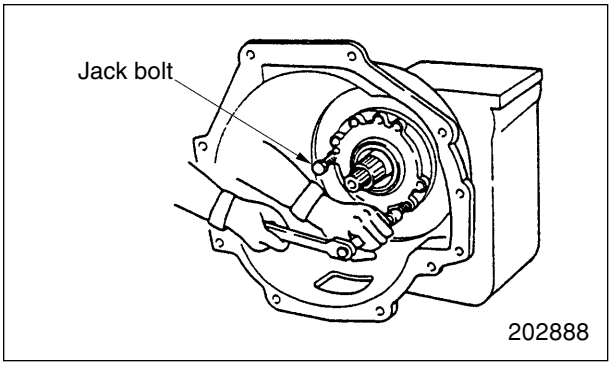
Suggestion for Disassembly

Removing pump body assembly

Unscrew all bolts securing the pump body assembly, and remove the assembly with the jack bolt holes in the stator shaft.

Special tool needed

Jack bolt	67284 - 15400



Inching Pedal Adjustment

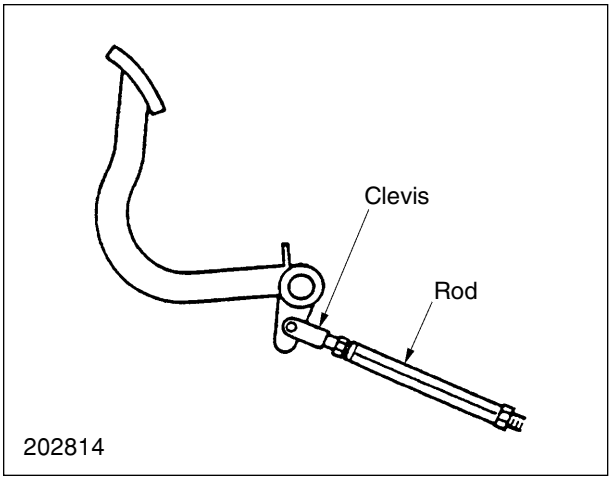
1. Adjusting brake

(1) Bleed air out of the brake lines from the reserve tank through master cylinder to the wheel cylinders.

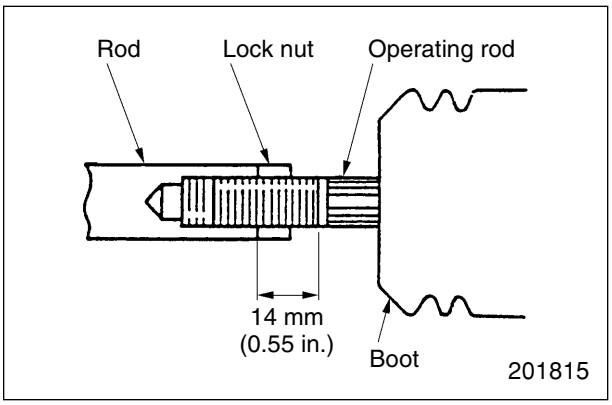
NOTE

For bleeding, refer to page 10-25 in the "GROUP 10 BRAKE SYSTEM."

(2) Screw the rod fully into the clevis on the brake pedal side.

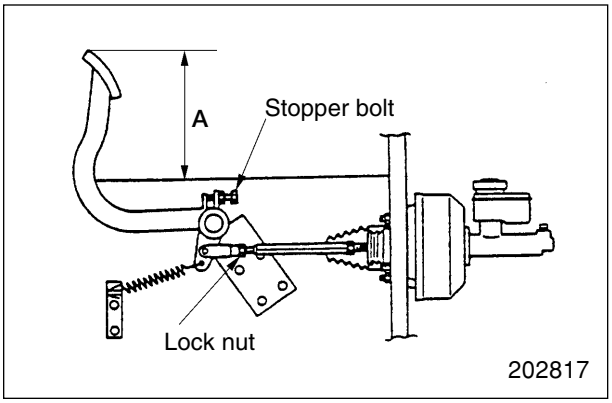


(3) Screw the lock nut on the operating rod of booster. Screw the operating rod into the rod until the remaining thread length measures 14 mm (0.55 in.) and tighten the lock nut.

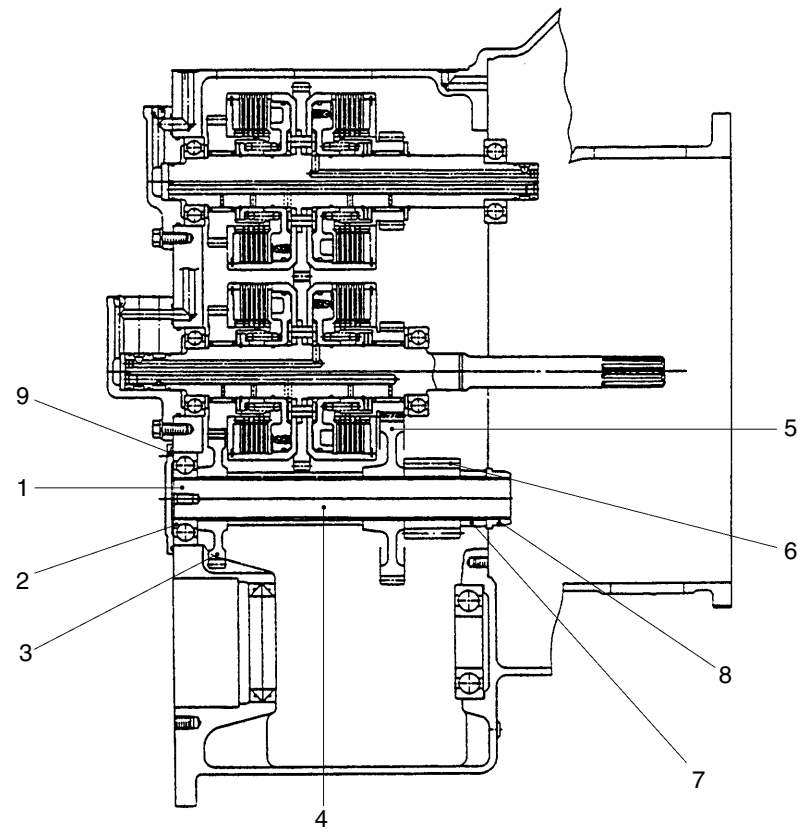


(4) Adjust the brake pedal height A to 223 mm (8.8 in.) by turning the operating rod, and tighten the lock nut on the pedal side.

(5) Decrease the brake pedal height A to 220 mm (8.7 in.) by the stopper bolt (until the operating rod push the booster slightly).



Countershaft (3rd shaft)



Sequence

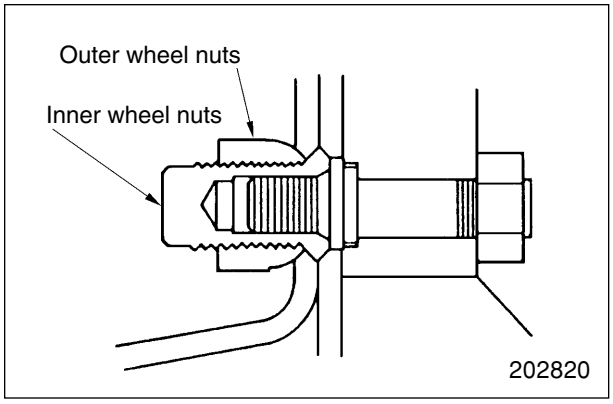
1 Countershaft
2 Ball bearing
3 Gear (forward 2nd speed countergear)
4 Spacer (Temporary reassembly)
5 Gear (forward 1st speed countergear)
6 Output gear (countergear)
7 Collar
8 Roller bearing (inner race)
9 Cover, O-ring

Suggestions for Reassembly

When placing gear (forward 2nd speed countergear) 3 in the transmission case, slightly pull out the input shaft subassembly and countershaft subassembly (2nd shaft) to prevent interference of these shafts with the gear.

Suggestion for Removal

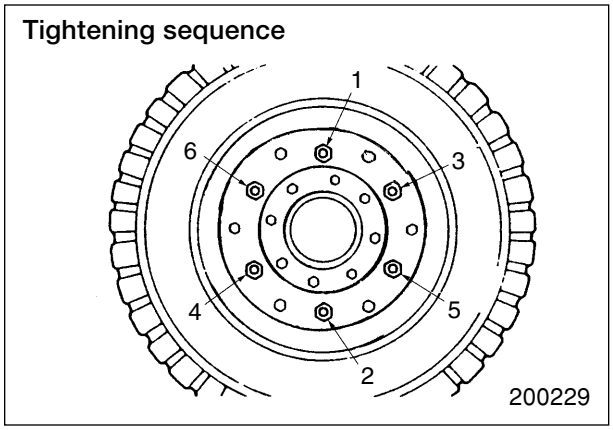
In case of the dual tire, unscrew the outer wheel nuts first and inner wheel nuts next.



Installation

To install, follow the reverse of removing procedure, and observe the following precautions:

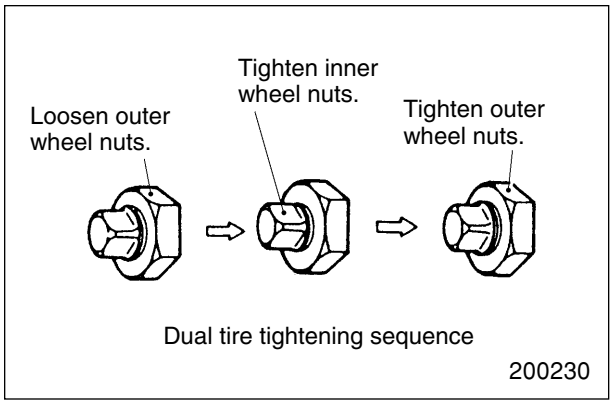
(1) Tighten the wheel nuts progressively and evenly to the specified torque in the sequence shown to prevent the wheels from wobbling.



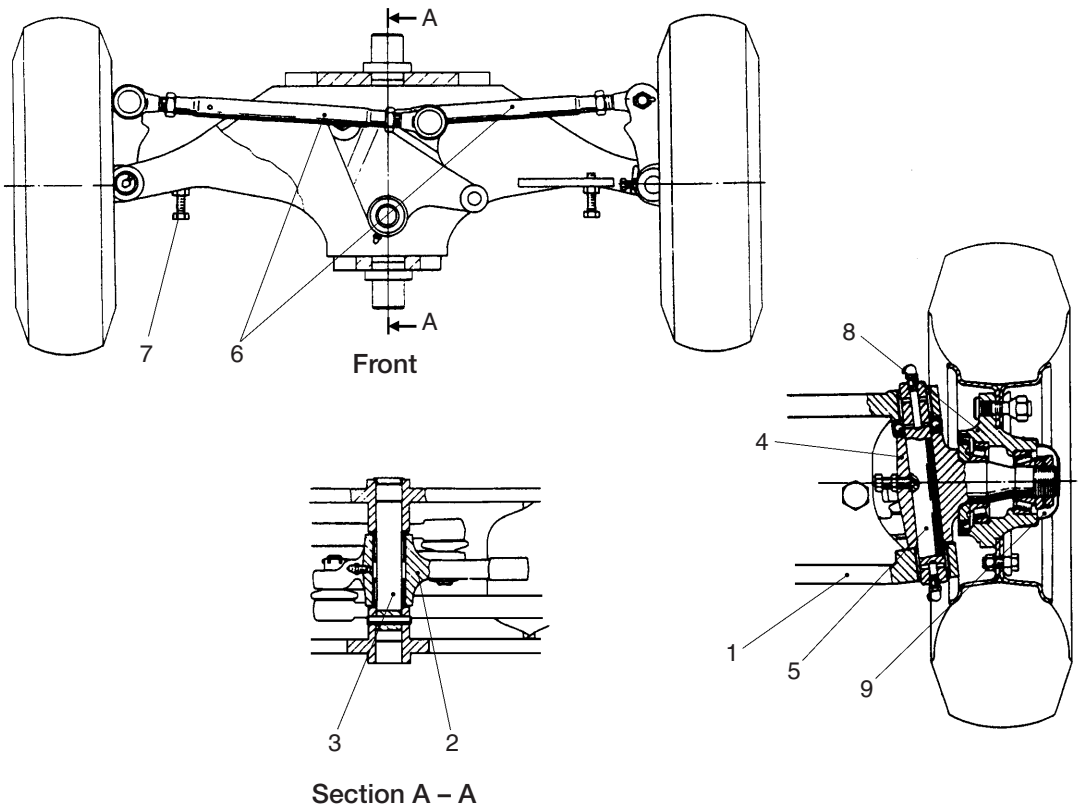
Item \ Truck Model	GP40K thru GP50K DP40K thru DP50K	
	1-speed transmission	2-speed transmission
Tightening torque for wheel nuts	403 N·m (41.1 kgf·m) [297 lbf·ft]	551 N·m (56.2 kgf·m) [406 lbf·ft]

The tightening torques for single tire and dual tire wheel nuts are the same.

(2) When retightening the wheel nuts of dual tires, be careful not to forget tightening the inner wheel nuts.



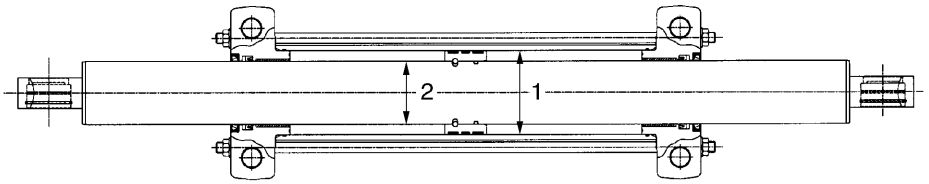
Reassembly



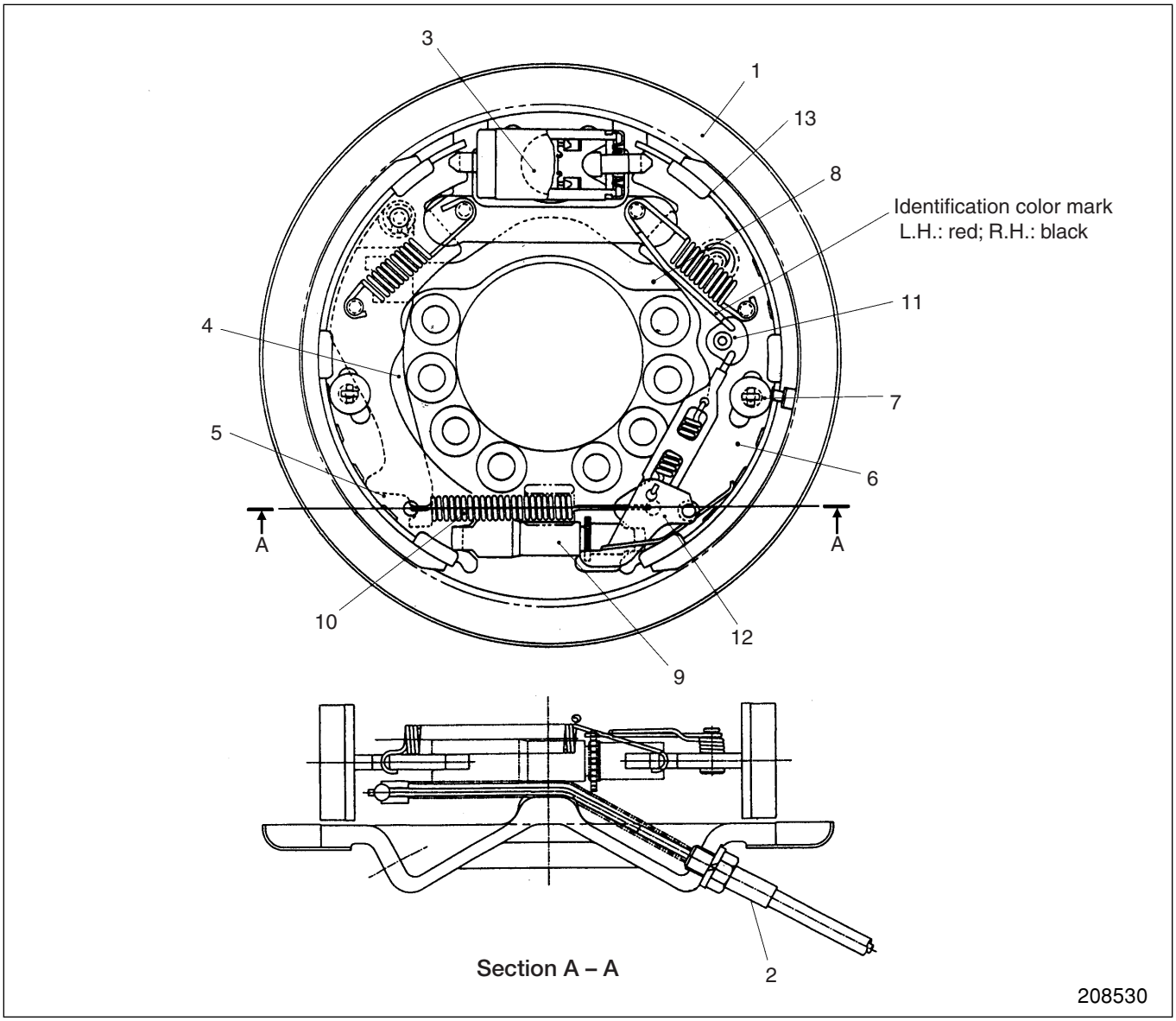
Sequence

1 Rear axle
2 Bellcrank, Needle roller bearing, Washer
3 Bellcrank pin, Spring pin
4 Knuckle, Needle roller bearing, Thrust bearing, Washer
5 Kingpin, Stopper bolt
6 Tie rod assembly, Tie rod ends, Lock nuts
7 Stopper bolt
8 Rear axle hub, Bearing, Retainer, Oil seal
9 Hub cap, Nut, Lock washer

A: Standard value
Unit: mm (in.)

Item			Truck Model: GP40K, GP40KL, GP45K DP40K, DP40KL, DP45K	Truck Model: GP50K DP50K
Steering cylinder	Internal diameter of cylinder tube 1	A	80 (3.15)	
	External diameter of piston rod 2	A	60 (2.36)	
	 208799			

Reassembly (GP45K, GP50K, DP45K, DP50K)



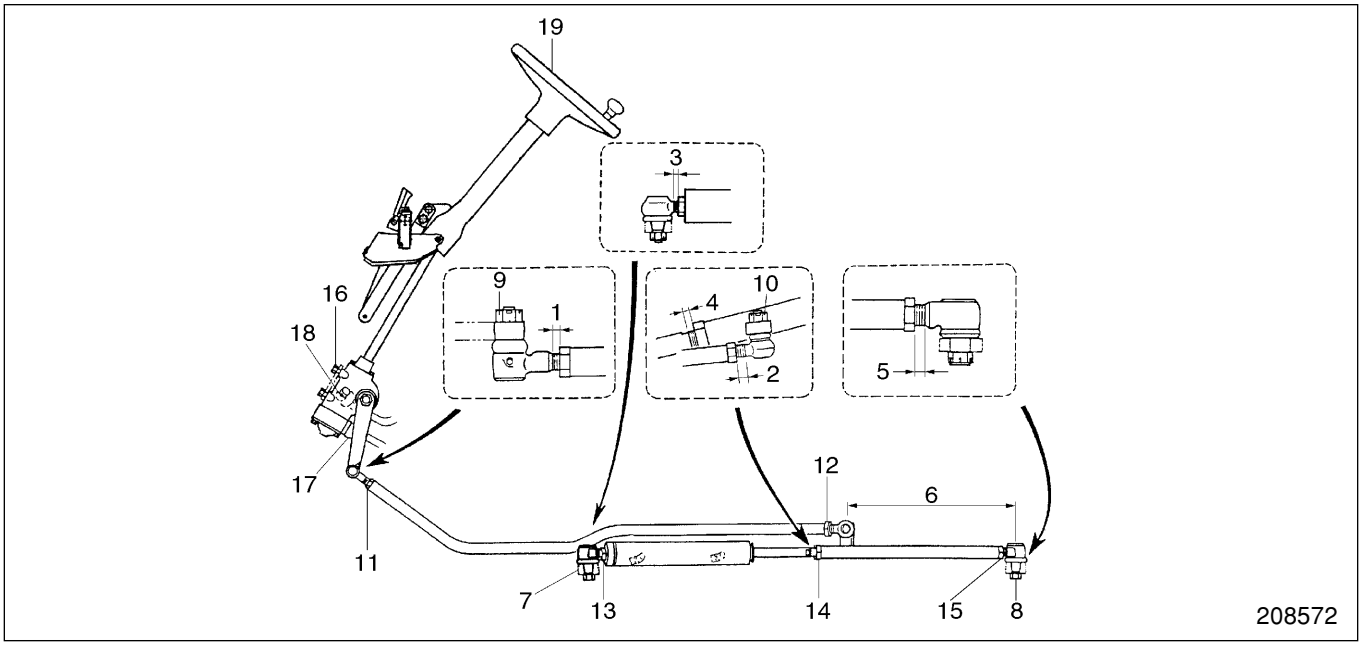
Sequence

1 Backing plate
2 Parking brake cable
3 Wheel cylinder

Preassemble parts 4 and 5 before installation.

4 Parking brake lever, Retainer, Webbed washer
5 Shoe and lining (primary)
6 Shoe and lining (secondary)
7 Hold-down spring, Cup, Pin
8 Strut, Retainer, Webbed washer
9 Adjusting screw
10 Return spring
11 Fitting link assembly, Cotter pin, Plane washer, Spring and link assembly, Lever, Link
12 Adjusting lever, Adjusting spring
13 Return spring

Assembly Dimensions and Tightening Torques



NOTE

Assembly dimensions 1 thru 5, refer to the effective thread length measured from the end face of the nut.

Item		Truck Model	GP40K, GP40KL, GP45K DP40K, DP40KL, DP45K	GP50K DP50K
1	Drag link end (front) assembly dimension	mm (in.)	12 (0.47)	
2	Drag link end (rear) assembly dimension	mm (in.)	14 (0.55)	
3	Power cylinder tie rod end assembly dimension	mm (in.)	9 (0.35)	7 (0.28)
4	End link (front) assembly dimension	mm (in.)	10 (0.39)	
5	End link (rear) assembly dimension	mm (in.)	3 (0.12)	
6	Center to center of ball studs	mm (in.)	470 (18.50)	
7	Tightening torque for power cylinder end nut	N·m (kgf·m) [lbf·ft]	157 (16) [116]	
8	Tightening torque for end link nut	N·m (kgf·m) [lbf·ft]	157 (16) [116]	
9	Tightening torque for drag link end nut	N·m (kgf·m) [lbf·ft]	49 (5) [36]	
10	Tightening torque for drag link end nut	N·m (kgf·m) [lbf·ft]	49 (5) [36]	
11	Tightening torque for drag link lock nut	N·m (kgf·m) [lbf·ft]	49 (5) [36]	
12	Tightening torque for drag link lock nut	N·m (kgf·m) [lbf·ft]	49 (5) [36]	
13	Tightening torque for power cylinder lock nut	N·m (kgf·m) [lbf·ft]	172 (17.5) [127]	441.3 ± 29 (45 ± 3) [326 ± 21.4]
14	Tightening torque for end link lock nut	N·m (kgf·m) [lbf·ft]	137.2 (14) [101]	
15	Tightening torque for end link lock nut	N·m (kgf·m) [lbf·ft]	137.2 (14) [101]	
16	Tightening torque for steering gear bolts	N·m (kgf·m) [lbf·ft]	59 (6) [43]	
17	Tightening torque for hydraulic oil hose clamp nut	N·m (kgf·m) [lbf·ft]	49 (5) [36]	
18	Tightening torque for return hose clamp nut	N·m (kgf·m) [lbf·ft]	39 to 49 (4 to 5) [29 to 36]	
19	Tightening torque for steering wheel mounting nut	N·m (kgf·m) [lbf·ft]	58.5 (6) [43]	

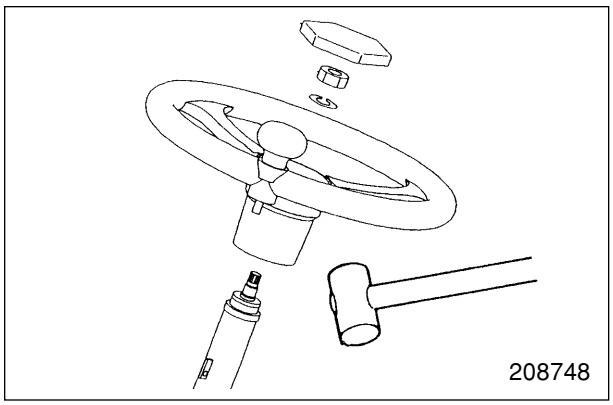
Start by:

Disconnect the electric wire cords from the console box and horn.

Suggestion for Removal

Steering wheel removal

Remove the steering wheel with soft head mallet.



NOTE

Do not hit the end of steering shaft when the steering wheel is removed.

Installation

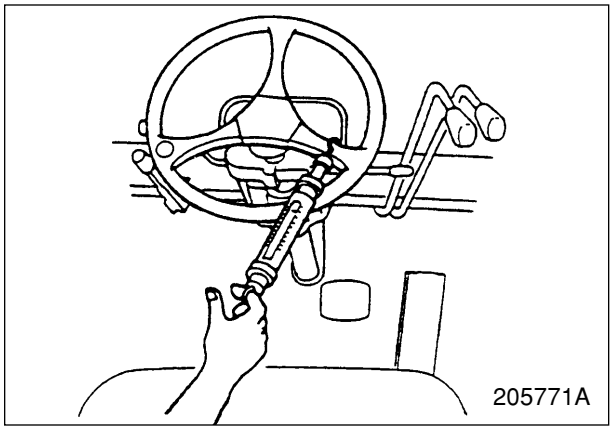
Follow the removal steps in reverse.

Inspection after Installation

Steering wheel play

Check the steering wheel play while idling the engine.

Steering



(1) Pull the hand brake lever. Run the engine and warm the hydraulic oil to an operation temperature of 40 to 60 °C (104 to 140 °F).

(2) Attach a spring scale to the rim (or a spoke) of the steering wheel, and measure the steering torque required to turn the steering wheel clockwise or counterclockwise.

Steering	1.96 N·m (0.2 kgf·m) [1.44 lbf·ft]
Tangential force	12.7 N (1.3 kgf) [2.87 lbf]

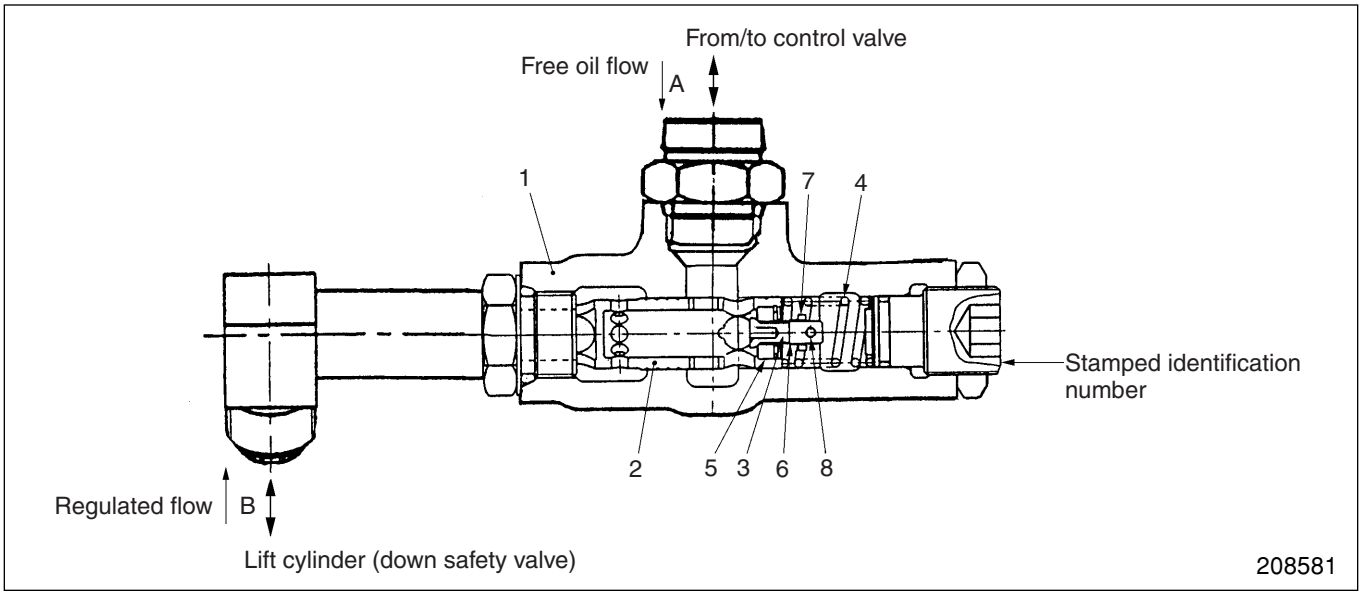
Air bleeding

Air in the hydraulic system such as the steering cylinder, the flow divider valve and the piping may cause shimmy and abnormal noise.

(1) Jack up the tires. For procedures, refer to the ”GROUP 9 REAR AXLE.”

(2) Depress an release the accelerator pedal repeatedly to change the engine revolution speed, while turning the steering wheel to lock-to-lock positions.

Flow Regulator Valve



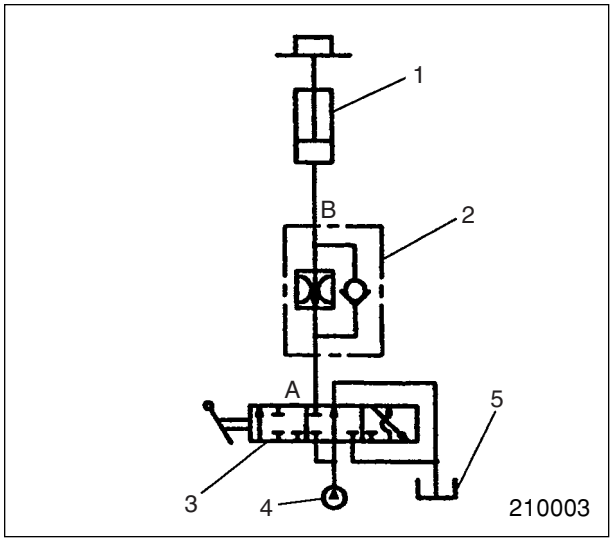
1 Valve body
2 Piston
3 Valve
4 Spring
5 Plate
6 Spring
7 Washer
8 Spring pin

The flow regulator valve is connected between the control valve and the lift cylinder. When the fork is lowered, the valve regulates and makes uniform the flow of oil that would otherwise vary with the load on the lift cylinder, so that the fork lowering speed is made constant irrespective of the load weight.

Truck Model	Identification No.
GP40K, GP40KL, GP45K, DP40K, DP40KL, DP45K	1
GP50K, DP50K	2

Hydraulic circuit diagram

1 Lift cylinder
2 Flow regulator valve
3 Lift valve
4 Pump
5 Hydraulic tank
A Free flow port
B Regulated flow port

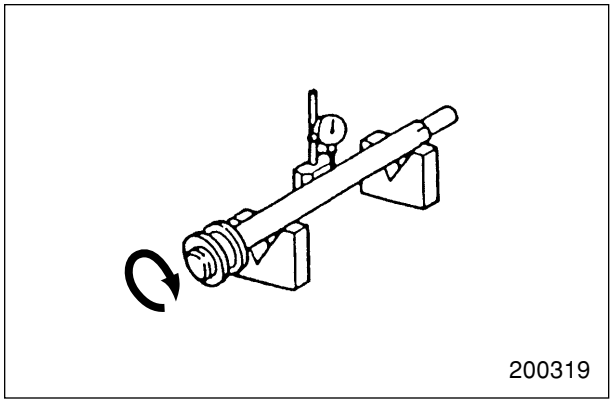


Inspection after Disassembly

1. Cylinder tube

(1) Check the bore wall for wear, grooving, scratch marks and rusting.

(2) Check the welds for cracks.



2. Piston rod

(1) Check for deflection in as shown.

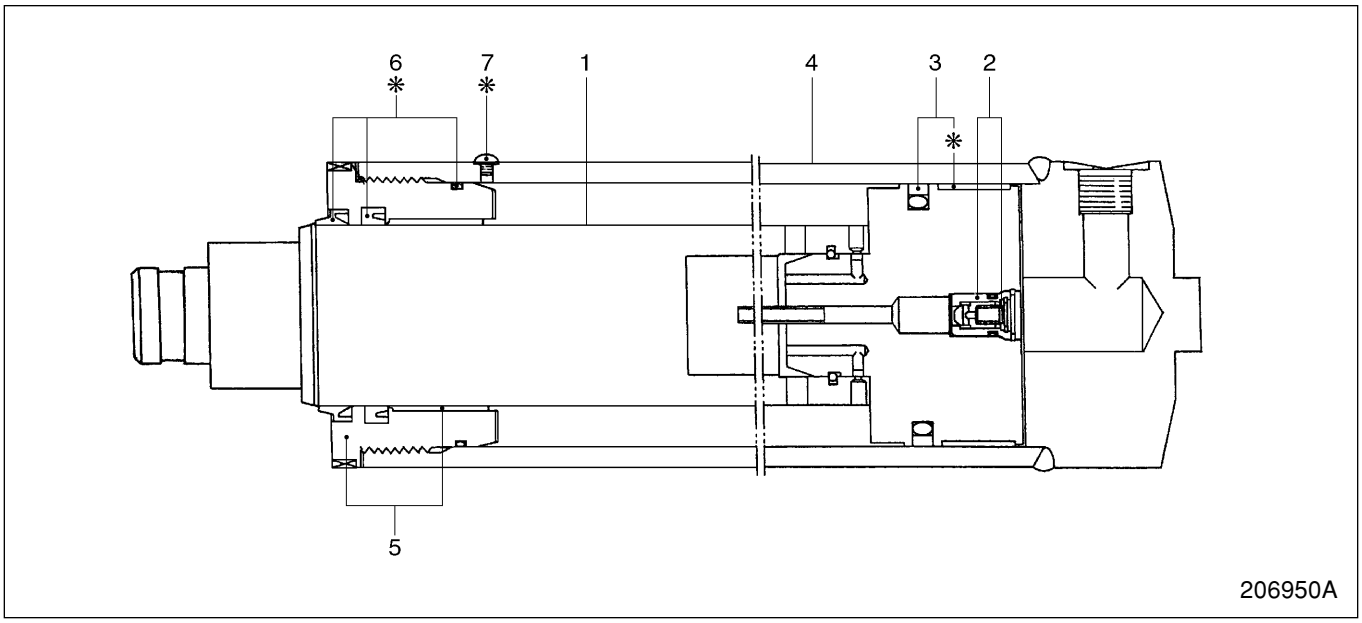
(2) Check for surface flaws such as grooving, scratch marks, rusting and wear. The rod must be replaced if its threads show a sign of stripping or any other damage.

3. Packings and rings

Replace all parts contained in the seal kit, once disturbed.

Reassembly

First Lift Cylinder (4F40A thru 4F50A, 4M40A thru 4M50A)



Sequence

1 Piston rod
2 Check valve, Snap ring
3 Slid ring, Seal ring
4 Cylinder tube
5 Cylinder head, Bushing

Install parts 6 to part 5.

6 U-ring, Wiper ring, O-ring
7 Plug, Gasket

NOTE

Marked ✻ are the parts included in the seal kit.

Testing

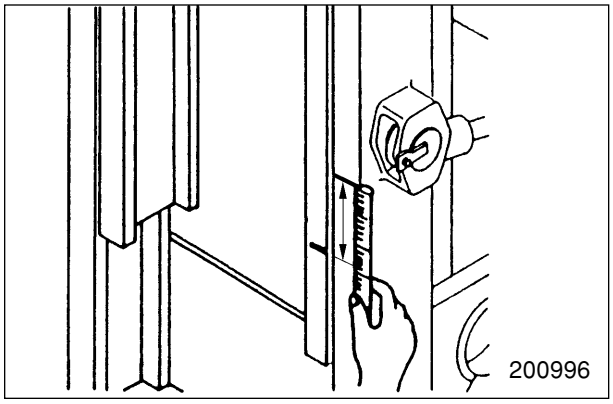
1. Descent test

(1) Pick up a load equal to the rated capacity, place the mast to a vertical position, lift the fork 1 to 1.5 m (3.3 to 4.9 ft), and stop the engine.

(2) Mark a reference line on the mast, and measure the descent (retraction of the piston rods) for 15 minutes.

Unit: mm (in.)

Descent (retraction of piston rods) with rated load for 15 minutes	50 (2), maximum



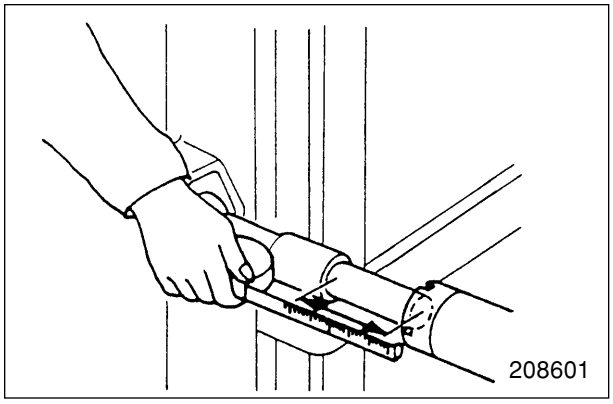
2. Forward tilt test

(1) Pick up a load equal to the rated capacity, place the mast to a vertical position, lift the fork about 50 cm (20 in.), and stop the engine.

(2) Measure the extension of tilt cylinder piston rods for 15 minutes.

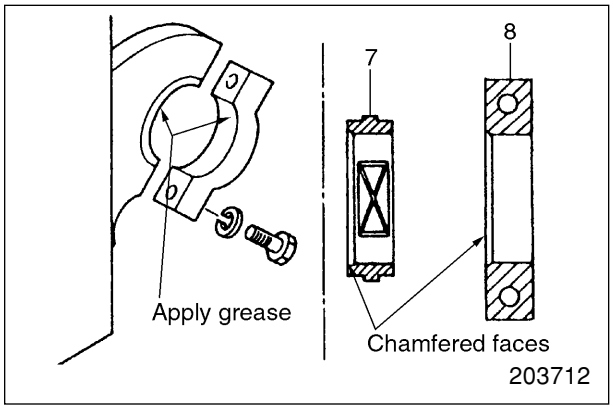
Unit: mm (in.)

Amount of forward tilt (extension of piston rods) with rated load for 15 minutes	30 (1.2), maximum



Installation

To install, follow the removal sequence in reverse, and service as follows.

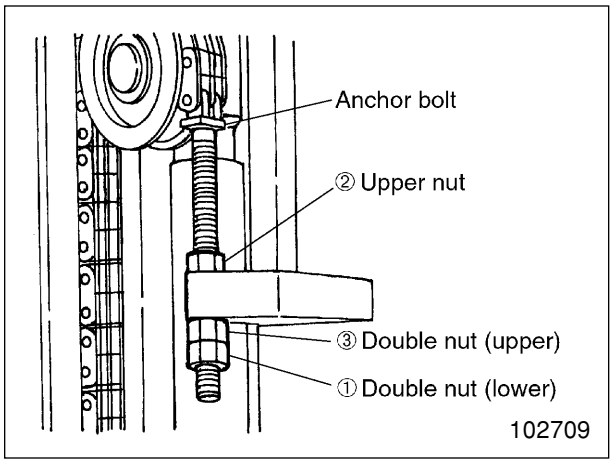


1. Procedure for mounting mast support bushings 7 and caps 8
   (1) Apply grease to the inner surfaces of caps and mast support bushings.
   (2) Install mast support bushings 7 and caps 8, making sure that the sides with larger chamfered area face toward the center of the vehicle.
   (3) Be sure to tighten the support tightening bolts securely.

Unit: N·m (kgf·m) [lbf·ft]

Item \ Truck Models	4 ton thru 5 ton models
Bolt tightening torque	290 (29.6) [214]

2. Adjust the chain tensions. (Refer to the "Inspection and Adjustment" section.) Tighten the nuts to the specified torque.



Tightening torque

Unit: N·m (kgf·m) [lbf·ft]

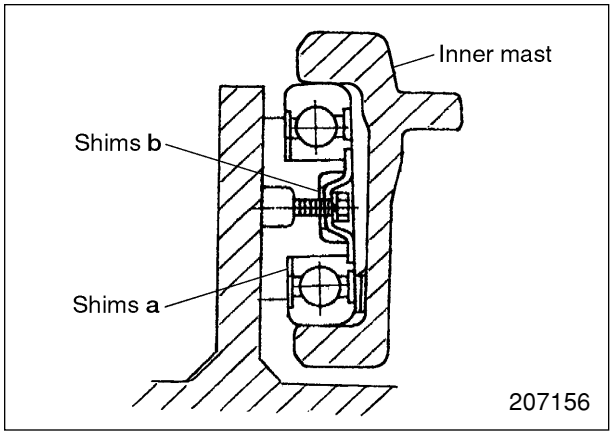
Item \ Truck Models	4 ton models	4.5, 5 ton models
Upper nut ②	210 (21.4) [155]	290 (29.6) [214]
Double nut (lower) ①		

3. Air bleeding of lift cylinders

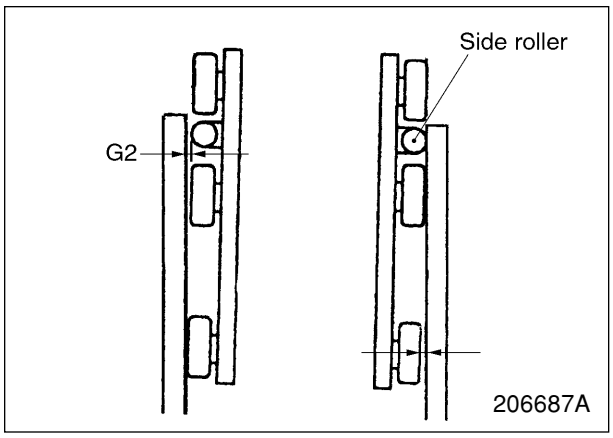
   Start the engine. Raise and lower the lift bracket with full stroke several times to bleed the cylinder.

4. After proper operation is confirmed, check the oil level.

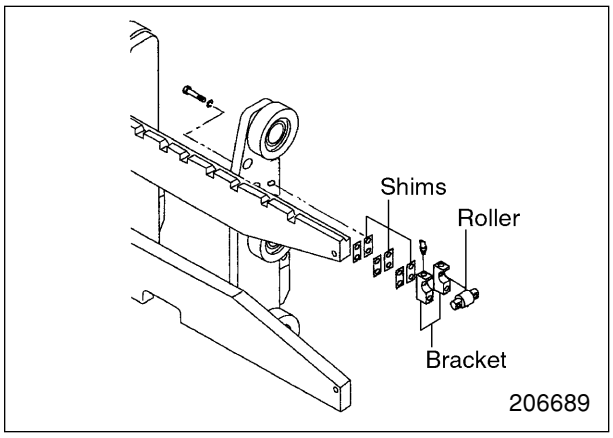
For the lift bracket center main roller, to extend 0.5 mm (0.02 in.) , insert a 0.5 mm (0.02 in.) shim a on the inside and remove the 0.5 mm (0.02 in.) shim b from the lower stopper, then tighten the bolts.



(7) Lower the lift bracket slightly from the top, then adjust clearance G2 between the side roller and mast by increasing or decreasing the thickness of the shims.



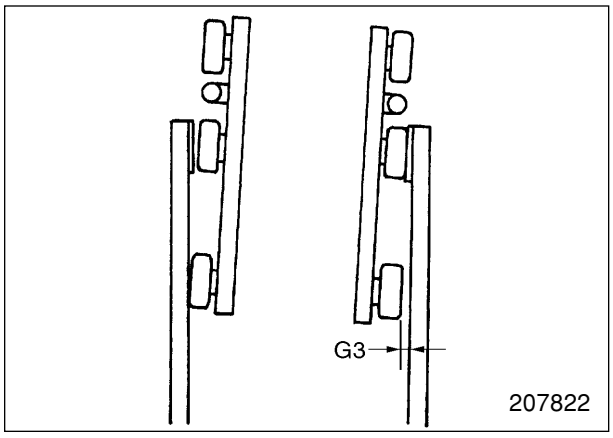
Adjust the side roller clearance by adding shims between the roller bracket and lift bracket.



(8) With the lift bracket at the top, adjust clearance G3 with shims.

NOTE

The lower main rollers are the same to the center main rollers in construction.



Abbreviation····· X: Check, C: Clean, D: Drain, L: Lubricate, R: Replace

Inspection point		Pre-start (daily/10 hours)	Every 50 Service hours or weekly, whichever comes first	Every 50 Service hours or weekly, whiever comes first	Every 500 Service hours or 2.5 months, whichever comes	Every 600 Service hours or 3 months, whichever comes first	Every 1200 Service hours or 6 months, whichever comes first	Every 2400 Service hours or 12 months, whichever comes	Others (see Note 1)	
Transmission & Drive	T/M oil	X								
	Last chance filter (T/M control valve)						C			
	T/M strainer						C			
	Adjust inching pedal for powershift T/M (mm)							X		
	Clutch master cylinder hoses & rubber parts							R		
	Clutch release cylinder hoses & rubber parts							R		
	Differential oil (liter)						R			
	Change T/M oil (liter)						R			
Wheel	Tire & rims									
	Wheel & nuts									
	Knuckles									
General	Oil, fuel & coolant leak	X								
	Damage	X								
	Functional test			X		X				

Note 1: *: Change in 1-2 years

**: Change in 2 years

***: Change in 2-4 years

Note 2: In corrosive or abrasive environments, clean, lubricate and change more frequently.

Note 3: When fuel with poor quality is used, check, drain, clean and change more frequently.

Note 4: Not required if battery is full maintenance free battery.

Note 5: Apply soap suds to the piping joints to check for any gas leakage after replacing the LPG tank.

Note 6: Replace oil every 200 hours or 1 month, whichever comes first.

Note 7: Check spark plug gap every 200 hours or 1 month, whichever comes first.

Replace spark plug every 3600 hours or 18 months, whichever comes first.

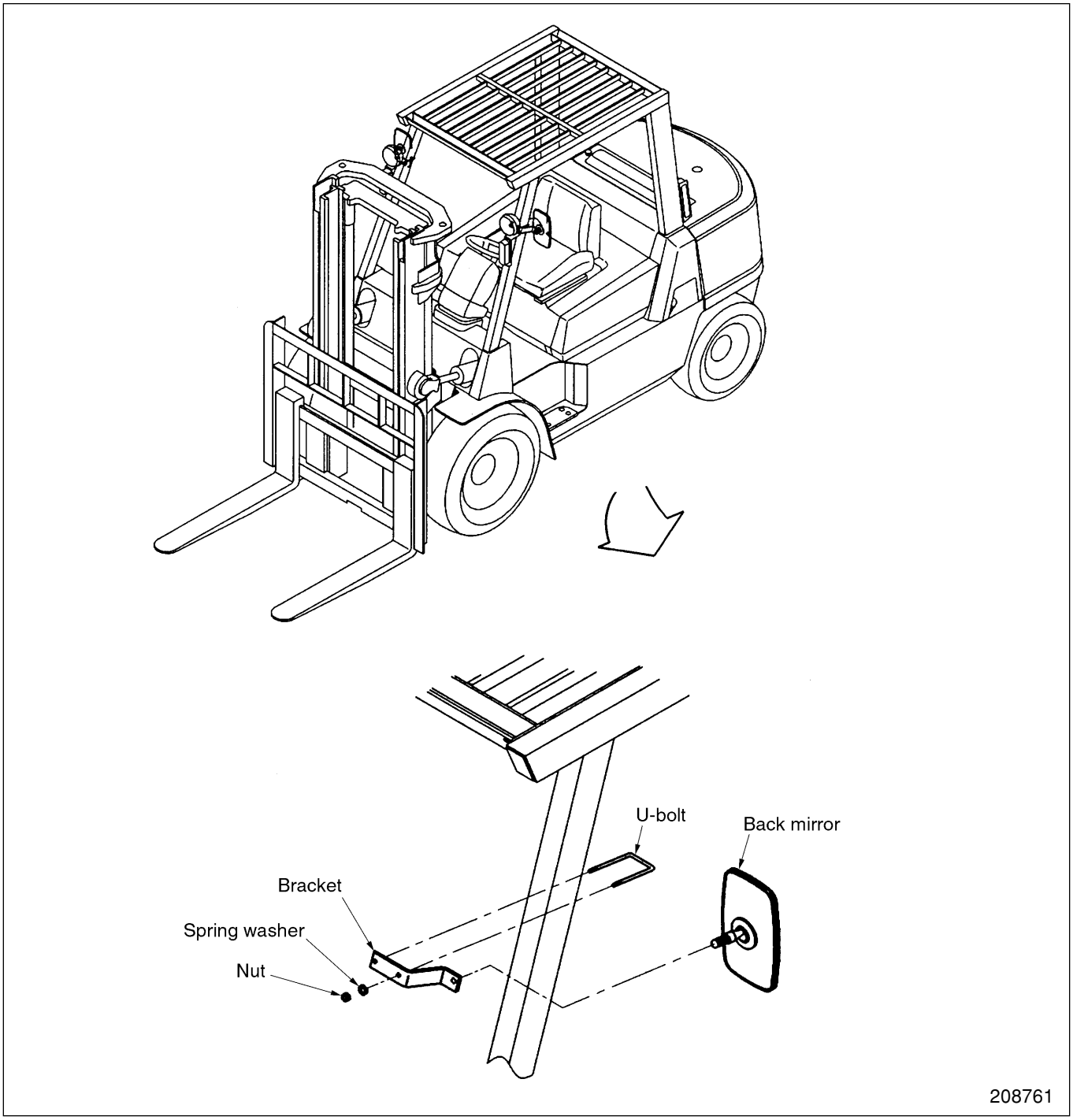
Back Mirror Kit

Description

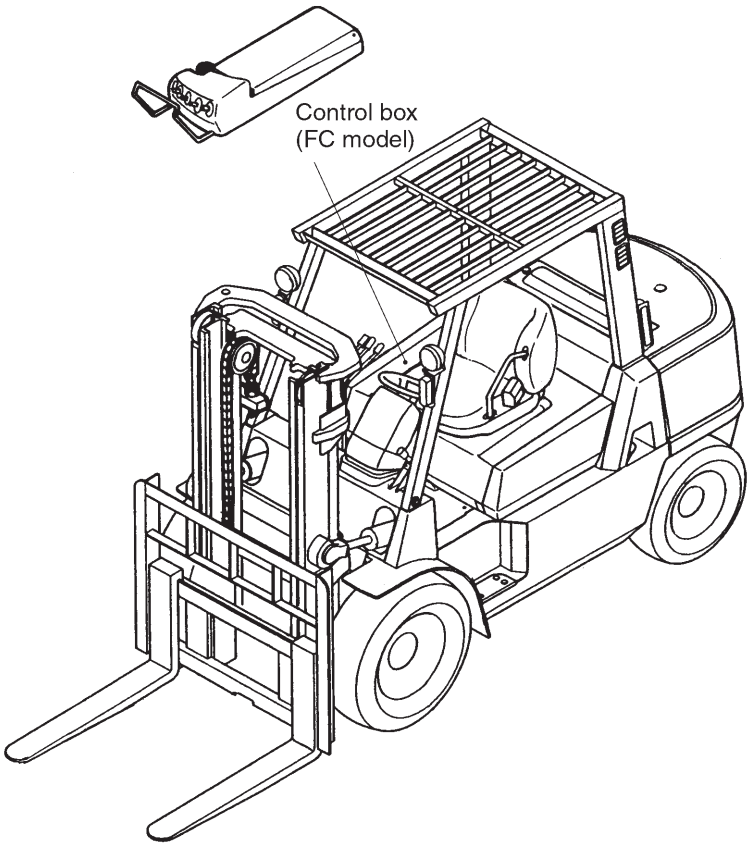
Back mirrors help the operator to stay aware of other vehicles and personnel operating or existing at the rear side of the truck.

Installation

Install parts as shown in the illustration.



Model View



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Truck Models Covered

This Service Manual furnishes servicing and maintenance information for the following trucks:

Truck model	Model code – Serial number	Engine mounted
GP40K	ET29C – 00011- up	TB45 gasoline engine
GP40KL	ET29C – 50001- up	TB45 gasoline engine
GP45K	ET29C – 80001- up	TB45 gasoline engine
GP50K	ET33B – 50001- up	TB45 gasoline engine
DP40K	ET19C – 00011- up	S6S diesel engine
DP40KL	ET19C – 50001- up	S6S diesel engine
DP45K	ET19C – 80001- up	S6S diesel engine
DP50K	ET28B – 50001- up	S6S diesel engine

Coolant

Fill the radiator with coolant containing antifreeze. Start and operate the engine to let it warm up while checking for abnormal noise. Make sure that the quantity of coolant is as specified by checking the level in the reserve tank.

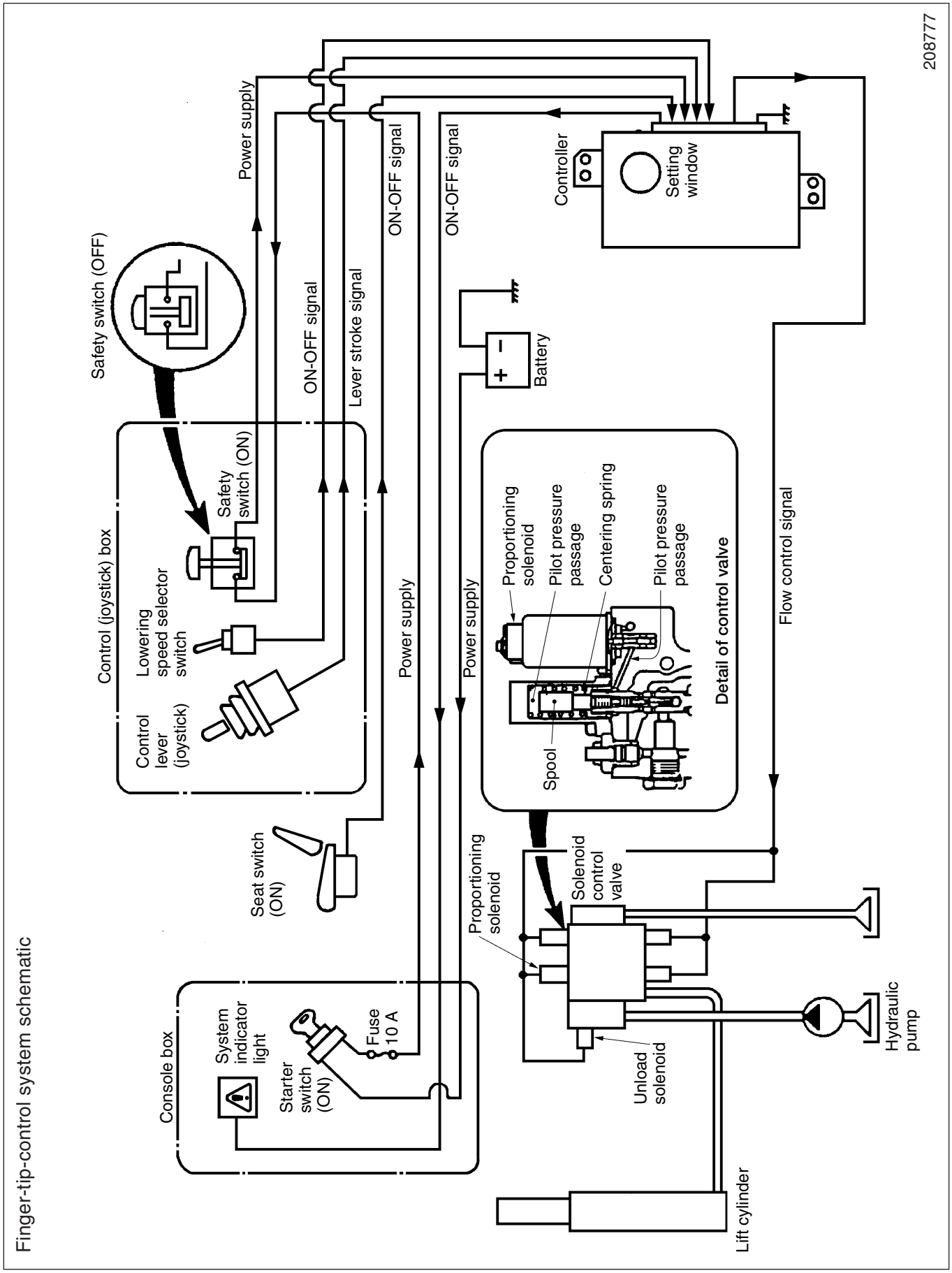
Quantity of coolant

Unit: liter (U.S. gal.)

Item \ Truck Model	GP40K, GP40KL, GP45K, GP50K	DP40K, DP40KL, DP45K, DP50K
Engine	11.2 (2.96)	7.1 (1.9)
Radiator	3.4 (0.9)	4.7 (1.2)
Reserve tank (FULL level)	0.65 (0.17)	0.65 (0.17)
Total quantity of coolant (including coolant in hoses)	15.3 (4.04)	14.7 (3.9)
Oil cooler	0.62 (0.16)	0.31 (0.08)

Radiator Cap

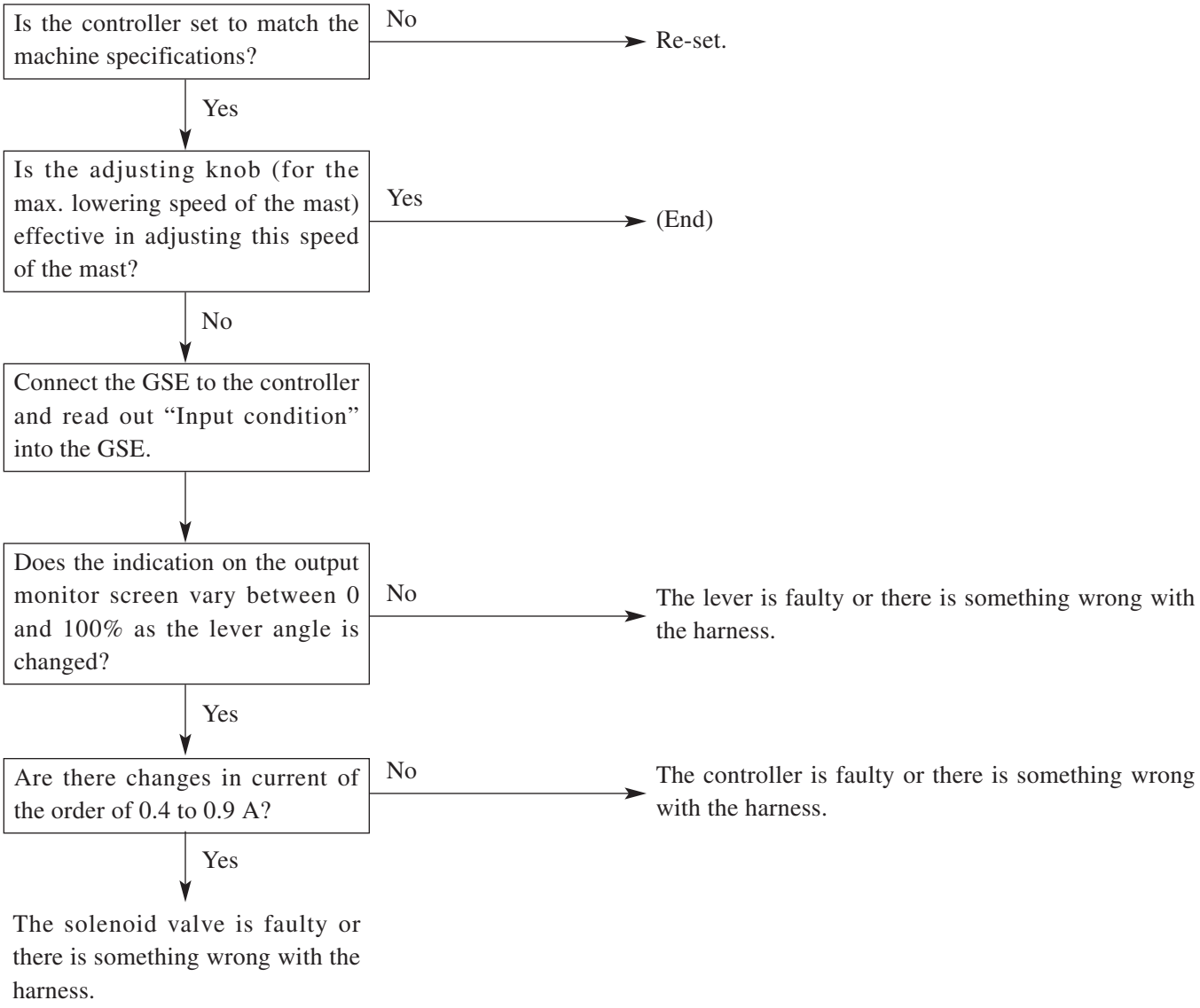
Opening pressure	90 ± 15 kPa (0.92 ± 0.15 kgf/cm^2) [13.1 ± 2.2 psi]
Vacuum valve	0 to 5 kPa (0 to 0.05 kgf/cm^2) [0 to 0.73 psi]



Finger-tip-control system schematic

(c) Case 5: The maximum lowering speed of the mast is too high (or too low).

Troubleshooting procedure



Refill Capacities

Unit: liter (U.S. gal.)

Item \ Truck Model		GP40K DP40K	GP40KL DP40KL	GP45K DP45K	GP50K DP50K
Radiator		14.7 (3.9)			
Torque converter		14 (3.7)			15 (4.0)
Gear oil	Differential	9.1 (2.40)			
Brake fluid reservoir		150 cc (9.2 cu in.)			
Hydraulic tank		64.4 (17.0)			
Fuel tank		115 (30.4)			

7. Clutch gears (forward and reverse)

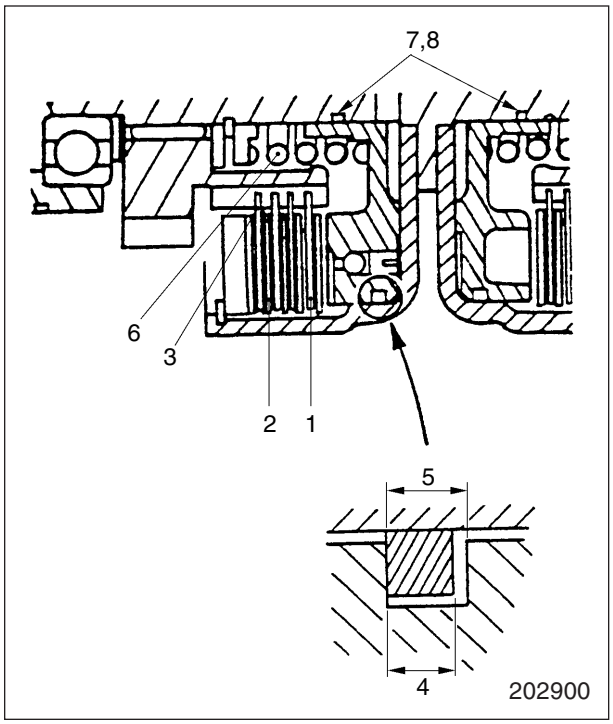
(1) Check the gear and splines for wear or damage.

(2) Check the gear surface in contact with needle roller bearing for wear or damage.

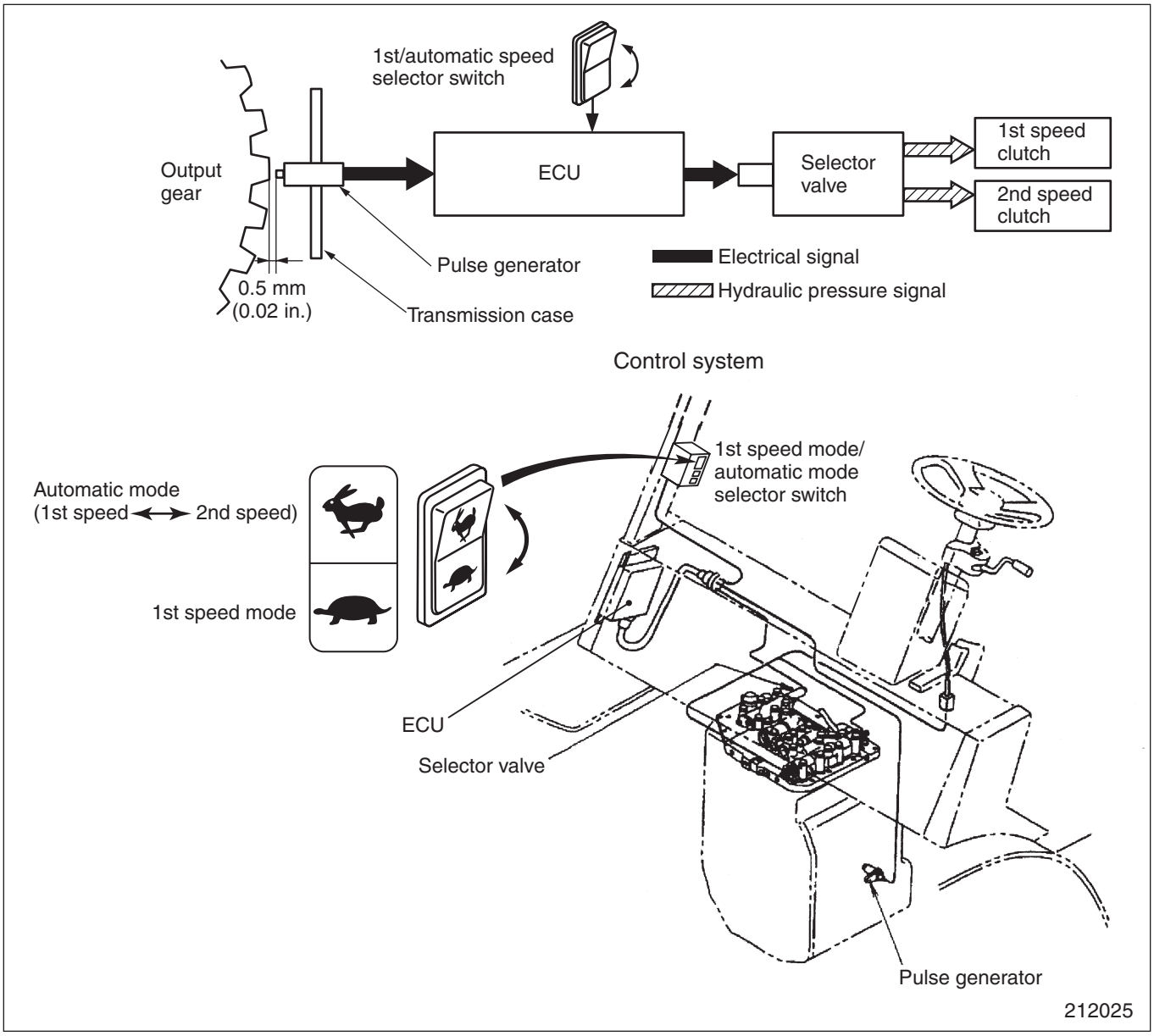
A: Standard value B: Repair or service limit

Unit: mm (in.)

Item \ Truck Model		GP40K thru GP45K DP40K thru DP45K
Thickness of mating plate 1	A	2.3 ± 0.07 (0.091 ± 0.0028)
	B	2.1 (0.083)
Thickness of friction plate 2	A	2.6 ± 0.1 (0.102 ± 0.004)
	B	2.2 (0.087)
Backlash of friction plate with gear 3	A	0.10 to 0.30 (0.0039 to 0.0118)
Width of seal ring 4	A	$4\ ^{-0.01}_{-0.03}$ $(0.16\ ^{-0.0004}_{-0.0012})$
	B	3.5 (0.138)
Width of seal ring groove in piston 5	A	$4\ ^{+0.2}_{+0.1}$ $(0.16\ ^{+0.008}_{+0.004})$
	B	4.5 (0.177)
Free length of clutch spring 6 Spring constant: k = N/mm (kgf/mm) [lbf/in.]	A	63 (2.48) k = 39.1 (3.992) [223.3]
	B	61 (2.40)
Width of clutch piston seal ring 7	A	2.5 ± 0.05 (0.098 ± 0.0020)
	B	2.0 (0.079)
Width of clutch piston seal ring groove 8	A	$2.5\ ^{+0.2}_{+0.1}$ $(0.098\ ^{+0.008}_{+0.004})$
	B	3.1 (0.122)



Control System



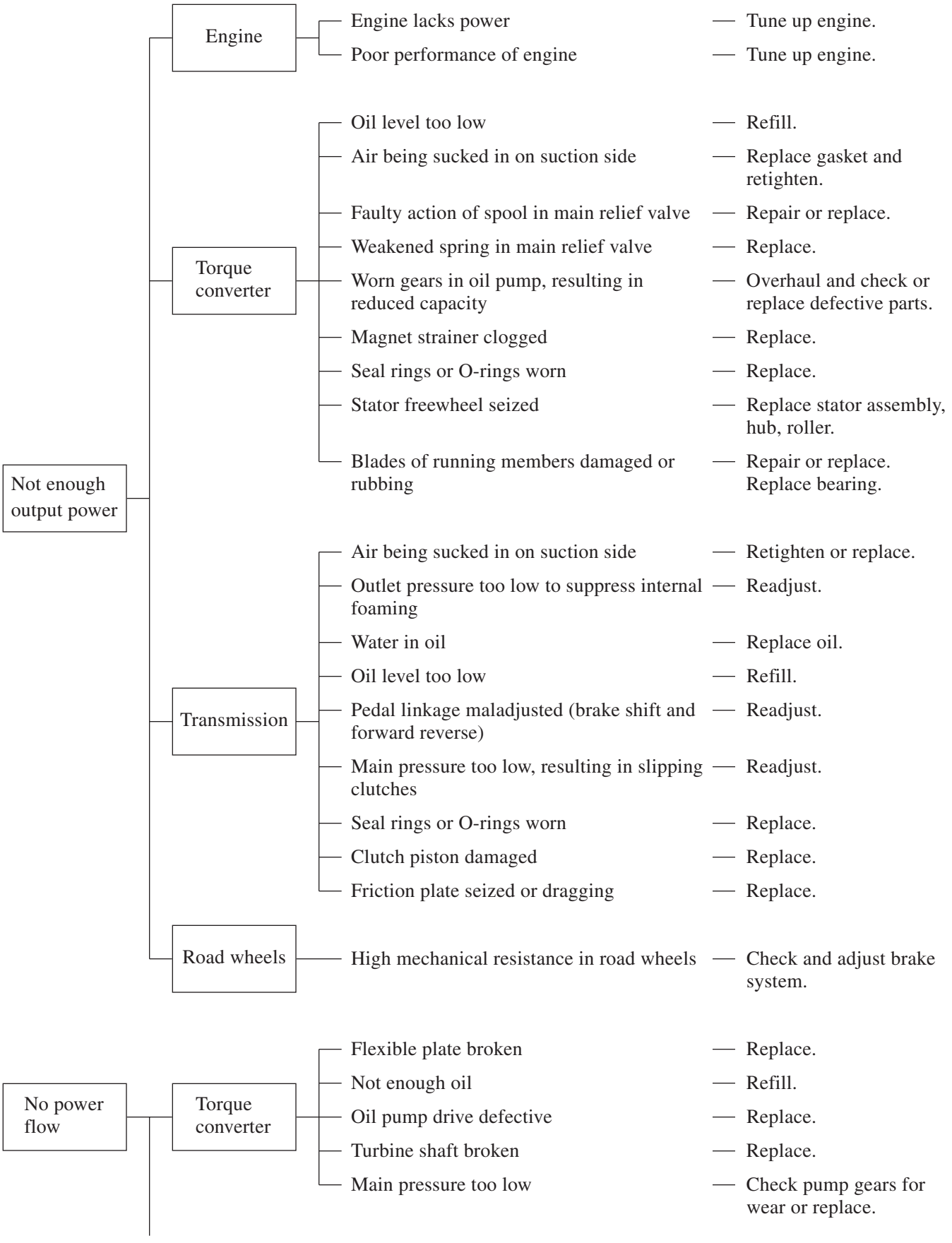
Locations of control devices

enabling 2 speeds for each of the forward and reverse directions with the dedicated control system, which consists of the pulse generator, ECU, and solenoid valves.

With the 1st speed mode/automatic mode selector switch, it is possible to shift the travel speed manually between the “Automatic 2-speed” and “Fixed 1st speed” modes whichever is more suitable for the current operational situation.

Select switch position		Travel speed
Automatic 2-speeds	1st speed	0 to 8 km/h (0 to 5.0 mph)
	2nd speed	9 to 24.5 km/h (5.6 to 15.2 mph)
1st speed		0 to 14 km/h (0 to 8.7 mph)

Troubleshooting

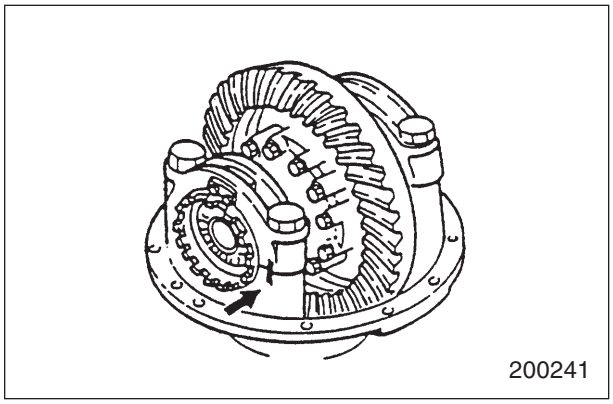


Suggestion for Disassembly

NOTE

(1) Prior to disassembly, measure the gear backlash to ensure correct reassembly.

(2) Make a mark across the bearing cap, adjusting screw and carrier on one side to ensure correct reassembly.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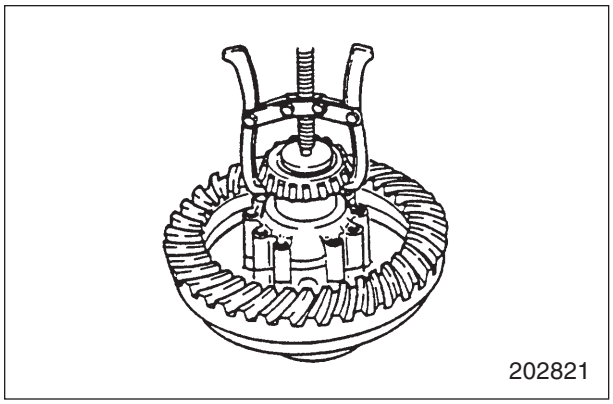
Unit: mm (in.)

Item \ Truck Model	GP40K thru GP45K DP40K thru DP45K	GP50K DP50K
Backlash of reduction bevel gear with pinion	0.25 to 0.33 (0.0098 to 0.0130)	0.30 to 0.41 (0.0118 to 0.0161)

Removing bearings

Use a bearing puller to remove the inner race of bearing.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Inspection and Repair

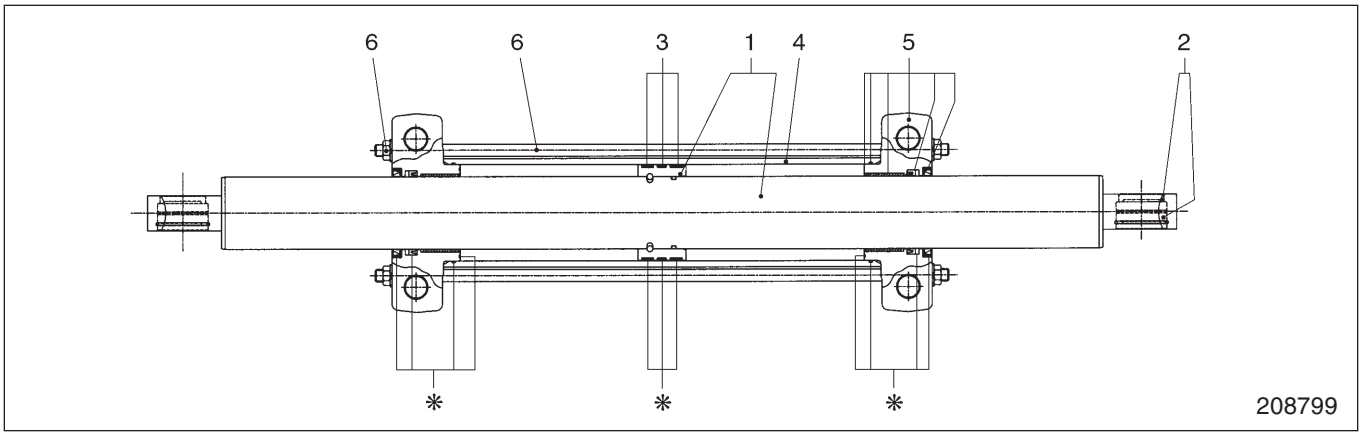
1. Reduction bevel gears

Check the reduction bevel gear and pinion for tooth contact. Check the gear teeth for wear, pitting, flaking or chipping. Minor flaws on the tooth surfaces can be repaired by grinding with an oil stone or sandpaper. If the gear is badly damaged to require replacement, replace the gear and pinion as a set.

2. Differential

(1) Check the differential cases for damage. Check, in particular, the seat formed of each case for carrying the side bearing inner race to see whether the seat surface is galled or not.

Reassembly



Sequence

1 Piston rod, Piston
2 Bearing, Stopper ring
3 Wear rings (2 pieces), Piston seal
4 Cylinder tube
5 Cylinder head, Bushing, O-ring, Oil seal, Backup ring, Dust seal
6 Bolt, Spring washer, Nut

NOTE

Parts marked with * are included in the seal kit.

Suggestions for assembly

(1) Replace the seal kit parts shown in the above figure when assembling.

(2) Clean the parts completely before assembly, and make sure that no dust is on them.

(3) Apply oil to the piston seal, O-ring, gasket, dust seal and inside the cylinder before assembly.

(4) Procedure for installing piston seal

(a) Grip the piston seal lightly by hand five or six times to soften the seal before installation.

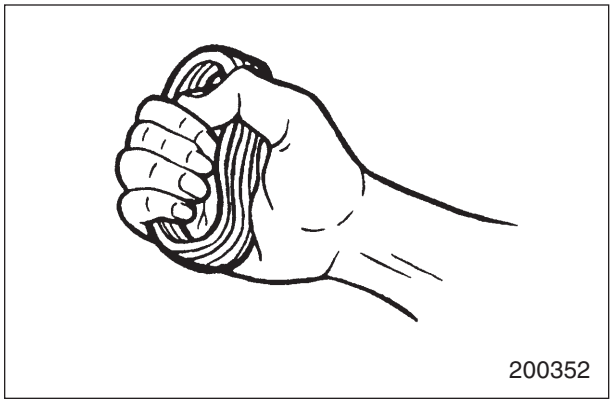
(b) Grip the piston rod in a vice using rag or soft plates so that the vice does not damage the rod. Apply a little oil to the piston seal. Insert one side of the seal into the fitting groove of the piston, and insert the other side.

(c) After installing the piston seal, insert the wear ring.

(5) Make sure that seal and rings on the cylinder head are installed in correct directions.

(6) Tighten nut 6 to the specified torque.

Nut tightening torque	70 ± 7 N·m (7.14 ± 0.71 kgf·m) [51.6 ± 5.2 lbf·ft]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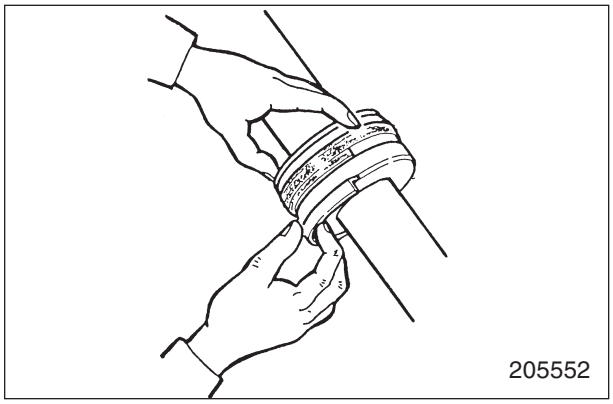
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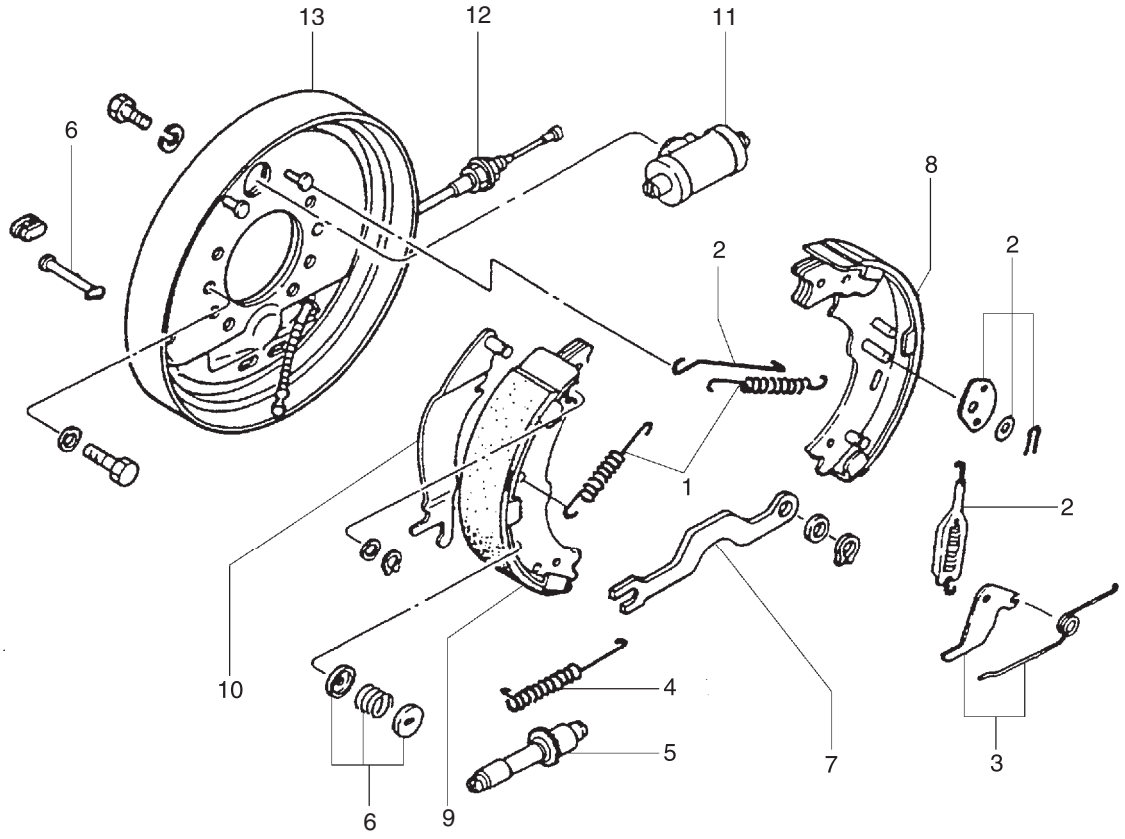
GP45K, GP50K
DP45K, DP50K



Sequence

1 Return springs
2 Fitting link assembly, Cotter pin, Plain washer, Spring and link assembly, Lever, Link
3 Adjusting lever, Adjusting spring
4 Return spring
5 Adjusting screw
6 Hold-down spring, Cup, Pin
7 Strut, Retainer, Web washer
8 Shoe and lining (secondary)
9 Shoe and lining (primary)
10 Parking brake lever, Retainer, Web washer
11 Wheel cylinder
12 Parking brake cable
13 Backing plate

Start by:

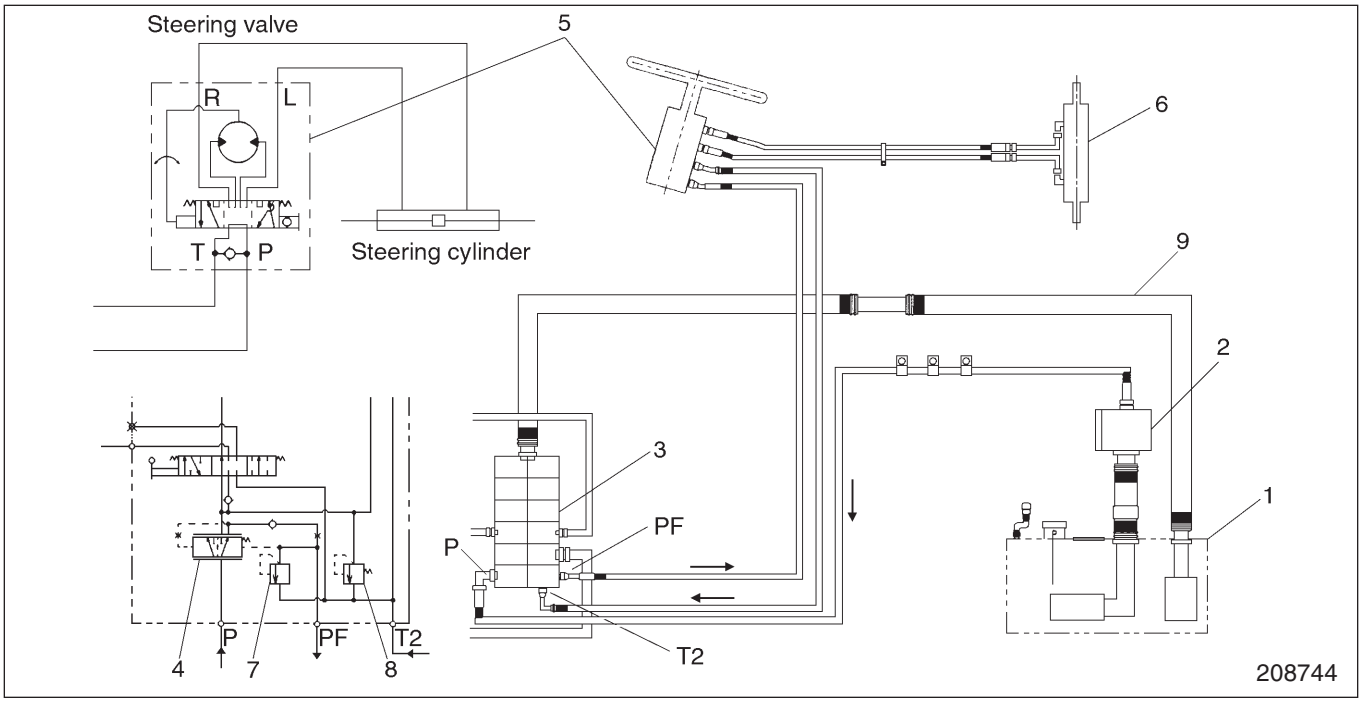
(1) Remove the front wheel.

(2) Remove the wheel hub and drum.

(3) Disconnect the parking brake lever and cable at the lower side of the brake.

(4) Disconnect the brake pipe from the brake assembly.

Steering Hydraulic System



1 Hydraulic tank
2 Hydraulic pump
3 Hydraulic control valve
4 Flow priority valve
5 Steering valve
6 Steering cylinder
7 Steering system relief valve
8 Main relief valve
9 Return line

The oil drawn by hydraulic pump 2 from hydraulic tank 1 enters the inlet section of the hydraulic control valve 3 through the P port. There is built-in flow priority valve 4 in the inlet section. The function of the flow priority valve is to deliver pressure oil preferentially to steering valve 5 through the PF port. (For the structure of the priority valve, refer to the "GROUP 10 HYDRAULIC SYSTEM.") From the PF port, the oil flows to the P port of the steering valve.

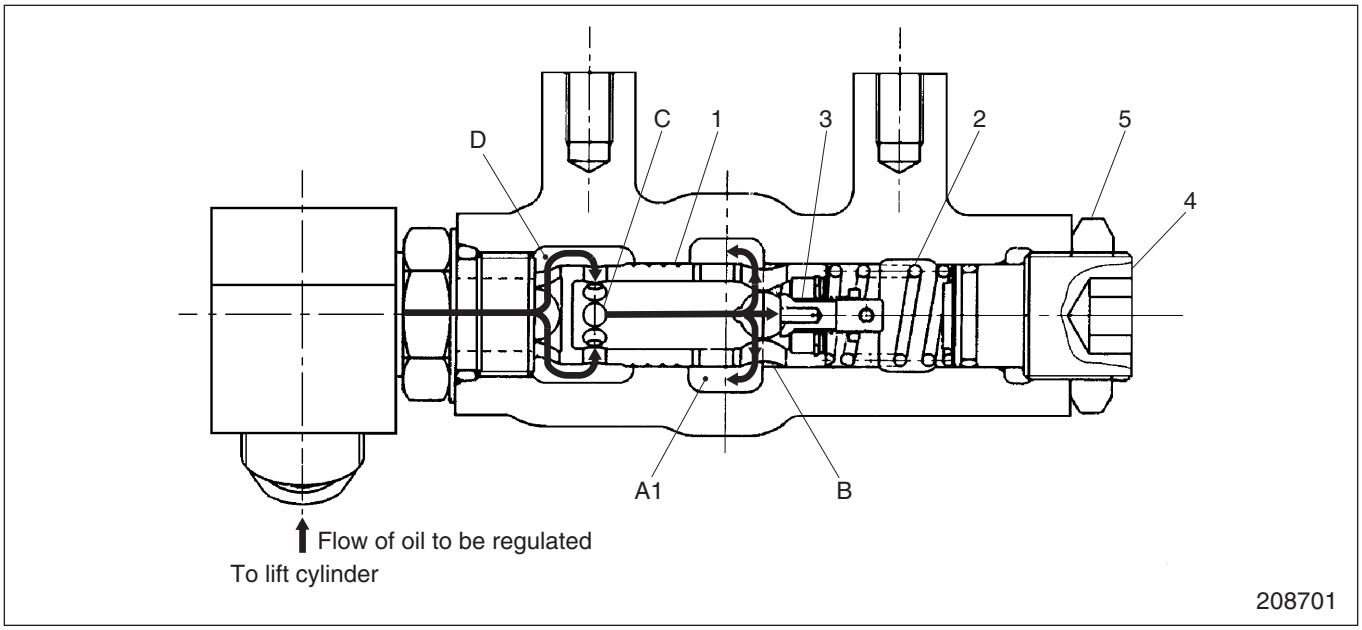
When the steering wheel is not turned (in the straight-ahead position), the oil flows through the steering valve's T port to the T2 port in the hydraulic control valve's inlet section and then returns to hydraulic tank 1 through return line 9.

When the steering wheel is turned right, the oil from the PF port enters the "Gerotor" passing through the P port and spool-and-sleeve valve in the steering valve 5. (The Gerotor is a small trochoid pump capable of delivering oil at a rate proportional to the number of turns in which the steering wheel is turned.) The oil delivered from the Gerotor is directed to the left chamber of steering cylinder through the R port, applying a rightward pressure to the cylinder rod. Simultaneously, the spool-and-sleeve valve in the steering valve 5 opens the return oil passage from the right chamber of the steering cylinder to the hydraulic tank 1. (The return oil goes through the steering valve's T port and then the hydraulic control valve 3 to the hydraulic tank 1.) These two steering valve's actions allow the tire wheels to turn to the right steering direction.

When the steering wheel is turned left, the L port of the steering valve 5 opens, allowing pressure oil to the right chamber of the steering cylinder. The oil flow in each passage is now reverse to that when the steering wheel is turned right, so that the truck makes a left turn.

The hydraulic pressure of the steering system is maintained at a level lower than the maximum pressure by steering system relief valve 7 which opens when the pressure is sensed at the PF port of the inlet cover section exceeds the limit. The relief valve is located below the inlet cover section and its opening pressure is set at 11.8 $^{+0.4}_{0}$ MPa (120 $^{+2}_{0}$ kgf/cm^2) [1714 $^{+70}_{0}$ psi].

Flow Regulator Valve



1 Piston
2 Spring
3 Check valve
4 Plug
5 Lock nut

A1: Cavity communicating with port A1 in lift control valve
B: Opening in piston 1 (4 pieces)
C: Opening in piston 1 (8 pieces)
D: Cavity

The flow regulator valve regulates the lowering rate of the mast lift cylinder.

The arrow in the drawing indicates the direction in which oil flows when the fork is lowering.

When the mast is lowering, the oil in the bottom end of the lift cylinder is pushed out by the weight of the load carried by the mast and, after passing through the flow regulator valve, flows back to port A1 in the lift control valve.

The oil from the lift cylinder enters cavity D and flows into the piston 1 through eight openings C. The oil then flows through four openings B, into cavity A1, and back to port A1 in the lift control valve.

When the flow rate of the return oil becomes excessive, the piston 1 moves to the right against the force of the spring 2. As the result of the piston movement, openings B are narrowed and thus the flow rate of oil passing these openings is reduced. In this way, the maximum flow rate of the return oil and thus the maximum lowering speed of the mast is regulated regardless of the weight of the load on the mast.

In addition to giving the spring chamber a damping effect that regulates the return speed of the spring, the check valve 3 prevents the mast from lowering in a jerky manner. The flow rate of oil can be adjusted by loosening or tightening the plug 4 to change the force of spring 2.

When the mast is rising, the oil goes to the lift cylinder flowing in the direction reverse to that of the lowering phase. As the piston 1 now moves fully to the left, no restriction is given to the flow of oil.

Truck Model	Identification No.
GP40K, GP40KL, GP45K, DP40K, DP40KL , DP45K	1
GP50K, DP50K	2

Suggestions for Reassembly

(1) Clean parts completely before reassembly, and make sure that parts are free of dust and other particles.

(2) Use new seal kit parts and repair kit parts.

(3) Apply oil to the seal kit parts such as U-ring, wiper ring, seal ring and the O-ring and to the slide ring and the bushing before reassembly. Also apply oil to the cylinder bore before reassembly.

(4) When holding the cylinder with a vice, be careful not to deform the cylinder by over-tightening.

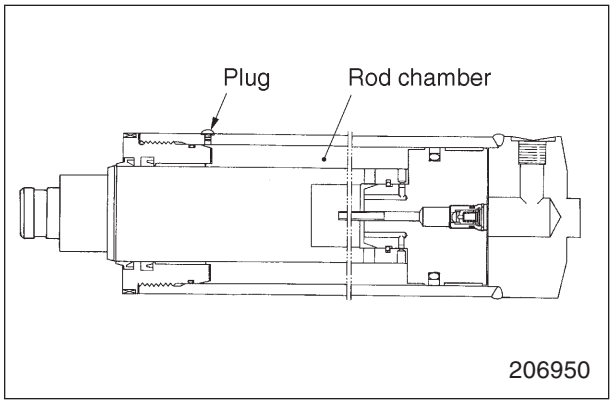
(5) Tighten parts such as the cylinder head, holder, piston, set screw and the valve to the specified torque. (Refer to "Service Data" section.)

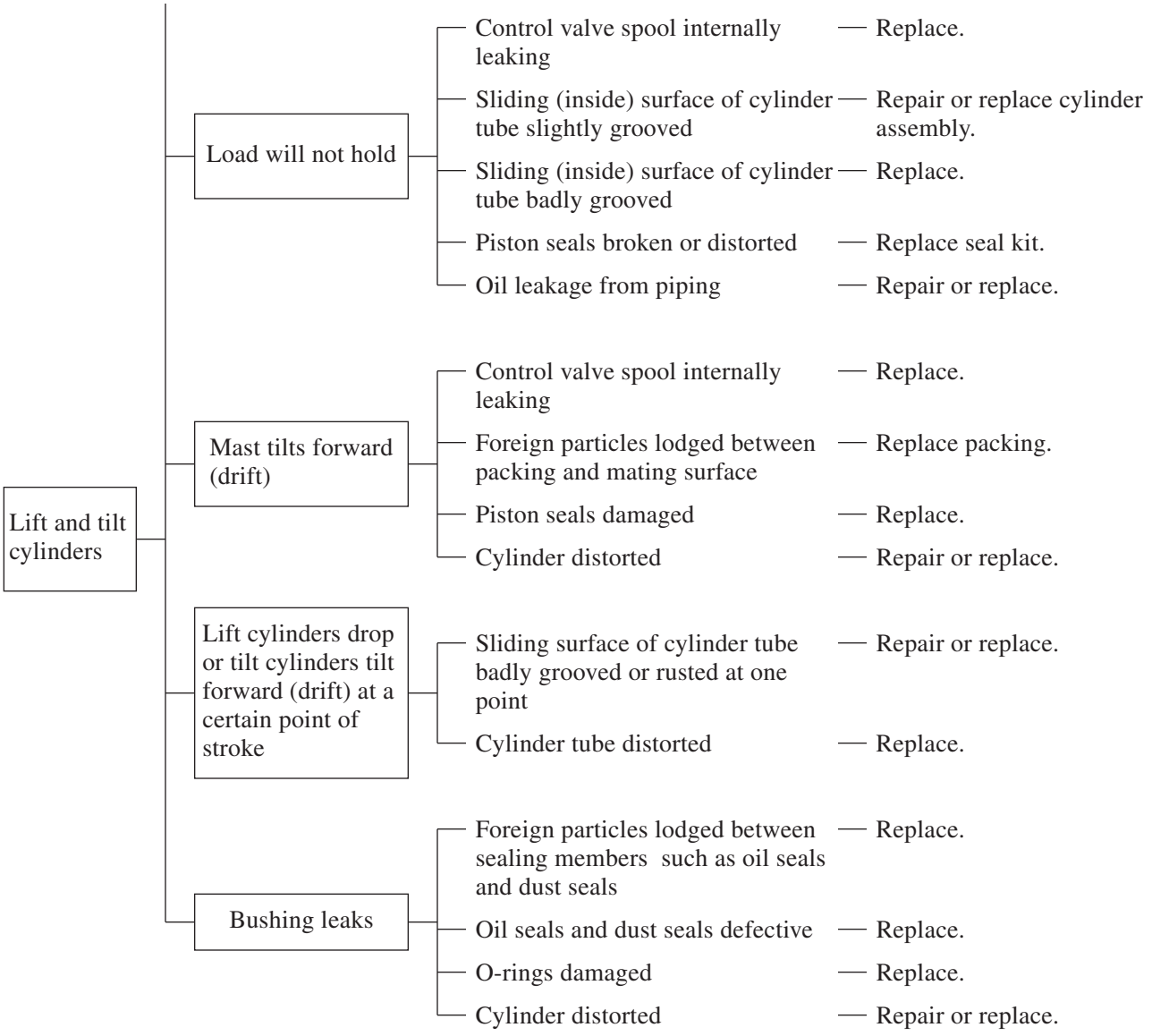
(6) Before tightening the cylinder head and the holder, apply Thread Lock to the threaded sections.

(7) After reassembling the first lift cylinder, fill the rod chamber with hydraulic oil (cushion oil).
Supply hydraulic oil from the plug, and tighten the plug to the specified torque.

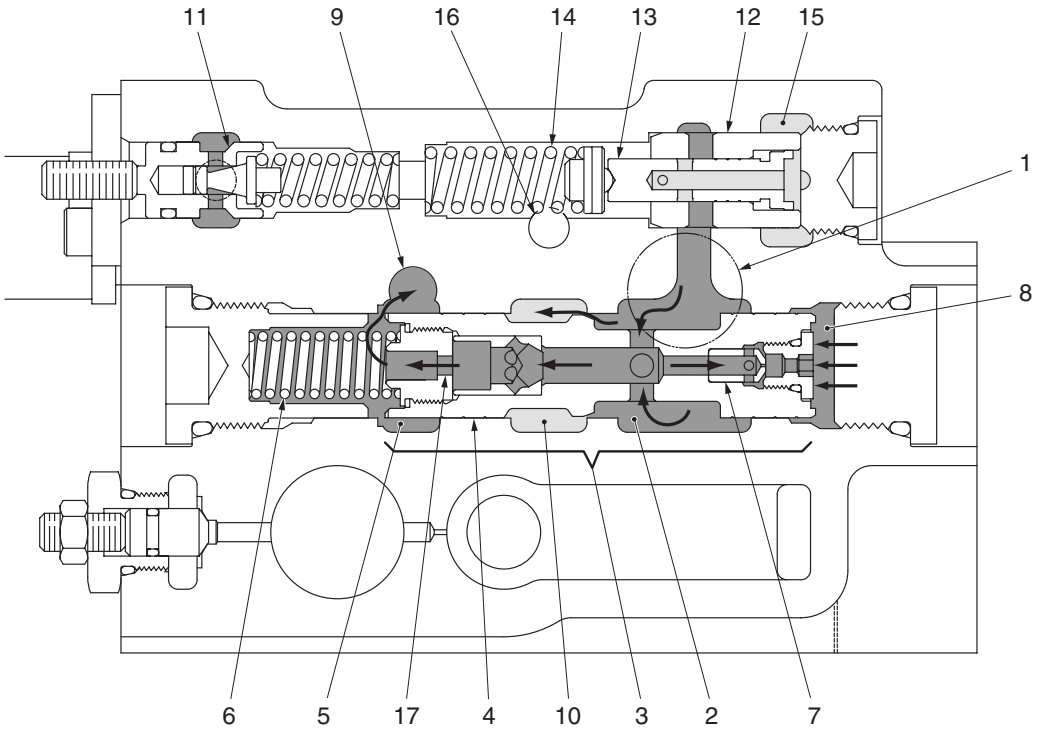
Unit: cc (cu. in.)

Item \ Mast model	4F40A, 4M40A	4F45A, 4F50A, 4M45A, 4M50A
Amount of hydraulic oil	160 to 180 (9.76 to 10.98)	190 to 210 (11.59 to 12.81)




Lift and tilt cylinders
Load will not hold
Control valve spool internally leaking — Replace.
Sliding (inside) surface of cylinder tube slightly grooved — Repair or replace cylinder assembly.
Sliding (inside) surface of cylinder tube badly grooved — Replace.
Piston seals broken or distorted — Replace seal kit.
Oil leakage from piping — Repair or replace.
Mast tilts forward (drift)
Control valve spool internally leaking — Replace.
Foreign particles lodged between packing and mating surface — Replace packing.
Piston seals damaged — Replace.
Cylinder distorted — Repair or replace.
Lift cylinders drop or tilt cylinders tilt forward (drift) at a certain point of stroke
Sliding surface of cylinder tube badly grooved or rusted at one point — Repair or replace.
Cylinder tube distorted — Replace.
Bushing leaks
Foreign particles lodged between sealing members such as oil seals and dust seals — Replace.
Oil seals and dust seals defective — Replace.
O-rings damaged — Replace.
Cylinder distorted — Repair or replace.

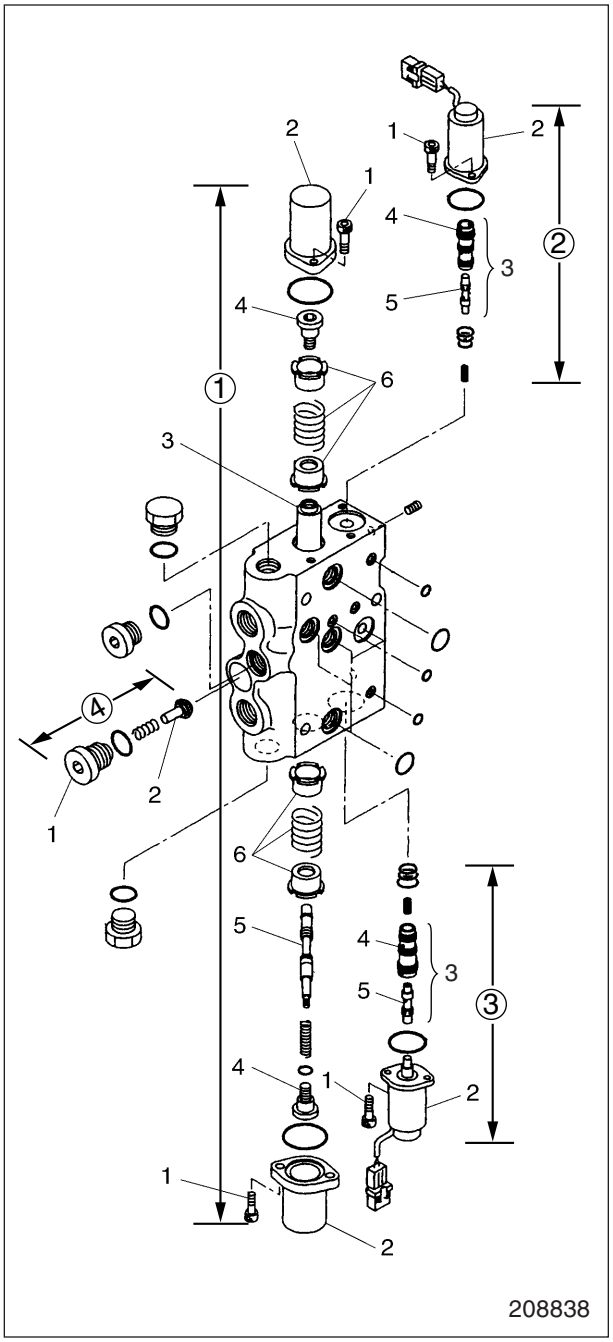
Operation of Valves in Hydraulic System



Flow priority valve and pressure reducing valve

1 P port (inlet of pressure oil from hydraulic pump)
2 Oil passage (from P port 1)
3 Flow priority valve
4 Flow priority valve spool
5 Oil passage (to PF port 9)
6 Spring
7 Valve
8 Chamber
9 PF port (to steering valve)
10 Excess oil passage (to bleed-off valve)
11 Steering system relief valve
12 Pressure reducing valve (for pilot oil to proportional electromagnetic control valve)
13 Shuttle
14 Spring
15 Pilot oil passage (to proportional electromagnetic control valve)
16 Return oil passage (to hydraulic tank)
17 Orifice

Tilt Section



Valves incorporated in tilt section

① Tilt control valve
② Proportional electromagnetic pressure control valve (SB2)
③ Proportional electromagnetic pressure control valve (SA2)
④ Load check valve

Suggestions for Disassembly

Tilt control valve ①

(1) Place the valve on a bench with the valve spool in its horizontal position, then unscrew socket head bolts 1 to remove caps 2 on both ends of the tilt control valve.

(2) Remove cap screws 4 on both ends of spool 3 by unscrewing them using a hexagon wrench engaged in the socket in each of their heads. Be careful not to let drop tilt lock valve 5 inside spool 3.

(3) Remove spring and spring guide sets 6.

(4) Carefully draw spool 3 out of the valve housing, then take tilt lock valve 5 and small spring out of the spool.

Proportional electromagnetic pressure control valves ② , ③

(1) Unscrew and remove socket head bolts 1 to remove solenoid valve 2.

(2) Remove valve set 3. Sleeve 4 and spool 5 of the valve set have been selectively matched with each other; the combination must not be altered.

Load check valve ④

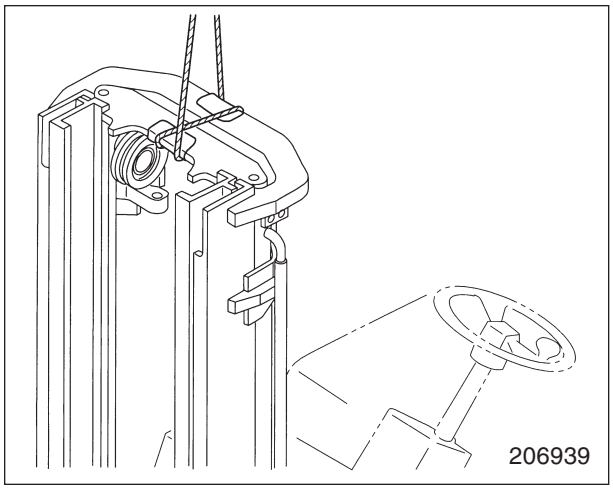
Unscrew and remove socket head plug 1, then remove valve 2 and the spring.

2. Separating mast and tilt cylinders 4

(1) Hitch a sling to the upper cross-member of the outer and inner masts, then lift with a hoist.

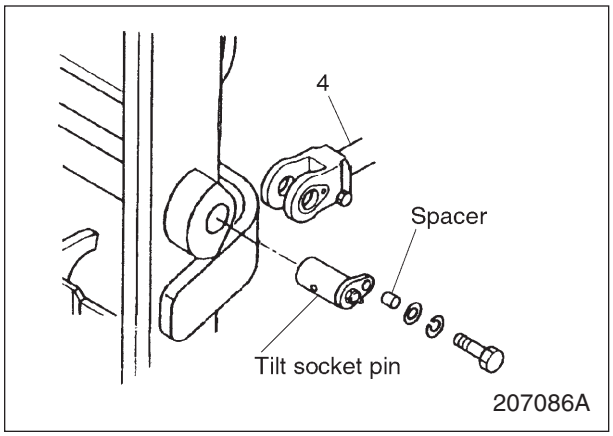
⚠ CAUTION

Be sure to use a hoist having a capacity enough to support the mast assembly.



(2) Place wood blocks under the tilt cylinder mounting section and remove the tilt socket pins, and separate the masts from the tilt cylinders.

(3) Start the engine, and pull back the tilt lever to retract the tilt cylinder rods.



3. Disconnecting high-pressure hoses for lift cylinder

Place the mast in the bottom position, disconnect the hoses at the flow regulator valve.

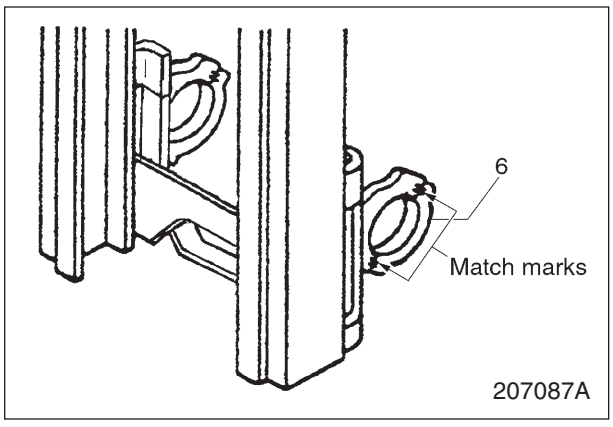
4. Removing mast support bearing caps 6

(1) Mark the bearing caps to ensure the correct reassembling before removing them.

(2) Remove the cap bolts and lift off the mast assembly. Lay it down flat on a level floor.

NOTE

Lay the mast assembly on a floor large enough to disassemble the parts.



Checking Clearance between Lift Bracket Roller and Inner Mast

NOTE

- The check procedure for the lift bracket is the same for the Simplex mast, Duplex mast and Triplex mast.

For the lift bracket to move smoothly, it is essential that the following three clearances are within the specified ranges.

(1) Clearance F between main roller circumference and mast thrust surface a

Clearance F	1.0 mm (0.04 in.) or less

(2) Clearance G between roller side surface and mast thrust surface b

Clearance G	0.1 to 0.5 mm (0.004 to 0.020 in.)

(3) Clearance G1 between side roller circumference and mast side roller thrust surface

Clearance G1	0.1 to 0.5 mm (0.004 to 0.020 in.)

Necessity of clearance check for lift bracket rollers

Clearance / Roller	Clearance F	Clearance G
Upper roller	require	**not require
Middle roller	***not require	require
Lower roller	require	require

**: Not necessary to adjust. Roller structure allows no shim adjustment.

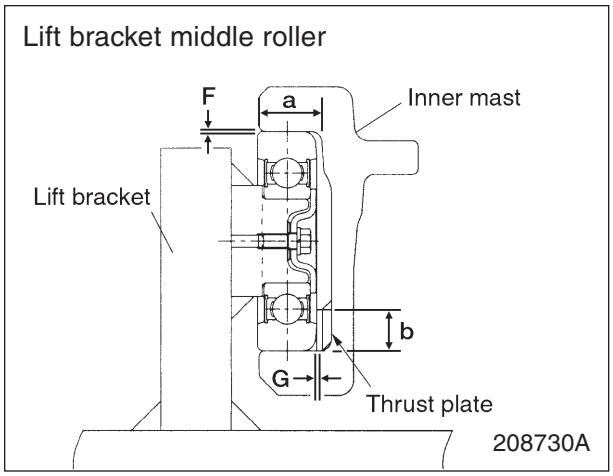
***: Always use S-size rollers.

1. Back-to-front clearance check on lift bracket main rollers

(1) Raise the forks a little from the floor.

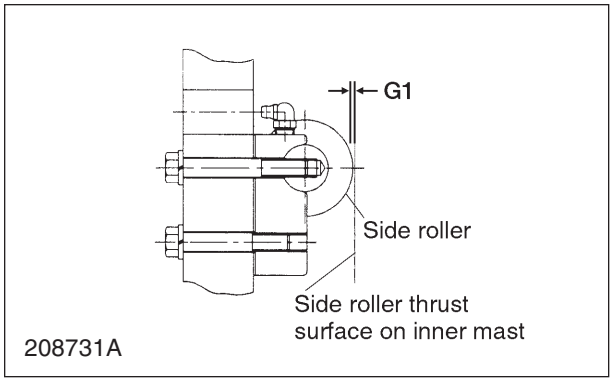
(2) Insert a bar between the upper part of lift bracket and the inner mast, and push the inner mast to one side. Using feeler gauges, measure the clearance F between the main roller and inner mast on the opposite side.

(3) If clearance F is out of specification, use oversize rollers. Remove lift bracket from mast and replace rollers with proper sized rollers. For roller replacement procedure, refer to "Installing lift bracket rollers" on pages 11-19 and 11-20.

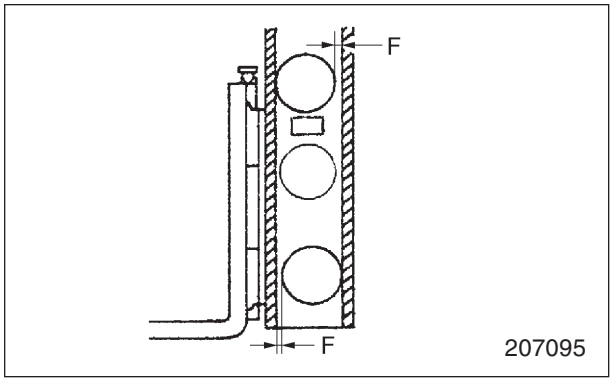


Typical example of relation between main roller and inner mast

*: Only the middle roller requires clearance to the thrust plate.



Relation between side roller and inner mast



Parts to be Changed Periodically

The following parts should be periodically changed as noted below.

These parts are made of materials which will deteriorate overtime. Further, it is difficult to determine visually whether or not they are still in good condition. Changing at proper intervals will reduce the risk of injury to the operator and damage to the truck.

Ref. No.	Parts to be changed	Interval
1	Rubber parts of brake master cylinder	2000 service hours or 1 year, whichever comes first
2	Rubber parts of brake wheel cylinders	2000 service hours or 1 year, whichever comes first
3	LP-Gas related parts	2000 service hours or 1 year, whichever comes first
4	High pressure hoses of hydraulic system	2000 to 4000 service hours or 1 to 2 years, whichever comes first
5	Rubber parts of power cylinder	4000 service hours or 2 years whichever comes first
6	Hydraulic hoses of steering system	2000 to 4000 service hours or 1 to 2 years, whichever comes first
7	Lift chains	4000 to 8000 service hours or 2 to 4 years, whichever comes first
8	Fuel hoses	4000 to 8000 service hours or 2 to 4 years, whichever comes first

Note: Periodic changes of these parts are not covered by Warranty.

Semi Underside Guard Kit

Description

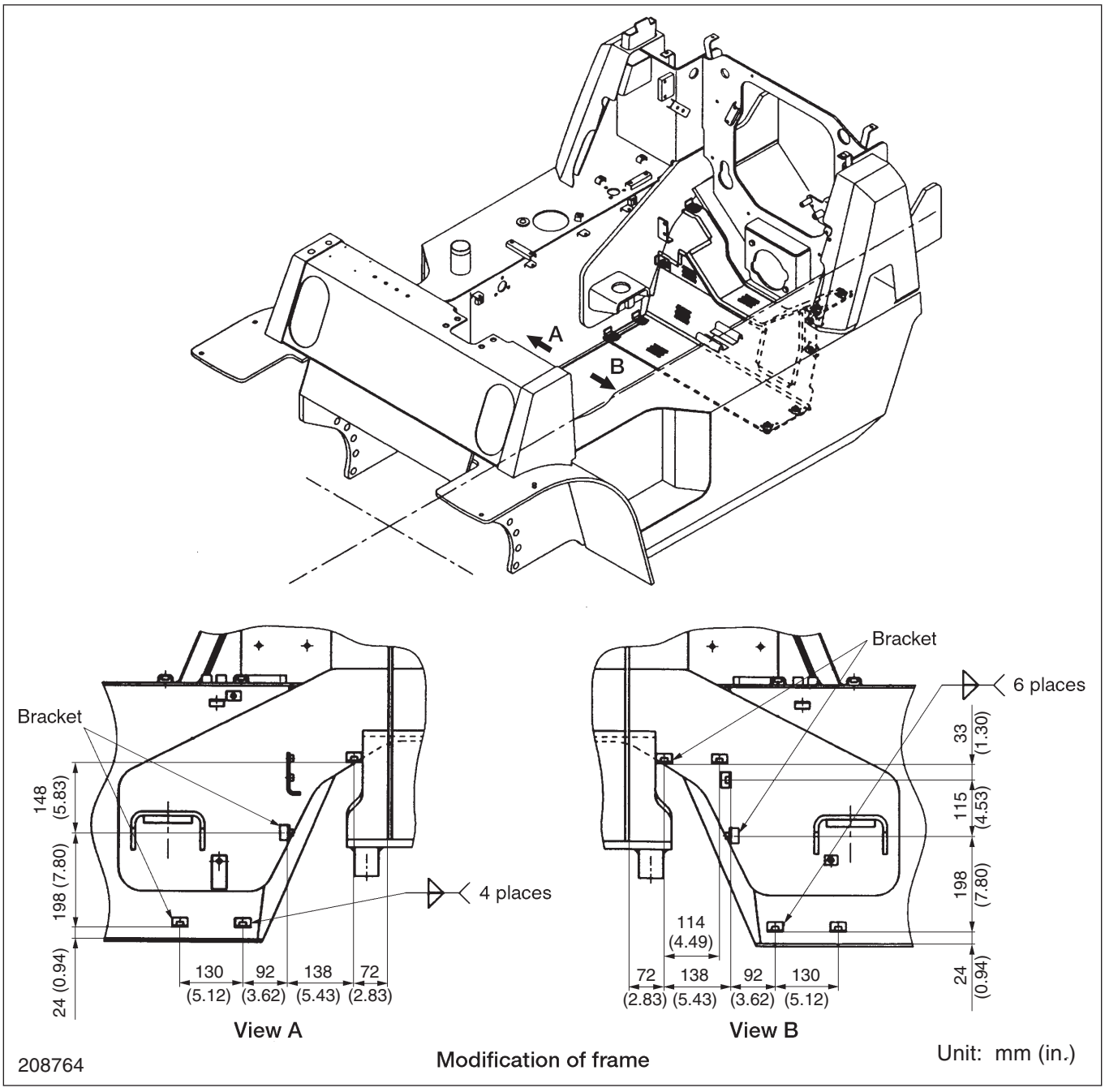
(1) The metal screen reduce the risk of foreign objects on the ground to hit and get jammed into the universal joint.

(2) The metal screen also protects the radiator from fibered dust which may cause clogging and overheating when caught in the fins.

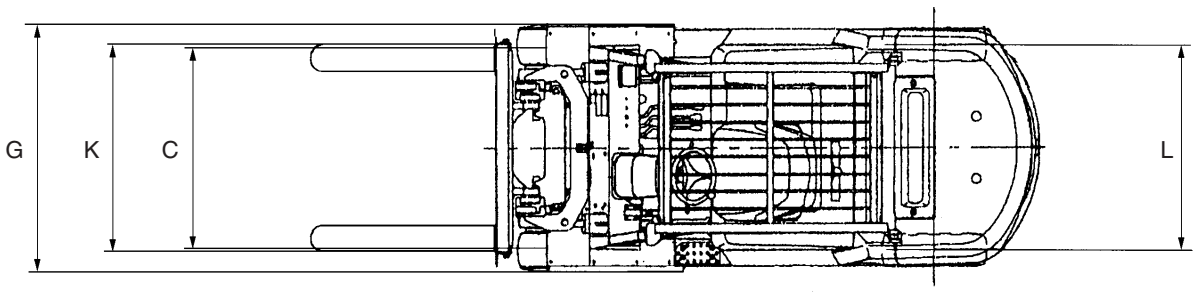
Installation

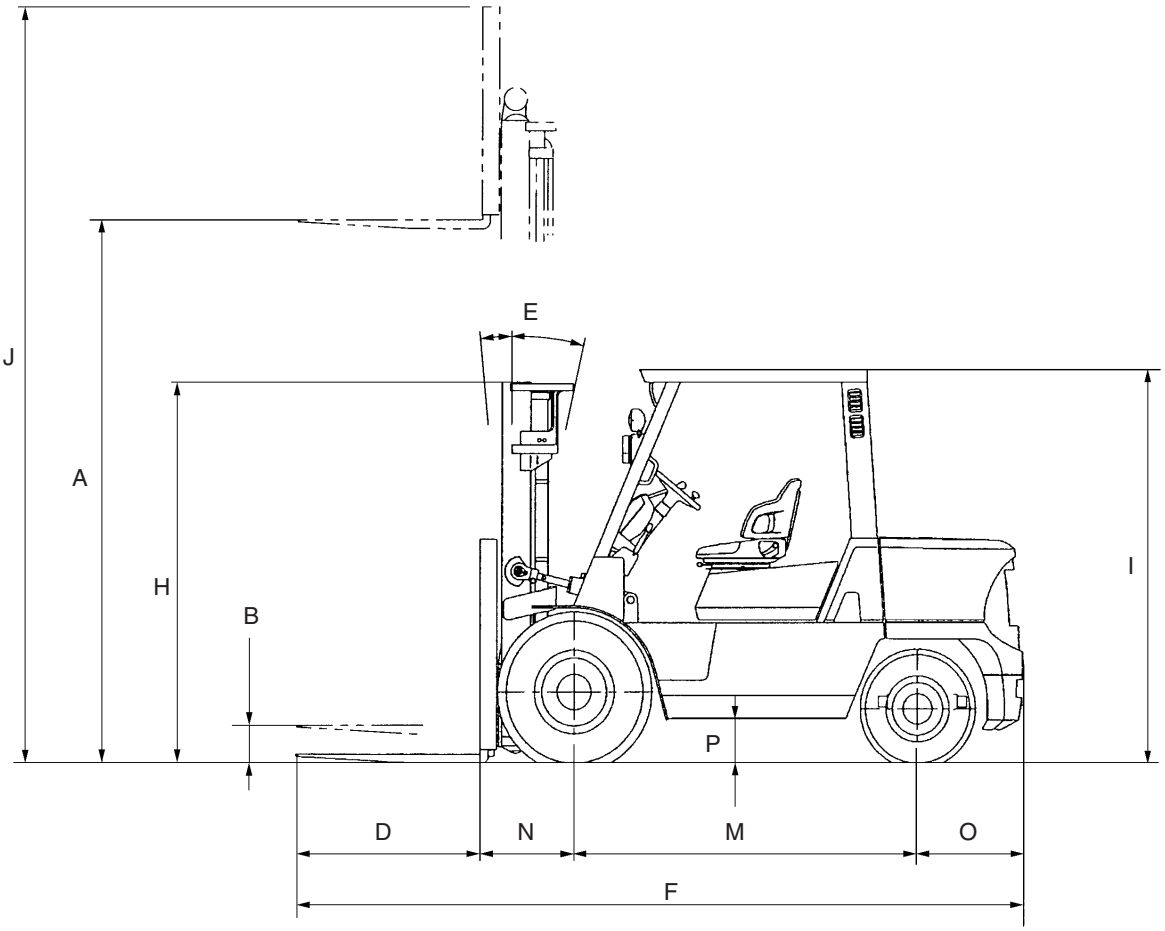
(1) See the bracket installation procedure for the frame assembly.

(2) Install underside covers to the rear cross member skirt.



Dimensions



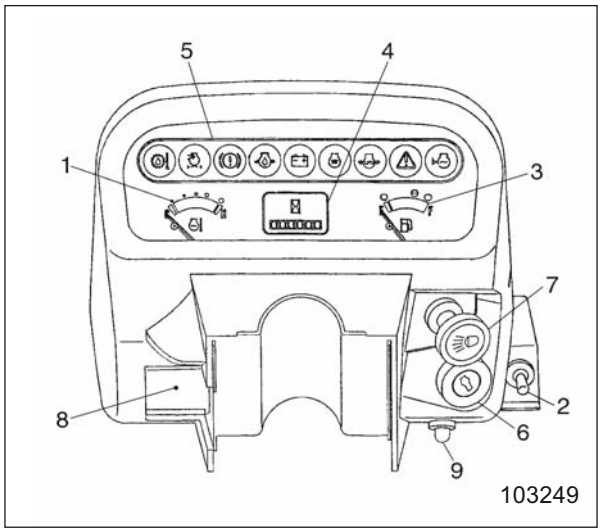


202762A

Structure et fonctions

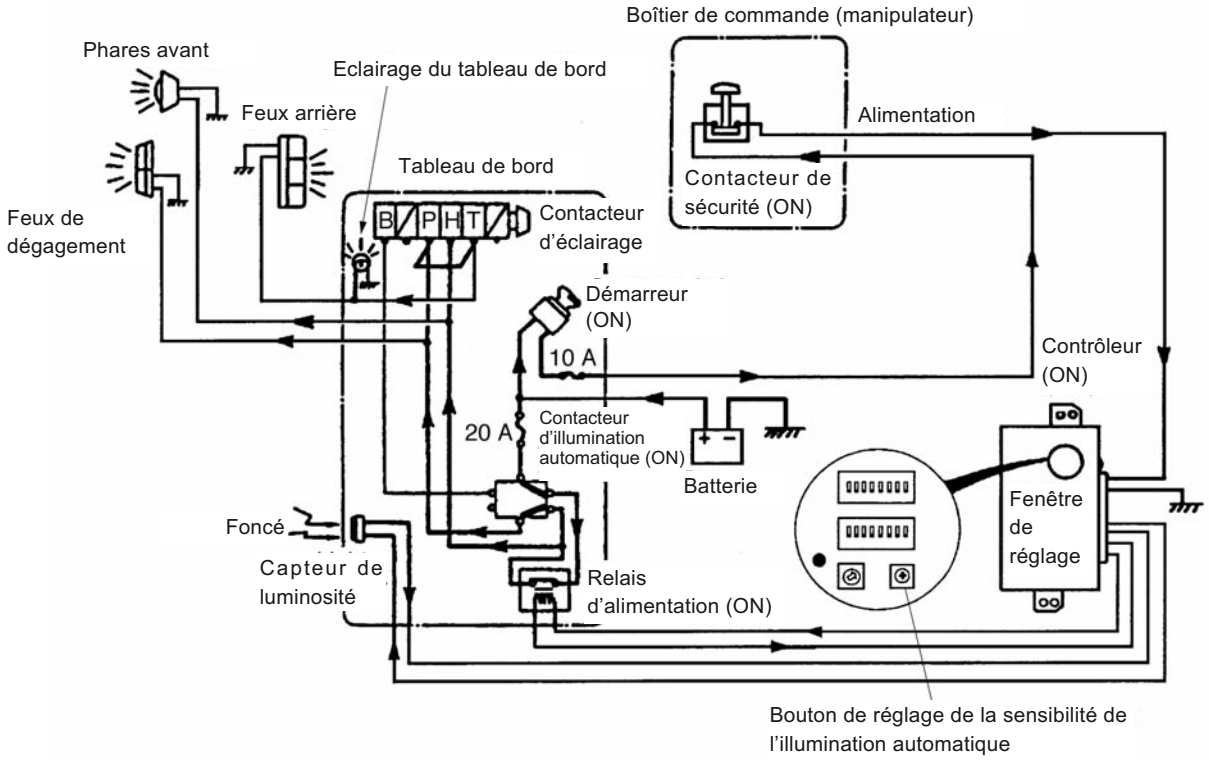
Tableau de bord

1 Thermomètre de réfrigérant moteur
2 Sélecteur de vitesse de translation
3 Jauge de carburant (pour modèles de moteur diesel)
4 Compteur horaire
5 Panneau de surveillance
6 Démarreur
7 Contacteur d'éclairage
8 Boîte à fusibles
9 Contacteur d'illumination automatique (modèle FC)



(2) Le capteur de luminosité est essentiellement constitué d'un dispositif à résistance, dont la résistance est comparée à celle de la résistance variable (bouton de réglage de la sensibilité de l'illumination automatique) à l'intérieur du contrôle. La résistance du capteur augmente au fur et à mesure que la luminosité diminue. En mode de fonctionnement, lorsque la résistance du capteur devient supérieure à celle de la résistance variable, le circuit de comparaison active le relais d'alimentation pour fermer ses contacts et activer les phares.

Quand le contacteur d'illumination automatique est réglé sur ON, le démarreur sur | (ON) et le contacteur de sécurité sur ON.



208782

Opération–1

(f) Cas 8: La DEL (rouge) du contrôleur demeure allumée.

Procédure de dépannage

La DEL demeure-t-elle éteinte pour indiquer que l'alimentation est défectueuse?

Non → La tension entre le circuit 201 sur le côté mâle de CN4 et la masse est-elle de 10 volts au moins?

Oui → La résistance entre le circuit 201 (sur le côté femelle de CN4) et les circuits 182 et 183 (sur CN53) est-elle inférieure à 0,1 ohm?

Non → Contrôlez la continuité du circuit d'alimentation (à l'intérieur du tableau de bord). Réparez et corrigez toute ouverture éventuelle.

Oui → Pendant que vous vérifiez si chaque connecteur est fermement raccordé, assurez-vous que la DEL s'allume. Si ce n'est pas le cas, contactez le fabricant.

Non → La résistance entre les circuits 183 et 201 sur le côté mâle de CN54 est-elle inférieure à 0,05 ohm?

Oui → Contrôlez la continuité du faisceau B. Réparez et corrigez toute ouverture éventuelle.

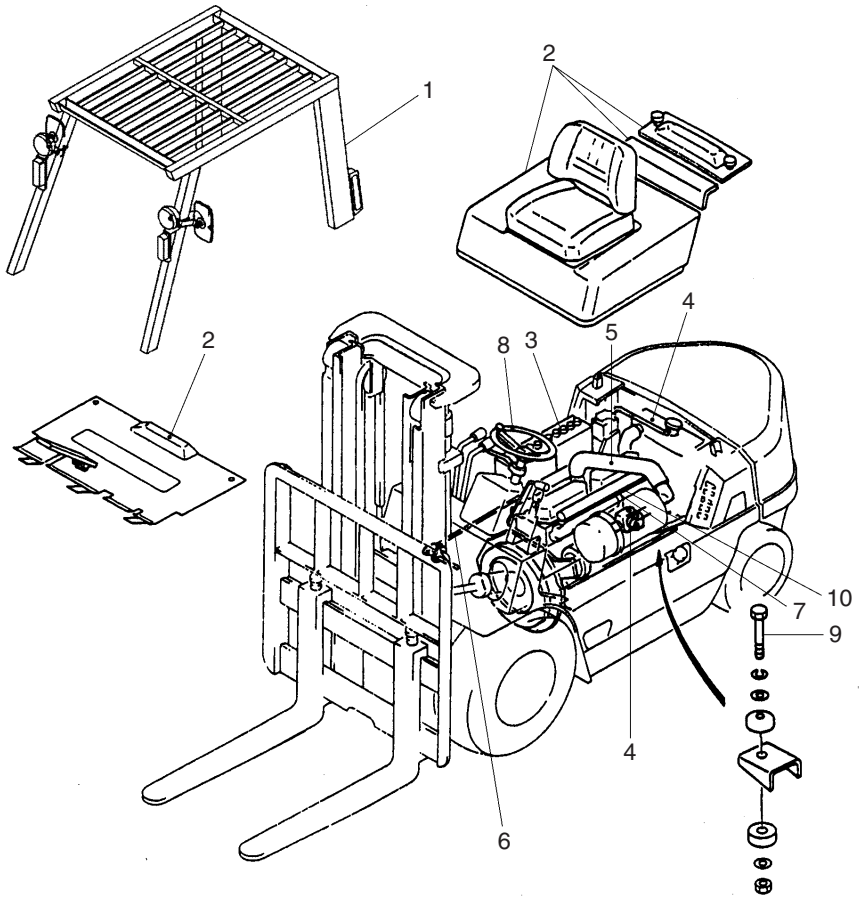
Non → Vérifiez si le contacteur de sécurité et le faisceau du capot moteur ne présentent pas une ouverture de circuit. Réparez et corrigez toute ouverture éventuelle ou remplacez le contacteur si nécessaire.

Si la DEL demeure allumée;
Les interrupteurs DIP sont-ils correctement réglés?
SW2-8 est-il réglé sur OFF?

Non → Réajustez.

Oui → Remplacez le contrôleur.

Dépose du moteur sous forme d'unité seule



Séquence

1 Faisceaux des feux, protection supérieure
2 Couvercle du radiateur, siège, couvercle du moteur, tôle de plancher
3 Batterie, faisceaux (connectés entre le moteur et la transmission)
4 Flexibles du radiateur, réservoir de réserve, flexibles du refroidisseur d'huile, radiateur
5 Flexible du filtre à air, tuyau d'échappement
6 Flexible de carburant, articulation de la pédale d'accélérateur
7 Flexibles de dépression
8 Volant
9 Boulon de fixation du moteur
10 Ensemble du moteur

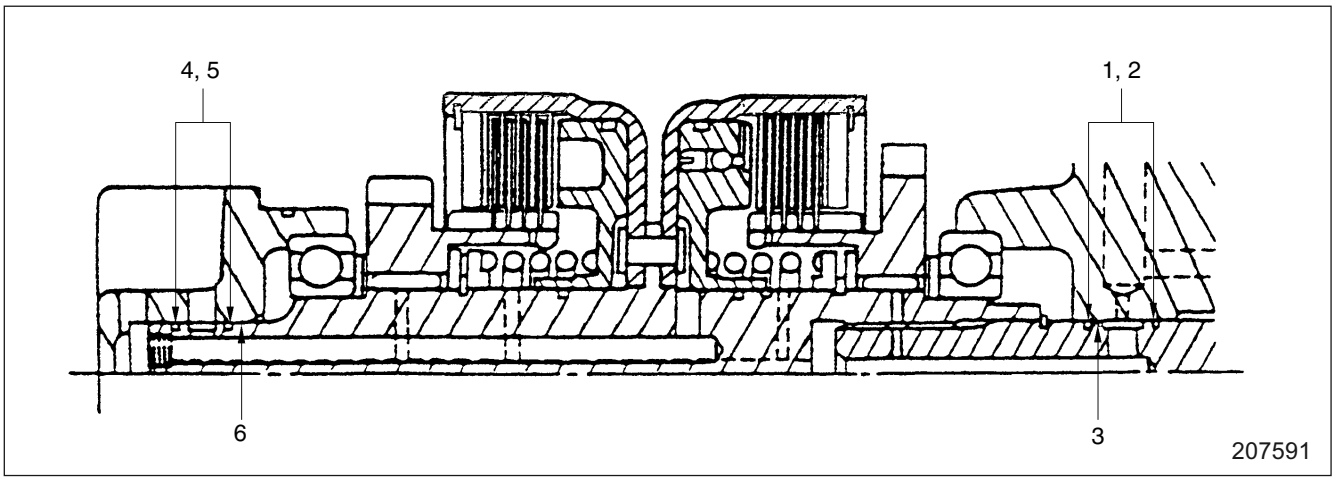
8. Arbre de la turbine et arbre d'embrayage

Contrôlez l'usure ou autre défaut des bagues d'étanchéité et de l'arbre.

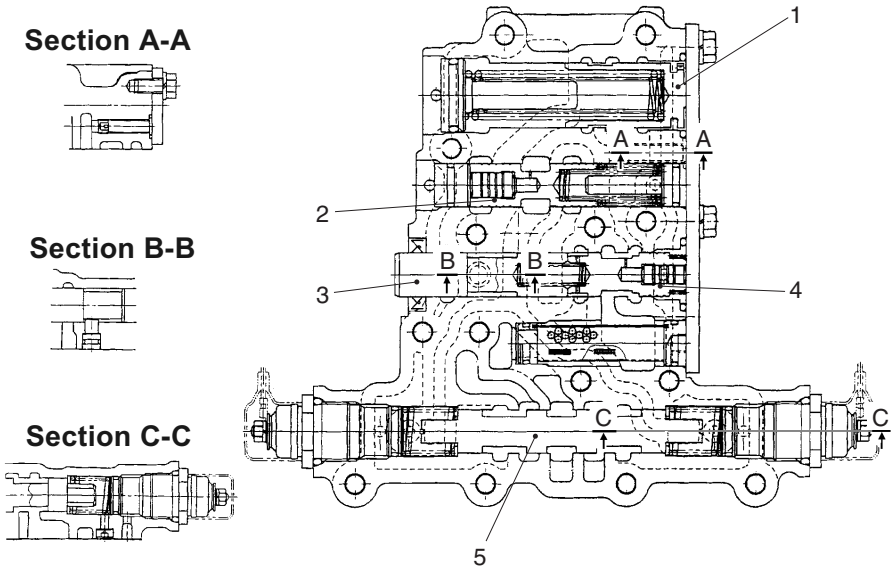
A: Valeur standard B: Limite de réparation ou de service

Unité: mm

Elément \ Modèle de chariot		GP40K à GP45K DP40K à DP45K
Largeur de la bague d'étanchéité de l'arbre de turbine 1	A	2,5 ± 0,05
	B	2,0
Largeur de la rainure de la bague d'étanchéité dans l'arbre de turbine 2	A	$2{,}5\ ^{+0{,}2}_{+0{,}1}$
	B	3,0
Diamètre intérieur de l'arbre de la turbine en contact avec la bague d'étanchéité 3	A	$35\ ^{+0{,}025}_{0}$
	B	35,2
Largeur de la bague d'étanchéité de l'arbre d'embrayage 4	A	2,5 ± 0,05
	B	2,0
Largeur de la rainure de la bague d'étanchéité de l'arbre d'embrayage 5	A	$2{,}5\ ^{+0{,}2}_{+0{,}1}$
	B	3,0
Diamètre intérieur du carter d'asservissement en contact avec la bague d'étanchéité 6	A	$35\ ^{+0{,}025}_{0}$
	B	35,2

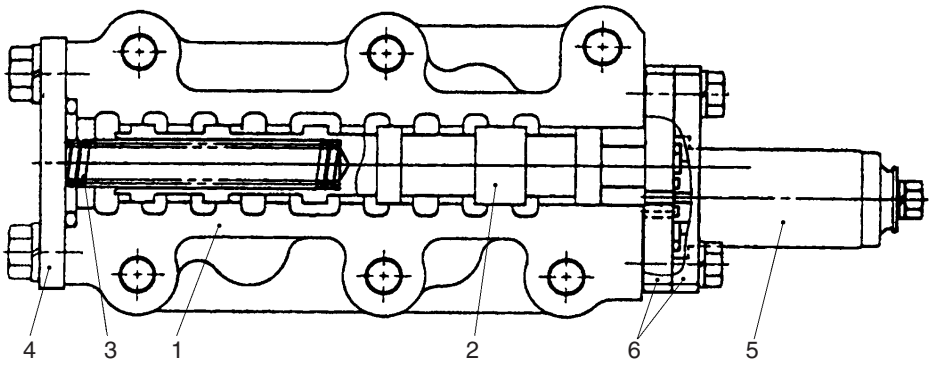


Distributeur



1 Clapet de l'accumulateur
2 Clapet régulateur
3 Plongeur du clapet d'embrayage
4 Clapet d'embrayage
5 Tiroir de sens de marche

Clapet sélecteur



1 Corps d'électrovanne
2 Electrovanne
3 Ressort
4 Couvercle
5 Couvercle
6 Electrovanne (clapet électromagnétique)

Absence de débit de puissance	Transmission	Huile insuffisante	Remplissez.
		Mauvais réglage de l'articulation de la pédale à réglage progressif	Réajustez.
		Usure de la bague d'étanchéité dans le carter de servocommande	Remplacez.
		Usure des O-rings sur l'arbre d'entrée	Remplacez.
		Desserrage ou glissement du bouchon de l'arbre d'entrée, entraînant des fuites d'huile	Réparez.
		Embrayage grippé	Remplacez.
		Arbres brisés	Remplacez.
		Tambour d'embrayage, et plus particulièrement la rainure du jonc d'arrêt, défectueux	Remplacez.
		Rupture du jonc d'arrêt installé sur le tambour d'embrayage	Remplacez.
		Colmatage du passage d'huile alimentant la pression d'huile dans le piston d'embrayage	Nettoyez ou remplacez
		Usure des cannelures de l'arbre	Remplacez les arbres.
	Groupe motopropulseur	Rupture de pièces dans le différentiel de démultiplication ou l'essieu avant	Réparez ou remplacez.
Bruit anormal	Convertisseur de couple	Plaque flexible brisée	Remplacez.
		Roulements endommagés	Remplacez.
		Frottement des lames du membre en fonction	Remplacez.
		Boulons desserrés	Resserrez ou remplacez.
		Usure des cannelures	Remplacez.
		Pompe à huile bruyante	Réparez ou remplacez.
	Transmission	Grippage ou glissement de l'embrayage	Remplacez la plaque d'embrayage.
		Roulements usés ou grippés	Remplacez.
		Engrenages brisés	Remplacez.
		Boulons desserrés	Resserrez ou remplacez.
		Usure des cannelures	Remplacez.
	Bruit sourd	Crépine d'huile colmatée	Nettoyez.
		Clapet de sécurité principal défectueux	Nettoyez ou remplacez.
		Restriction dans le tuyau d'huile	Remplacez.
		Huile trop visqueuse par temps froid	Remplacez l'huile
		Instruments en panne	Remplacez.
		Utilisation d'un type d'huile erroné	Remplacez l'huile
	Faible bruit	Crépine d'huile colmatée	Nettoyez ou remplacez.
		Pompe à huile défectueuse	Remplacez.
		Fuites d'huile excessives	
		• Ressort du clapet de sécurité principal brisé ou affaibli	Remplacez.
		• Tiroir du clapet de sécurité principal défectueux	Réparez ou remplacez.
		Aspiration d'air à l'intérieur	Resserrez ou remplacez la garniture.
		Niveau d'huile insuffisant	Remplissez.

(2) Vérifiez l'usure et l'état des surfaces de glissement des rondelles de butée et des engrenages.

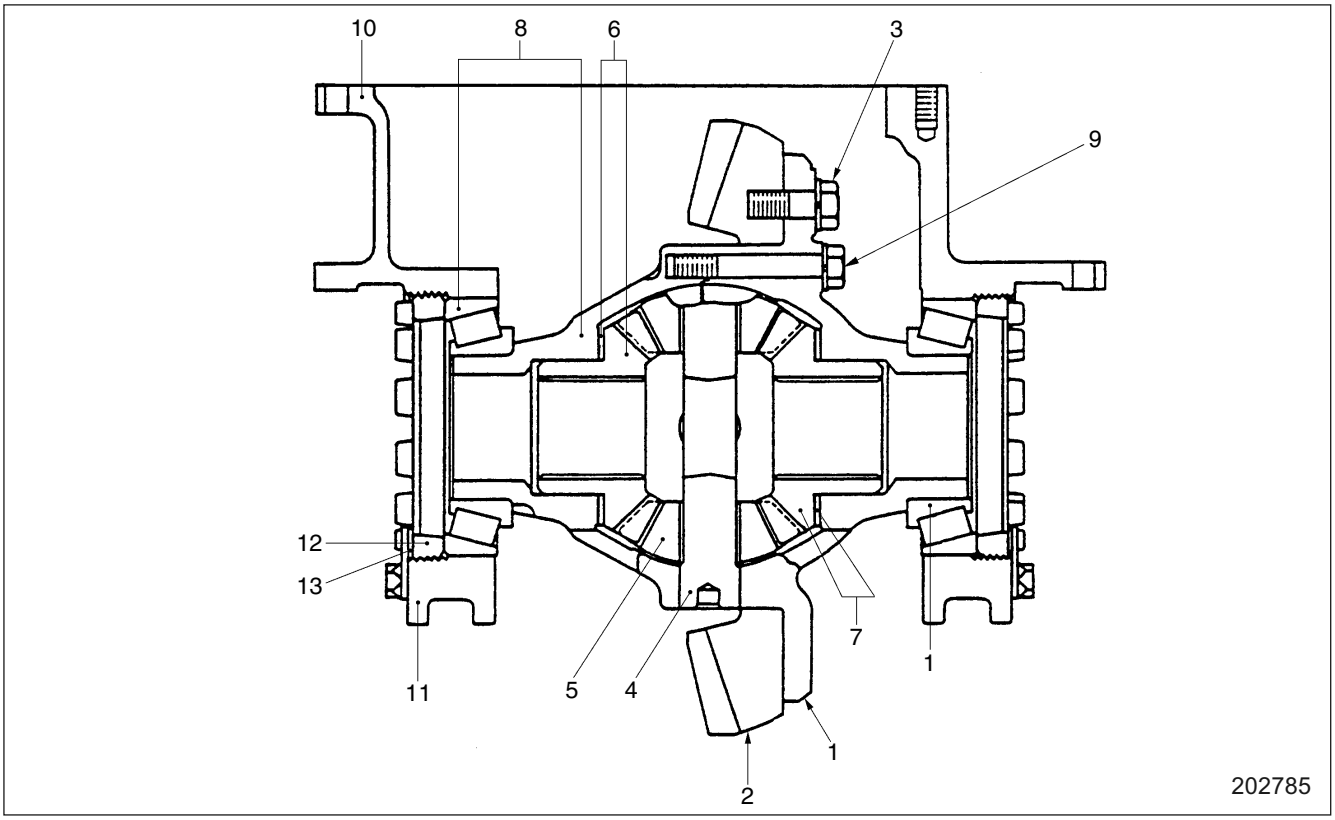
(3) Vérifiez si les dents des pignons et engrenages coniques du différentiel ne sont pas usées, piquées, gravillonnées, éraillées, etc.

(4) Contrôlez l'ajustement de chaque pignon sur le spider.
A: Valeur standard B: Limite de réparation ou de service

Unité: mm

Montage des pignons coniques du différentiel le sur spider	A	0,169 à 0,278
	B	0,5

Montage



Séquence

1 Carter du différentiel (gauche), roulement de galet taraudé
2 Engrenage de démultiplication
3 Boulon
4 Spider du différentiel
5 Pignon conique du différentiel, rondelle de butée
6 Engrenage conique du différentiel, rondelle de butée
7 Engrenage conique du différentiel, rondelle de butée
8 Carter du différentiel (droit), roulement de galet taraudé
9 Boulon
10 Bâti de différentiel
11 Chapeau de roulement, boulon, rondelle de verrouillage
12 Vis de réglage
13 Boulon, rondelle de verrouillage, plaque de verrouillage

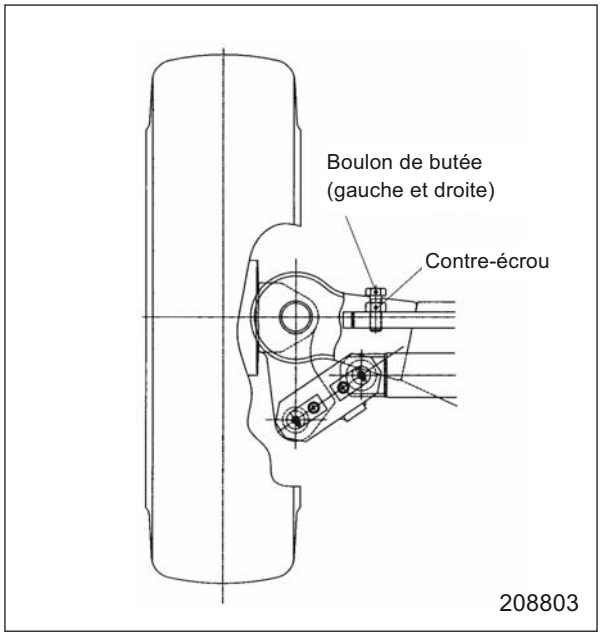
Réglage

Rayon de braquage minimum

(1) Mesurez l'angle de braquage de la roue arrière à l'aide d'une jauge pour rayon de braquage.

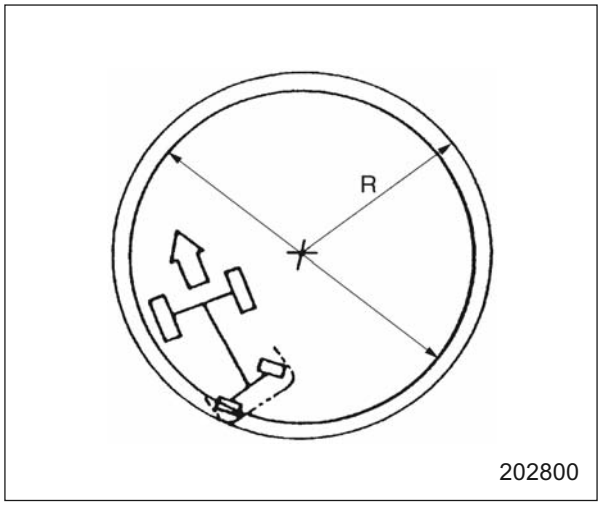
(2) Si l'angle de braquage n'est pas compris dans la plage spécifiée, ajustez-le à l'aide du boulon de butée du joint d'articulation.

Angle de braquage	Vers l'intérieur	80°
	Vers l'extérieur	55°



(3) Pendant que vous conduisez le chariot à basse vitesse, tournez le volant à fond dans les deux directions et contrôlez le diamètre des chemins de roulement à l'extérieur de la roue arrière dans les deux opérations de braquage.

(4) Le rayon de braquage minimum R s'obtient à partir de la moitié du diamètre de braquage plus la longueur entre le centre du pneu arrière et le bord extérieur du contrepoids.



Unité: mm

Elément / Modèle de chariot	Rayon de braquage minimum
GP40K, DP40K	2.735
GP40KL, DP40KL	2.775
GP45K, DP45K	2.820
GP50, DP50K	2.965

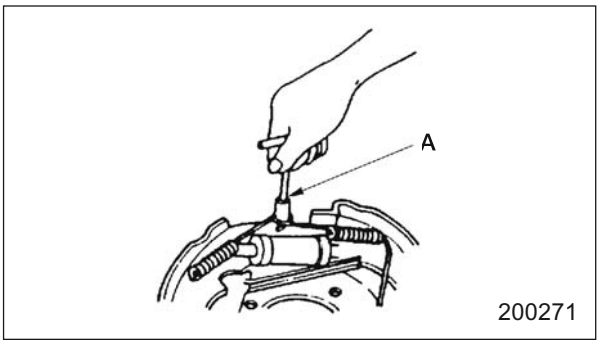
Suggestions de démontage

1. Dépose des ressorts de retour

A l'aide de l'outil spécial A, déposez les ressorts de retour de la plaque de guidage du patin.

Outil spécial requis

Outil de dépose de ressort A	64309 - 15411

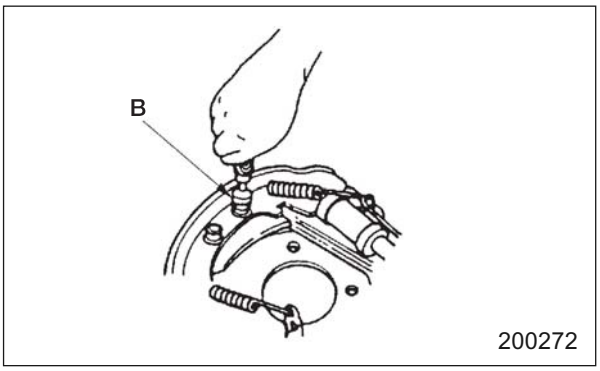


2. Dépose des ressorts de maintien

A l'aide de l'outil spécial B, déposez les ressorts de maintien de la plaque d'appui.

Outil spécial requis

Retenue du ressort B	91868 - 00600



Contrôle et réparation

1. Plaque d'appui

(1) Contrôlez les fissures.

(2) Contrôlez le couple de serrage des boulons.

Unité: N·m (kgf·m)

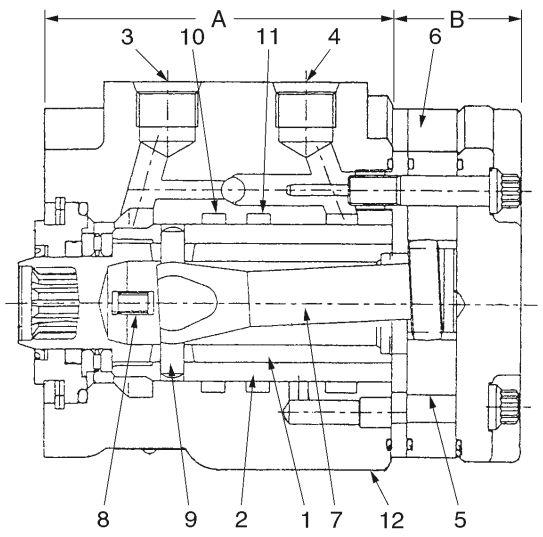
Modèle de chariot / Elément	GP40K, GP40KL DP40K, DP40KL	GP45K, GP50K DP45K, DP50K
Couple de serrage des boulons de la plaque d'appui	160 à 196 (16,3 à 20,0)	238 à 284 (24,3 à 29,0)

2. Ensembles de patin et de garniture

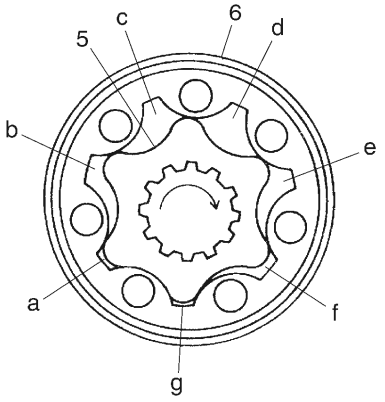
(1) Vérifiez la présence de fissure sur le patin et la garniture.

(2) Remplacez la garniture si elle est excessivement imbibée d'huile, durcie ou endommagée de toute autre façon.

Engrenage de direction



a, b, c: Mesure des admissions de la pompe
d, e, f: Mesure des sorties de la pompe



208745

1 Tiroir
2 Manchon
3 Orifice de sortie (T)
4 Orifice d'entrée (P)
5 Rotor
6 Bague du rotor
7 Arbre d'entraînement
8 Ressort de centrage
9 Broche
10 Orifice de virage à gauche (L)
11 Orifice de virage à droite (R)
12 Logement

A: Etage de commande
B: Etage de mesure

Le clapet de direction comprend deux sections: l'étage de commande A et l'étage de mesure B.

L'étage de commande A comprend le tiroir 1, le manchon 2 et le logement 12, constituant un distributeur de direction de type rotatif. Le tiroir 1 est accouplé par cannelure à l'arbre de direction. Quand le tiroir 1 tourne, le manchon 2 pivote et ouvre les passages suivants pour former un circuit hydraulique:

(1) un passage permettant à l'huile de s'écouler depuis l'orifice d'admission 4 jusqu'à l'étage de mesure B;

(2) un passage permettant à l'huile de s'écouler depuis l'étage de mesure B jusqu'à l'orifice L ou R;

(3) un passage permettant à l'huile de retourner depuis le vérin de direction jusqu'à l'orifice T.

L'étage de mesure B est une petite pompe hydraulique de type engrenage trochoïdale, appelée « gérotor » et constituée d'une bague de rotor 6 et du rotor 5. Le tiroir 1 et le rotor 5 sont connectés entre eux via l'arbre d'entraînement 7. Le rotor tourne donc dans le même sens et à la même vitesse que le volant de direction.

Quand l'opérateur ne tourne pas le volant, l'huile s'écoule de l'orifice P vers l'orifice T, puis retourne dans le réservoir hydraulique. L'huile ne s'écoule pas vers l'étage de mesure B, car elle est bloquée par le tiroir 1 et le mancheon 2.

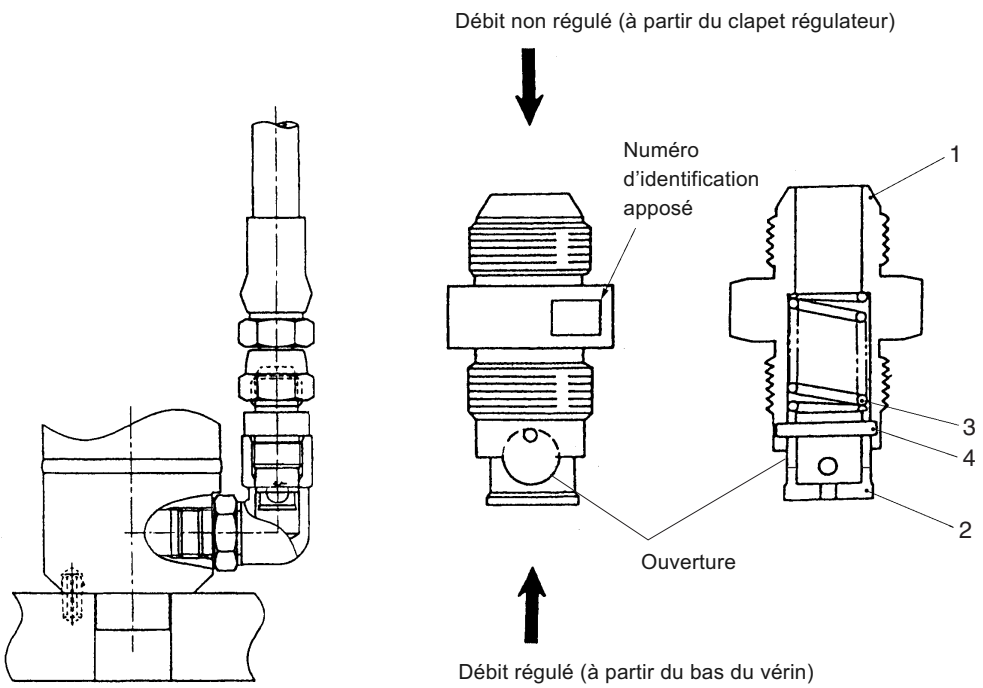
Quand l'opérateur tourne le volant vers la droite, le passage dans le clapet de direction s'ouvre et permet à l'huile sous pression de s'écouler à travers l'orifice d'admission 4 dans les zones a, b et c.

Au fur et à mesure que le rotor 5 tourne en même temps que le volant, l'huile des zones d, e et f est forcée dans le vérin de direction à travers l'orifice de virage à droite 11. Quand le volant tourne vers la gauche, l'huile s'écoule dans la direction opposée à celle ci-dessus, en pénétrant dans le vérin de direction à travers l'orifice de virage à gauche 10.

Comme l'huile sous pression provenant de l'orifice 4 applique la force de rotation au rotor 5, l'effort de l'opérateur sur le volant est réduit.

Quand l'opérateur arrête de tourner le volant, le ressort de centrage 8 ramène le tiroir 1 sur sa position d'origine. Dans cette position, le tiroir 1 et le manchon 2 bloquent le débit d'huile provenant de la pompe hydraulique principale dans le clapet de direction tout en fermant aussi les passages entre les orifices.

Clapet de sécurité d'abaissement



1 Connecteur
2 Clapet
3 Ressort
4 Axe à ressort

Le clapet de sécurité d'abaissement se trouve au bas du vérin de levage gauche (applicable uniquement au mât Simplex).

Même si le débit d'huile provenant des vérins de levage devient excessif à cause d'une anomalie dans la tuyauterie entre les vérins de levage et le clapet régulateur de débit ou à cause d'un mauvais réglage du clapet régulateur de débit, le clapet de sécurité d'abaissement empêche la chute brutale du mât en régulant le débit d'huile de sortie des vérins de levage.

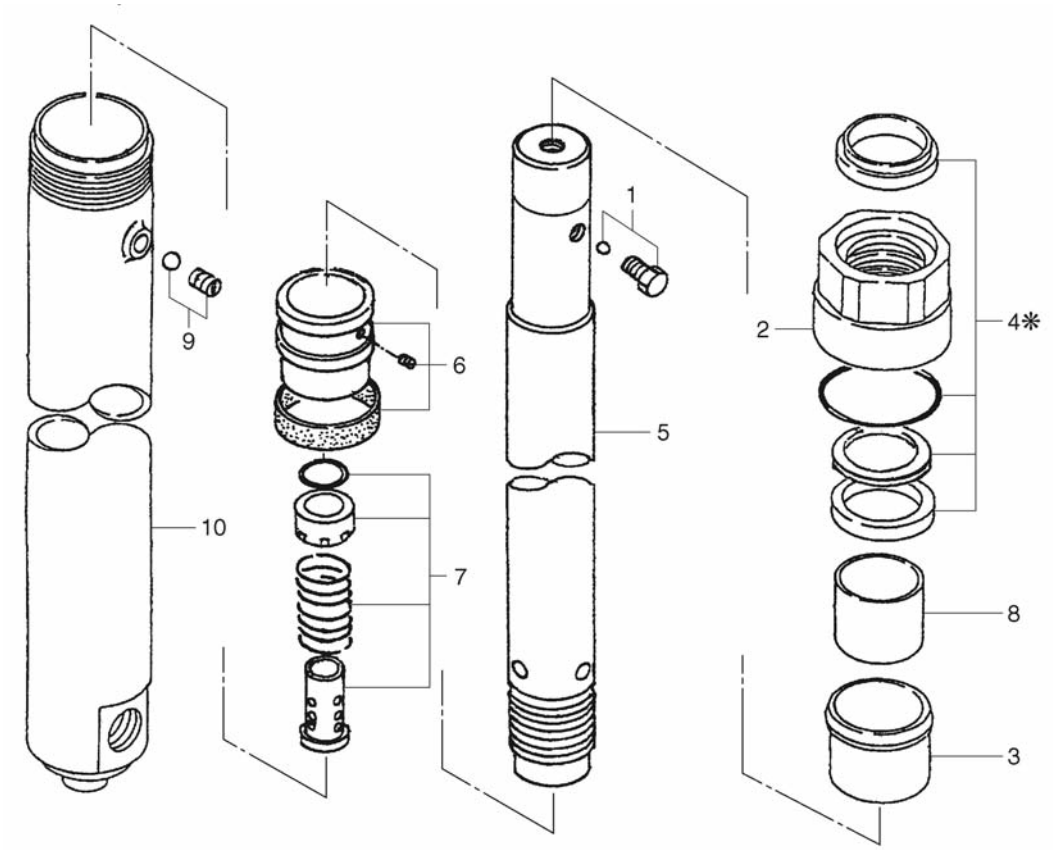
Modèle de chariot	Identification N°
GP40K, GP40KL, DP40K, DP40KL	90
GP45K, GP50K, DP45K, DP50K	120

Si le flexible est endommagé, par exemple, un volume d'huile inhabituellement élevé s'écoule hors du bas du vérin approprié vers le clapet régulateur de débit. Ce flux d'huile force le clapet 2 à remonter contre la force du ressort 3 Le clapet rétrécit ensuite l'ouverture dans celui-ci et le flux d'huile provenant du vérin est restreint. Cela empêche le mât de descendre soudainement.

Deuxième vérin de levage du mât Duplex

Démontage

Pour modèle de mât 4F40A



Séquence

1 Clapet, bille d'acier
2 Retenue
3 Culasse
4 Joint à lèvre, joint en U, bague d'appui, O-ring
5 Tige de piston
6 Bague coulissante, vis de réglage, piston
7 Jonc d'arrêt, clapet anti-retour, ressort, tiroir d'amortissement
8 Douille
9 Bille d'acier, vis
10 Tube de vérin

REMARQUE

La douille 8 ne se remplace pas séparément. En cas de défaut, remplacez la tête du vérin 3 avec un kit.

REMARQUE

Les pièces désignées par un astérisque (*) sont incluses dans le kit de joint d'étanchéité.

Suggestions de démontage

Dépose de la retenue

Pour déposer la retenue, enveloppez le tube du vérin dans un chiffon et maintenez-le dans un étau. Déposez la retenue à l'aide de la clé.

Clé à ergots	Largeur entre les aplats: 65 mm

Données techniques

A: Valeur standard

Unité: mm

Elément \ Modèle de chariot					DP40K	DP40KL	DP45K	DP50K	GP40K	GP40KL	GP45K	GP50K
Vitesse de levage (charge nominale) (mât Simplex) mm/sec				A	500		430	420	530		440	430
Vitesse de levage (sans charge) mm/sec				A	520		450	440	510		460	450
Vitesse d'abaissement (charge nominale) (mât Simplex) mm/sec				A	500							
Degrés de l'angle d'inclinaison vers l'avant (chariot standard avec mât Simplex)				A	6°							
Degrés de l'angle d'inclinaison vers l'arrière (chariot standard avec mât Simplex)				A	10°							
Dérive du vérin de levage (rétraction de la tige du piston) (charge nominale pendant 15 minutes) [température de l'huile: 45 °C]				A	50, maximum							
Dérive du vérin d'inclinaison (extension de la tige du piston) (charge nominale pendant 15 minutes) [température de l'huile: 45 °C]				A	30, maximum							
Réglage du clapet de sécurité principal kPa (kgf/cm^2)				A	19.123 $^{+490}_{0}$ (195 $^{+5}_{0}$)							
Cylindrée de la pompe hydraulique (pompe à engrenage) cm^3/rev				A	50 (3,05)/rev							
Distributeur	Distributeur MC	Effort de fonctionnement du tiroir (au régime moteur maximal)	Point mort N (kgf)	A	127 (12,9)							
			Pleine course N (kgf)	A	158 (16,1)							
		Couple de serrage des boulons d'ancrage	7/16" N·m (kgf·m)	A	65 (6,6)							
			1/2" N·m (kgf·m)	A	101 (10,3)							
	Distributeur FC	Couple de serrage de l'écrou du goujon N·m (kgf·m)		A	44 ± 4,4 (4,5 ± 0,45)							
Réglage du clapet de sécurité du circuit de direction kPa (kgf/cm^2)				A	11.800 $^{+490}_{0}$ (120 $^{+5}_{0}$)							
Couple de serrage du filtre de retour N·m (kgf·m)				A	49 (5)							
Couple de serrage de la crépine d'aspiration N·m (kgf·m)				A	49 (5)							
Clapet régulateur de débit			Débit (sans charge) litre/min	A	100		115		100		115	
Couple de serrage du joint universel de la pompe hydraulique (pompe à engrenage) N·m (kgf·m)				A	22 (2,2)							
Couple de serrage des joints de flexible hydraulique sur la pompe hydraulique (pompe à engrenage) et le distributeur N·m (kgf·m)				A	118 (12)							
Couple de serrage des joints de tuyau hydraulique sur le distributeur et le clapet régulateur de débit N·m (kgf·m)				A	118 (12)							

Clapet de priorité du débit

Ce clapet achemine l'huile fournie par la pompe hydraulique vers le circuit de direction en lui accordant la priorité par rapport aux circuits de commande du mât.

L'huile provenant de l'orifice P 1 pénètre dans le clapet de priorité du débit 3 et le clapet réducteur de pression 12.

L'huile d'alimentation qui a pénétré dans le clapet de priorité du débit 3 s'écoule ensuite comme suit:

(1) L'huile traverse le passage 2, le creux dans le tiroir 4, puis la restriction 17, où elle est étranglée avant de s'écouler dans le passage 5. L'huile sort ensuite du passage 5 via l'orifice PF 9 (connecteur équipé d'un clapet anti-retour à bille) et est acheminée vers le clapet de direction.

(2) Une partie du débit qui traverse le passage 2 et pénètre dans le creux du tiroir 4 s'écoule à travers le clapet 7 et atteint la chambre 8. Ce débit applique une force vers le gauche au tiroir 4.

Cette force vers la gauche s'équilibre avec la force vers la droite du ressort 6 à une certaine position du tiroir 4 et le tiroir se règle ici. Dans cette condition, l'huile alimente le circuit de direction à un certain débit tandis que l'huile en excès s'écoule dans le passage 10 via le passage 2.

(3) Quand le taux d'alimentation de la pompe hydraulique augmente, le tiroir 4 monte davantage en permettant à l'excès d'huile de s'écouler via les passages 2 dans le passage 10, puis vers le clapet de purge.

Le clapet 7 a pour fonction de ralentir l'écoulement de l'huile dans la chambre 8 et d'accélérer le débit qui quitte cette chambre 8. Cette fonction est indispensable pour ralentir le mouvement vers la gauche du tiroir 4 et accélérer le mouvement vers la droite, afin de limiter le débit d'huile en excès avant qu'une pénurie d'huile d'alimentation ne paralyse le circuit de direction.

Le clapet de sécurité du circuit de direction 11 protège ce circuit contre les pressions excessivement élevées. La pression du clapet est réglée sur 11,8 $^{+0,5}_{0}$ MPa (120 $^{+5}_{0}$ kgf/cm^2).

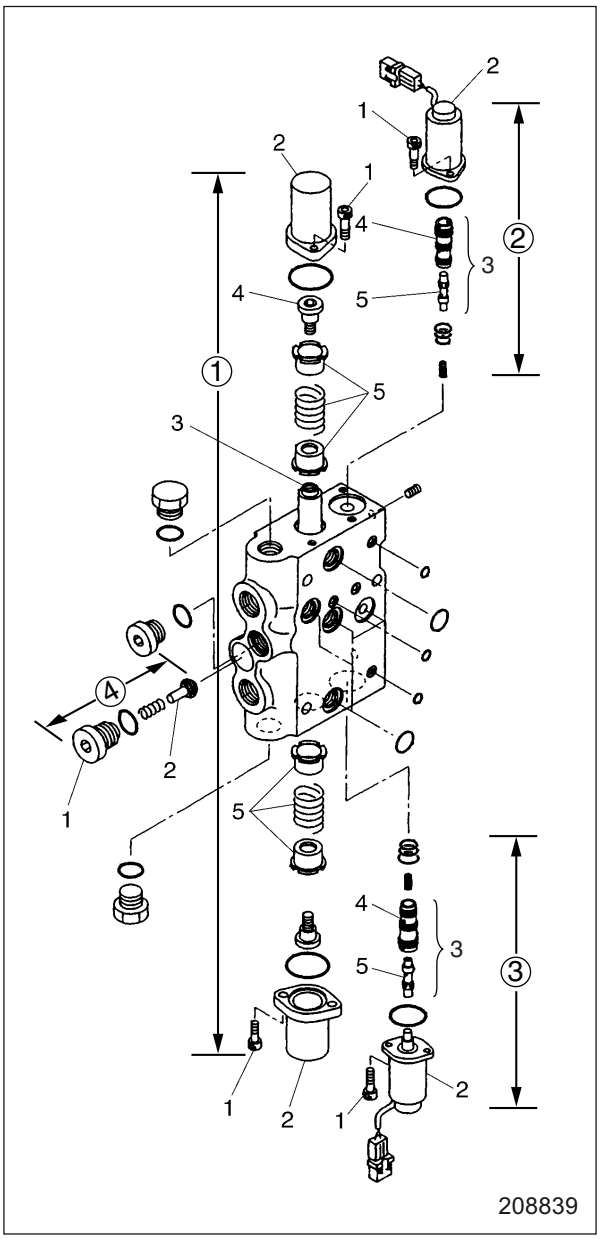
Clapet réducteur de pression

Le clapet réducteur de pression 12 réduit la pression de l'huile fournie par la pompe à la pression (pilote) appropriée à sa manipulation par le clapet de commande de pression électromagnétique proportionnel.

L'huile qui pénètre dans le clapet réducteur de pression 12 via l'orifice P 1 s'écoule dans le creux du clapet d'échange 13 qui glisse dans le manchon du clapet 12 et est acheminée à travers le passage d'huile pilote 15 vers le clapet de commande de pression électromagnétique proportionnel.

Quand la pression de l'huile du passage d'huile pilote 15 est élevée, le clapet d'échange 13 se déplace vers la gauche à cause de la force du ressort 14. Cela rétrécit l'orifice dont l'ouverture varie en fonction de la position relative des orifices du manchon et du clapet d'échange 13, en réduisant le débit auquel l'huile s'écoule dans le clapet réducteur de pression et en diminuant donc la pression dans le passage 15 jusqu'à la pression de conception standard. Quand la pression du passage d'huile pilote 15 est lente, les actions des composants du clapet sont opposées à celles mentionnées ci-dessus, et la pression dans le passage 15 augmente jusqu'à la pression de conception standard.

Section de l'accessoire



Clapets incorporés à l'étage de l'accessoire

(Dans un distributeur à 4 clapets, le clapet d'échange est incorporé au clapet n°4. Pour plus d'informations sur la procédure de démontage, consultez la section relative à l'ensemble du clapet d'admission.)

① Clapet de commande d'accessoire
② Clapet de commande de pression électromagnétique proportionnel (SB3)
③ Clapet de commande de pression électromagnétique proportionnel (SA2)
④ Clapet anti-retour de retenue de charge

Suggestions de démontage

Clapet de commande d'accessoire ①

(1) Placez le clapet sur un établi en positionnant le tiroir à l'horizontale, puis dévissez les boulons à tête creuse 1 pour déposer les bouchons 2 aux deux extrémités du clapet de commande de l'accessoire.

(2) Déposez les vis du chapeau 4 aux deux extrémités du tiroir 3 en les dévissant avec une clé hexagonale engagée dans la douille de chaque tête.

(3) Déposez les jeux de ressort et guide de ressort 5.

(4) Tirez délicatement le tiroir 3 hors du logement du distributeur.

Clapets de commande de pression électromagnétique proportionnels ② , ③

(1) Dévissez et déposez les boulons à tête creuse 1, puis déposez l'électrovanne 2.

(2) Déposez l'ensemble du clapet 3 et le ressort. Le manchon 4 et le tiroir 5 ont été adaptés de manière sélective l'un à l'autre. La combinaison ne peut pas être modifiée.

Clapet anti-retour de retenue de charge ④

Dévissez et déposez le bouchon à tête creuse 1, puis déposez le clapet 2 et le ressort.

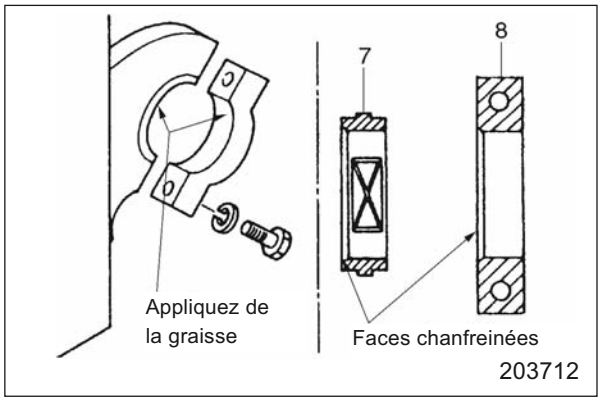
Poids des principaux composants [mât Simplex, hauteur de levage de 3,0 m]

Unité: kg

Modèles de mât / Elément	4V40A	4V45A	4V50A
Mât extérieur	340	380	380
Mât intérieur	220	260	260
Support de levage (dosseret inclus)	260	265	310
Fourches (deux), standard	180	180	260
Vérin de levage (deux)	80	90	90
Total (autres pièces incluses)	1.080	1.190	1.320

Pose

Suivez la procédure de dépose dans l'ordre inverse ainsi que les instructions ci-après:



1. Procédure de fixation des douilles de support du mât 7 et des bouchons 6.
   (1) Appliquez de la graisse sur les surfaces intérieures des bouchons et des douilles de support du mât.
   (2) Installez les douilles de support du mât 7 et les bouchons 6, en veillant à orienter vers le centre du chariot les côtés de la plus grande face chanfreinée.
   (3) Veillez à serrer fermement les boulons de serrage du support.

Unité: N·m (kgf·m)

Modèles de mât / Elément	4V40A à 4V50A
Couple de serrage du boulon	290 (29,6)

2. Réglez la tension de la chaîne. (Consultez la section relative au réglage de la tension de la chaîne, à la page 11-27.)
3. Purge de l'air des vérins de levage

   Mettez le moteur en marche. Levez et abaissez le support de levage sur toute sa course à plusieurs reprises pour purger le vérin.
4. Une fois le bon fonctionnement confirmé, contrôlez le niveau d'huile.

2. Contrôle du jeu droite-gauche sur les galets principaux du support de levage et les galets latéraux

(1) Levez le mât jusqu'en haut.

(2) Montez un comparateur à cadran sur le mât intérieur en reposant son point de contact sur le côté du support de levage.

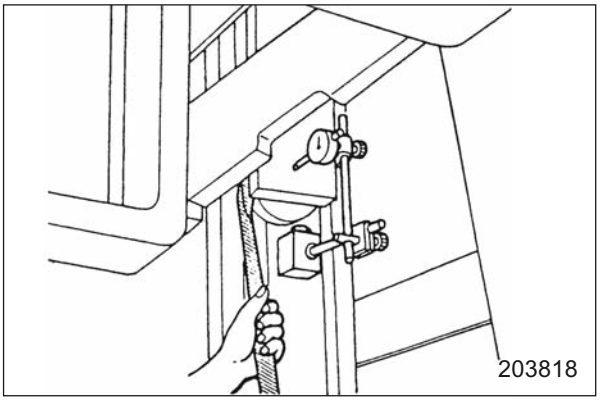
(3) Allez du côté opposé du mât et poussez le support de levage vers un côté à l'aide d'une barre. Réglez le comparateur sur zéro.

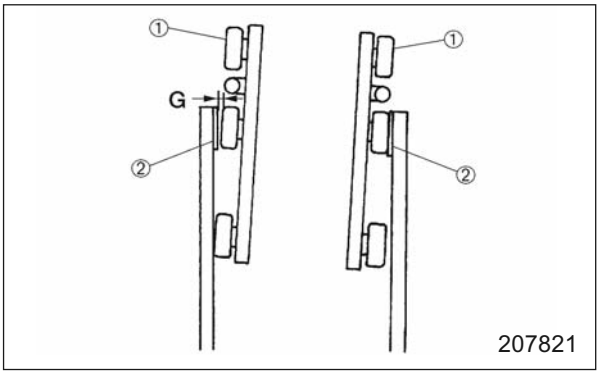
(4) Insérez une barre entre le mât intérieur et le support de levage, sur le côté du comparateur, puis poussez le support de levage vers le côté opposé.

(5) Relevez la mesure du comparateur.

Cette valeur est le jeu G entre le galet intermédiaire et la plaque de butée ②.

(6) Si le jeu G n'est pas compris dans la spécification, ajoutez des cales au siège du galet pour obtenir le jeu correct. Déposez le support de levage du mât et réglez l'épaisseur des cales pour les galets. Pour plus d'informations sur les procédures de pose et de réglage, consultez la section « Pose des galets du support de levage », à la page 11-20.

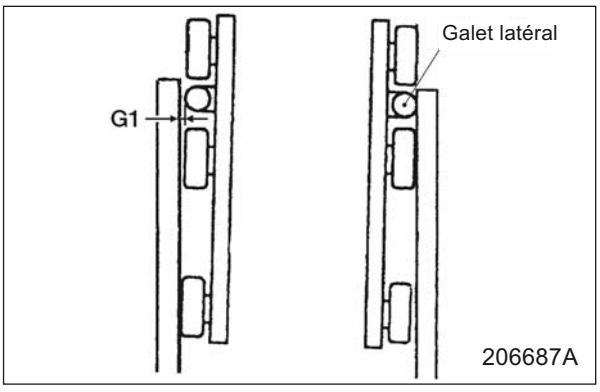




① Galet supérieur ② Plaque de butée

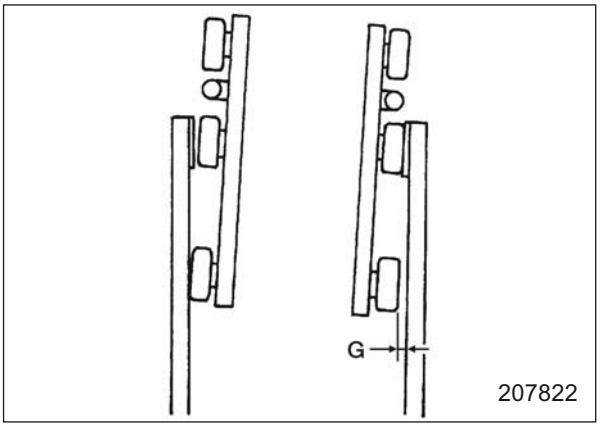
(7) Abaissez légèrement le support de levage depuis le haut, puis contrôlez le jeu G1 entre le galet latéral.

Si le jeu G1 n'est pas compris dans la spécification, ajoutez des cales au siège du support du galet pour obtenir le jeu correct. Déposez le support de levage du mât et réglez l'épaisseur des cales. Pour plus d'informations sur les procédures de pose et de réglage, consultez la section « Pose des galets du support de levage », à la page 11-19.



(8) Quand le support de levage est en haut, contrôlez le jeu G.

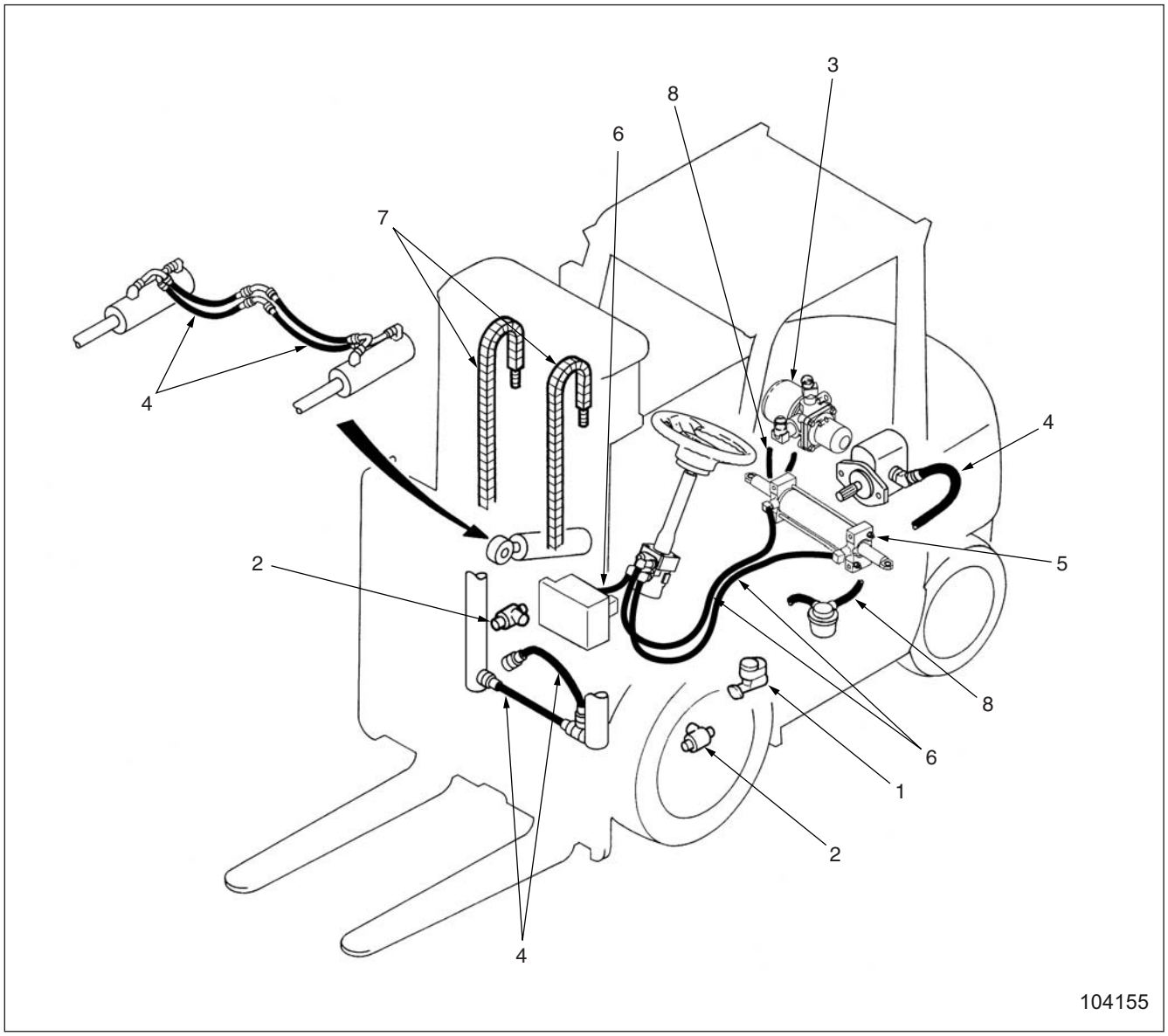
Si le jeu G n'est pas compris dans la spécification, ajoutez des cales au siège du galet pour obtenir le jeu correct. Déposez le support de levage du mât et réglez l'épaisseur des cales pour les galets. Pour plus d'informations sur les procédures de pose et de réglage, consultez la section « Pose des galets du support de levage », à la page 11-19.

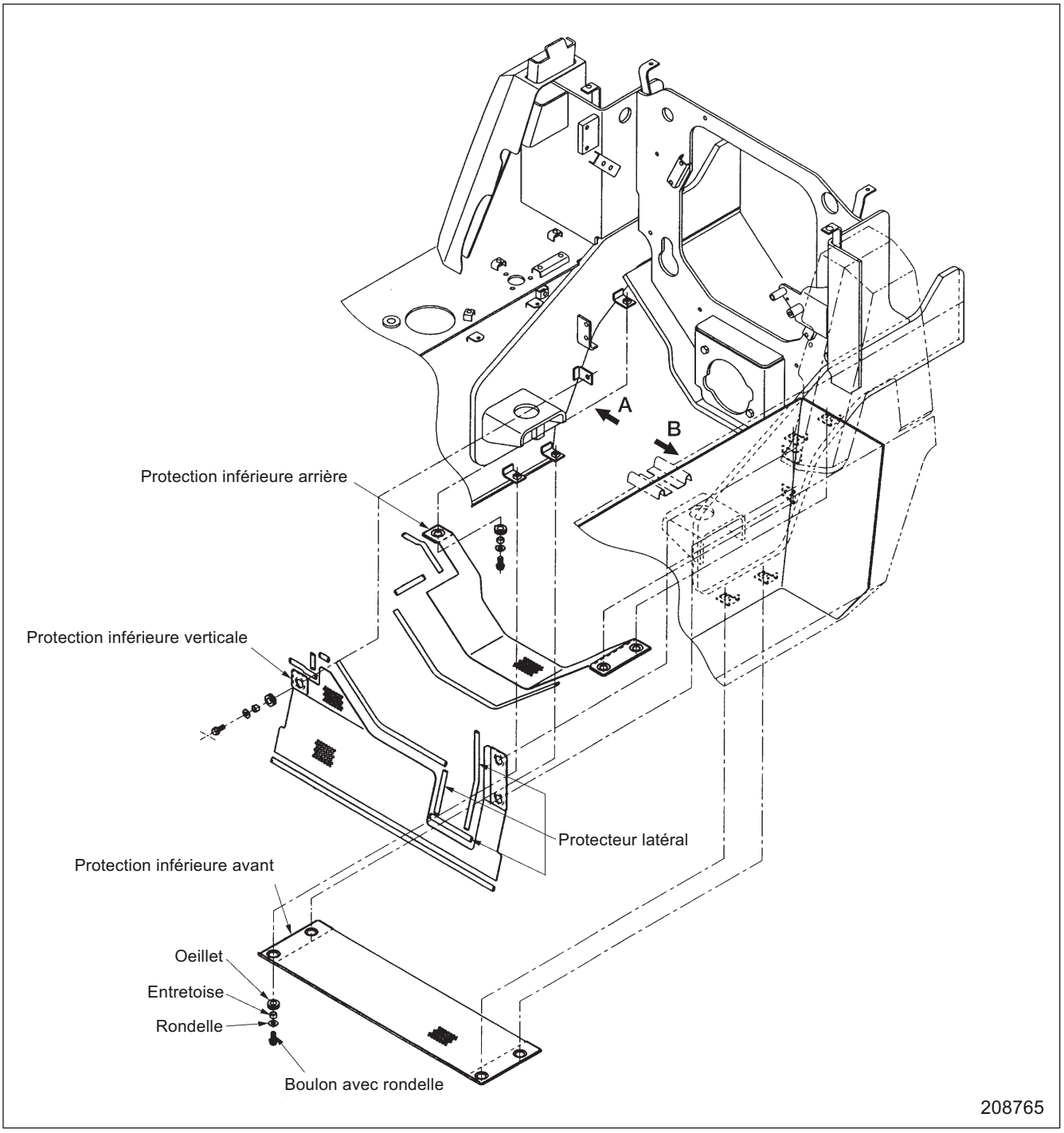


REMARQUE

Les galets principaux inférieurs possèdent la même construction que les galets principaux intermédiaires.

Emplacement des pièces à remplacer périodiquement

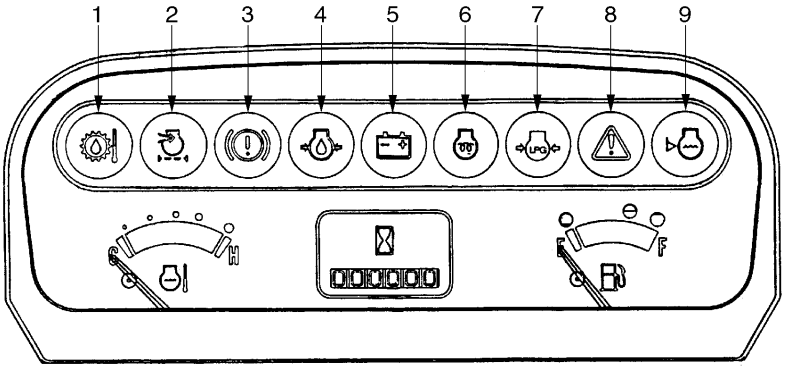



A
B
Protection inférieure arrière
Protection inférieure verticale
Protecteur latéral
Protection inférieure avant
Oeillet
Entretoise
Rondelle
Boulon avec rondelle
208765

Einheit: mm

Ref. Nr.	Punkt / Gabelstaplermodell		GP40K DP40K	GP40KL DP40KL	GP45K DP45K	GP50K DP50K
A	Maximaler Hub		3.300			
B	Freier Hub		150			160
C	Gabelspannweite (außen)		300 bis 1.190			
D	Gabellänge		1.220			
E	Neigewinkel (vorwärts – rückwärts)		6° – 10°			
F	Gesamtlänge		4.290	4.340	4.395	4.525
G	Gesamtbreite (über Reifen)	Einzelreifen	1.415	1.460		
		Doppelreifen	1.780			1.965
H	Gesamthöhe (bis zur Spitze des abgesenkten Hubgerüsts)		2.320		2.400	
I	Gesamthöhe (bis zur Spitze des abgesenkten Hubgerüstes)		2.250			
J	Gesamthöhe (ausgefahrenes Hubgerüst)		4.570			4.590
K	Spurweite (vorne)	Einzelreifen	1.175			
		Doppelreifen	1.445			
L	Profil (hinten)		1.180			
M	Radstand		2.000			2.150
N	Überhang vorne		557		562	582
O	Überhang hinten		513	563	613	573
P	Bodenfreiheit (am Rahmen)		252			

OK-Monitor



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Funktion

Nr.	Anzeigelampe	OFF	Ein oder blinkt	Bemerkungen
1	Öltemperaturanzeigelampe für Lastschaltgetriebe	Normal	Überhitzung	
2	Anzeigelampe für Luftfilterelement	Normal	Verstopft	Option
3	Bremsflüssigkeitsstandanzeige	Normal	Niedrig	
4	Motoröldruck-Warnleuchte	Normal	Niedrig	
5	Warnleuchte, wenn die Lichtmaschine nicht auflädt	Normal	Nicht ordnungsgemäß	
6	Glühkerzenanzeige	Normal		Dieselmotor Modelle
7	Warnlampe Flüssiggasrestdruck	Normal	Wasser ablassen	Option
8	Systemanzeigeleuchte	Normal	Nicht ordnungsgemäß	FC-Modelle
9	Bremsflüssigkeitsstandanzeige	Normal	Niedrig	Option

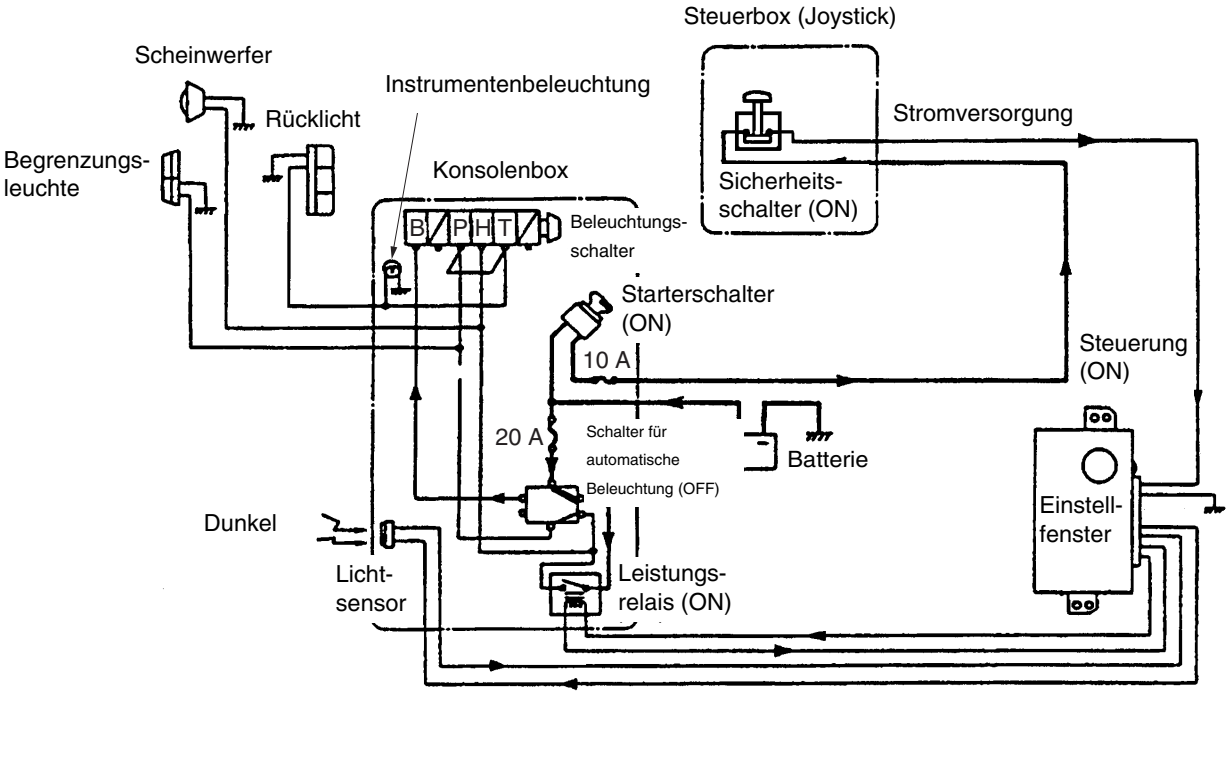
Überprüfung der Glühlampen der Anzeigeleuchten

Die Lampen sind in Ordnung, wenn die Anzeigelampen aufleuchten, sobald der Schlüsselschalter in die Stellung I (ON) gedreht wird. (Die Anzeigelampen erlöschen, sobald der Motor anspringt.)

Gabelstaplermodell	Anzeigeleuchte Nr.
MC-Modell mit Dieselmotor	**1, 2, 3, 4, 5, 6**
MC-Modell mit Flüssiggasmotor	**1, 2, 3, 4, 5**
FC-Modell mit Dieselmotor	**1, 2, 3, 4, 5, 6, 8**
FC-Modell mit Flüssiggasmotor	**1, 3, 4, 5, 8**

(3) Wenn der Schalter für automatische Beleuchtung abgeschaltet ist, kann der Beleuchtungsschalter zum Einschalten einer Leuchte verwendet werden, die durch die Position dieses Schalters gewählt wird. Auch in diesem Zustand schaltet das Leistungsrelais sich abhängig von Veränderungen der Helligkeit in der Umgebung ein oder aus, dies hat jedoch keinen Einfluss auf die mit dem Beleuchtungsschalter eingeschaltete Leuchte. Mit ausgeschaltetem Schalter für automatische Beleuchtung, Anlasserschalter I (ON) und Sicherheitsschalter ON.

Mit ausgeschaltetem Schalter für automatische Beleuchtung, Anlasserschalter I (ON) und Sicherheitsschalter ON



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Funktion-2

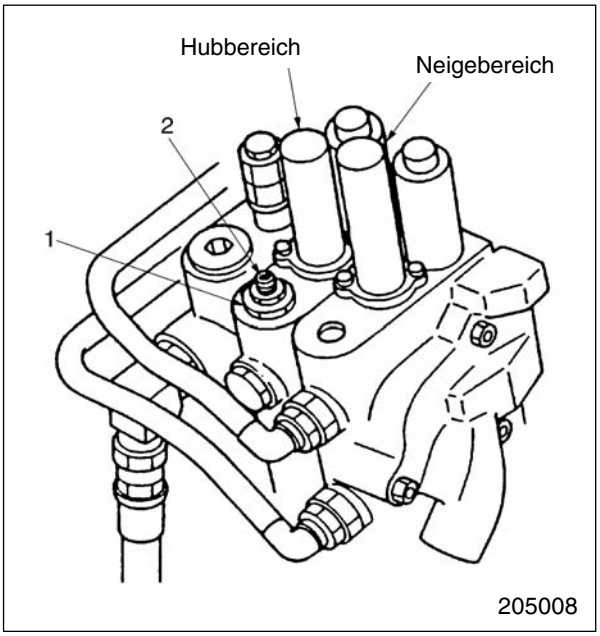
4. Bewegen des Hubgerüsts im Notfall

Fällt der Gabelstapler während der Arbeit aus und muss er an einen anderen Ort oder in die Werkstatt gefahren (wenn der Motor intakt ist) oder abgeschleppt werden, verfahren Sie wie folgt:

(1) Absenken des Hubgerüstes

(a) Die Kontermutter **1** am Hubbereich des Steuerventils lösen.

(b) Mit einem Innensechskantschlüssel die Schraube **2** langsam lösen. Hierdurch senkt sich das Hubgerüst aufgrund der Schwerkraft: wenn die Schraube **2** angezogen wird, kommt das Hubgerüst zum Stillstand.



⚠ VORSICHT

Vor dem Durchführen dieser Schritte sicherstellen, dass sich niemand unter dem Hubgerüst befindet.

(c) Die Kontermutter **1** anziehen.

⚠ VORSICHT

Es ist gefährlich, Mutter 1 gelöst zu lassen: das Hubgerüst könnte sich plötzlich senken.

(2) Heben, Neigen oder Hilfsfunktion

⚠ VORSICHT

Die Schritte (a) bis (i) unten sind bei folgenden Aktionen gefährlich:

Maßnahme	Bemerkungen
Senken des Hubgerüsts	Hubgerüst fällt ungebremst nach unten.
Kippen von Scharniergabel (oder Schaufel) Kippen der Kippgabel (oder Schaufel)	Ruckartiges Kippen. (Die Last fällt herunter.)
Lösen einer festgeklemmten Last	Die Last fällt herunter.

Beginnen mit:

(1) Kühlmittel aus dem Kühler ablaufen lassen.

(2) Das Massekabel von der Batterie trennen.

Vorschläge für den Ausbau

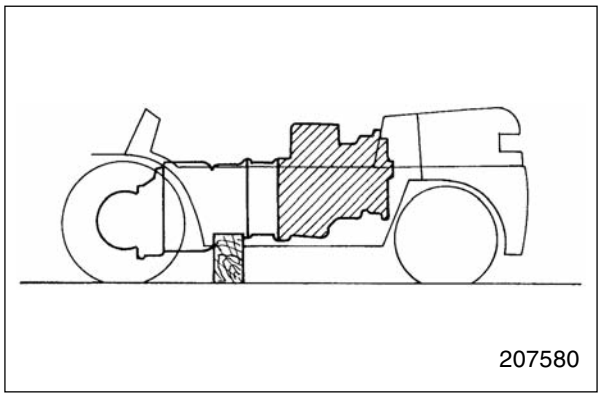
(1) Für den Ausbau der folgenden Teile verweisen wir auf den vorherigen Abschnitt “Ausbau von Motor und Antriebsstrang als montierte Einheit”.

   (a) Kabelbäume

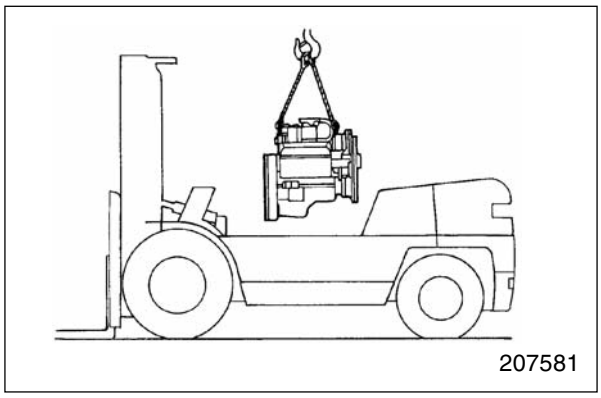
   (b) Universalgelenk

(2) Ausbau des Motors

   (a) Einen Holzklotz unter das Getriebegehäuse stellen. Dieser Schritt ist erforderlich, weil die hinteren Stützen des Getriebes (Beine) ausgebaut werden.



   (b) Den Motor vorsichtig vom Rahmen heben und darauf achten, dass er nicht gegen andere Teile stößt.



9. Kupplungswelle, Gegenwellen und Abtriebswelle

(1) Schiebekeile auf Verschleiß oder Beschädigung überprüfen.

(2) Ölbohrungen auf Verstopfung überprüfen.

10. Zahnräder

Jedes Zahnrad auf Verschleiß der Zähne oder Keile überprüfen.

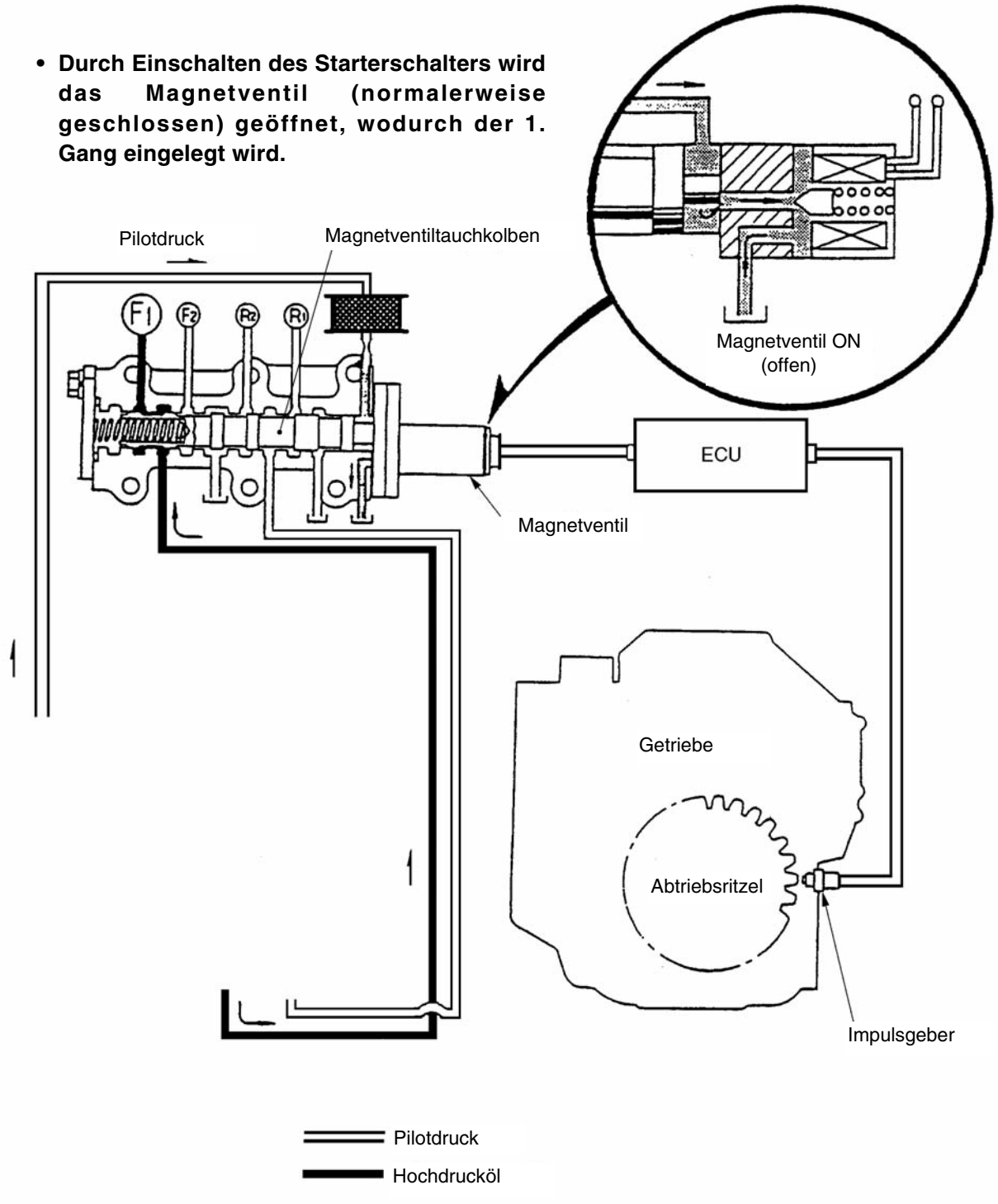
11. Siebbaugruppe

Zerlegen und reinigen. Schadhaften Filter austauschen.

Hydraulikssteuerung (vorwärts 1. Gang)

Vorwärts 1. Gang [unter 9 km/h]

- **Durch Einschalten des Starterschalters wird das Magnetventil (normalerweise geschlossen) geöffnet, wodurch der 1. Gang eingelegt wird.**



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Öl leckt

- Leckende Öldichtungen — Lippen und Gleit-flächen auf Verschleiß überprüfen. Dichtungen austauschen.
- Leckender Anschluss am Gehäuse — Dichtung nachziehen oder austauschen.
- Leckender Leitungsverbinder oder Anschluss — Leitung, Dichtung und O-Ringe reparieren oder austauschen.
- Leckender Ablassstopfen — Nachziehen oder Dichtung austauschen.
- Risse oder Randblasen am Gehäuse — Austauschen.
- Öl wird aus Getriebegehäuse geblasen
  - Wasser in Öl — Ölwechsel.
  - An der Ansaugseite wird Luft angesaugt — Dichtung austauschen und nachziehen.
  - Öl leckt aus Entlüfter — Reparieren.
- Ölstand zu hoch — Ölstand absenken.

Öltemperatur zu hoch

- Drehmoment-wandler
  - Ölstand zu hoch oder zu niedrig — Für korrekten Ölstand sorgen.
  - Ölsieb verstopft — Reinigen oder austauschen.
  - Reibende Kanten der Laufelemente — Reparieren oder austauschen.
  - Stator-Freilauf fehlerhaft — Statorgruppe austauschen.
  - Luft wird angesaugt — Dichtung nachziehen austauschen.
  - Wasser in Öl — Ölwechsel.
  - Verstopfung in Ölleitung (dadurch reduzierte Zirkulation) — Reparieren oder austauschen.
  - Lager verschlissen oder festgefressen — Reparieren oder austauschen.
  - Instrumente außer Betrieb — Austauschen.
- Getriebe
  - Kupplungen schleifen — Kupplungsplatte austauschen.
  - Lager verschlissen oder festgefressen — Reparieren oder austauschen.
  - Steuerungsgestänge fehlerhaft — Reparieren oder austauschen.
- Sonstiges
  - Gabelstapler wird nicht ordnungsgemäß betrieben — Dem Benutzer empfehlen, den Gabelstapler sachgemäß zu fahren.
  - Sonstiges
    - Kühllüfterriemen beschädigt — Austauschen.
    - Ölkühler verstopft — Reinigen oder austauschen.
    - Bremsen rupfen — Prüfen und neu einstellen.

Hauptdruck zu hoch

- Hauptreglerventil fehlerhaft — Ventilbaugruppe reparieren oder austauschen.
- Ölviskosität zu hoch da Temperatur zu niedrig — Ölwechsel.
- Verkehrte Ölsorte verwendet — Ölwechsel.

Vorschläge für den Zusammenbau

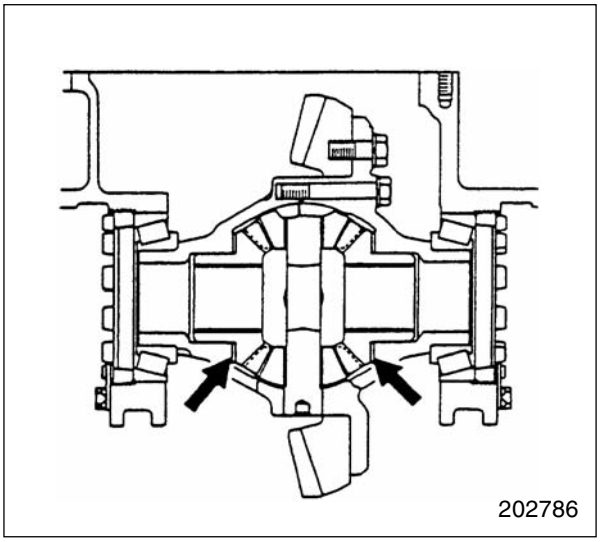
1. Einbau der Differentialkegelritzel

Die Druckscheiben des Kegelrades dienen zur Einstellung des Spiels zwischen Kegelrädern und Ritzeln. Das Spiel messen und, wenn es die Wartungsgrenze überschreitet, die Druckscheiben austauschen.

A : Standardwert B: Reparatur- oder Servicegrenzwert

Einheit: mm

Differentialkegelrad Spiel	A	0,20 bis 0,40
	B	0,6

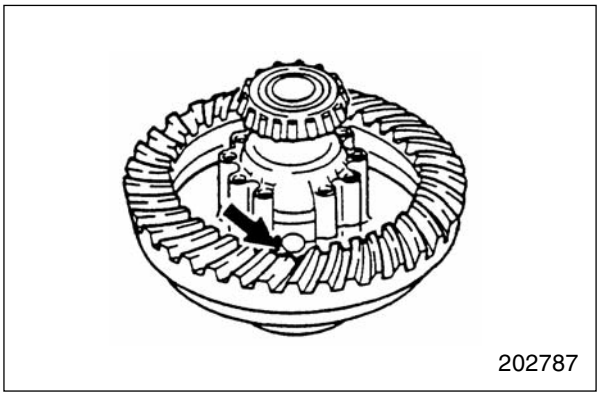


2. Einbauen des Differentialgehäuses

(1) Die rechte und linke Gehäusehälfte unter Ausrichtung der Markierungen zusammensetzen.

(2) "LOCTITE 271" auf die Gewinde der Schrauben auftragen und die Schrauben gleichmäßig anziehen, um eine freie Zahnradbewegung zu gewährleisten.

Gabelstapler-modell / Element	GP45K DP40K bis DP45K	GP40K, GP40KL, GP50K DP50K
Anzugsmoment für Zahnrad-schrauben	304 Nm (31 kpm)	441 Nm (45 kpm)

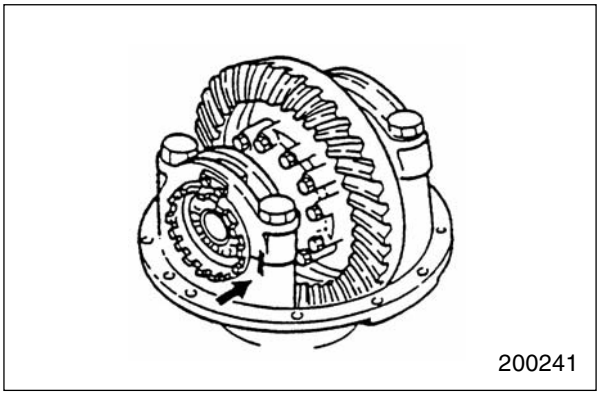


3. Einbauen der Differentialgehäuse

(1) Nach Positionierung der Gehäusebaugruppe auf dem Träger die Lagerdeckel provisorisch anbringen, indem Sie die Kopfschraube handfest anziehen. Die Deckel müssen fest angezogen werden, nachdem die Vorspannung der Lager eingestellt wurde.

(2) Zwischen dem rechten und linken Deckel unterscheiden und jeden Deckel korrekt unter Bezugnahme auf die Markierungen positionieren.

Anzugsmoment für Lager-deckelschrauben	446 ± 44 Nm (45,5 ± 4,5 kpm)



Fehlerbehebung

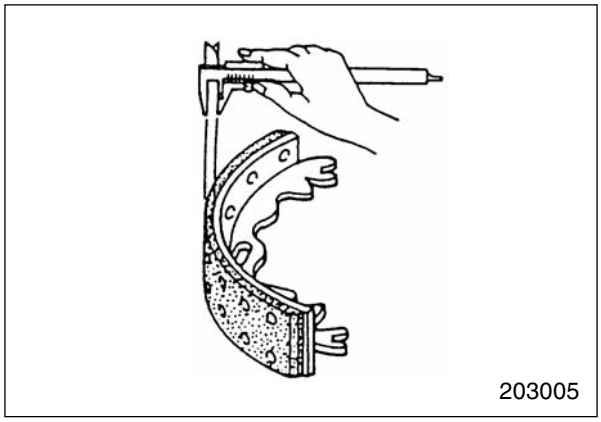
Schwergängige Lenkung	Unzureichende Schmiermittelmenge in Hinterachse oder Lenkteilen	— Fett einfüllen.
	Fehlerhaftes Lenksystem	— Siehe Abschnitt “Fehlerbehebung” unter “GRUPPE 9 LEN-SYSTEM”, sowie Inspektion oder Reparatur.
Langsame Rückwärtsdrehung des Lenkrades	Zu stark angezogenes Lenksystem oder Hinterachsteile	— Mit dem vorgeschriebenen Anzugsmoment nachziehen.
Lenkrad neigt zum Drehen nach einer Seite	Abstand im externen Durchmesser zwischen den rechten und linken Reifen	— Durch Originalreifen ersetzen.
Lenkrad flattert	Verschleiß oder Bruch der Kegelrollenlager	— Lager austauschen.
	Fehlerhaftes Lenksystem	— Siehe unter “GRUPPE 9 LENKSYSTEM”, sowie Inspektion oder Reparatur.
Ungleichmäßiger oder vorzeitiger Verschleiß der Hinterreifen	Schlechte Ausrichtung der Räder	— Räder neu ausrichten.
	Unterschiedliche Reifentypen für rechte und linke Räder	— Durch Originalreifen ersetzen.

(3) Die Dicke des Belages überprüfen und ihn austauschen, wenn er über den Servicegrenzwert hinaus verschlissen ist.

A : Standardwert B: Reparatur- oder Servicegrenzwert

Einheit: mm

Element \ Gabelstapler-modell		GP40K, GP40KL DP40K, DP40KL	GP45K, GP50K DP45K, DP50K
Dicke des Belags	A	5,62	10
	B	3 Maximum	4,2 Maximum



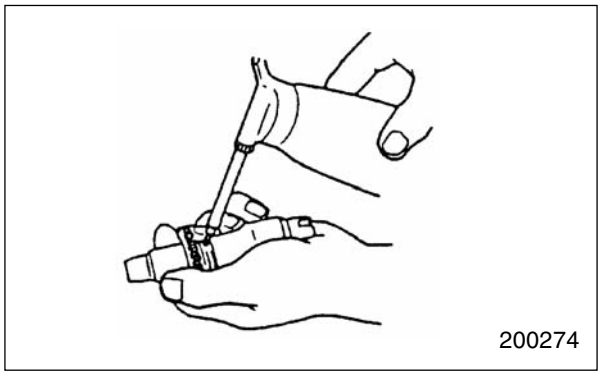
3. Bremstrommeln

Die Innenfläche auf Riefen oder abnormalen Verschleiß überprüfen. Eine geriefte oder auf andere Weise schadhafte Trommel durch Schleifen reparieren, sofern der Servicegrenzwert des Innendurchmessers nicht überschritten wird.

A : Standardwert B: Reparatur- oder Servicegrenzwert

Einheit: mm

Innendurchmesser der Bremstrommel	A	$317{,}5\ ^{+0{,}2}_{0}$
	B	318,5



4. Stellschraube

Die Schraube von Hand drehen, um zu überprüfen, ob die rotierenden Teile sich gleichmäßig drehen.

5. Feststellbremsgestänge

(1) Den Hebelhaltestift und die Stiftbohrung auf Verschleiß überprüfen und bei starkem Verschleiß das Gestänge austauschen.

(2) Den Feststellbremszug ersetzen, falls er überdehnt, beschädigt oder verrostet ist.

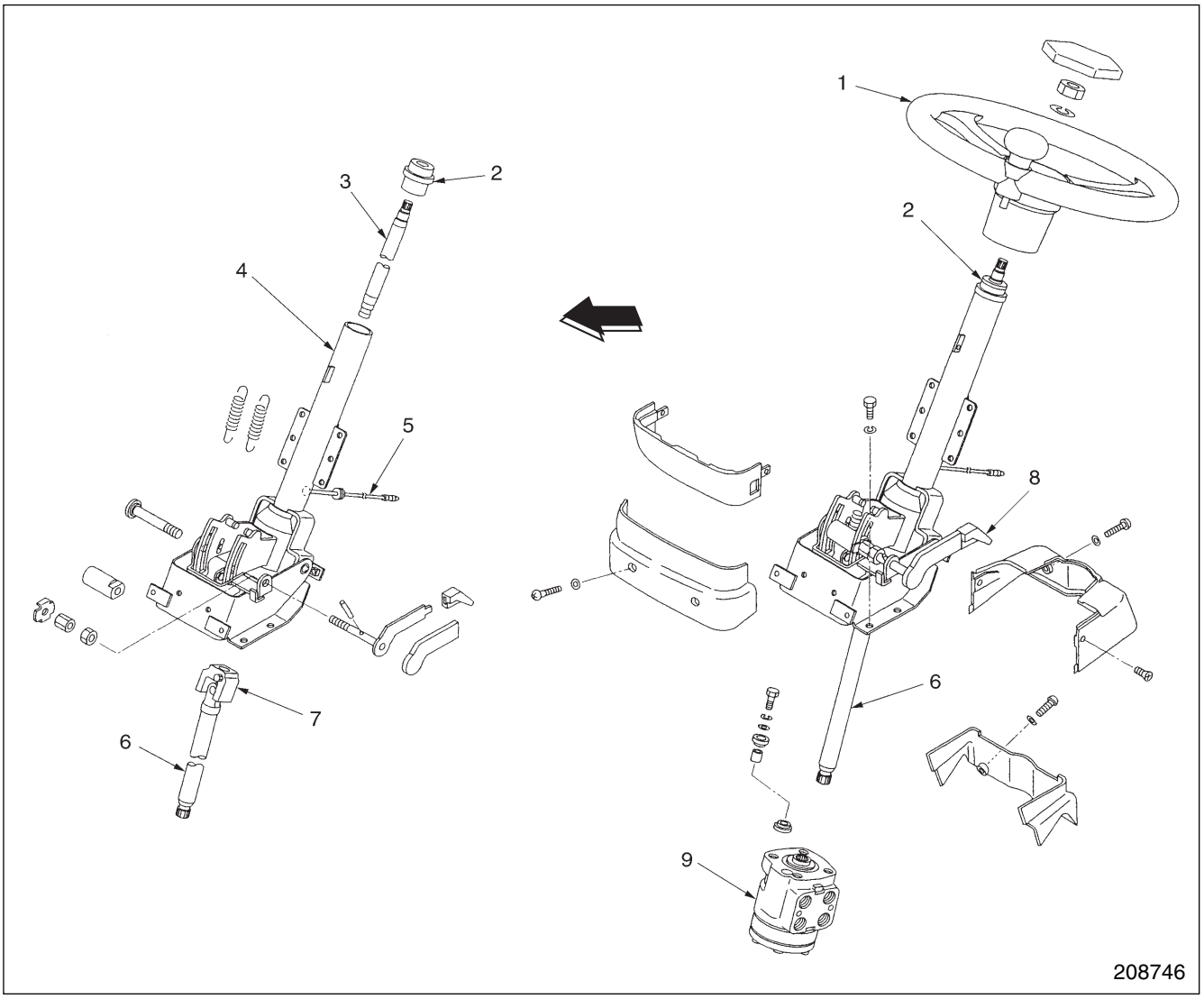
6. Andere Teile

(1) Die Rückholfedern der Bremsbacke auf Risse und Materialermüdung prüfen.

(2) Die Einstellfeder auf Risse und Materialermüdung prüfen.

(3) Überprüfen Sie den Einbauzug auf überdehnte oder gebrochene Litzen.

Verstellbare Lenksäule



1 Lenkrad
2 Säulenbuchse
3 Lenkwelle
4 Säulengehäuse
5 Hupenkabel
6 Antriebswelle
7 Universalgelenk
8 Knopf für Neigesperre
9 Lenkventil

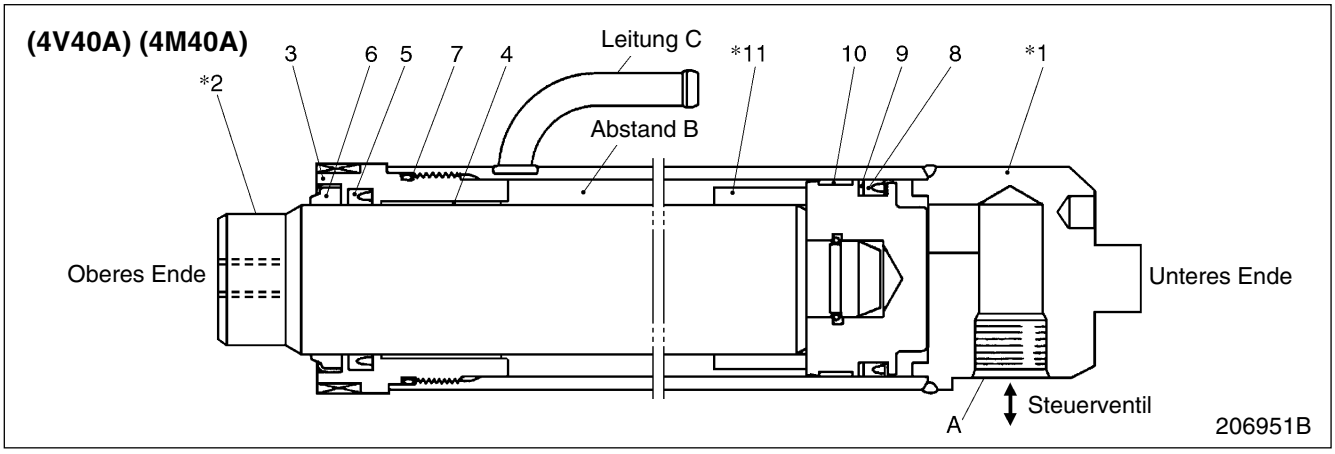
Die Zylinderbaugruppe der verstellbaren Lenksäule ist mit Schrauben am Armaturenbrett befestigt.

Lenkrad **1,** Lenkwelle **3**, Gelenk **7** (mit Universalgelenk) und Antriebswelle **6** des Lenkventils **9** sind mit einander verkeilt und rotieren als Einheit, wenn das Lenkrad gedreht wird.

Lenkwelle **3** und Antriebswelle **6** sind über das Universalgelenk **7** mit einander verbunden, sodass der Winkel zwischen ihnen verändert werden kann. Der Fahrer kann die gewünschte Fahrposition wählen, indem er das Lenkrad **1** vorwärts oder rückwärts bewegt, während er den Knopf **8** für die Neigesperre herunterdrückt. Der Neigungswinkel kann in einem Bereich von 6° von der Mitte aus nach vorne und hinten verändert werden.

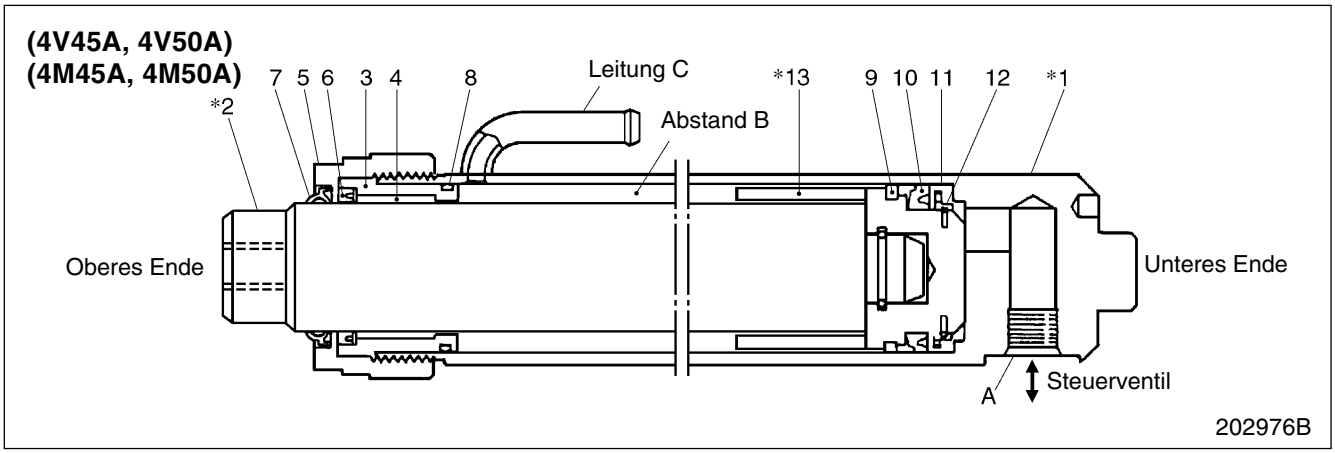
Hubzylinder

Hubzylinder Simplex-Hubgerüst und Zweiter Zylinder Triplex-Hubgerüst



Hauptkomponenten

*1	Zylinderrohrbaugruppe	5	U-Ring	9	Stützring
*2	Kolbenstangengruppe	6	Wischerring	10	Buchse
3	Zylinderkopf	7	O-Ring	*11	Distanzstück
4	Buchse	8	U-Ring	A:	Einlass- und Auslassöffnung



Hauptkomponenten

*1	Zylinderrohrbaugruppe	6	U-Ring	11	U-Ring-Halter
*2	Kolbenstangengruppe	7	Wischerring	12	Anschlag
3	Zylinderkopf	8	O-Ring	*13	Abstandshalter
4	Buchse	9	Kolbenring	A:	Einlass- und Auslassöffnung
5	Halterung	10	U-Ring-Baugruppe		

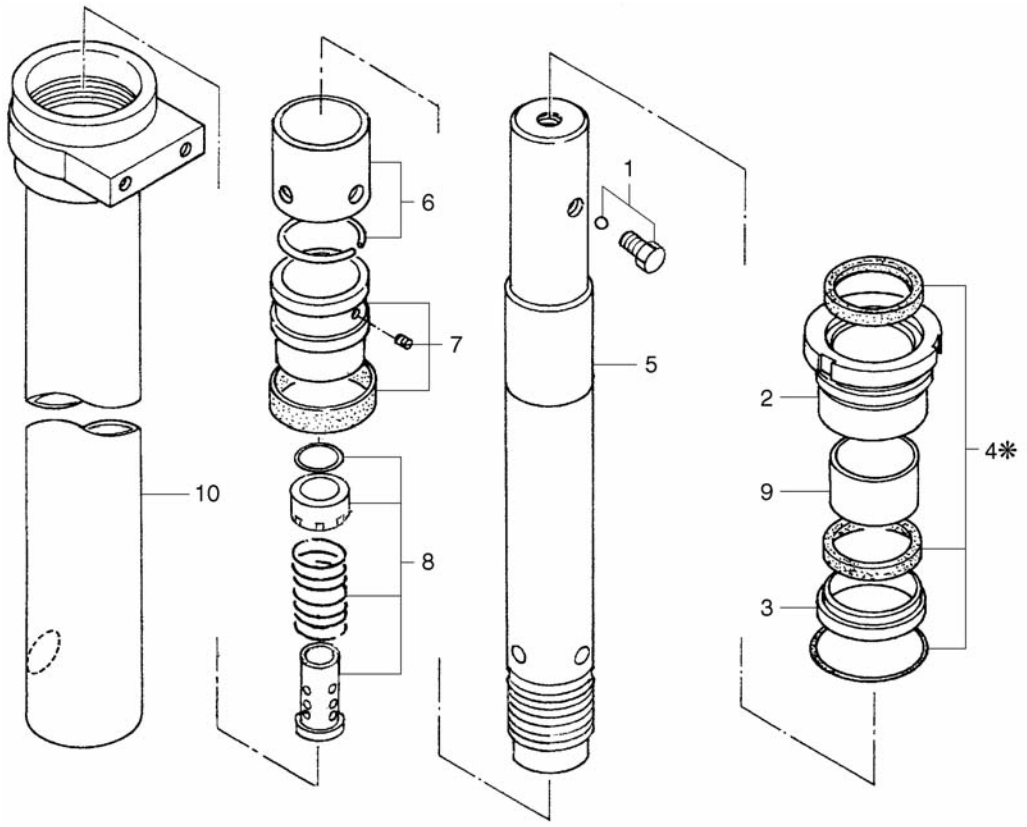
HINWEIS

Abmessungen der mit * markierten Teile variieren je nach den Spezifikationen (Hubhöhe).

Der Kanal **A1** des Hydraulikregelventils ist an den Kanal **A** des Hubzylinders angeschlossen. Wenn das Hydrauliksteuerventil Drucköl zum Kanal **A** gelangen lässt, hebt sich die Kolbenstangenbaugruppe **2** im Hubzylinder, während Öl und Luft aus Kammer **B** in die Rücklaufleitung durch Leitung **C** gelangen.

Wenn sich der Kolben nach unten bewegt, wird das Öl durch Kanal **A** abgelassen. In Kammer **B** entsteht nun ein Unterdruck. Ein Teil des Öls in der Rücklaufleitung wird durch den Unterdruck in die Kammer gesaugt und das Öl schützt Stange und Zylinderwände vor Rost.

Für Hubgerüst-Modell 4F45A, 4F50A



Reihenfolge

1 Ventil, Stahlkugel
2 Zylinderkopf
3 Abstandshalter
4 U-Ring, Wischerring, O-Ring
5 Kolbenstange
6 Distanzstück, Sprengring
7 Gleitring, Stellschraube, Kolben
8 Sprengring, Rückschlagventil, Feder, Pufferspule
9 Buchse
10 Zylinderrohr

HINWEIS

Buchse **9** kann nicht einzeln ersetzt werden. Wenn sie schadhaft ist, Zylinderkopf **2** durch einen Zylinderkopfsatz ersetzen.

HINWEIS

Mit einem Stern (*) gekennzeichnete Teile sind im Dichtungssatz enthalten.

Vorschläge für das Zerlegen

Ausbauen des Zylinderkopfs

Um den Zylinderkopf auszubauen, spannen Sie die Hubgerüstbefestigung des Zylinderrohrs in einen Schraubstock ein. Bauen Sie den Zylinderkopf unter Verwendung eines Schraubenschlüssels aus.

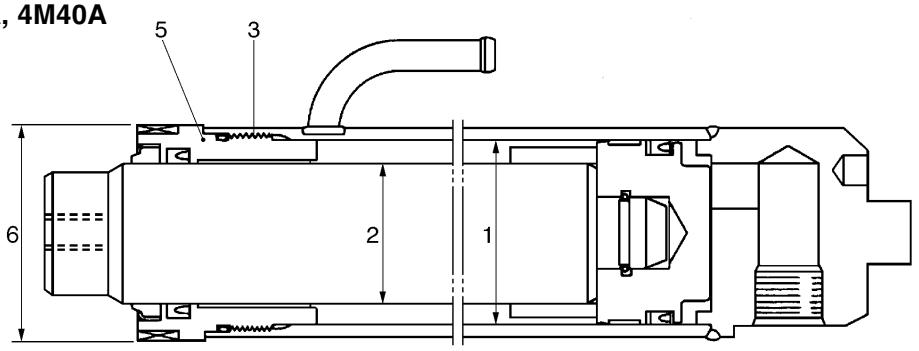
Benötigtes Spezialwerkzeug

Schraubenschlüssel	05312 - 10500

A : Standardwert
Einheit: mm

Element	Hubgerüsttyp		4V40A 4M40A	4V45A, 4V50A 4M45A, 4M50A
Simplex-Hubgerüst Hubzylinder und Triplex-Hubgerüst zweiter Hubzylinder	Innendurchmesser des Zylinderrohrs **1**	A	65	70
	Durchmesser der Kolbenstange **2**	A	50	50
	Gewindedurchmesser des Zylinderkopfs oder Halters **3**	A	M69 × 1,5	M79×2,0
	Schlüsselweite **4**	A	—	85
	Anzugsmoment von Halter oder Zylinderkopf **5** Nm (kpm)	A	343 ± 78 (35 ± 8)	422 ± 96 (43 ± 9,8)
	Durchmesser des Zylinderkopfes **6**	A	75	—

4V40A, 4M40A



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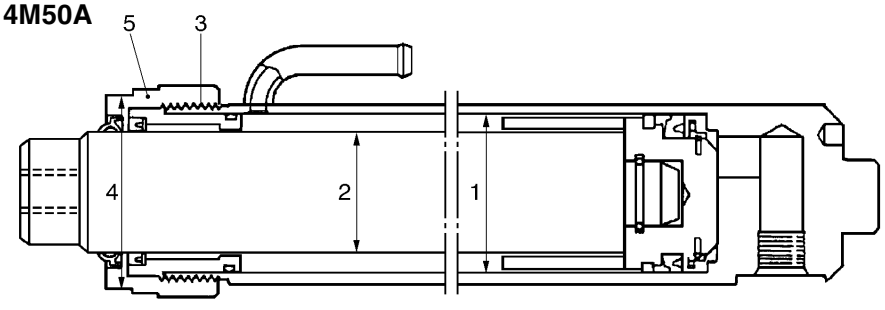
4V45A, 4V50A
4M45A, 4M50A



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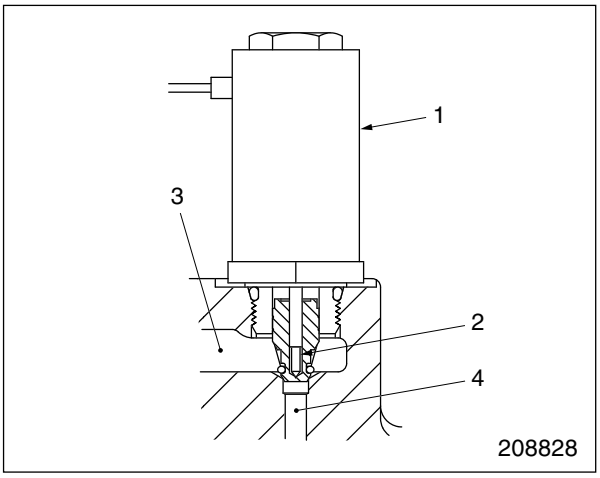
Entlastungsmagnetventile

Diese Ventile sind ON-OFF Magnetventile, die dem Lastdrucköl entweder erlauben, in die entsprechenden Ablassventile zu strömen oder es unterbrechen. Das Magnetventil für den Hub-Neige-Kreis ist in die Einlassventilbaugruppe eingegliedert und das für den Zusatzgerätkreis ist in die Blockbaugruppe eingegliedert.

Beide Magnetventile sind von ihrer Konstruktion her identisch wie rechts gezeigt. Wenn sich der Joystick in Neutralposition befindet, trägt das Magnetventil **1** keine Energie, sodass die Stange **2** in gehobener Position bleibt. Das Öl in Kanal **3** kann dann in Kanal **4** fließen, der zum Hydrauliktank führt.

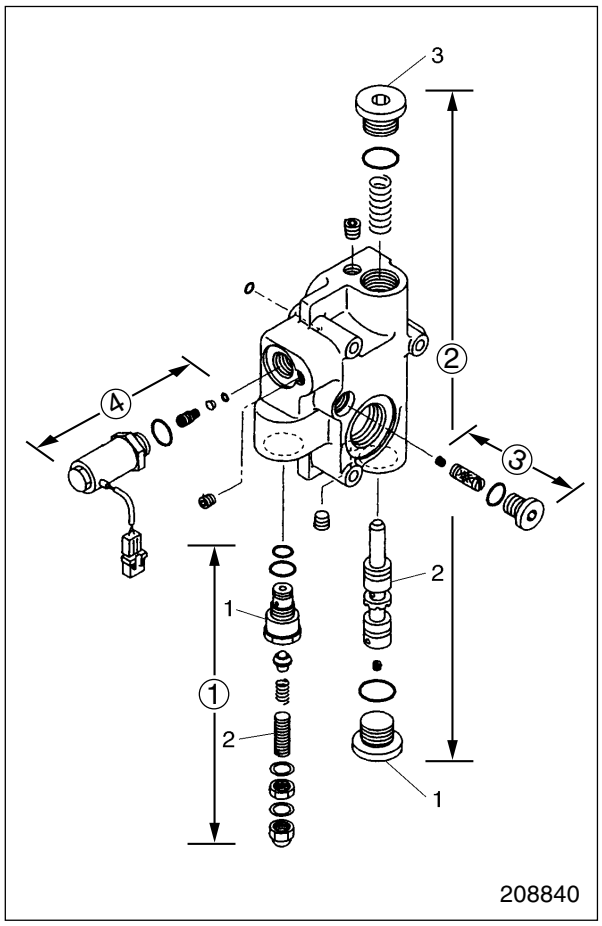
Wenn der Joystick in eine andere als die Neutralposition bewegt wird, wird der Magnet **1** mit Strom versorgt, sodass die Stange **2** nach unten bewegt wird, um Kanal **3** und **4** im Teller zu schließen. Das Lastdrucköl in Passage **3** wird dann aufgebaut.



Magnetventil

1 Magnetventil
2 Stange
3 Kanal für Lastdrucköl
4 Kanal zum Hydrauliktank

Blockbaugruppe



Zur Blockbaugruppe gehörende Ventile

① Überdruckventil für Anbaugerätekreislauf
② Ablassventil
③ Sieb
④ Entlastungsmagnetventil (SLB)

Vorschläge für das Zerlegen

Überdruckventil ①

Schrauben Sie das Ventilgehäuse **1** ab, um das Überdruckventil als Baugruppe auszubauen. Die Einstellschraube **2** sollte nur gelockert werden, wenn dies unbedingt erforderlich ist; dadurch wird die Druckeinstellung beeinflusst und es werden Neujustierungen notwendig.

Ablassventil ②

(1) Innensechskantstopfen **1** abschrauben und entfernen, dann Spulen **2** entfernen.

(2) Innensechskantstopfen **3** abschrauben und entfernen, dann die Feder entfernen.

Sieb ③

Innensechskantstopfen **1** abschrauben und entfernen, dann Sieb **2** durch Losschrauben vom Gehäuse entfernen. Zuletzt die Öffnung entfernen.

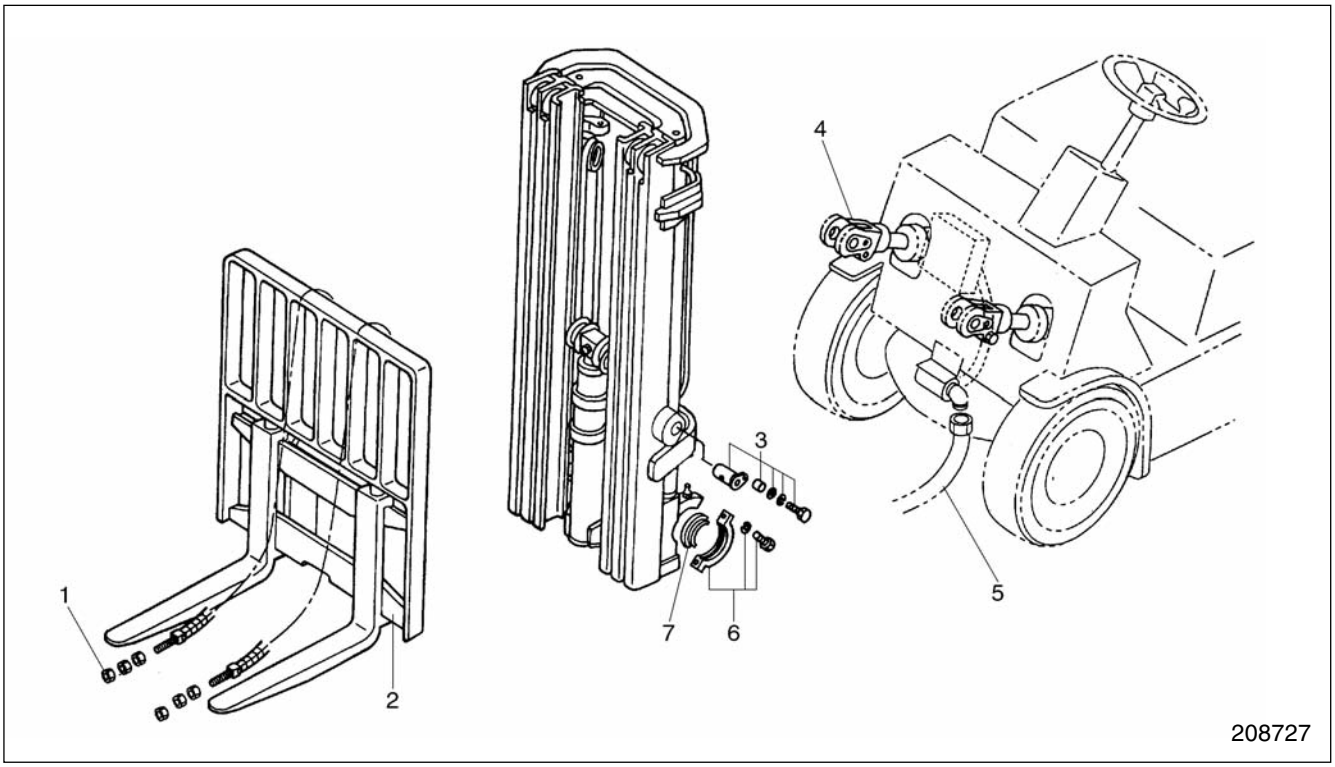
Entlastungsmagnetventil (SLB) ④

Schrauben Sie das Magnetventil selbst los, um es auszubauen.

Hubgerüst- und Hubhalterungsbaugruppe

Nachfolgend werden die Verfahren zum Aus- und Einbauen der Hubgerüstbaugruppe beschrieben. Beachten Sie, dass das Triplex-Hubgerüst als Beispiel verwendet wird.

Ausbau des Duplex-Hubgerüsts und Triplex-Hubgerüsts



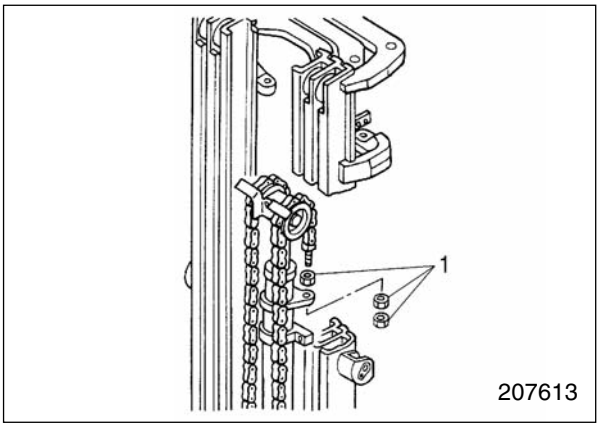
Reihenfolge

1 Muttern
2 Gabel, Hubhalterung, Lastgitter
3 Neigesockelstift, Schraube, Unterlegscheibe, Distanzstück
4 Neigezylinder
5 Hochdruckschlauch für Hubzylinder
6 Hubgerüstträgerlagerdeckel, Schraube, Unterlegscheibe
7 Hubgerüsthalterungsbuchse

Vorschläge für den Ausbau

1. Ausbau der Hubhalterung 2

(1) Die Hubhalterung **2** absenken und Holzklötze unter die Baugruppe legen. Das Hubgerüst vorwärts neigen, das innere Hubgerüst auf den Boden absenken, dann die Muttern **1** von den Ankerbolzen der ersten Hubketten lösen.



Prüfen des Abstandes für Hubgerüstrolle

HINWEIS

- Das Hubgerüstspiel an den unten gezeigten Stellen justieren.
  1. Simplex-Hubgerüst und Duplex-Hubgerüst: Hauptrollen zwischen äußerem Hubgerüst und innerem Hubgerüst
  2. Triplex-Hubgerüst: Hauptrollen zwischen äußerem Hubgerüst und mittlerem Hubgerüst und Hauptrollen zwischen mittlerem Hubgerüst und innerem Hubgerüst.
- Konstruktion siehe “Einbau der Hubgerüstrollen” auf Seite 11-21.

Unabhängig vom Hubgerüstmodell gleitet das innere Hubgerüst vom äußeren Hubgerüst aufwärts und abwärts. Die Hubgerüstrollen sorgen für reibungslose Bewegung und die Abstände an zwei Stellen müssen innerhalb der spezifizierten Bereiche liegen.

(1) Spiel **F** zwischen Hauptrollenperipherie und Hubgerüstdruckseite **a**

Einheit: mm

Abstand **F**	1,0 mm oder weniger

(2) Spiel **G** zwischen Hauptrollen-Seitenfläche und Hubgerüstkanalfläche **b**

Einheit: mm

Abstand **G**	0,1 bis 0,5

Die Abstände zwischen den Hubgerüstrollen und den Hubgerüstkanälen wie folgt überprüfen:

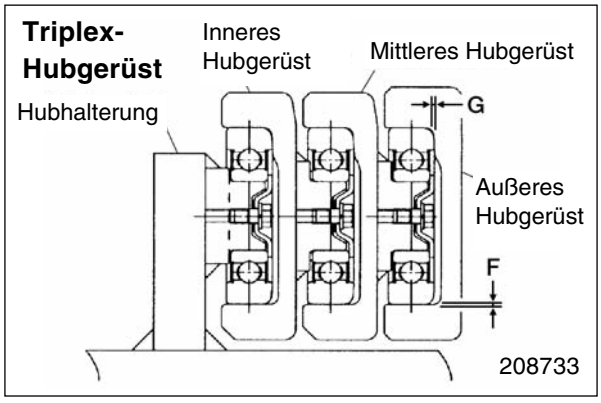
1. Prüfung des Axialspiels der Hubhalterungshauptrollen

(1) Das Hubgerüst vollständig nach hinten neigen.

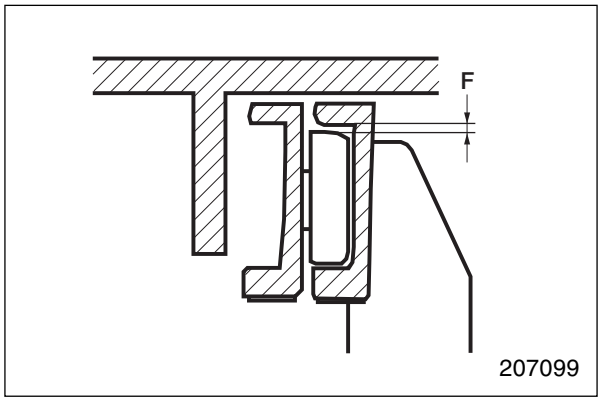
(2) Unter Verwendung einer Spaltlehre, den Abstand **F** zwischen der unteren Rolle des inneren Hubgerüsts und dem äußeren Hubgerüst messen.

(3) Wenn der Abstand **F** außerhalb der Spezifikation liegt, übergroße Rollen benutzen.

Verfahren zum Austausch und Einbau der Hubgerüstrollen siehe “Einbau der Hubgerüstrollen” auf Seite 11-21. Verfahren zum Ausbau der Hubgerüstrollen siehe “Ausbau der Hubgerüstrollen” auf Seite 11-33.

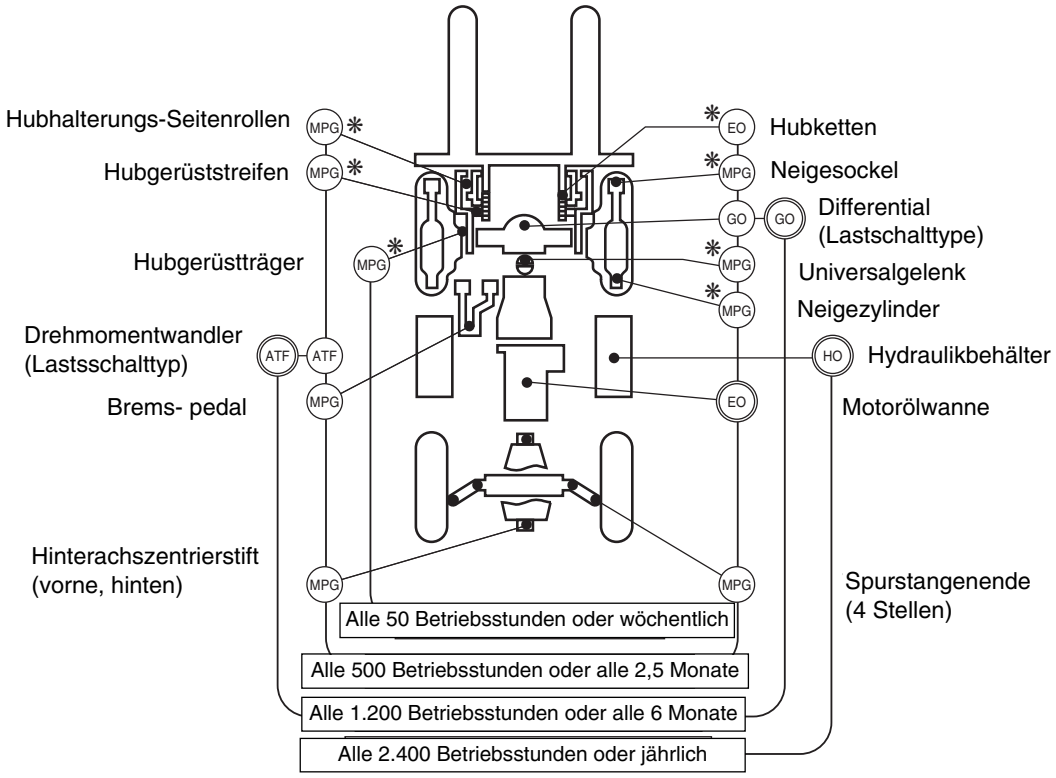


Hubhalterung, untere Rolle des mittleren Hubgerüsts und Rolle des inneren Hubgerüsts



Schmieranweisungen

Schmiertabelle



◯ Prüfen und nachfüllen

◎ Wechsel

* Schmierpunkt auf beiden Seiten

Schmierschlüssel:

ATF – Drehmomentwandleröl
MPG – Mehrzweckfett
GO – Getriebeöl
EO – Motoröl
BF – Bremsflüssigkeit
HO – Hydrauliköl

208819E

Drehmomentwandlerölfiltersatz

Bezeichnung

Dieser Satz verringert bei Gabelstaplern, die unter staubigen Bedingungen eingesetzt werden, die Menge schädlicher Fremdpartikel, die ins Getriebe eindringen.

Einbau

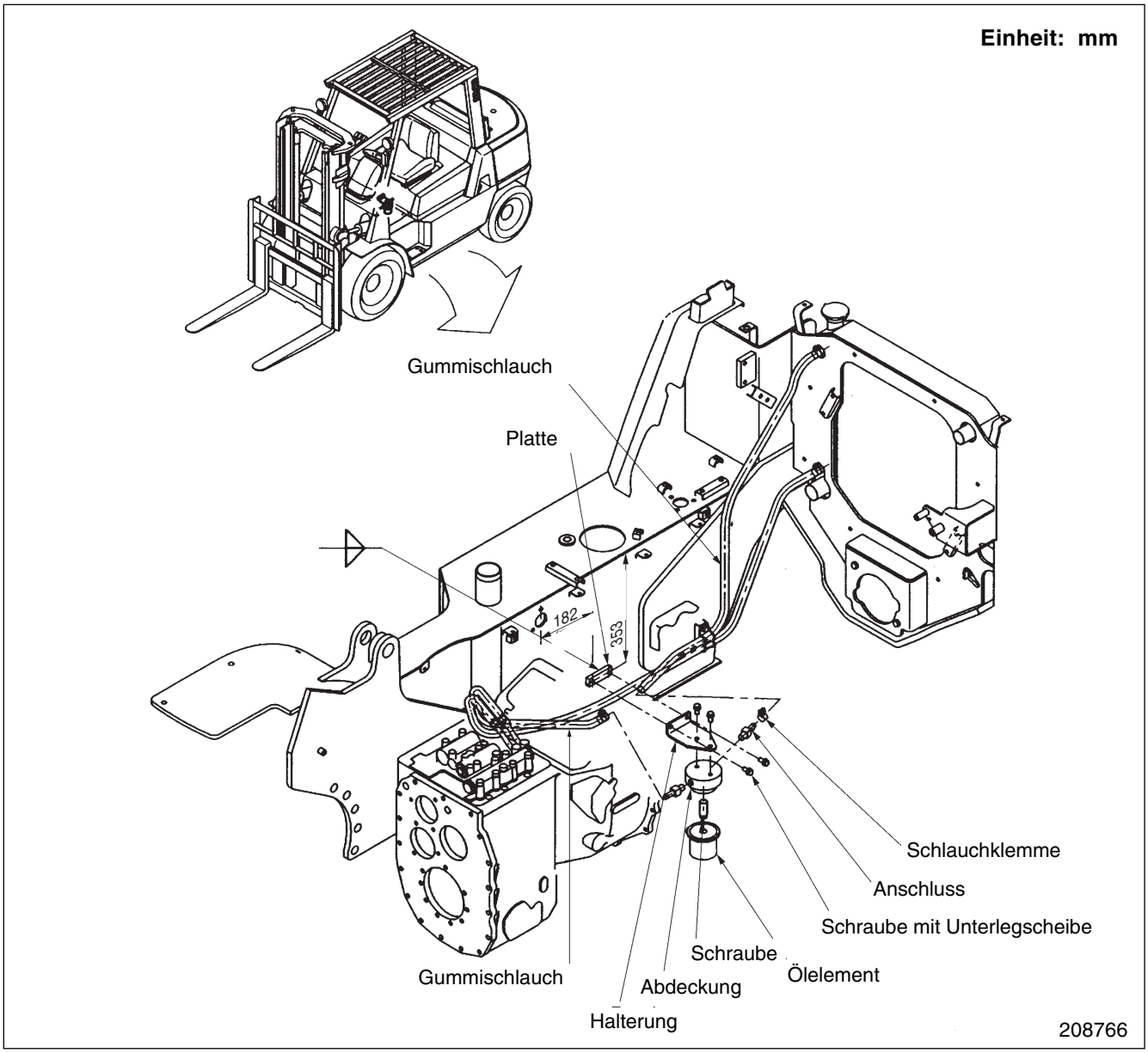
(1) Zwei Platten an den Rahmen schweißen. Siehe Zeichnung.

(2) Ölfilter an der Halterung anbringen und Halterung mit Schrauben am Rahmen befestigen.

(3) Schläuche anschließen.

Hinweis

Den Ölfilter in Abständen von maximal 1.200 Stunden austauschen.

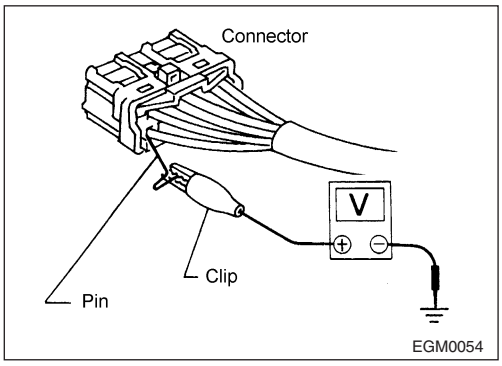


Connector Terminal Inspection

CONNECTOR INSPECTION PROCEDURE

In circuit inspection, inappropriate connector probing will cause connector damages and/or poor connection. The probes provided with the circuit tester may be too large to probe connector terminals without damaging them. Always use alligator clips and "T" pins according to the following procedure.

INSPECTION FROM HARNESS SIDE

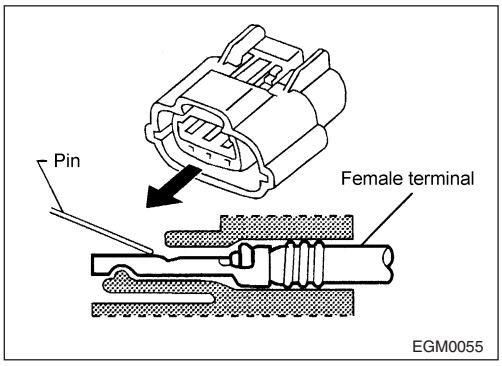


For a standard connector without any waterproofing, use "T" pins from the harness side.

CAUTION:

- **For a connector with a rear cover, such as ECM connectors, remove the rear cover before the inspection.**
- **For a waterproof connector, do not probe the terminals from the harness side. Doing so may damage the seal.**

INSPECTION FROM TERMINAL SIDE

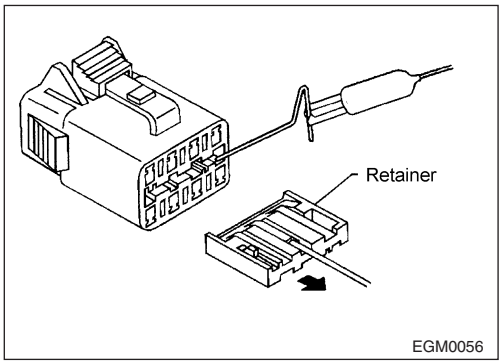


1. Female terminal

- Female connector terminals have a small notch difference inside. Insert a "T" pin along the step to inspect.

CAUTION:

- **Do not insert any objects to a female connector terminal other than the corresponding male connector terminal.**



- In case of a female connector terminal without any notches, remove the retainer before probing.

1. Warm up the engine sufficiently.
2. Release the fuel pressure. (Refer to EC section, “Release of fuel pressure.”)
3. Turn ignition switch OFF.
4. Disconnect air hose from throttle body and move it out of position.
5. Remove all spark plugs.

CAUTION:

- **Blow spark plug clean with compressed air when removing it.**

6. Install a rev counter or electronic system diagnosis tester (SST). (Refer to EC-11, “Inspection of idle speed, ignition timing, and air-fuel ratio” in EC section.)
7. Remove injector harness connector.
8. Attach an adapter to Allen compression gauge (commercial service tool) and set it to the engine.
9. Depress accelerator pedal fully. Turn ignition switch to “START” and crank the engine. Record the compression pressure and the engine speed after the gauge indication stabilizes. Repeat the measurement on each cylinder.

   Compression pressure kPa (bar, kg/cm^2, psi)/rpm

   Standard:

   1,187 (11.87, 12.1, 172)/200

   Repair limit:

   892 (8.92, 9.1, 129)/200

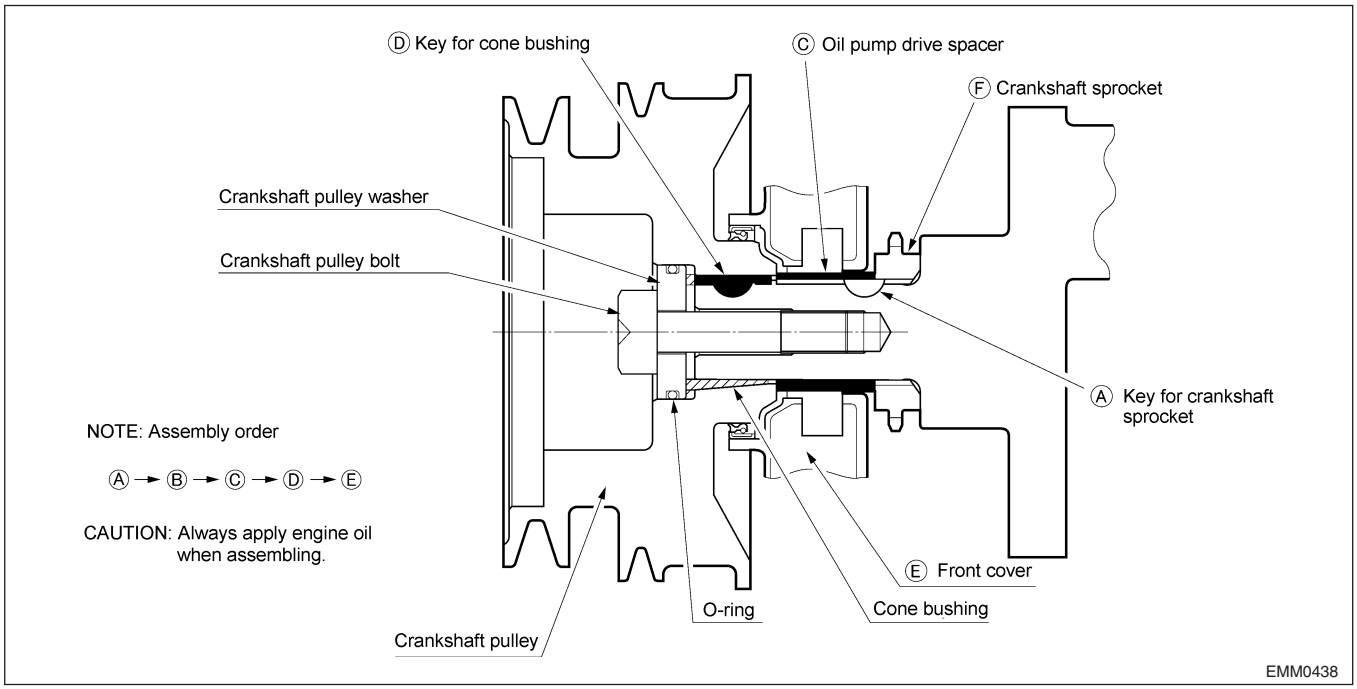
   Difference limit among cylinders:

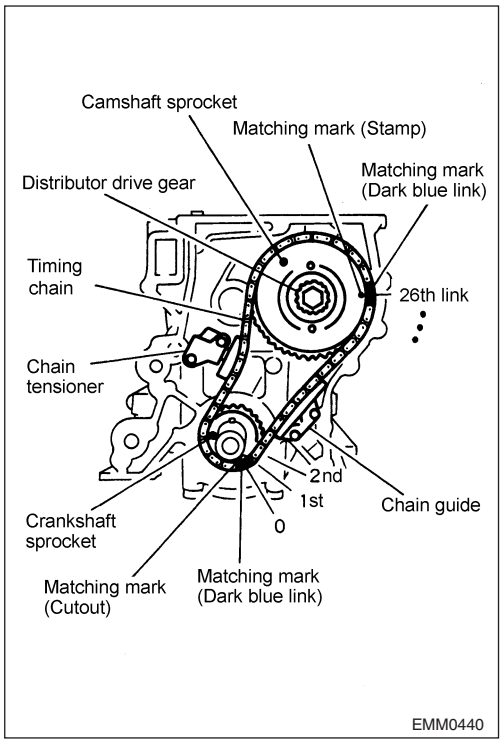
   98 (0.98, 1.0, 14)/200

   - Check battery for the specific gravity if engine speed is not within the standard, and measure again under normal conditions.
   - Check valve clearance and components around the combustion chamber (valve, valve seat, pistons, piston rings, cylinder bore, cylinder head, cylinder head gasket) if compression pressure is not within the standard, and measure again.
   - Add a small amount of engine oil from spark plug hole if compression pressure of some cylinders is low, and measure again.
   - It is possible that piston ring is worn or damaged if compression pressure is improved by adding engine oil. Check piston ring, and replace it if necessary.
   - There may be a valve malfunction if compression pressure is not improved by adding engine oil. Check valve, and then replace valve or cylinder head if necessary.
   - If compression pressures of adjacent two cylinders are low, and if pressures cannot be improved by adding engine oil, gasket is leaking. Replace cylinder head gasket.

10. Install removed parts.

Removal (Cont'd)





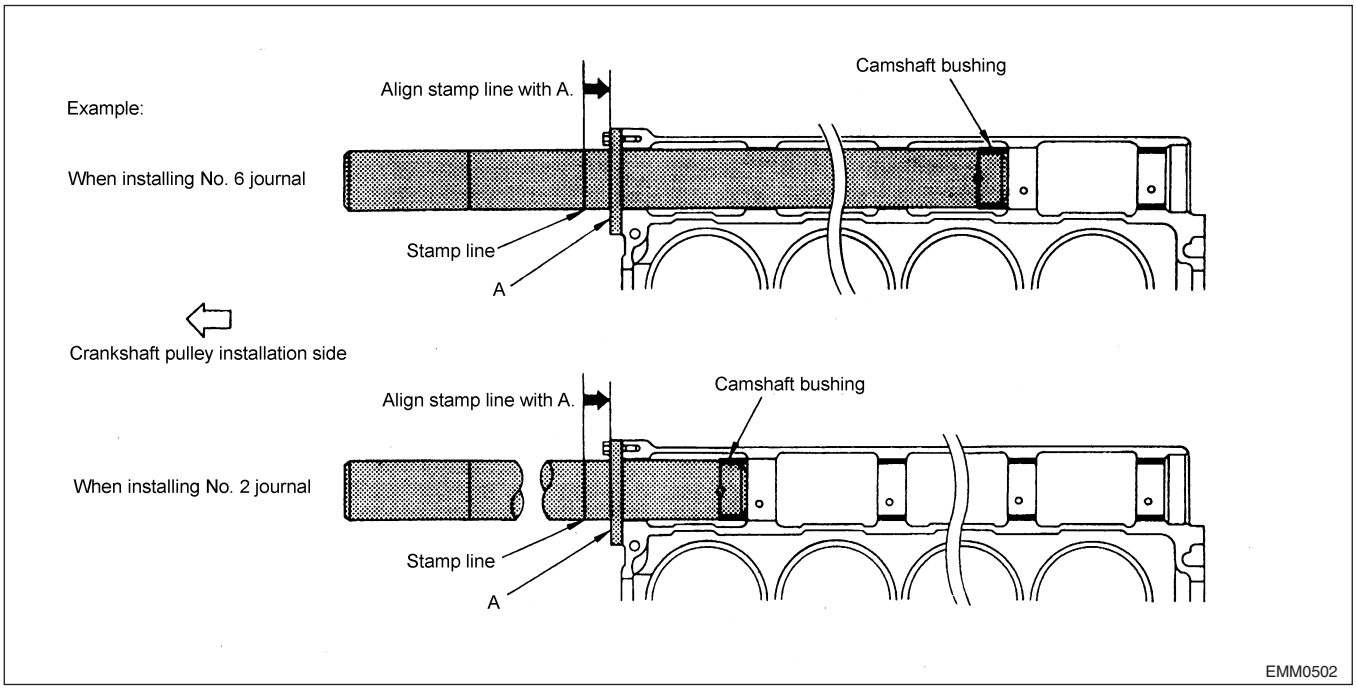
Installation

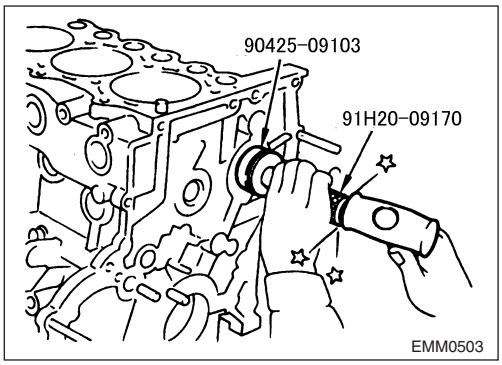
NOTE:

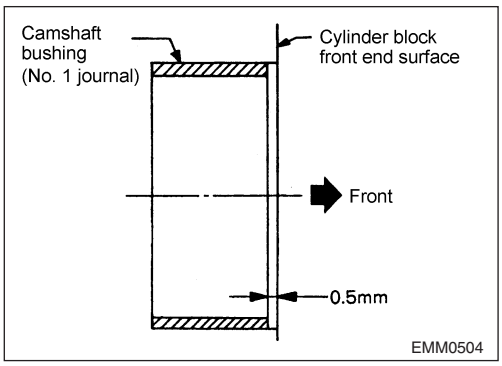
- Installing condition and matching mark location of each part are shown in the figure.

1. Install the key for crankshaft sprocket after making sure that crankshaft key groove and camshaft key point straight up.

Inspection After Disassembly (Cont'd)







- Make sure that oil holes in each journal and cylinder block oil holes are aligned after installing each journal.

4. Install camshaft bushing (journal 1).

- Align journal oil hole with cylinder block oil hole.
- Press-fit until journal front end is 0.5 mm (0.02 in.) inside from cylinder block front end surface using a drift (SST).
- Make sure that journal oil hole and cylinder block oil hole are aligned after installing journal.

Inspection of Idle Speed, Ignition Timing, and Air-Fuel Ratio

STANDARD AT IDLE

Idle speed [N position] (rpm)	675±50
Ignition timing (BTDC/rpm)	10±2/675
CO density (%) HC density (ppm)	00.1 or less 50 or less

CAUTION:
- **Perform "Idle Air Volume Learning" (EC section) when idle speed or ignition timing is outside the standard.**

- Turn ignition switch ON, and then make sure that no malfunction is detected by self-diagnosis.
- Make sure that engine is free of oil pressure pump loads and any electrical loads. Perform the inspection with the shift lever in the N position.
- Warm up engine and transaxle to the normal operating temperature.

IDLE SPEED

WITH SST

1. Connect SST to vehicle side data link connector.
2. Select "ENG SPEED" in "DATA MONITOR" mode. Make sure that the idle speed is 675±50 rpm.

CAUTION:
- **Perform "Idle Air Volume Learning" (EC section) when idle speed is outside the standard.**

WITHOUT SST

1. Connect an adapter harness for molded coils (SST) between the distributor harness connectors, and install a tachometer.
2. Make sure that idle speed is 675±50 rpm.

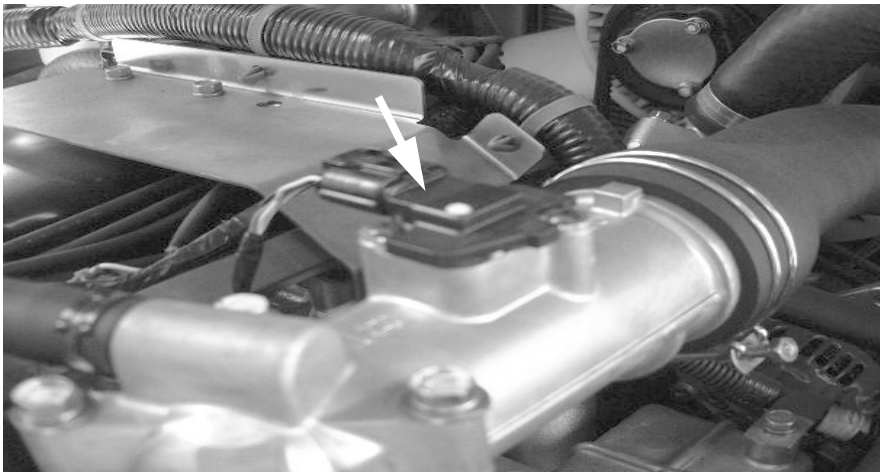
CAUTION:
- **Perform "Idle Air Volume Learning" (EC section) when idle speed is outside the standard.**

CO/HC DENSITY INSPECTION

The vehicle uses an air-fuel ratio feedback system with a self-learning function. Because a wide compensation range is available, no additional CO/HC density adjustment is necessary.
- Warm up engine to normal operating temperature. Confirm idle speed and ignition timing are within the standards. Then, check CO/HC density with a CO/HC measuring device.
- Check condition of air-fuel ratio feedback with the following steps when measured values are outside the standard:

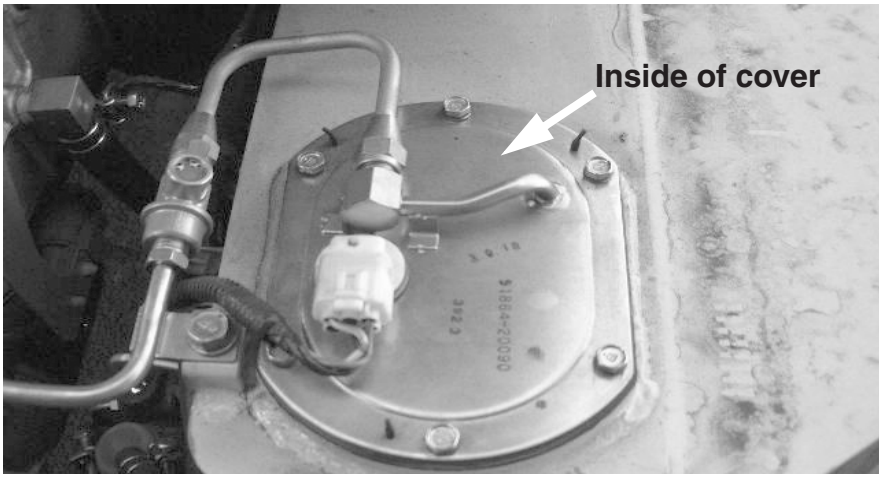
Component Parts Location (Cont'd)

Mass air flow sensor



Electronic throttle control actuator

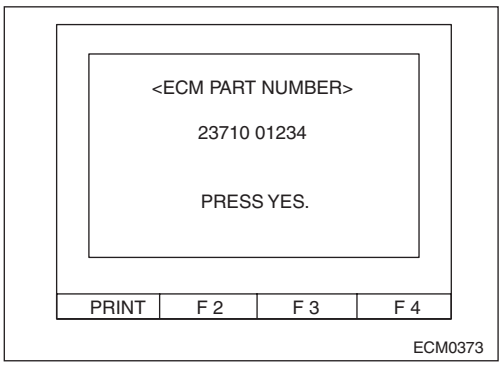
Fuel pump



SST (Cont'd)

CONTROL UNIT PART NUMBER

Displays part number of ECM mounted on vehicle.



Self-diagnosis Function (without SST)

DESCRIPTION

- In self-diagnosis, when any of the critical sensors or actuator and exhaust gas control systems necessary for ECM control return a malfunction and self-diagnosis detection conditions are satisfied, a DTC corresponding to the suspect system is stored in ECM for easier trouble diagnosis. Self-diagnostic results can be displayed with ECM warning lamp in the combination meter.
- Diagnosis test mode

OPERATION PROCEDURE

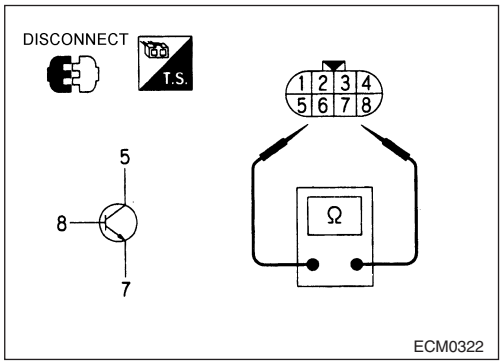
- Refer to the following for how to activate self-diagnosis mode or erase self-diagnostic results.

CAUTION:

- **When a malfunction occurs in accelerator pedal position sensors, self-diagnosis (without SST) cannot be activated. Thus, use SST to perform self-diagnosis, and repair malfunctioning part.**

Component Parts Inspection (Cont'd)

POWER TRANSISTOR



- Check resistance between terminals of the power transistor by applying and exchanging (+ and -) the inspection rods of an analog circuit tester.

Inspection Terminals and Results (at room temperature)

Positive probe to 8 and negative probe to 7:
Except 0 or ∞Ω

Positive probe to 7 and negative probe to 8:
Except 0 or ∞Ω

Positive probe to 5 and negative probe to 8:
Except 0 or ∞Ω

Positive probe to 8 and negative probe 5:
∞Ω

Positive probe to 7 and negative probe 5:
∞Ω

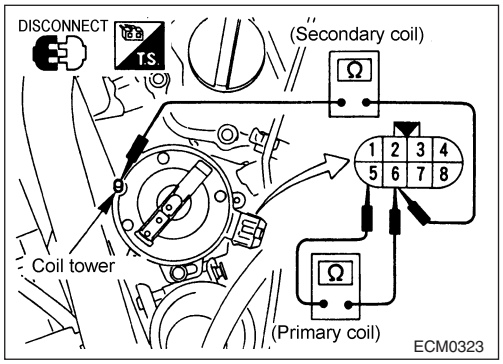
Positive probe to 5 and negative probe to 7:
Except 0 or ∞Ω

CAUTION:

- **Do not use a digital circuit tester because the standard is different.**

- Check distribution functions (rotor and distributor cap) of the distributor.

IGNITION COIL



- Check resistance of the following:

Primary coil resistance (5 - 6):
Approx. 2.2 kΩ

Secondary coil resistance:
Approx. 11.5 kΩ

(Between coil tower tip metal and 6 with the distributor cap removed.)

HIGH-TENSION CABLE

1. Removal and installation
1) Remove intake manifold cover.
2) Disconnect spark plug side.
3) Disconnect distributor side and remove high-tension cable.

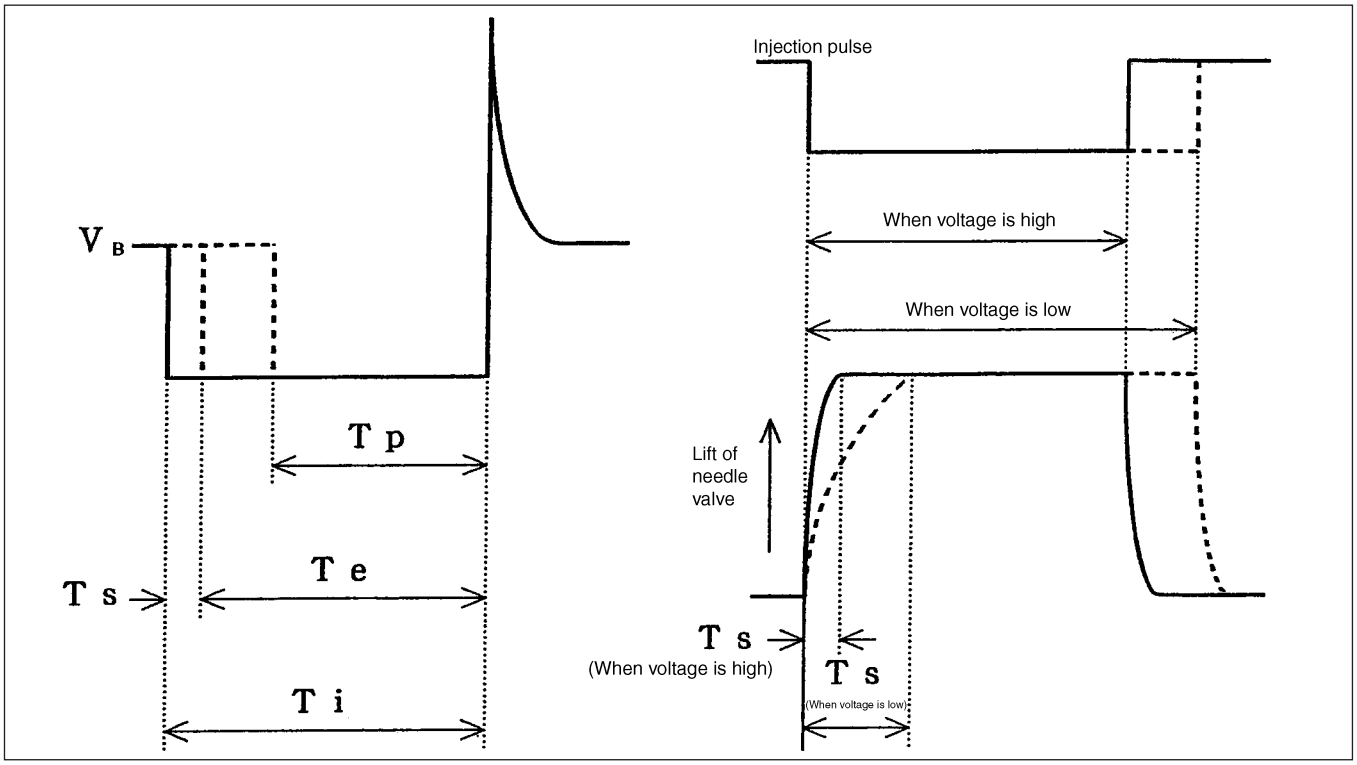
CAUTION FOR INSTALLATION

- Securely install distributor cap and high-tension code when matching both cylinder numbers.

2. Inspection

- Check resistance of high-tension cable.

For No. 1 cylinder: Approx. 2.7 kΩ
For No. 2 cylinder: Approx. 2.8 kΩ
For No. 3 cylinder: Approx. 4 kΩ
For No. 4 cylinder: Approx. 5 kΩ
For No. 5 cylinder: Approx. 5.2 kΩ
For No. 6 cylinder: Approx. 6.1 kΩ



Tp (Basic injection pulse width)

- Tp is a pulse duration dependent on intake air quantity and engine speed and totally independent of compensation control.

  = Intake air quantity/Engine speed x Constant

Ts (Voltage correction pulse width)

- With 14V as the basis, Ts is used to correct the delay in injector's valve opening due to voltage drop.
- Therefore, fuel injection is not directly affected.
- Also, Ts can be checked with SST (handheld tester) when fuel is cut.

  = Voltage correction pulse width at 14V + (14V - V_B) x Constant

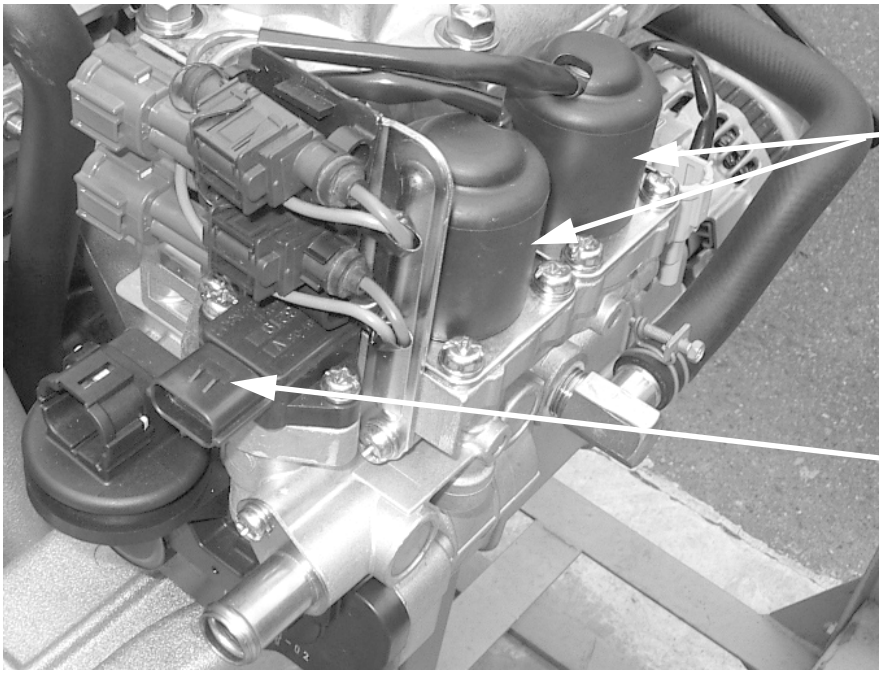
  V_B:Battery voltage

Te (Effective injection pulse width)

- Te is obtained by deducting voltage correction pulse width (Ts) from final injection pulse width (Ti).

  = Basic injection pulse time (Tp) x Air-fuel ratio feedback correction factor x Air-fuel ratio learning control correction factor x Various correction factors x Fuel cut factor

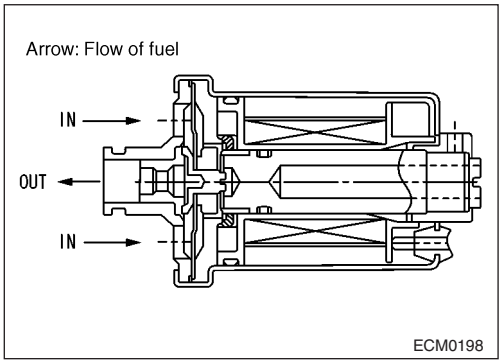
LPG injectors and holder assembly



LPG injectors and fuel pressure sensor are installed with built-in mechanical relief valve.

LPG INJECTOR

- Injectors for LPG gas injection are used.



LPG ASSISTANCE INJECTOR

- When LPG injectors alone cannot satisfy fuel requirement for engine running at high speed under high load, LPG assistance injectors join them to maintain maximum engine output under such engine condition.

FUEL PRESSURE SENSOR

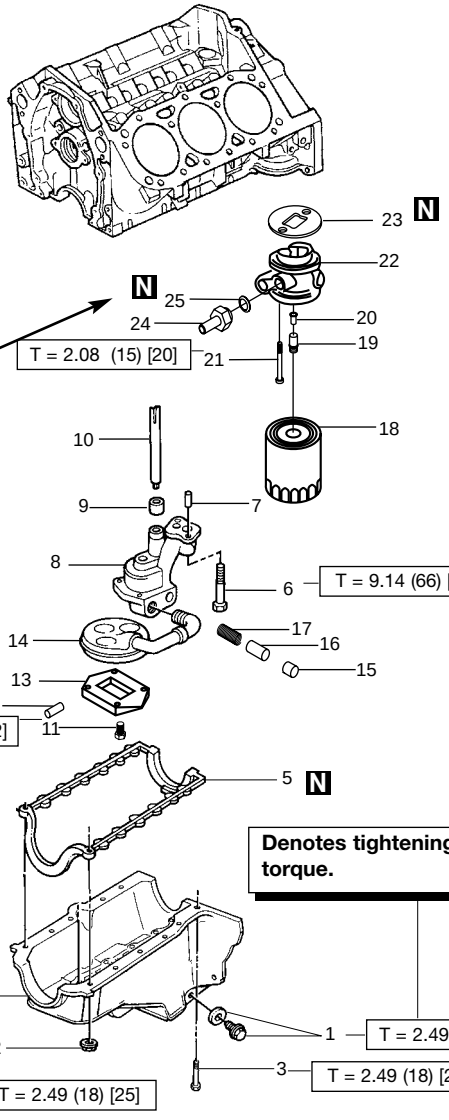
- Sensor generates output signals to optimize fuel injection quantity when fuel pressure is low at low temperature or for other reason.

Removal and Installation

Unit: kgf-m (lb-ft) [N-m]
***kgf-m (lb-in.) [N-m]**

Removal steps

1. Plug
2. Nut
3. Bolt
4. Pan
5. Gasket
6. Bolt
7. Pin
8. Pump
9. Retainer
10. Shaft
11. Bolt
12. Pin
13. Cover
14. Screen (A)
15. Plug
16. Valve
17. Spring
18. Filter
19. Fitting
20. Valve
21. Bolt
22. Adapter - Oil Filter
23. Gasket
24. Connector
25. Gasket



Denotes nonreusable part.

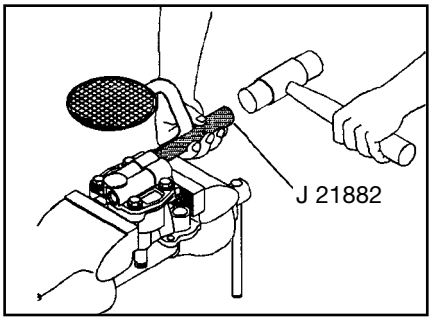
Lubricate all internal parts with engine oil during

Denotes tightening torque.

INSTALLATION OR REMOVAL SERVICE POINTS

(A) Install the oil pump screen.

- If removed, replace the oil pump screen. The oil pump screen must have a good press fit into the oil pump body.
- Mount the oil pump in a soft jawed vise.
- Apply sealer to the end of the pipe.
- Use the (J 21882) and a soft-faced hammer to tap the oil pump screen into the pump body. The screen must align parallel with the bottom of the oil pan when it is installed.



Operating procedures, cautions, etc., on removal, installation, disassembly and reassembly are described.

This alphabetical letter corresponds to a part that is indentified in the drawing on the first page of each section. The letter appears during an explanation of removal, installation, disassembly or reassembly steps.

Sealers, Adhesives and Lubricants

Application	Type of Material	GM Part Number	MCFA Part Number
Balancer Shaft Driven Gear Bolt	Threadlock	12345382	A000006061
Camshaft Retainer Bolt	Threadlock	12345382	A000006061
Crankshaft Balancer Keyway	Adhesive	12346141	A000000165
Cylinder Head Bolt	Sealant	12346004	2I4256
Engine Block to Crankshaft Rear Oil Seal Housing Junction at the Oil Pan Sealing Surfaces	Adhesive	12346141	A000000165
Engine Block to Engine Front Cover Junction at the Oil Pan Sealing Surfaces	Adhesive	12346141	A000000165
Engine Block at the Lower Intake Manifold Sealing Surfaces	Adhesive	12346141	A000000165
Engine Block Coolant Drain Hole Plug	Sealant	12346004	2I4263
Engine Block Oil Gallery Plug	Sealant	12346004	2I4263
Engine Coolant Temperature (ECT) Gauge Sensor	Sealant	12346004	2I4263
Engine Oil	SAE 5W30 Oil	12345610 5QT	
Engine Oil Pressure Sensor	Sealant	12346004	2I4263
Engine Oil Pressure Sensor Fitting	Sealant	12346004	2I4263
Engine Oil Supplement	Lubricant	1052367	
Exhaust Manifold Bolt/ Stud	Threadlock	12345382	A000006061
Expansion Cup Plug (Balance Shaft Rear Bearing Hole)	Sealant	12346004	2I4263
Expansion Cup Plug (Camshaft Rear Bearing Hole)	Sealant	12346004	2I4263
Lower Intake Manifold Bolt	Threadlock	12345382	A000006061
Oil Level Indicator Tube	Sealant	12346004	2I4263
Oil Pump Screen Tube	Sealant	12346004	2I4263
Valve Rocker Arm Stud	Threadlock	12345493	2I4256
Valve Train Component Prelube	Lubricant	12345501	
Water Pump Bolt	Sealant	12346004	2I4263

Form-In-Place Gasket (FIPG)

The engine has several places where the form-in-place gasket (FIPG) is in use. To ensure the gasket is fully sealed, use the following precautions when applying the FIPG:

1. It is absolutely necessary to apply the sealant in the right amount, evenly and without a break.
2. Bead size, continuity, and location are crucial to a good seal. Too thin a bead causes leakage. Too thick a bead can be squeezed out of location and cause blockage or narrowing in the fluid feed line.

NOTE Since the FIPG used in the engine hardens as it reacts with moisture in the air, it is normally used in the metallic flange area.

Disassembly

The parts assembled with the FIPG can be easily disassembled. Break the seal by striking it with a mallet or by inserting a flat, thin gasket scraper and hammering it through the joint. Use caution to prevent damage to the joined parts.

Surface Preparation

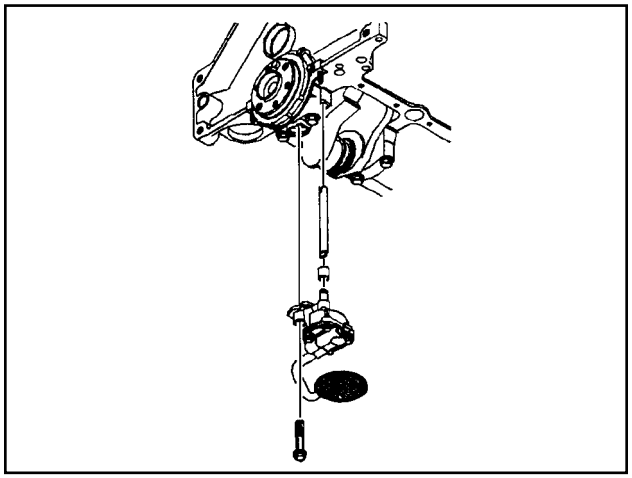
Use a gasket scraper or wire brush to thoroughly remove all surface oil and dirt from all gasket application surfaces. Completely remove any old FIPG still remaining in the bolt holes. All application surfaces must be flat.

Form-In-Place Gasket Application

Apply the FIPG in a smooth, continuous bead without any breaks. Also cover the bolt hole circumference with an even, continuous bead. Wipe away any excess and mount the parts while the FIPG is still wet (15 minutes or less). Check the mounted parts and wipe away any excess sealant.

Oil Pump Removal

1. Remove the bolt that attaches the oil pump to the rear crankshaft bearing cap.



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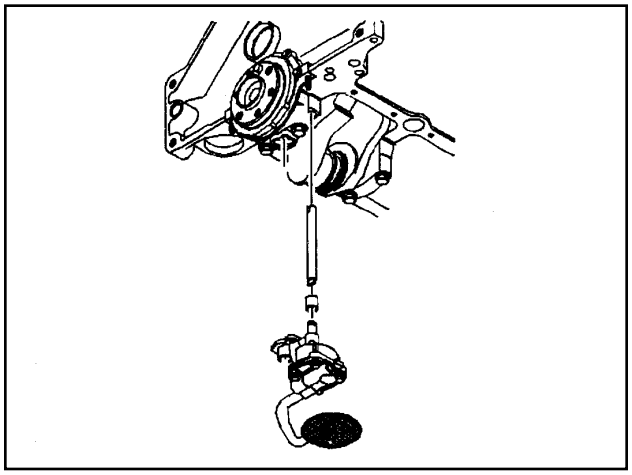
2. Remove the oil pump driveshaft and the



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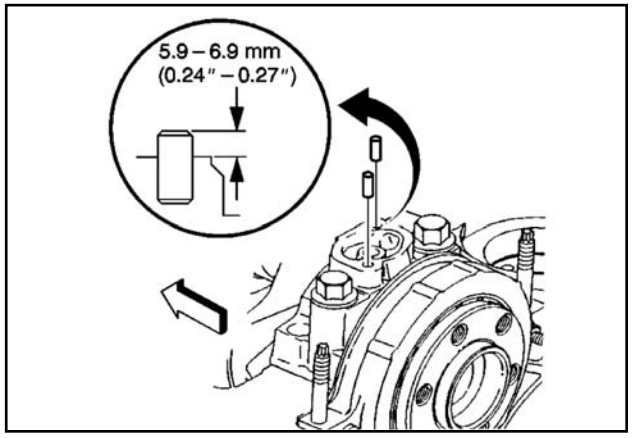
3. Inspect the pins (oil pump locator) for damage, and replace the pins if required.



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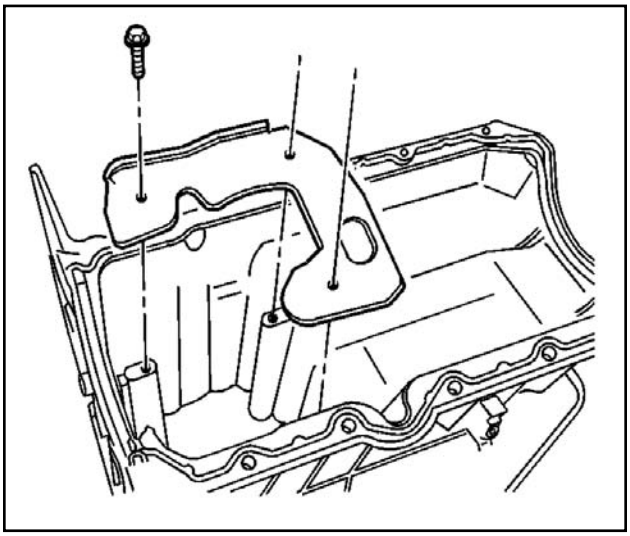
Oil Pan Clean and Inspect

1. Remove the oil pan baffle bolts and the oil pan baffle.



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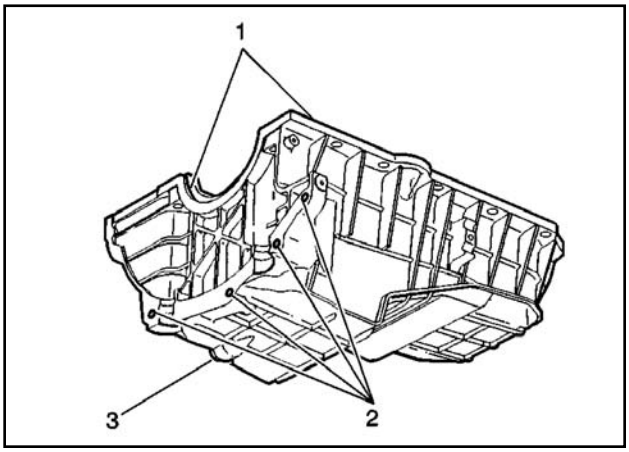
⚠ CAUTION

Safety glasses must be worn or eye injury may occur.

2. Clean the oil pan and the oil pan baffle in cleaning solvent.
3. Dry the oil pan and the oil pan baffle with compressed air.
4. Inspect the oil pan for the following:
   - Gouges or damage to the oil pan sealing surfaces (1)
   - Damage to the threaded holes (2)
   - Damaged oil pan drain hole threads (3)
   - Damage to the oil pan baffle
   - Damage to the exterior of the oil pan
     A damaged oil pan may interfere with the proper position of the oil pump screen, or may not distribute oil properly in the oil pan sump area.



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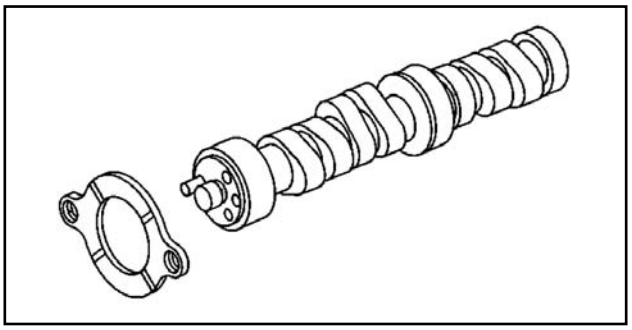
Camshaft and Bearings Clean and Inspect

Tools Required

- J 7872 Magnetic Base Indicator Set

1. Clean the engine camshaft in cleaning solvent.
2. Dry the engine camshaft with compressed air.
3. Inspect the camshaft retainer plate for damage. If the camshaft retainer plate is damaged, replace as necessary.
4. Inspect the camshaft bearings for correct fit into the engine block camshaft bearings bores. The camshaft bearings have an interference fit to the engine block camshaft bearing bores and must not be loose in the engine block camshaft bearing bores.



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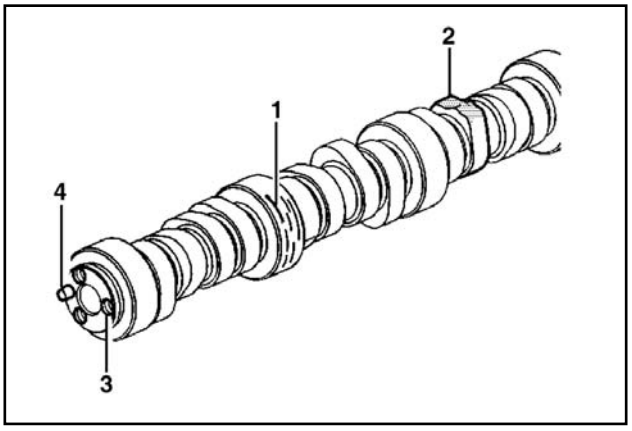
NOTE

Important: If any camshaft bearing is excessively worn or scored, replace all the camshaft bearings.

5. Inspect the camshaft bearings for excessive wear or scoring.
6. Inspect the engine camshaft for the following:
   - Worn, scored or damaged bearing journals (1)
   - Worn engine camshaft lobes (2)
   - Damaged bolt hole threads (3)
   - Damaged camshaft sprocket locator pin (4)



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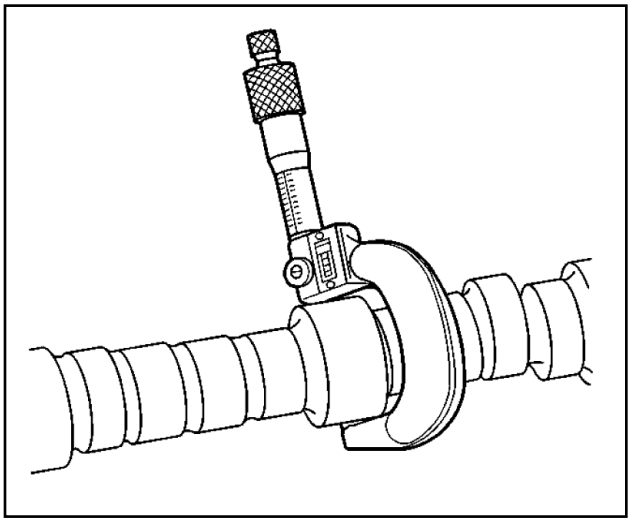
7. Measure the engine camshaft journals with a micrometer. If the camshaft journals are more than 0.025 mm (0.0010 in) out-of-round, then replace the engine camshaft.



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8. Measure for a bent engine camshaft or excessive engine camshaft run out using the magnetic base indicator J7872.
   - Mount the engine camshaft in a suitable stand between centers.
   - Use the magnetic base indicator J7872 to check the intermediate engine camshaft journals.
9. Measure the engine camshaft lobe lift using the magnetic base indicator J7872.
   - Place the engine camshaft on the V-blocks.
   - Use the magnetic base indicator J7872 to measure the engine camshaft lobe lift.
10. Replace the engine camshaft if the engine camshaft lobe lift is not within specifications. Refer to General Specifications.