CATERPILLAR®

99719-60100

Service Manual

GP15, GP18, GP20, GP25, GP30, GP35; DP15, DP18, DP20, DP25, DP30, DP35 Chassis & Mast

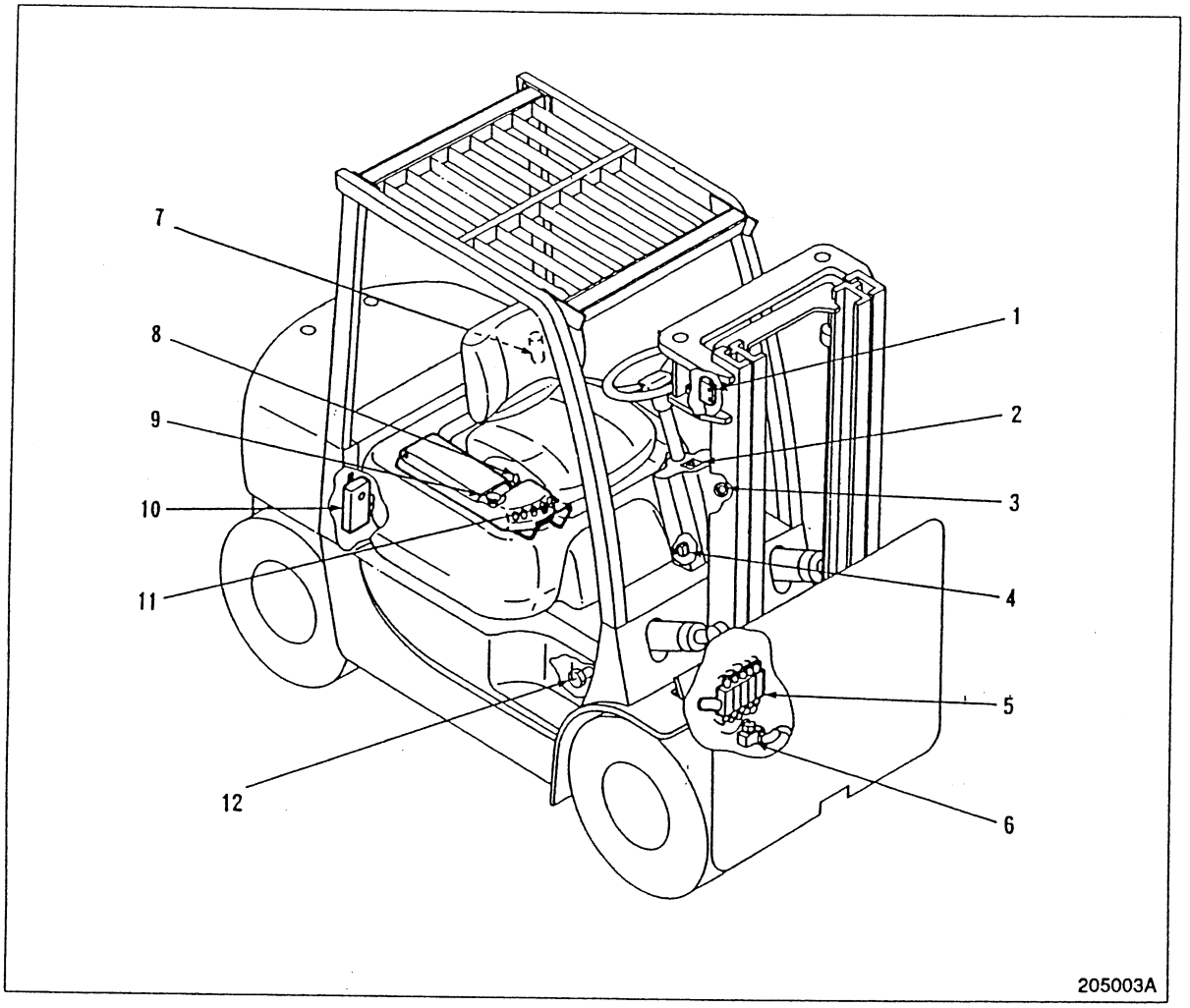
AC

For use with 4G63, 4G64 Gasoline,
S4Q2,S4S Diesel Engine Service Manual

Truck model					GP25	DP25	GP30	DP30	GP35	DP35
Power train	Clutch	Type			Dry, single-disc type (Op. wet type)		Dry, single-disc type (Op. wet type)		Dry, single-disc type (Op. wet type)	
		Size (OD × ID)		mm [in.]	275 × 180 [10.8 × 7.1]	275 × 175 [10.8 × 6.9]	275 × 180 [10.8 × 7.1]	275 × 175 [10.8 × 6.9]	275 × 180 [10.8 × 7.1]	275 × 175 [10.8 × 6.9]
		Material			DR-8	Special	DR-8	Special	DR-8	Special
	Clutch booster (wet)	Type			Master VAC		Master VAC		Master VAC	
		Master cylinder ID		mm [in.]	15.87 [0.6248]		15.87 [0.6248]		15.87 [0.6248]	
		Release cylinder ID			19.05 [0.7500]		19.05 [0.7500]		19.05 [0.7500]	
	Torque converter	Type			3-element, 1-stage, 2-phase		3-element, 1-stage, 2-phase		3-element, 1-stage, 2-phase	
		Manufacturer's type			Daikin 66H8		Daikin 66H8		Daikin 66H8	
		Stall torque ratio			3.0		3.0		3.0	
	Transmission	Control and shift			Hydraulic column shift		Hydraulic column shift		Hydraulic column shift	
		Power-shift	Ratios	Forward	2.195		2.195		2.195	
				Reverse	2.258		2.258		2.258	
		Manual	Type		Synchro-mesh		Synchro-mesh		Synchro-mesh	
			Shift		Floor		Floor		Floor	
			Forward ratio	1st	4.958		4.958		4.958	
				2nd	2.375		2.375		2.375	
			Reverse ratio	1st	4.958		4.958		4.958	
				2nd	2.375		2.375		2.375	
	Transfer	Type of gears			Spur		Spur		Spur	
		Gear ratio	Manual transmission		1.257	1.135	1.394	1.167	1.394	1.167
			Powershift transmission		1.394	1.167	1.394	1.257	1.394	1.257
	Reduction gear	Type of gears			Spiral bevel		Spiral bevel		Spiral bevel	
		Ratio			5.667		5.667		5.667	
	Differential	Axle housing			Banjo		Banjo		Banjo	
		Type of gears – number	Gears		Straight bevel – 2		Straight bevel – 2		Straight bevel – 2	
			Pinions		Straight bevel – 2		Straight bevel – 2		Straight bevel – 2	
Steering system	Type				Recirculating ball-and-nut		Recirculating ball-and-nut		Recirculating ball-and-nut	
	Gear ratio				19.8		19.8		19.8	
	Turning angle	Inside		deg. -min.	80°36'		78°05'		78°05'	
		Outside			52°54'		52°14'		52°14'	
	Steering wheel diameter			mm [in.]	330 [13]		330 [13]		330 [13]	
	Power steering	Type			Semi-integral type		Semi-integral type		Semi-integral type	
		Power cylinder ID x rod OD		mm [in.]	45 × 22 [1.77 × 0.87]		45 × 22 [1.77 × 0.87]		45 × 22 [1.77 × 0.87]	
		Effective stroke			272 [10.7]		272 [10.7]		272 [10.7]	
		Relief pressure		kPa (kgf/cm²) [psi]	7 845 (80) [1138]		7 845 (80) [1138]		7 845 (80) [1138]	9 807 (100) [1422]
		Flow rate		liter [cu in.]/ min	10.5±0.5 [640.1±30.5]		10.5±0.5 [640.1±30.5]		10.5±0.5 [640.1±30.5]	12±1.0 [732.3±61.0]
Traveling system	Front axle				Full-floating tubular type		Full-floating tubular type		Full-floating tubular type	
	Rear axle				Elliott type		Elliott type		Elliott type	
	Mounting	Front wheels			Fixed type		Fixed type		Fixed type	
		Rear wheels			Center-pivot type		Center-pivot type		Center-pivot type	
	Wheel alignment	Toe-in		mm [in.]	0		0		0	
		Camber		degree	1		1		1	
		Caster			0		0		0	
		Kingpin inclination			5		5		5	

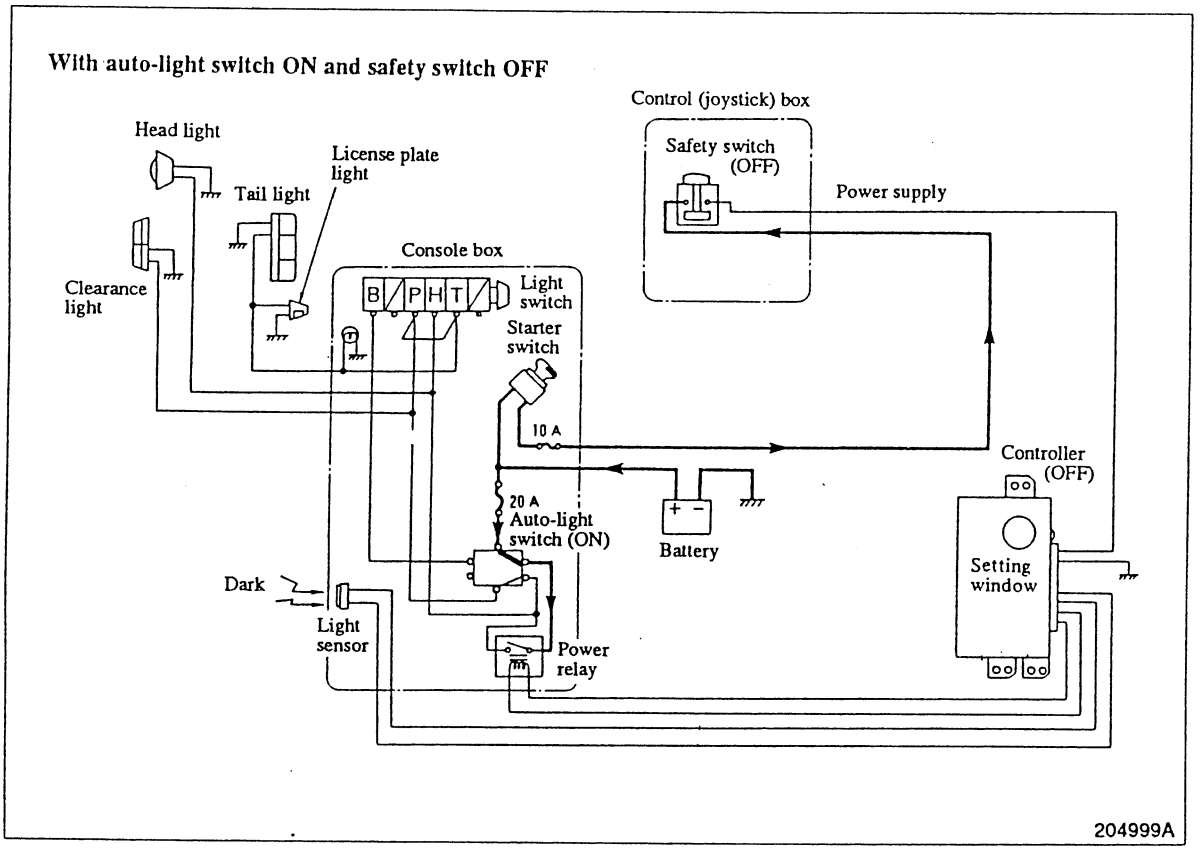
AC (ADVANCED CONTROL SYSTEM)

Nomenclature



1 Full free switch (for full free mast)
2 System indicator light
3 Light sensor
4 Auto-light switch
5 Solenoid-actuated control valve
6 Hydraulic (pressure) transducer
7 Seat switch
8 Lowering speed selector switch
9 Safety switch
10 Controller
11 Joystick levers (finger-control system)
12 Travel speed pickup (option)

(4) Turning OFF the safety switch with the auto-light switch ON causes the power relay to remain OFF. Under this condition, all lights will not come ON. If the auto-light switch is OFF, the light switch is effective and can turn ON each selected light, regardless of the safety switch and starter switch.



Operation — 3

Operation Logic:

Auto-light switch OFF				Auto-light switch ON					
				Dark			Bright		
Light switch	OFF	1st position	2nd position	OFF	1st position	2nd position	OFF	1st position	2nd position
Clearance/tail/ license plate lights		○	○	○	○	○			
Head lights			○	○	○	○			

REMOVAL AND INSTALLATION

Engine and Transmission

Removal

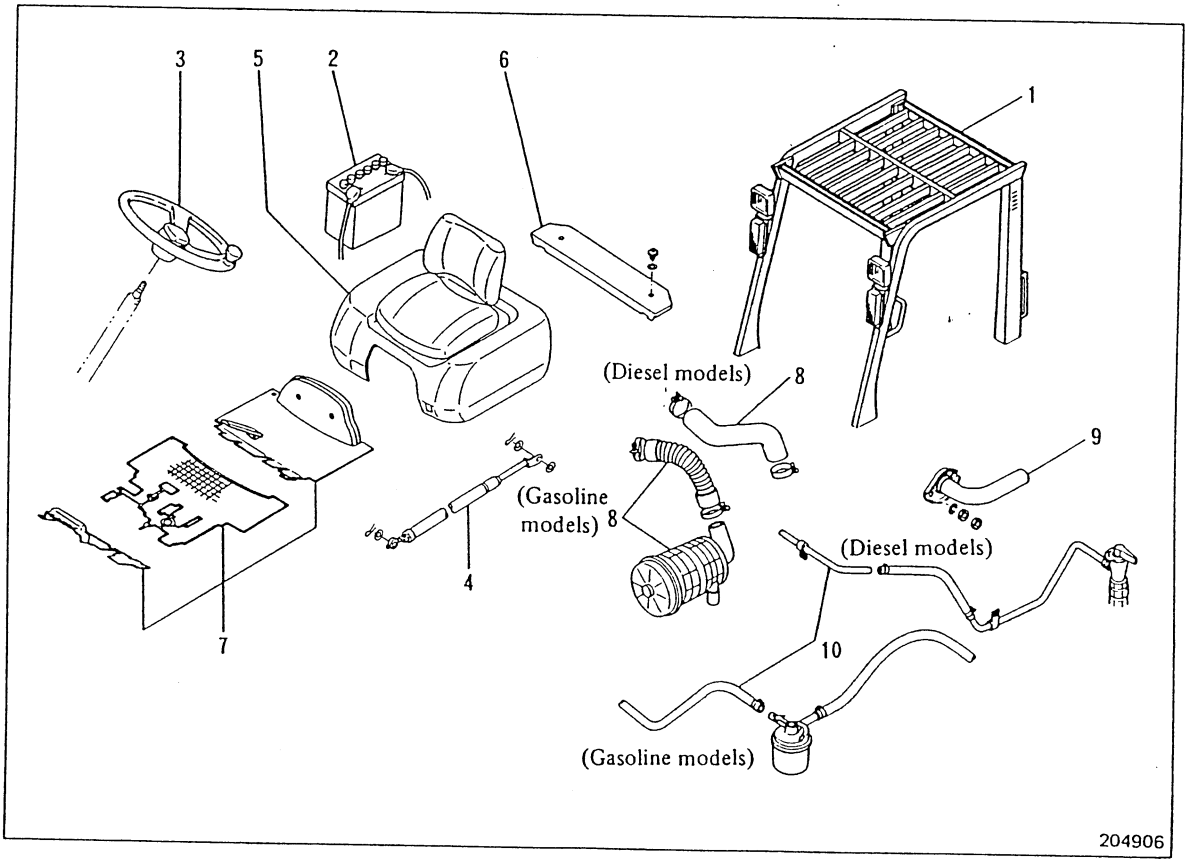
The engine can be removed alone but the transmission has to be removed together with the engine. These pages are devoted to the explanation of removal of the transmission and engine held together as a unit.

NOTE

1) Removal and installation of the gasoline engine differ from those of the diesel engine.

2) Removal and installation of the powershift transmission differ from those of the manual transmission. The same is true of the dry-type and wet-type clutches.

Overhead guard, cover and air cleaner



Sequence

1 Overhead guard, head lamps
2 Battery, cables
3 Steering wheel
4 Gas spring
5 Engine hood, seat
6 Radiator cover
7 Front cover, floor plate, floor mat
8 Air hose, air cleaner
9 Exhaust pipe
10 Fuel hose

7. Connect the battery cable to the negative (-) terminal of the battery lastly after making sure that all the harnesses and cables have been connected properly.

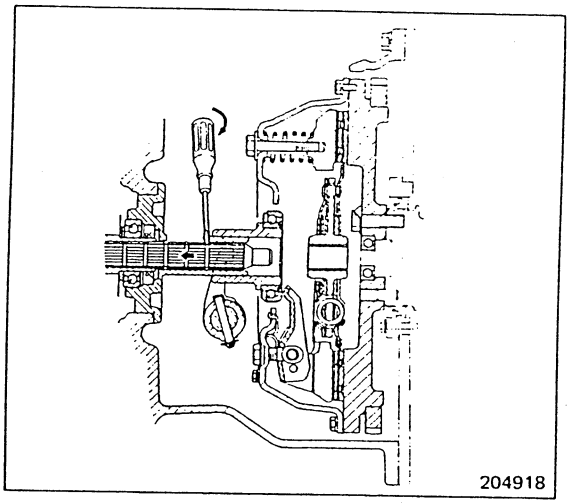
8. Refill the engine with oil and coolant and the transmission with oil, and check for leaks. Unless otherwise specified, use antifreeze of 35% concentration by volume.

9. Prime the fuel system.

10. After completing the inspection, start the engine, and check the clutch booster for operation (wet-type clutch models). Move the mast and steering for a while, and check the oil level in the hydraulic tank. Also, check the engine oil level, coolant level and transmission oil level.

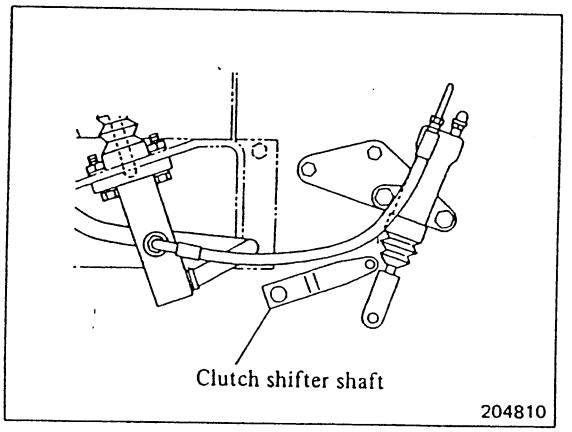
2. Sliding input shaft into transmission

Slide the input shaft into the clutch to expose the stopper ring on the transmission side. Remove the stopper ring, and slide the shaft into the transmission. The shaft is arrested in position by steel ball and will be too tight to slide at first.



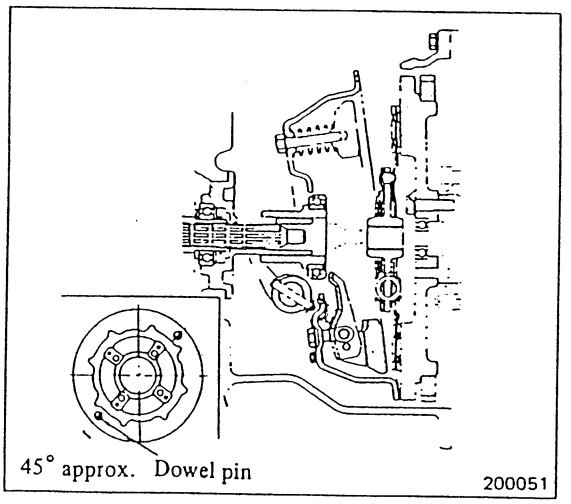
3. Removing clutch release cylinder pin

Loosen the bleeder valve of the release cylinder to relieve hydraulic pressure. Pull out the pin connecting the cylinder to the clutch shifter shaft, and raise the shaft by moving it away from the clevis of release cylinder rod.



4. Removing clutch disc assembly and pressure plate assembly

Position the flywheel dowel pins as shown.



3. Return spring

Measure the free length of return spring. If it is in excess of the service limit, replace the spring.

Unit: mm [in.]

Free length 2	A	85 ± 2.5 [3.3 ± 0.1]

4. Piston cup and valve seal

Check rubber parts for damage or swelling.

Unit: mm [in.]

Outside diameter of piston cup 3	A	17.0 ± 0.2 [0.7 ± 0.01]

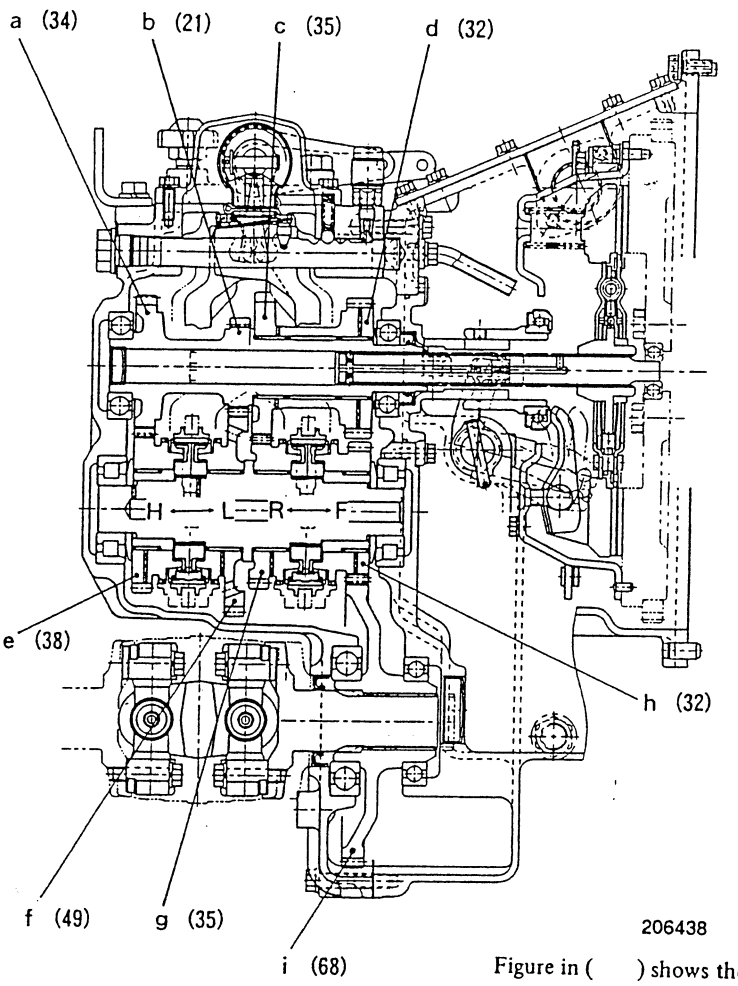
Reassebly

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

(1) Wash all metal parts with a volatile cleaning solvent and blow dry with compressed air.

(2) Apply a thin coat of rubber grease (METAL RUBBER #20) or brake fluid to the cylinder bore and piston cup.

DESCRIPTION



F: Forward
R: Reverse
L: Low (1st-speed)
H: High (2nd speed)

Power flow

Speed	Path
F – L	b → f h → i
F – H	a → e h → i
R – L	b → f g → c d → i
R – H	a → e g → c d → i

Figure in ( ) shows the number of gear teeth.

This transmission is of synchronized countershaft type and provides a selection of two speeds, forward and reverse. The components other than the output flange and universal joint are common to the dry-type clutch and wet-type clutch.

		Reduction ratio
Forward	L	$\frac{49}{21} \times \frac{68}{32} = 4.958$
	H	$\frac{38}{34} \times \frac{68}{32} = 2.375$
Reverse	L	$\frac{49}{21} \times \frac{35}{35} \times \frac{68}{32} = 4.958$
	H	$\frac{38}{34} \times \frac{35}{35} \times \frac{68}{32} = 2.375$

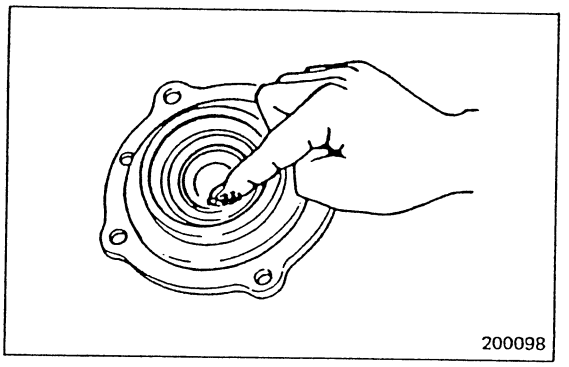
2. Shifter case oil seal installation

(1) Using an installer (special tool), install the oil seal to the shifter case.

Special tool needed

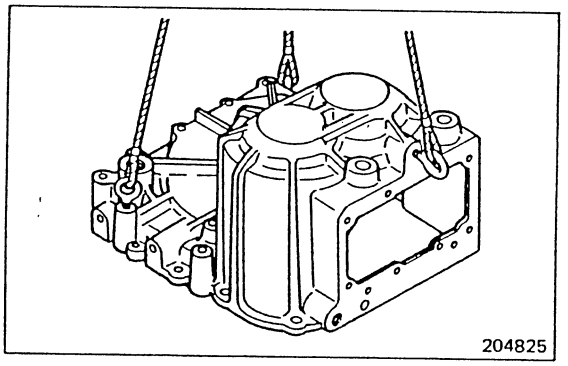
Installer	91268-05200

(2) Coat the oil seal lip with grease. Do not fill the void between the lips of the oil seal.



3. Transmission housing installation

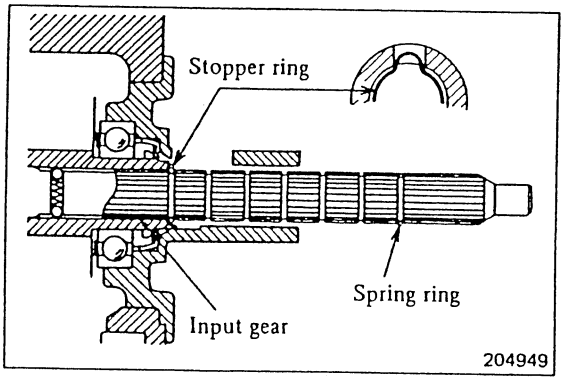
Fasten a hoist to the transmission housing. With the housing held in a horizontal position, install the housing to the clutch housing by aligning the 3rd shaft bearing with its bore in the clutch housing. Be sure to put the gasket on the mating flange.



4. Input shaft installation

(1) Coat the splines with molybdenum disulfide.

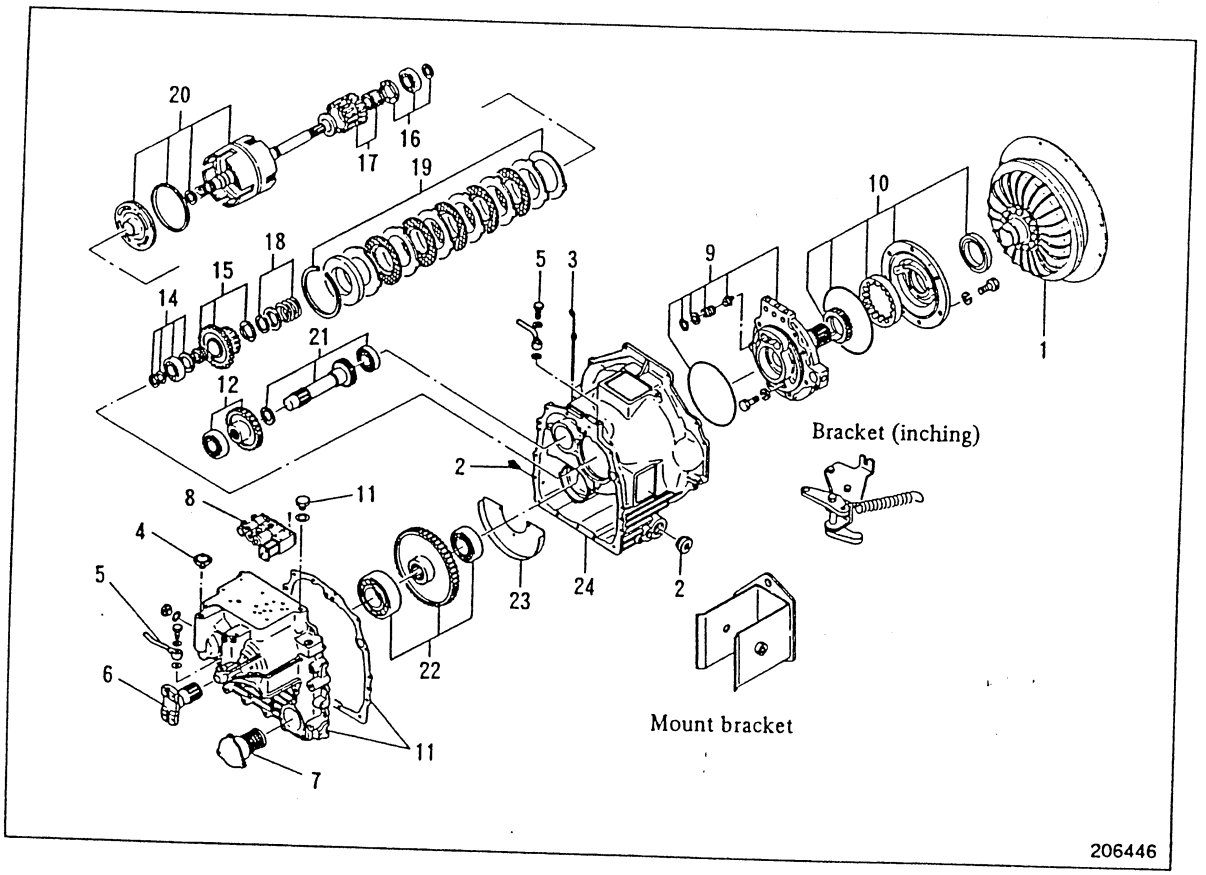
(2) Install the stopper ring to the input shaft, and insert the shaft into the housing until the stopper ring comes in contact with the input gear.



DISASSEMBLY AND REASSEMBLY

Transmission Assembly

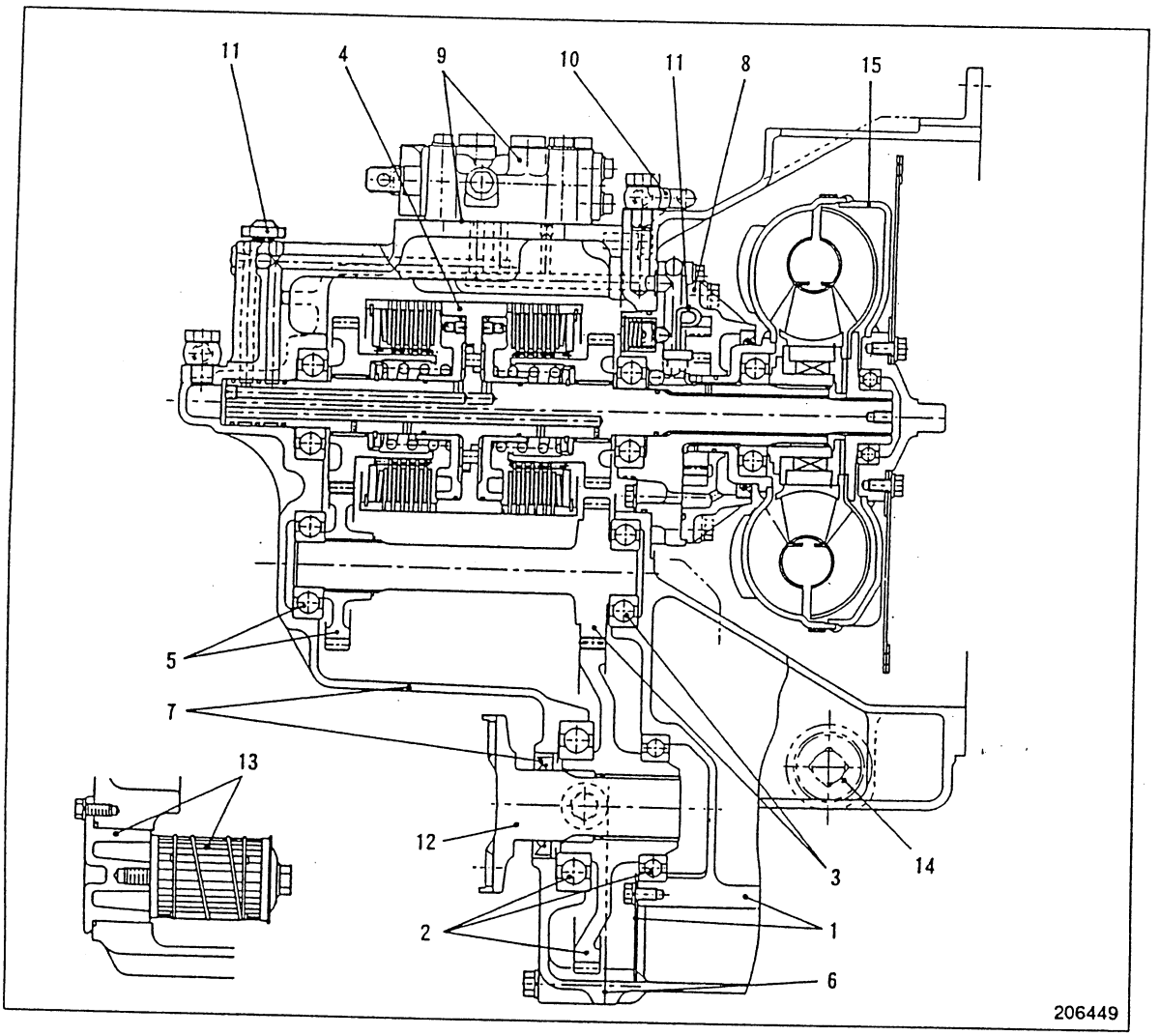
Disassembly



Start by:

1. remove two mount brackets from the transmission housing.
2. remove the brackets (inching) and springs

Transmission assembly



Sequence

1 Torque converter housing, baffle plate
2 Output gear, ball bearing
3 Idler shaft, ball bearing, snap ring
4 Input shaft assembly
5 Idler gear, ball bearing
6 Gasket, O-ring
7 Transmission housing, oil seal
8 Pump assembly, O-ring
9 Gasket, control valve, O-ring
10 Oil pipe, eyebolt, gasket
11 Air breather, oil level gauge, pipe
12 Output flange
13 Magnet strainer, filter case
14 Drain plug, gasket, sender unit
15 Torque converter assembly

7. Similarly read the stall speed for reverse drive.

	GP15/18 (DP15/18)	GP20/25 (DP20 thru 35)	GP30/35 (DP20 thru 35)
Stall speed (tolerance: ± 100)	1870 (2084)	1791	1971 (2095)

NOTE

The stall speed is determined on the basis of a combination of the engine and torque converter. It will vary if the engine or torque converter is changed.

10-m [33-ft] Starting Acceleration Test

1. Stand ready to start with the engine idling and the FORWARD-REVERSE lever in the neutral position.

2. At the signal, shift into forward and, at the same time, depress the accelerator pedal all the way.

3. Measure the amount of time that the truck elapses to travel 10 meters (33 feet) by using a watch.

4. Measure for reverse, too.

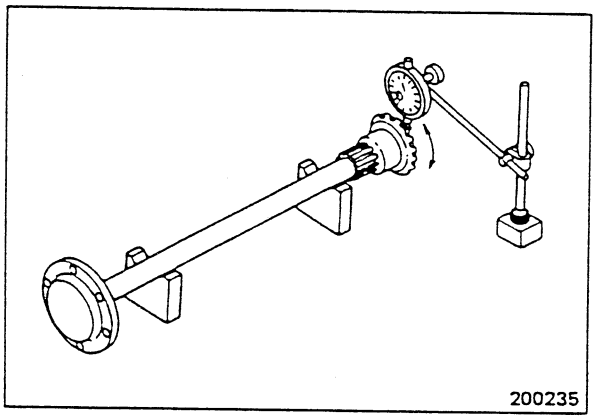
Time required for 10 m [33 ft] travel (no load)	5 seconds, maximum

Inspection after disassembly

1. Axle shafts

(1) Looseness of mating splines

Mount the differential bevel gear on the splined end of the shaft, and set a dial indicator as shown. Rotate the bevel gear against the contact point of the indicator and read the free movement (looseness of mating splines).

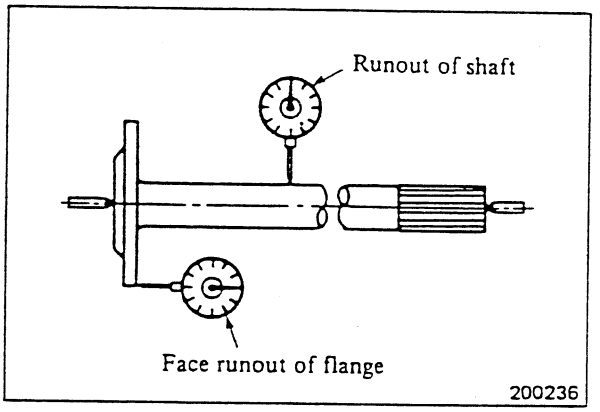


Unit: mm [in.]

Free movement (looseness of mating splines)	A	0.007 to 0.17 [0.0028 to to 0.0067]
	B	0.5 [0.020]

(2) Runout

(a) Set a dial indicator at the middle part of the axle shaft. Rotate the shaft against the contact point of the indicator and read the runout of the shaft.



Unit: mm [in.]

		GP(DP)15 thru 18	GP(DP)20 thru 35
Runout of axle shaft (1/2 of dial indicator reading)	A	0.5 [0.020] maximum	1.0 [0.039] maximum
	B	1.0 [0.039]	2.0 [0.079]

(b) Set a dial indicator against the flange of the axle shaft as shown. Rotate the shaft against the contact point and read the face runout of the flange.

Unit: mm [in.]

Face runout of axle shaft flange	A	0.05 [0.0020]
	B	0.5 [0.020]

2. Axle housing

(1) Check the surfaces of axle housing in contact with the mast bearing for damage.

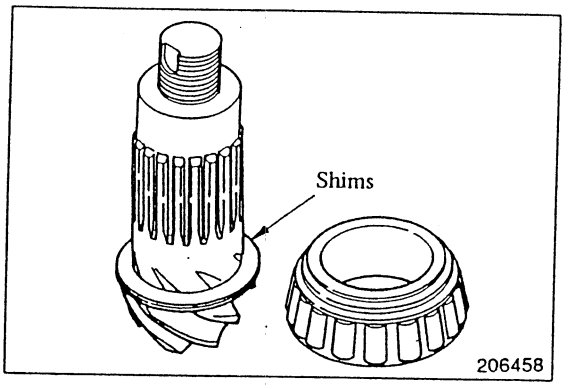
(2) Check the entire axle housing for distortion, dents and other defects,

[Example]

Where the error is –0.10 mm [–0.004 in.], we find the total shim thickness to be 1.9 mm [0.075 in.]:

1.8 + 0.1 mm [0.071 + 0.004 in.] =
1.9 mm [0.075 in.]

The shims are available in four sizes, 0.1 mm [0.04 in.], 0.2 mm [0.008 in.], 0.5 mm [0.020 in.] and 1.0 mm [0.039 in.].



9. Installing oil seal

Using an installer (special tool), put oil seal 13 in carrier cover 12.

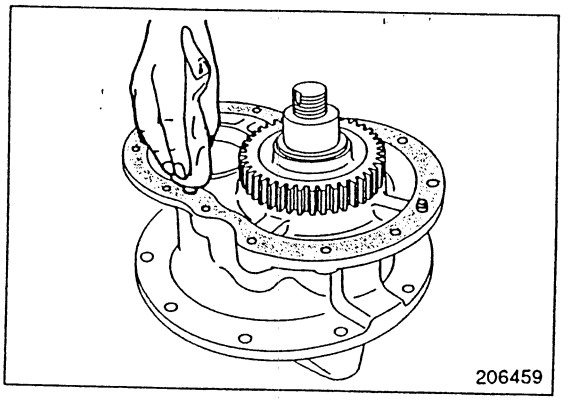
Special tool needed

Installer	91268-05400

10. Applying grease to oil seal

Apply grease to the oil seal installed to carrier cover 12.

Recommended grease: LG2

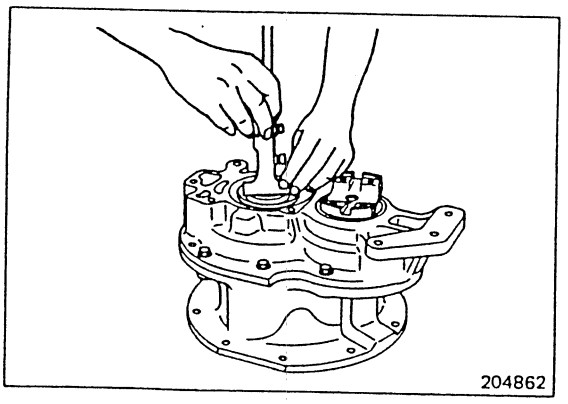


11. Applying sealant

When putting differential carrier 9 and carrier cover 12 together, apply sealant to the flange.

12. Adjusting reduction pinion preload

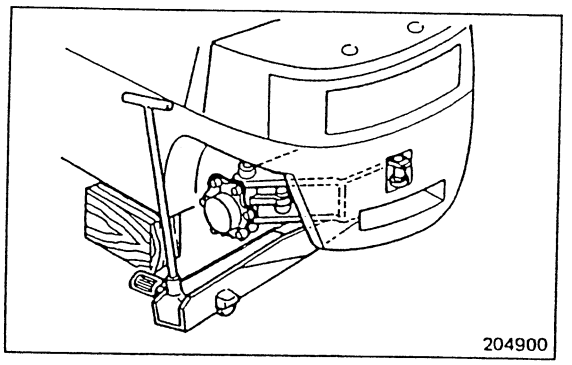
(1) After installing tapered roller bearing 21, measure difference between the reduction pinion and tapered roller bearing to determine the required amount of shim thickness. The standard value of total shim thickness is 2.3 mm [0.091 in.].



Suggestion

Rear axle assembly removal

After disconnecting the rear axle from the frame, use a garage jack to take the rear axle off. Be sure to support the axle at its center.

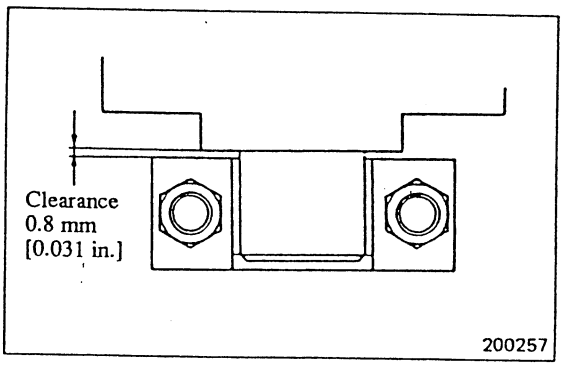


Installation

To install, follow the reverse of removal procedure, and proceed as follows:

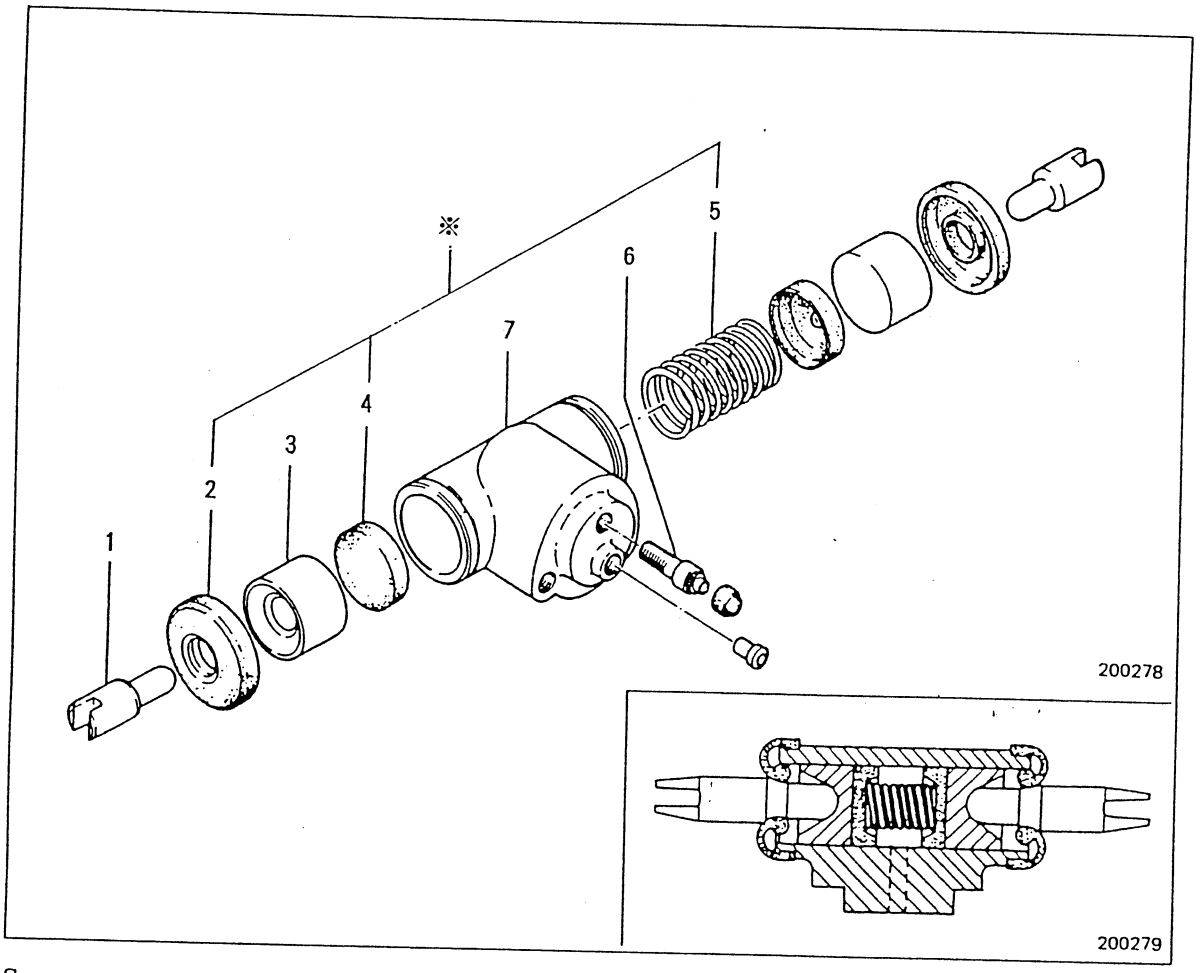
Bearing support clearance adjustment

Adjust by means of thrust washers so that the total fore-aft clearance is less than 0.8 mm [0.031 in.].



Wheel Cylinders

Disassembly



Sequence

1 Connector link
2 Boot
3 Piston
4 Piston cup
5 Return spring
6 Bleeder screw, cap
7 Cylinder body

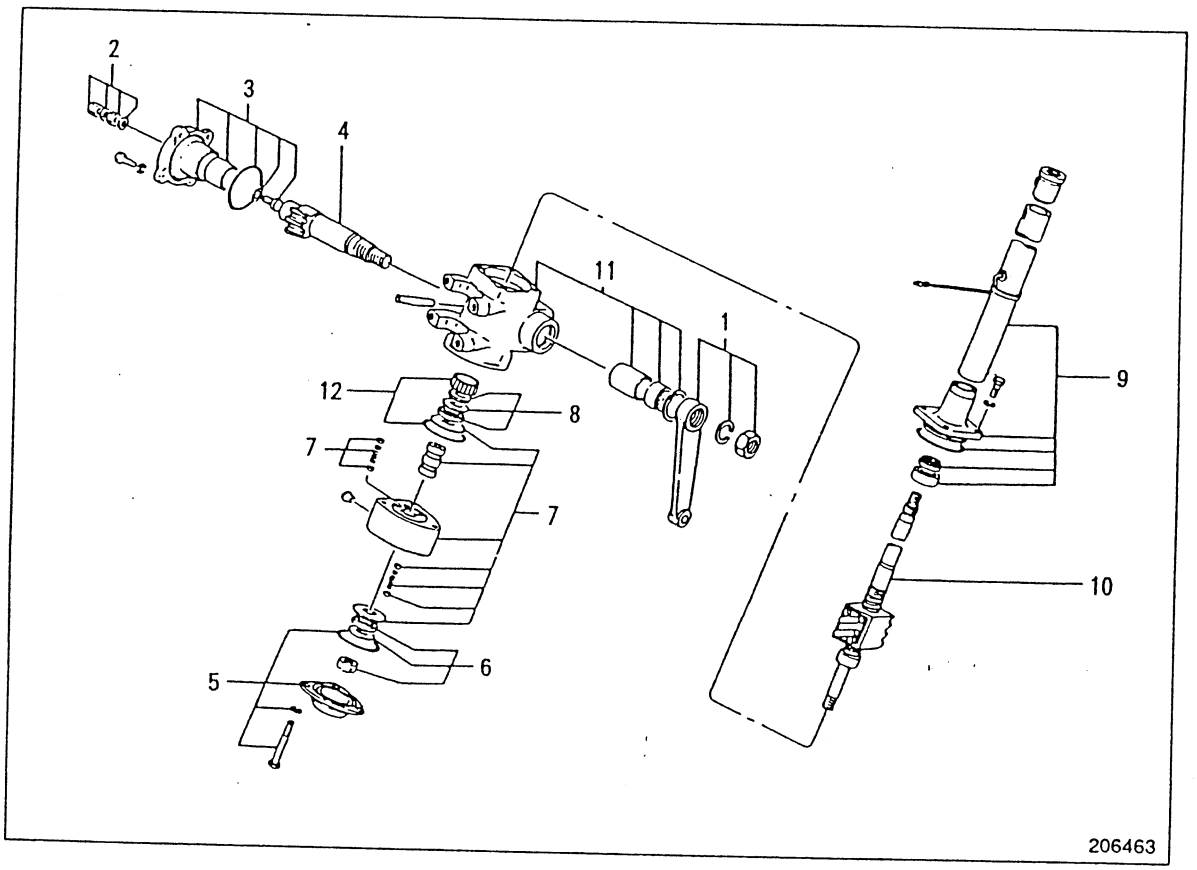
NOTE

The parts (*) to be changed periodically are involved in the Repair Kit.

DISASSEMBLY AND REASSEMBLY

Steering Gear

Disassembly



Sequence

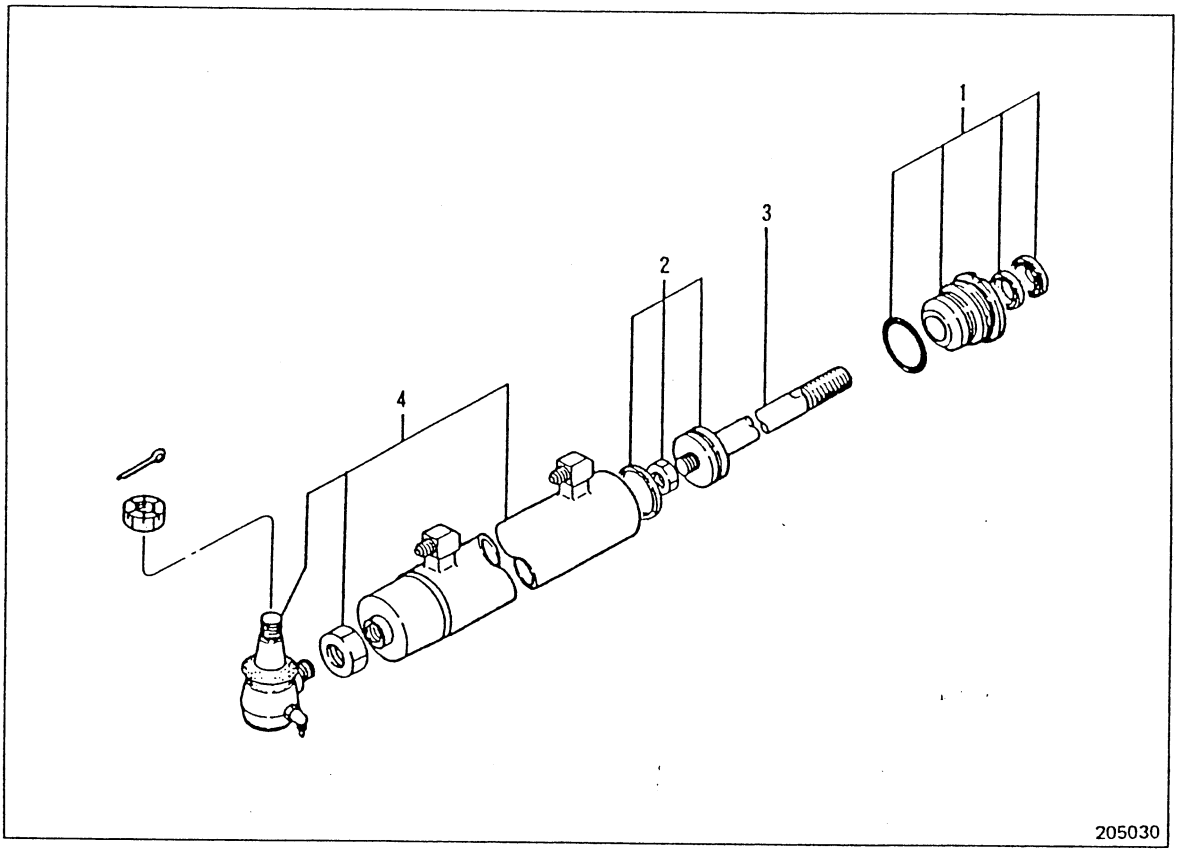
1 Pitman arm, nut, spring washer
2 Cap nut, gasket, nut
3 Side cover, O-ring, shim, adjusting screw
4 Sector shaft
5 End cover, O-ring
6 Lock nut, ring plate, needle roller bearing
7 Valve assembly
[Ring plate, valve spool, reaction piston, spring, pipe seat, valve housing]
8 Ring plate, needle roller bearing
9 Steering column assembly
[Oring, ball bearing, oil seal, column bushing]
10 Ball screw assembly
11 Gear box, snap ring, oil seal
12 Needle roller bearing, O-ring

Start by:

before assembling the steering gear, measure the starting torque of the worm with a torque wrench or spring balancer.

Power Cylinder

Disassembly



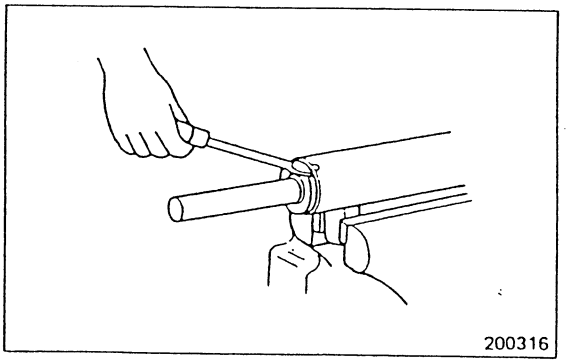
Sequence

1 Guide assembly
[Dust seal, packing, bushing guide, O-ring]
2 Piston, self-locking nut, seal
3 Piston rod
4 Cylinder tube, tie rod end, nut, pin

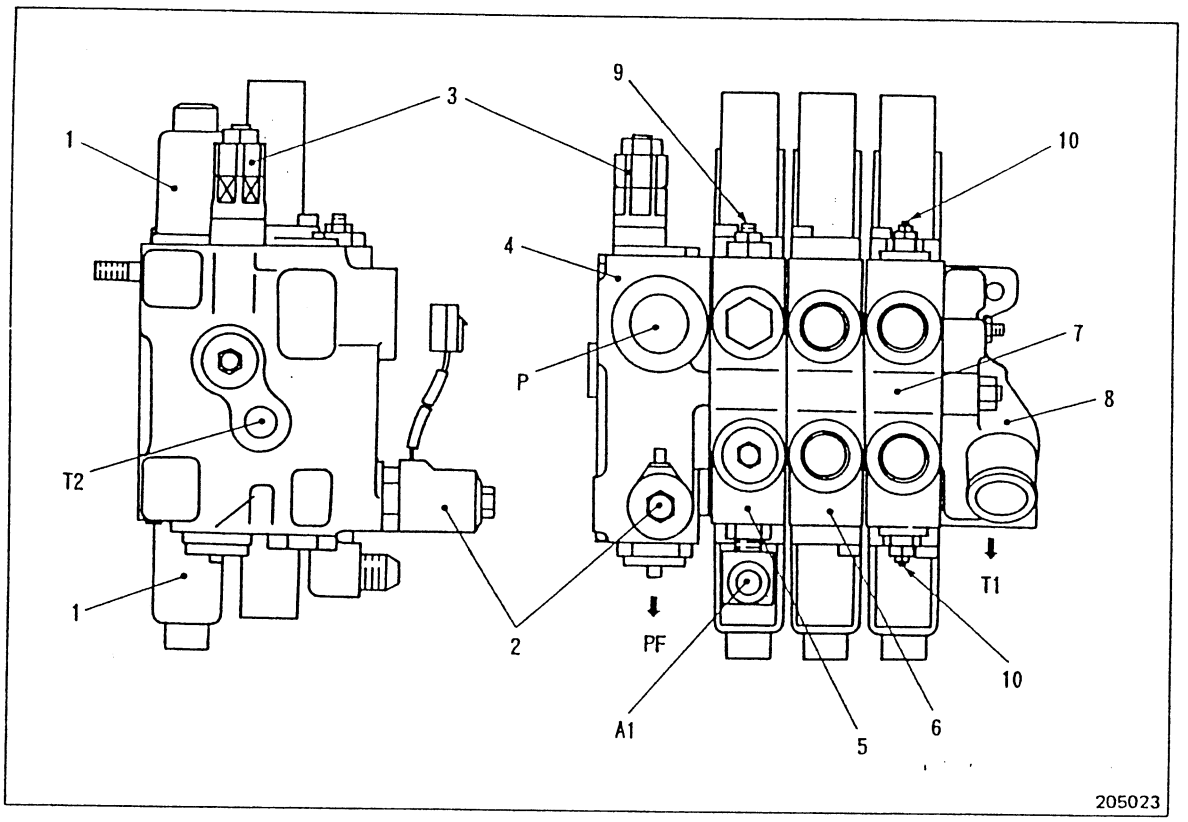
Suggestions

Guide removal

(1) Loosen the staked spot of the cylinder tube, using a pointed tool or, say, a screwdriver, with the cylinder gripped in a vise at its port (elbow) section.



Solenoid-Operated Control Valve



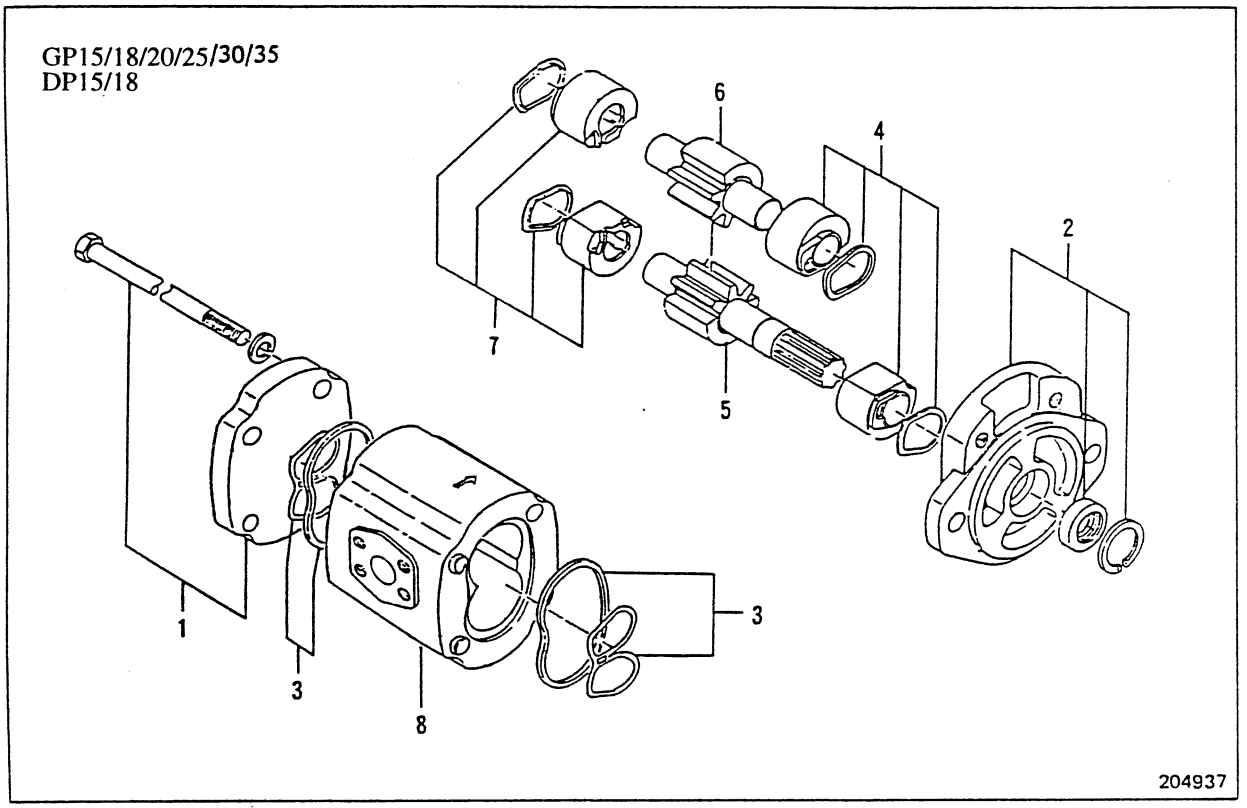
1 Proportioning solenoids
2 Unload solenoid
3 Main relief valve
4 Inlet section (with built-in flow divider valve)
5 Lift section
6 Tilt section
7 Attachment section
8 End cover
9 Emergency shutoff valve (for releasing lift lock)
10 Shutoff valve assembly [overload relief valve (option)]

P From hydraulic pump
PF To steering control valve
T1 To hydraulic tank
T2 From steering control valve
A1 To lift cylinders

The inlet section has a built-in flow divider valve. The lift section has a built-in lift lock valve: this valve locks the lift cylinders when the lift circuit is out of order. The emergency shutoff valve is for releasing this lift lock. The tilt section has a built-in tilt lock valve. The spools are actuated by the pilot pressure, the pilot pressure being controlled by the unload solenoids and proportioning solenoids.

DISASSEMBLY AND REASSEMBLY

Hydraulic Pump



Sequence

1 Cover, bolt
2 Mounting flange, snap ring, oil seal
3 Body seal, bushing seal
4 Backing rings, bushings
5 Drive gear
6 Driven gear
7 Backing rings, bushings
8 Body

General working tips

(1) Driving with a hammer or similar tool in an attempt to loosen or force out any part of the pump is not permissible. This applies particularly to the body, gears and bushings.

(2) Lay out each part removed in disassembly, identifying its location and position, so that it can be restored to its exact original condition in reassembly. This applies in particular to the pump gears and their bushings. Have them laid out neatly in, say, trays.

(3) Before starting reassembly, visually inspect all parts to be sure they are perfectly clean, and apply hydraulic oil to the sliding surfaces of the pump body.

(4) Replace seals and seal rings at each disassembly.

(5) Give a thin coat of grease to the lip of each oil seal and to the seals just before fitting them.

(6) There are four bushings for the two pump gears. Be sure to combine each with the gear from which it was removed in disassembly.

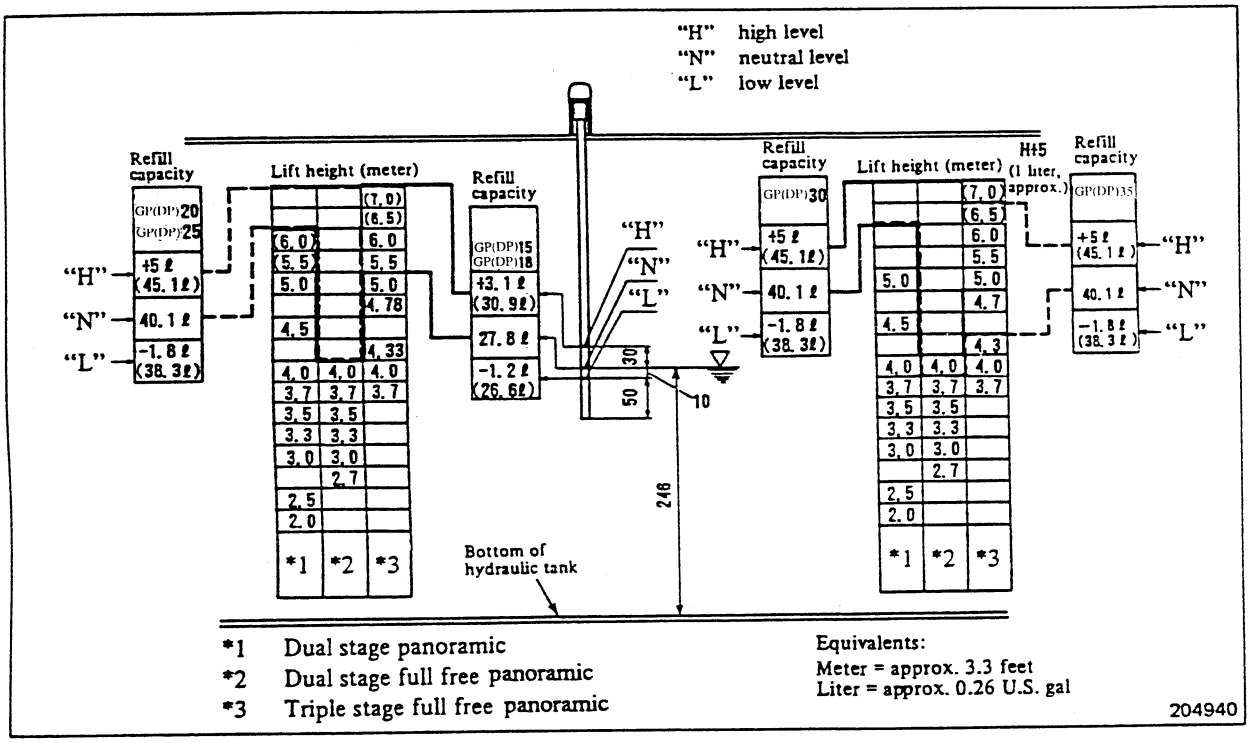
INSPECTION AND ADJUSTMENT

Hydraulic Tank

1. Hydraulic oil

Check the hydraulic oil in the tank for cleanliness. Oil appearing dirty or whitish (showing more or less emulsification) must be changed.

2. Refill capacities and the amount of oil required



Remarks:

(1) How to read the chart

[Example]

1.5 thru 1.8 ton models: In the truck equipped with a triple-stage full free 5.0 m [165.5 ft] panoramic mast, maintain the oil level at "N" mark on the level gauge with the mast lowered all the way. In the case of 5.5 to 7.0 m [18.2 to 23.1 ft] masts, maintain it at "H" mark with the mast lowered all the way.

3.5 ton models: In the truck equipped with any of the dual-stage full free masts up to 3.7 m [12.2 ft] lift height, maintain the oil level at "N" mark. In the case of 4.0 m [13.2 ft] masts, maintain it at "H" mark with the mast lowered all the way.

(2) Another general rule is this: In any machine, regardless of the mast-and-attachment combination, the oil level should not be above "H" mark on the level gauge when the mast is all the way down. In addition, about 5 mm [0.2 in.] length of the bottom end of the gauge should be in the oil when the mast is all the way up.

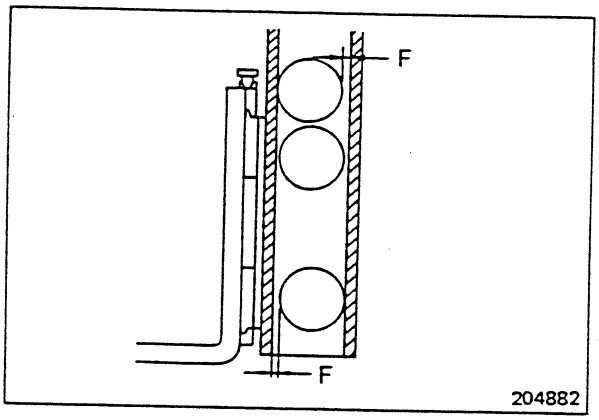
Clearance Adjustment on Lift Bracket

1. Longitudinal clearance adjustment 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 a feeler gauge, measure the clearance F between the main roller and inner mast on the opposite side.

Clearance F	0.1 to 1.0 mm [0.004 to 0.039 in.]

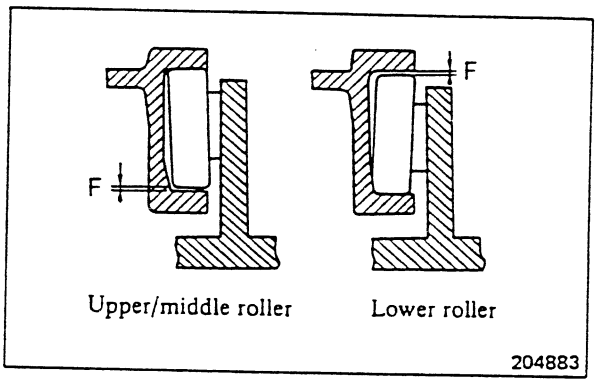


(3) If the clearance F is out of specification, use oversize rollers.

Roller sizes

Unit: mm [in.]

Diam. of main roller	GP(DP)15/18	GP(DP)20 thru 35
S	99 [3.90]	114 [4.49]
M	100 [3.94]	115 [4.53]
L	101 [3.98]	116 [4.57]



2. Lateral clearance adjustment on lift bracket main rollers and side rollers

(1) Raise the mast all the way.

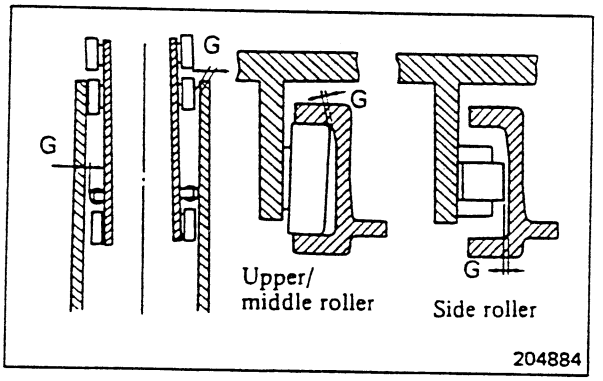
(2) Set a dial indicator on the inner mast with its contact point rested on the side of the lift bracket.

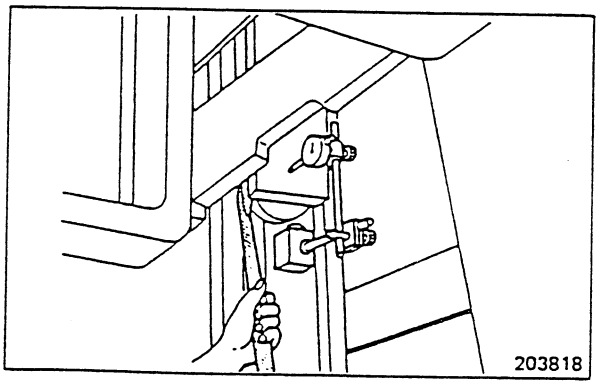
(3) Go over to the opposite side of the mast, and push the lift bracket to one side with a bar. Set the indicator to zero.

(4) Insert a bar between the inner mast and lift bracket on the indicator side, and push the lift bracket to the opposite side.

(5) Read the lateral clearance of the rollers.

Clearance G	0.1 to 0.5 mm [0.004 to 0.020 in.]





Lighting system

Complaint		Possible cause
Lamps – general	Will not light	a) Dead or weak battery b) Fuses blown out c) Open or short in circuit d) Poor ground e) Switch defective f) Filament burnt off in bulbs
	Will light dimly	a) Dead or weak battery b) Burned contact points in switches c) Loose terminals
Turn signals	Will not flicker	a) Turn signal switch defective b) Turn signal relay defective
	Will not go out	a) Turn signal relay defective b) Bulbs burnt out
	Will flicker too slow	a) Wrong wattage of bulbs b) Bulbs burnt off c) Turn signal relay defective
	Will flicker too fast	a) Wrong wattage of bulbs b) Turn signal relay defective
Other lights	Backup lamps will not light	Backup lamp switch defective
	License number plate lamp will not light	Lighting switch defective
Horn	Will not give blast of sound	a) Fuse blown out b) Open or short in circuit c) Horn switch defective d) Horn defective
	Will give ugly blast of sound	a) Horn switch defective b) Horn defective

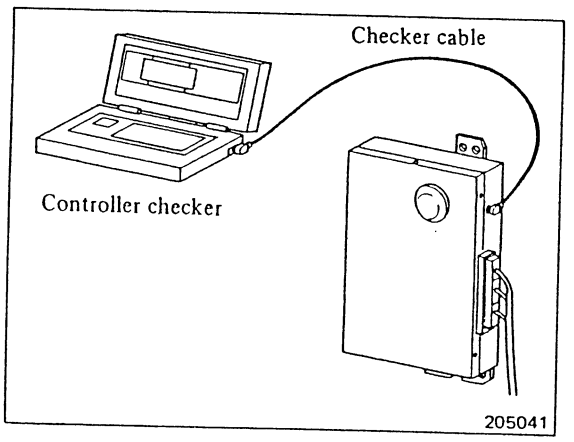
FRONT AXLE AND REDUCTION DIFFERENTIAL

Complaint	Possible cause
Gear noise comes out continuously during normal cruising run	a) Teeth worn excessively or tooth contact out of adjustment in spiral bevel drive b) Reduction gear bearings worn excessively c) Hub bearings broken d) Improper tooth contact between reduction pinion (on output shaft) and reduction gear
Irregular noise comes out during normal traveling	a) Bearings associated with spiral bevel drive or hub bearings broken b) Differential side gears having broken teeth, or thrust washers worn c) Foreign particle in axle housing d) Bolts securing axle shaft or differential carrier loose
Abnormal noise comes out when turning a corner	a) Fit of differential gears in differential case out of specification due to wear b) Teeth broken or differential pinions or side gears, or pinions seized on spiders
Differential overheats	a) Bearings broken due to too large a preload b) Backlash between reduction pinion (on output shaft) and reduction gear too small

(3) Plug the checker cable into the controller and checker.

Special tool needed

Controller checker	91105-00100
Checker cable	91105-00300



NOTE

Pushing each plug end fully into the socket.

(4) First, turn ON the starter switch, and then the checker's power switch. After this, select the forklift menu (by referring to the checker instruction book).

NOTE

Before plugging in or unplugging the checker cable, be sure to have the starter switch turned OFF.

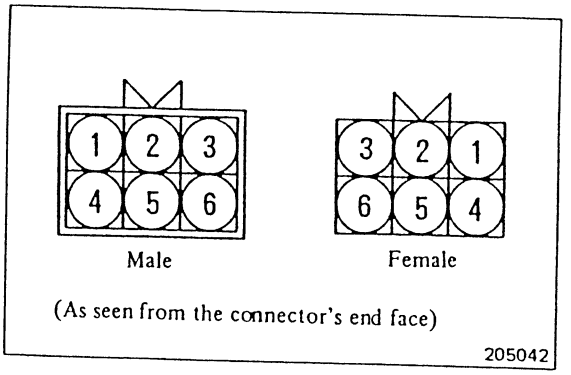
3. Troubleshooting cases as examples

(1) Explanatory notes and reminders

(a) In the text and diagrams to follow, electrical connectors are abbreviated CN. An individual CN will be identified by a number suffix (used in the electrical wiring and connection diagrams).

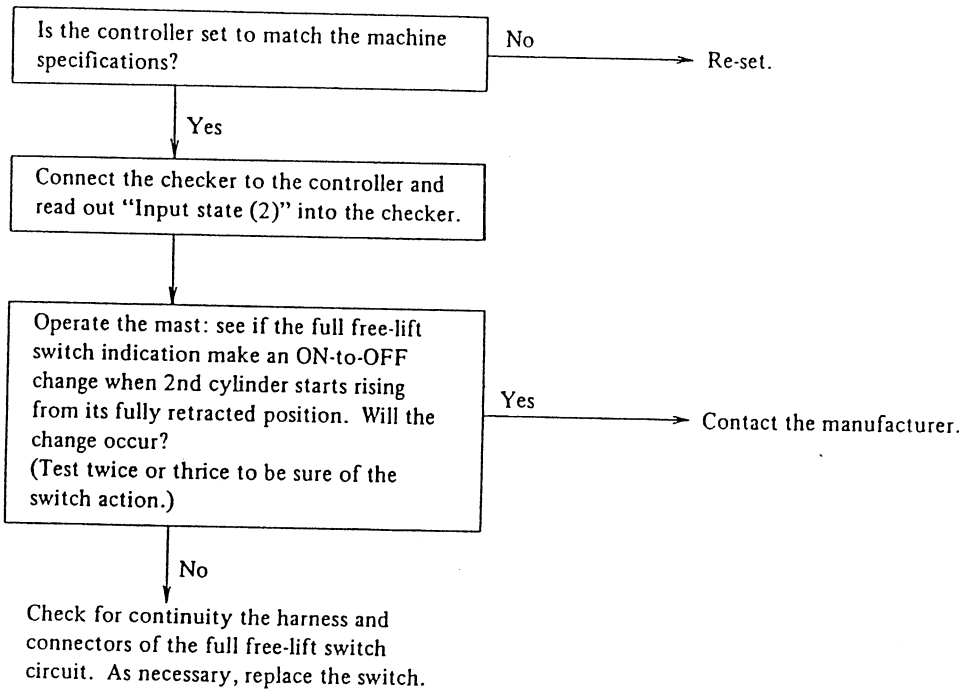
(b) In the flowchart diagrams, the numerical notation in the box, ☐, is a circuit number. The terminals of a connector too will be identified by circuit numbers. As to the configuration of terminals in each connector, refer to the wiring diagram.

(c) The wiring diagrams show the connector's terminal configuration on its male side: remember, the configuration on the female side is a mirror image of the male-side configuration.



(d) Case 6 : During the lowering action of a full free-lift mast, 1st and 2nd lift cylinders differ in actuating speed.

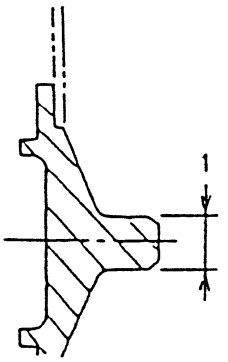
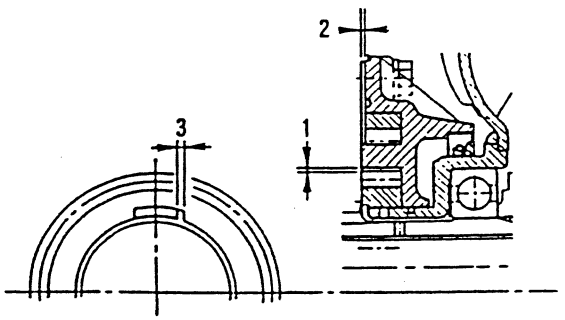
Troubleshooting procedure



A-Assembly standard B-Repair or service limit

Powershift transmission — continued

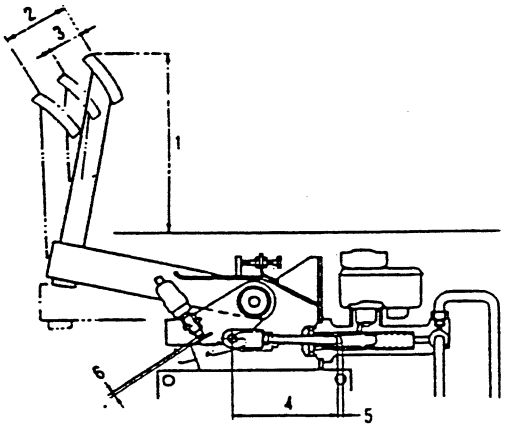
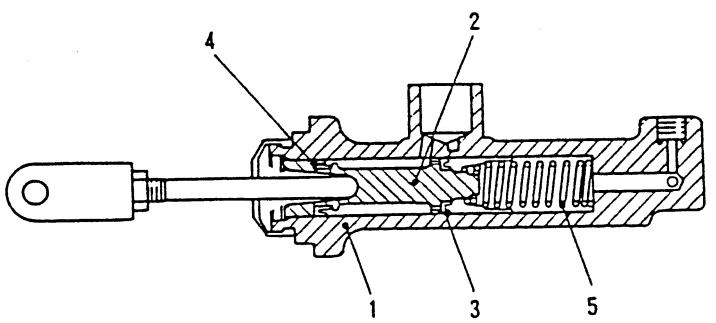
Unit: mm [in.]

Item			Truck model: GP15/18 DP15/18	GP20/25 DP20/25	GP30/35 DP30/35
Pilot boss	Diameter 1	A	$15^{-0.006}_{-0.024}$ [$0.59^{-0.00024}_{-0.00094}$]		
		B	14.95 [0.5886]		
	 200411				
Oil pump	Tip clearance 1	A	0.3 to 0.33 [0.012 to 0.0130]		
	Side clearance 2	A	0.040 to 0.083 [0.00157 to 0.00327]		
		B	0.15 [0.0059]		
	Clearance between pump boss and drive gear	A	0.1 to 0.4 [0.004 to 0.016]		
	Backlash	A	0.1 to 0.18 [0.004 to 0.0071]		
		B	0.3 [0.012]		
	Capacity, liter [cu in.]/min	A	DP: 33 [2014] at 2200 rpm GP: 36 [2197] at 2400 rpm		
		B	DP: 23 [1404] at 2200 rpm GP: 26 [1587] at 2400 rpm		
	 204831				

Brake system

A-Assembly standard B-Repair or service limit

Unit: mm [in.]

Item			Truck model: GP15/18 DP15/18	GP20/25 DP20/25	GP30/35 DP30/35
Brake pedal	Height of pedal 1	A	220 [8.7]		
	Stroke (to a point where brakes start to apply) 2	A	35 to 61 [1.4 to 2.4]	53 to 89 [2.1 to 3.5]	
	Free play of pedal 3	A	10 to 16 [0.4 to 0.6]		
	Set length of push rod 4	A	106.6 [4.197]		
	Clearance between piston and push rod 5	A	2 [0.08]		
	Projection of stop lamp switch 6	A	2 [0.08]		
	 204944				
Master cylinder	Inside diameter of cylinder body 1	A	$19.05^{+0.052}_{0}$ [$0.7500^{+0.00205}_{0}$]		
	Diameter of piston 2	A	$19.05^{-0.020}_{-0.053}$ [$0.7500^{-0.00079}_{-0.00209}$]		
	Clearance between cylinder and piston	A	0.020 to 0.105 [0.00079 to 0.00413]		
		B	0.2 [0.008]		
	Diameter of primary cup (lip side) 3	A	$20^{0}_{-0.3}$ [$0.79^{0}_{-0.012}$]		
		B	(Replace every year)		
	Diameter of secondary cup (lip side) 4	A	20.2 ± 0.2 [0.795 ± 0.008]		
		B	(Replace every year)		
	Free length of return spring 5	A	46.8 [1.843]		
		B	(Replace every year)		
	 204936				

Mast and forks

A-Assembly standard B-Repair or service limit

Unit: mm [in.]

Item			Truck model	GP15/18 DP15/18	GP20/25 DP20/25	GP30/35 DP30/35
Forks and chains	Difference in height between fork tips		A	5 [0.20]		
	Thickness of forks		A	35^{+3}_{0} [$1.38^{+0.12}_{0}$]	GP/DP20: 37^{+3}_{0} [$1.46^{+0.12}_{0}$] GP/DP25: 42^{+3}_{0} [$1.65^{+0.12}_{0}$]	50^{+3}_{0} [$1.97^{+0.12}_{0}$]
			B	32 [1.26]	GP20,DP20: 35 [1.38] GP25,DP25: 40 [1.57]	GP30,DP30: 42 [1.65] GP35,DP35: 45 [1.77]
	Length of tilt chains (per 20 links)		A	318 [12.52]	381 [15.00]	508 [20.00]
			B	327 [12.87]	392 [15.43]	523 [20.59]
Rollers	Diameter of main roller	M	A	100 [3.94]	115 [4.53]	
		L	A	101 [3.98]	116 [4.57]	
		S	A	99 [3.90]	114 [4.49]	
	Diameter of side roller		A	42 [1.65]		
Mast and lift bracket	Distance between outer mast main rollers (inside to inside) A		A	511 [20.12]	559 [22.01]	
	Distance between inner mast main rollers (outside to outside) B		A	581 [22.87]	639 [25.16]	
	Distance between lift bracket main rollers (outside to outside) C, D		A	477 [18.78]	523 [20.59]	
	Distance between lift bracket side rollers (outside to outside) E		A	482 [18.98]	528 [20.79]	
	Longitudinal clearance of lift bracket main rollers (with forks slightly lifted) F		A	0.1 to 1.0 [0.004 to 0.039]		
	Lateral clearance of lift bracket main rollers (fully raised) G		A	0.1 to 0.5 [0.004 to 0.020]		
	Longitudinal clearance of mast main rollers (in the whole lift range) H		A	0.1 to 1.0 [0.004 to 0.039]		
	Lateral clearance of inner mast main rollers (fully raised) J		A	0.1 to 0.5 [0.004 to 0.020]		
	Lateral clearance of outer mast main rollers (fully raised) K		A	0.1 to 0.5 [0.004 to 0.020]		
	Mast strip clearance (fully raised) L		A	0.1 to 0.5 [0.004 to 0.020]		

Inspection point		How to check	Intervals			Service data
			Pre-start	1 moth	12 month	
Mast and lift bracket	Cracks, distortion or other defects	Visual/ dye check	○	○	○	
	Mast supports — rattle or damage			○	○	
	Main rollers — clearance, damage	Feeler gauge/ dial gauge		○	○	Each roller to mast clearance (at max. height): 0.1 to 0.5 mm [0.004 to 0.020 in.]
Lift chains and chain wheels	Length of lift chains (20 links)	Scale			○	GP(DP)15/18: 318 mm [12.5 in.] GP(DP)20/25: 381 mm [15.0 in.] GP(DP)30/35: 508 mm [20.0 in.]
	Tension deflection) of lift chains	Scale	○	○	○	Both chains to be equal in tension
	Chains — damage or rusting	Visual	○	○	○	
	Chain wheels — wear, distortion or other defects	Visual		○	○	
	Chain wheel bearings — rattle	Feel		○	○	
	Chain anchor bolts — distortion or damage	Visual		○	○	
Forks and backrest	Forks — wear and distortion	Visual/scale	○	○	○	Fork thickness Refer to Service Data.
	Fork stopper pins — damage or distortion	Visual	○	○	○	
	Backrest mounting bolts — thightness	Torque wrench	○	○	○	
	Backrest — distortion or damage	Visual	○	○	○	
Lights	Operation	Test/visual	○	○	○	
Turn signals	Operation	Test	○	○	○	
Rear view mirrors	Rear vision	Visual	○	○	○	
Overhead guard	Installation and damage	Visual/wrench	○	○	○	
Chassis	Loosen bolts or nuts	Wrench			○	
	Operator's seat — damage and installation	Visual		○	○	
	Lubrication points	Lubricate		○	○	Lubricate mast supports every 1 week.
	Oil change	Inspect		○	○	

Ref. No.	Part number	Part name	Used for:	Used on: GP(DP)15 and 18	GP(DP)20 and 25	GP(DP)30 and 35
40	91268-03200	Puller	Removal of steering column needle roller bearing	O	O	O
41	91268-13400	Socket	Removal and installation of power cylinder guide	O	O	O
42	91268-12900	Guide	Installation of power cylinder piston	O	O	O
43	91268-13600	Rod cap	Installation of power cylinder guide	O	O	O
44	91268-03300	Plate	Assembly of steering control valve	O	O	O
45	91268-06200	Connector	Measurement of power steering relief pressure (to be used with 64309-17701 gauge kit)	O	O	O
46	91268-01600	Installer	Installation of tilt cylinder tube bushing	O	O	O
47	09305-00680 09305-00750 09305-00880	Hook wrench	Removal and installation of tilt cylinder guide bushing	O – –	– O –	– – O
48	64309-16300 F4540-06300	Pipe Connector	Measurement of control valve main relief pressure and overload relief pressure (to be used with 64309-17701 gauge kit on power-shift transmission models)	O O	O O	O O