CEBM003702

Shop Manual

avance LOADER

WA900-3LC

WHEEL LOADER

SERIAL NUMBERS **WA900-3LC** **A50001** and UP

It is our policy to improve our products whenever it is possible and practical to do so. We reserve the right to make changes or add improvements at any time without incurring any obligation to install such changes on products sold previously.

Due to this continuous program of research and development, periodic revisions may be made to this publication. It is recommended that customers contact their distributor for information on the latest revision.

November 2002
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DataKom Publishing Division

PRODUCT PUBLICATIONS INFORMATION

Various product Parts and Service Publications are available to all **KOMATSU** construction equipment owners, including operation and maintenance manuals, parts books and service manuals.

Special publications, such as service tool, air conditioning and turbocharger service manuals are also available as well as selected Operation and Service manuals in foreign languages.

The Publications listed below are available for this particular machine(s).

DESCRIPTION	FORM NUMBER
PARTS BOOK - PAPER:	
Chassis and Engine	BEPB006101
OPERATION AND MAINTENANCE MANUAL:	
Chassis and Engine	CEAM004002
SHOP MANUAL	
Chassis	CEBM003702
Engine	CEBM002602
SAFETY MANUAL	
Machine specific	WLT70-1

Parts and Service Publications can *only* be acquired by authorized KOMATSU distributors using the Komatsu America International Company Parts Inventory Processing System (PIPS).

If the PIPS system is not available at the distributor location, then the following Requisition for Technical Service Publications and Service Forms can be used. Form KDC91E is shown on the reverse side of this page.

TIGHTENING TORQUE OF HOSE NUTS

Use these torques for hose nuts.

Nominal No.	Thread diameter	Width across flat	Tightening torque	
	mm	mm	Nm	kgm
02	14	19	24.5 ± 4.9	2.5 ± 0.5
03	18	24	49 ± 19.6	5 ± 2
04	22	27	78.5 ± 19.6	8 ± 2
05	24	32	137.3 ± 29.4	14 ± 3
06	30	36	176.5 ± 29.4	18 ± 3
10	33	41	196.1 ± 49	20 ± 5
12	36	46	245.2 ± 49	25 ± 5
14	42	55	294.2 ± 49	30 ± 5

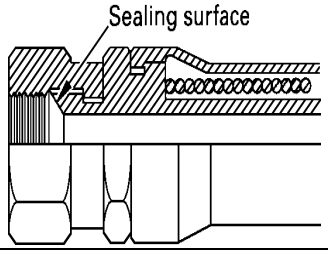
TIGHTENING TORQUE OF SPLIT FLANGE BOLTS

Use these torques for split flange bolts.

Thread diameter	Width across flat	Tightening torque	
mm	mm	Nm	kgm
10	14	65.7 ± 6.8	6.7 ± 0.7
12	17	112 ± 9.8	11.5 ± 1
16	22	279 ± 29	28.5 ± 3

TIGHTENING TORQUE FOR FLARED NUTS

Use these torques for flared part of nut.



Thread diameter	Width across flat	Tightening torque	
mm	mm	Nm	kgm
14	19	24.5 ±4.9	2.5 ±0.5
18	24	49 ±19.6	5 ±2
22	27	78.5 ±19.6	8 ±2
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30	36	176.5 ±29.4	18 ±3
33	41	196.1 ±49	20 ±5
36	46	245.2 ±49	25 ±5
42	55	294.2 ±49	30 ±5

SPECIFICATIONS

	Machine model	WA900-3LC	
	Serial Number	A50001and up	
Performance	Bucket capacity (standard lift boom) Rated load (standard lift boom)	11 cu. m 19800 kg	(14.4 cu. yd.) (43659 lbs)
	Bucket capacity (standard lift boom) Rated load (high lift boom)	9.5 cu. m 18000 kg	(12.4 cu. yd.) (39683 lbs)
	Travel speed	**km/h**	**mph**
	Forward 1st 2nd 3rd	7 12.3 28.3	4.3 7.6 17.4
	Reverse1st 2nd 3rd	7.1 12.4 28.3	4.4 7.7 17.6
	Grade-ability	25°	25°
	Minimum turning radius, outside corner of bucket (standard) Minimum turning radius, outside corner of bucket (high lift)	11065 mm 11150 mm	36 ft., 4 in. 36 ft., 7 in.
Dimensions		**mm**	**IN**
	Overall length (standard lift boom) Overall length (high lift boom)	14,430 14935	568.1 588
	Overall width (chassis)	4585	180.9
	Bucket (with bolt-on cutting edge)	4815	190
	Overall height (top of ROPS cab)	5275	207.7
	Overall height (bucket raised, standard lift boom) Overall height (bucket raised, high lift boom)	9680 9875	381 388.8
	Wheelbase	5450	214.6
	Tread	3350	131.9
	Minimum ground clearance	550	21.6
	Height of bucket hinge pin (standard lift boom) Height of bucket hinge pin (high lift boom)	6960 7445	274 293.1
	Dumping clearance (tip of cutting edge)	5020	198
	Digging depth (10 degree dump angle, standard lift boom) Digging depth (10 degree dump angle, high lift boom)	585 550	23 22
	Bucket dump angle (max. height)	45°	45°
	Bucket tilt angle (SAE carrying position)	50°	50°

Replenishing Coolant Conditioner

Install a “precharge” coolant filter when the coolant is changed or a significant (more than 50%) coolant loss occurs. When antifreeze is added, add coolant conditioner equal to 1.0 unit per 3.8 liters (1 US gal) of antifreeze.

NOTICE:

Mixing of DCA4 and other supplemental coolant additives is not recommended because there is currently no test kit available to measure concentration levels with mixed chemical solutions.

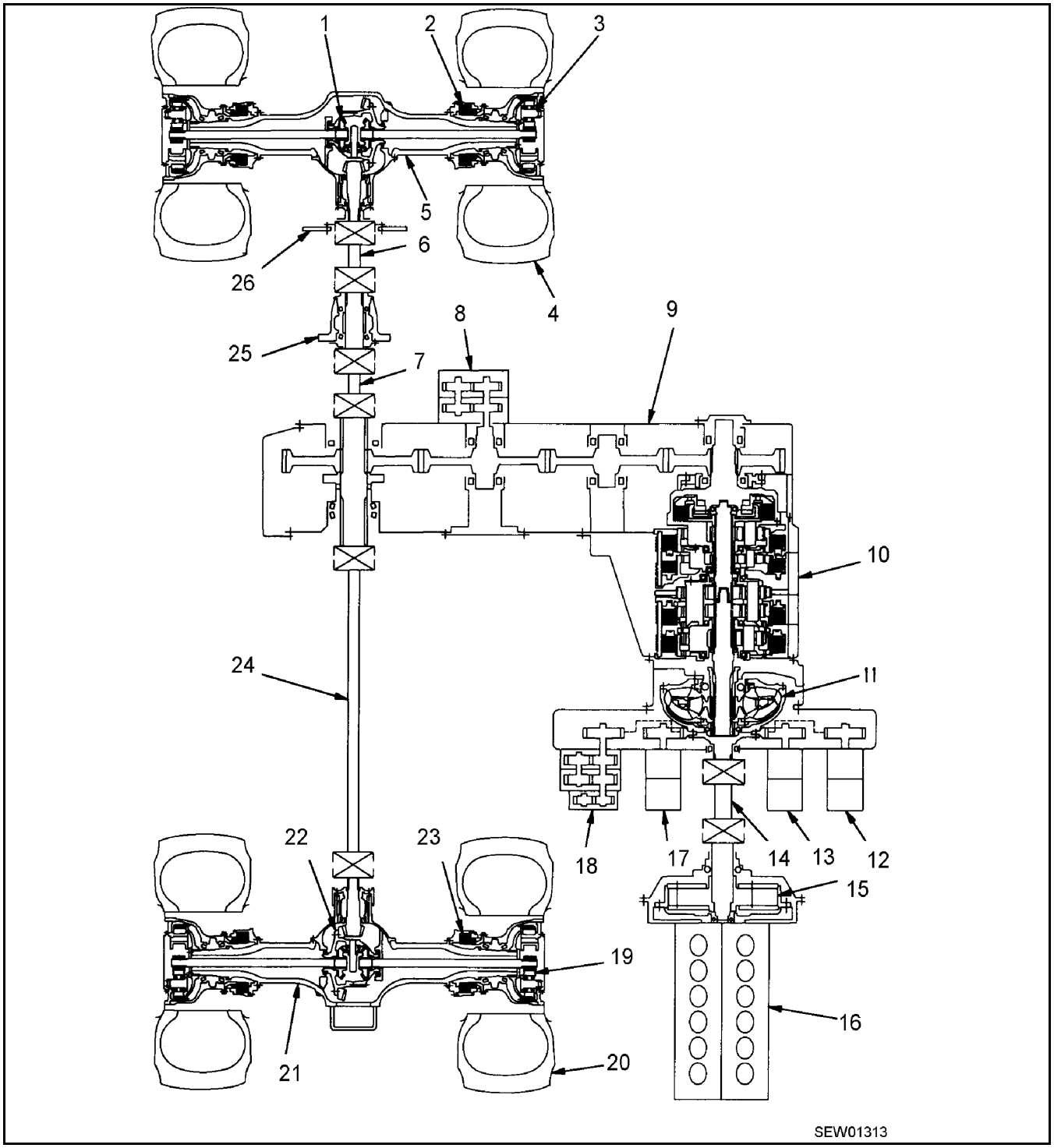
Supplemental Coolant Additive Maintenance Guide

Use supplemental coolant additives (corrosion inhibitors) to protect the engine cooling system from corrosion. Antifreeze alone does **not** provide enough corrosion protection for a heavy duty diesel engine. Supplemental corrosion protection **must** be supplied through periodic additions of supplemental coolant additives to the coolant.

To protect against corrosion, a new coolant charge **must** be brought up to 0.26 SCA unit per liter [one unit per U.S. gallon] of coolant (initial charge). Maintain the correct SCA concentration by changing the service coolant filter at each engine oil and filter change interval.

Each time the coolant is drained and replace, the coolant **must** be recharged with supplemental coolant additives. Use the appropriate replacement coolant filter listed in following tables. The coolant mixture **must** be drained and replaced as defined under “General.”

The amount of a replacement inhibitor is determined by the length of the service interval and the cooling system capacity. Refer to the DCA4 Unit Guide for the selection of the correct filter to replenish the SCA.



1. Differential (front)
2. Front brake
3. Final drive (front)
4. Front wheel
5. Front axle
6. Front drive shaft
7. Center drive shaft
8. Ground driven steering pump
9. Transfer
10. Transmission
11. Torque converter
12. Steering pump
13. Main pump
14. Upper drive shaft
15. Damper
16. Engine
17. Switch pump
18. Torque converter charging pump and PPC pump
19. Rear final drive
20. Rear wheel
21. Rear axle
22. Rear differential
23. Rear brake
24. Rear drive shaft
25. Center support
26. Parking brake

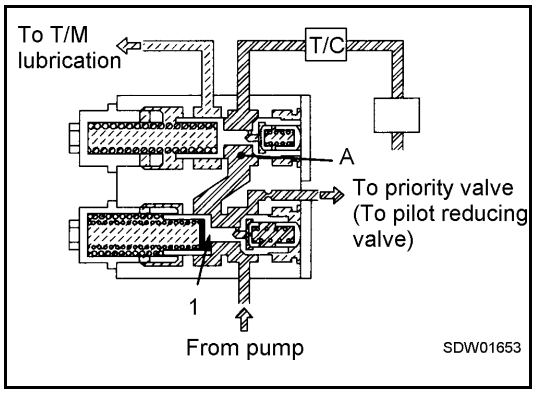
RELIEF VALVE

OUTLINE

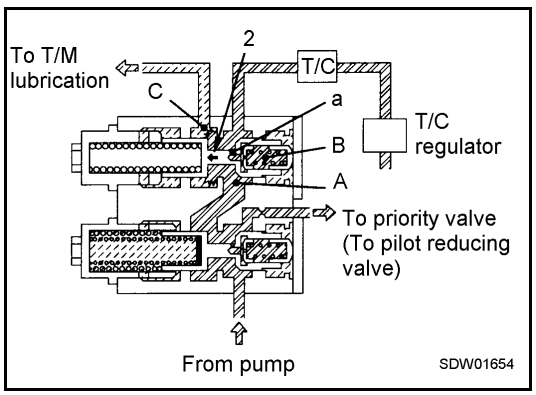
- The torque converter relief valve, located inside the transmission valve, acts to keep the oil entering the torque converter at a constant pressure. If the specified pressure is exceeded, the valve causes oil to drain.

FUNCTION

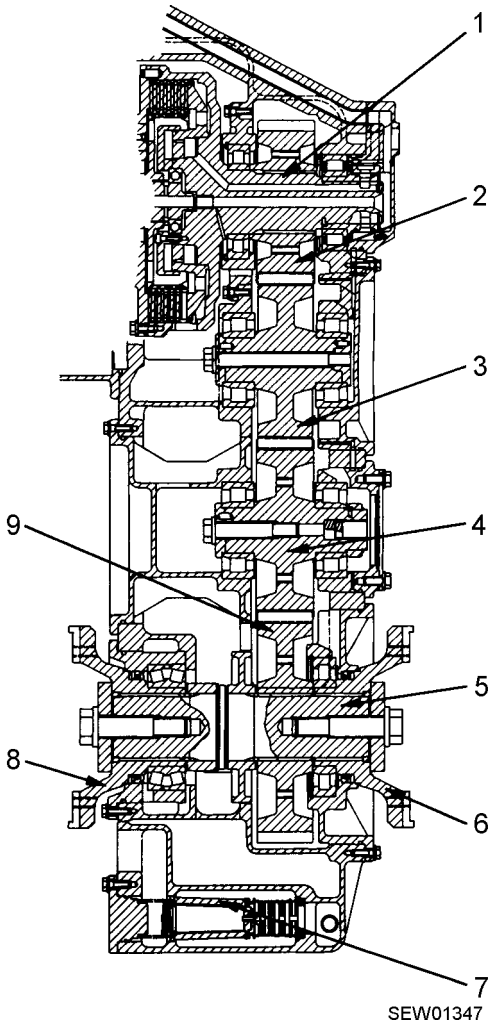
- The oil from the pump passes through transmission main relief valve (1), enters port **A**, and then flows to the torque converter.



- If the oil at port **A** exceeds the specified pressure, the oil from orifice **a** of torque converter relief valve (2) enters port **B** and moves torque converter relief valve (2) to the left in the direction of the arrow.
- As a result, the oil from port **A** flows from port **C**, lubricates the transmission, and is drained.



TRANSFER



1. Transmission output shaft
2. Transfer input gear (32 teeth)
3. Transfer idler gear (33 teeth)
4. Idler gear (34 teeth)
5. Output shaft
6. Front coupling
7. Strainer
8. Rear coupling
9. Output gear (44 teeth)

OUTLINE

- The transfer is installed at the power output end of the transmission and is secured to the transmission case by bolts.

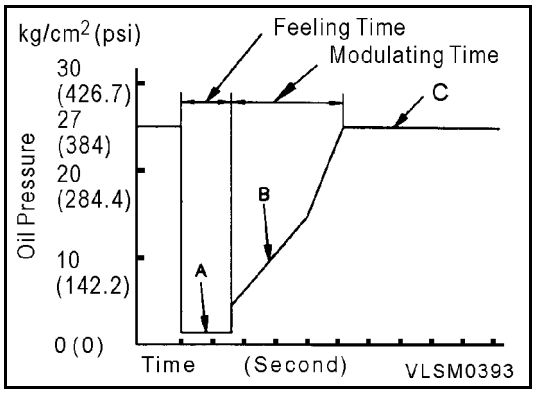
TRANSMISSION PATH

- Output shaft (1) of the transmission is coupled to transfer input gear (2) by a spline. The motive force is transmitted to output shaft (5) through idler gear (3), (4) and output gear (9).
- Part of the power transmitted to the output shaft is transmitted to the front axle through the center drive shaft and front drive shaft. The rest of the power is transmitted to the rear axle through the rear drive shaft.

MODULATING VALVE AND QUICK RETURN VALVE

FUNCTION

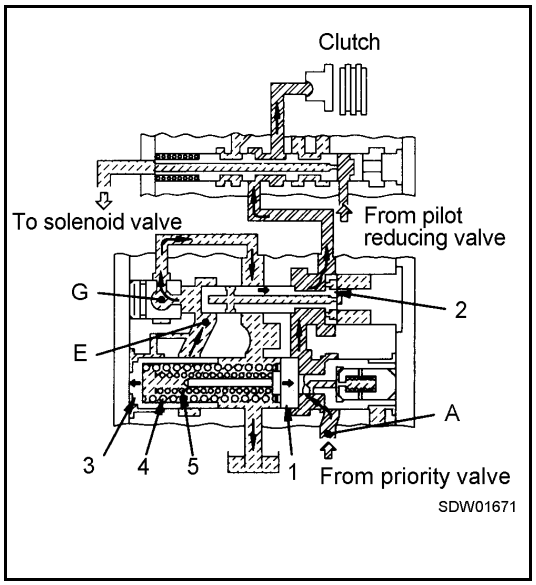
The modulating valve and quick return valve act together to make sure the transmission clutch pressure is raised smoothly. This reduces shock when shifting between speed ranges, and prevents the generation of peak torque in the power train. Therefore, operator fatigue is reduced to give better operating comfort, and at the same time, the durability of the power train is increased.



OPERATION

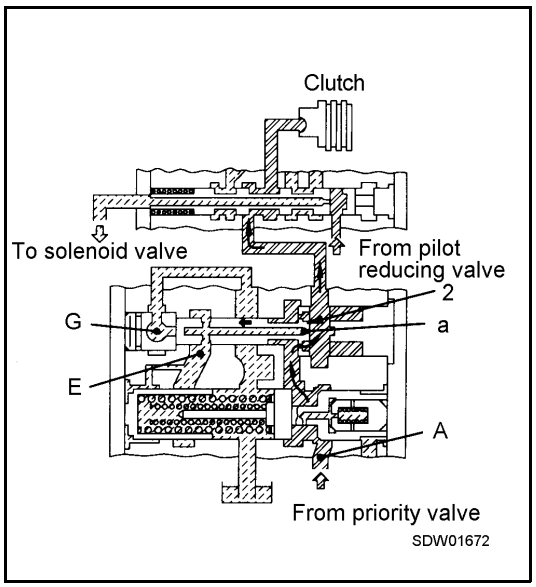
1. Immediately after shifting gear (point A)

When the gear shift lever is operated to engage the clutch, the passage from the pump to the clutch cylinder is opened and oil flows to the clutch cylinder. Using the force of this flow, quick return valve (2) moves to the right in the direction of the arrow, and connects port **E** and port **G**. When the back pressure of piston (3) is removed, the tension of springs (4) and (5) move modulating valve (1) to the right in the direction of the arrow. At the same time, piston (3) is returned to the left in the direction of the arrow.



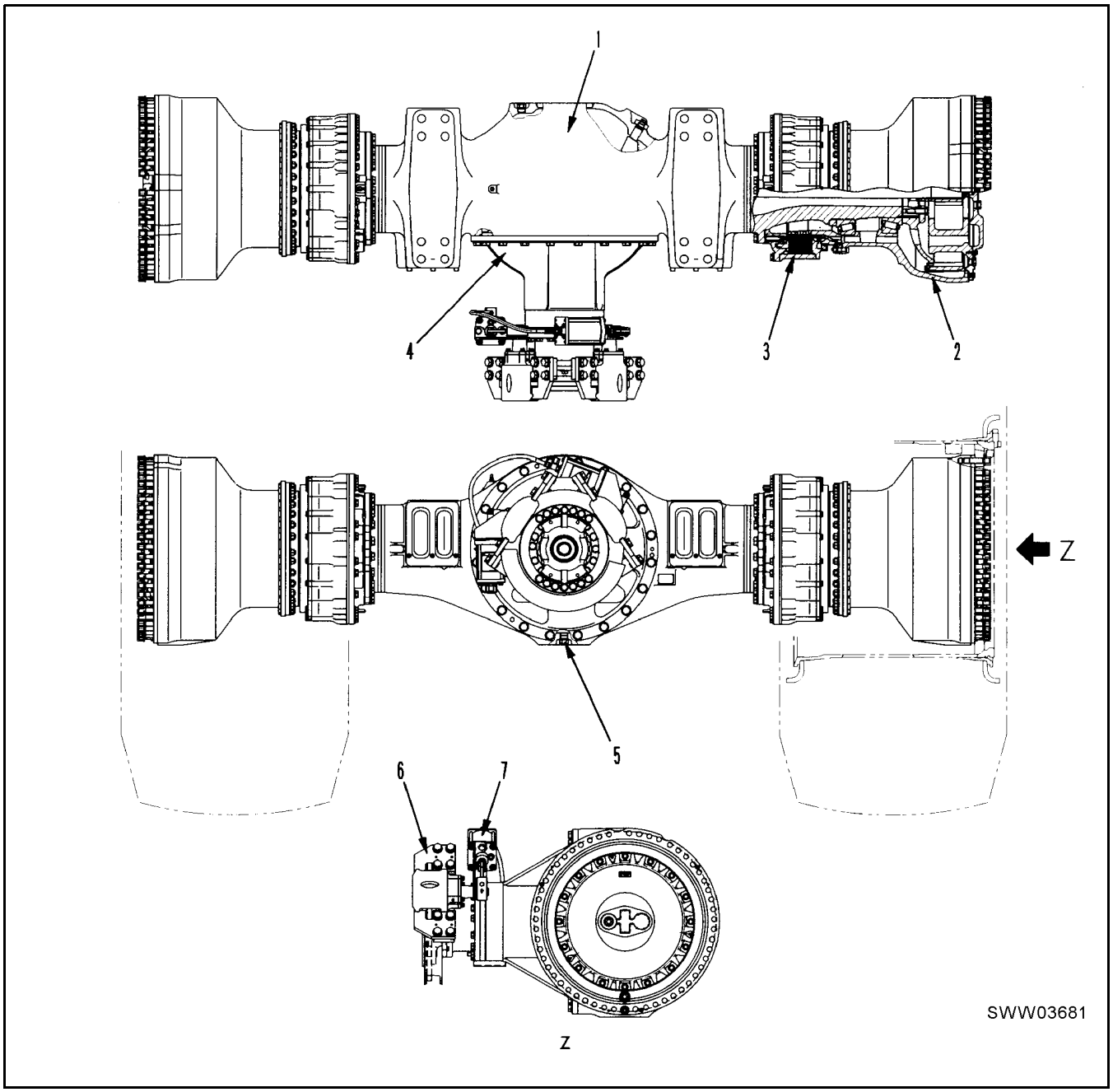
2. Hydraulic pressure starts to rise (point B)

When the oil sent under pressure from pump fills the circuit from port **A** to the clutch cylinder, the hydraulic pressure starts to rise. The oil passing through orifice **a** of quick return valve (2) moves quick return valve (2) to the left in the direction of the arrow. As a result, the passage between port **E** and port **G** closes.



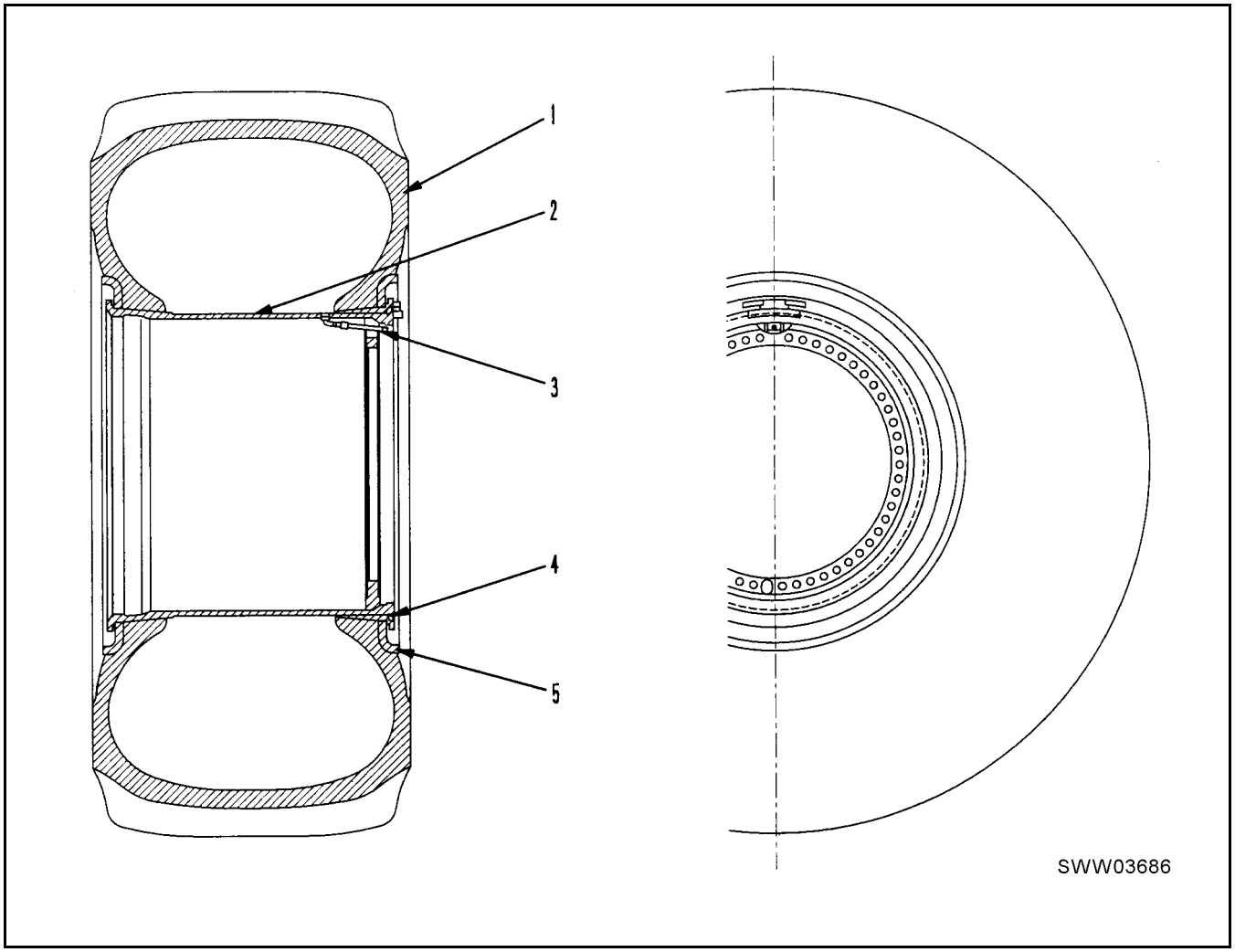
AXLE

FRONT AXLE



1. Front axle
2. Final drive
3. Brake
4. Front differential
5. Drain plug
6. Parking brake
7. Spring cylinder

TIRE AND WHEEL



1. Tire
2. Rim
3. Valve
4. Lock ring
5. Side ring

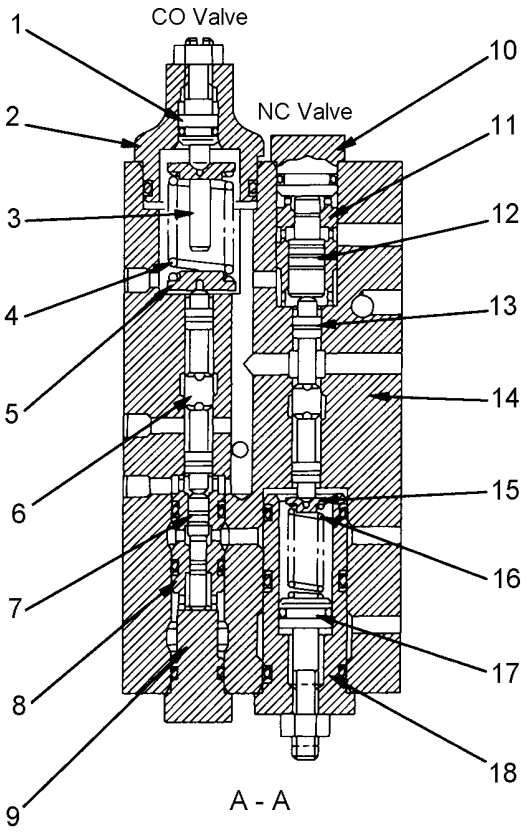
OUTLINE

The tires absorb shock that the machine receives from the road surface. At the same time, they transmit drive force by rotating in contact with the ground.

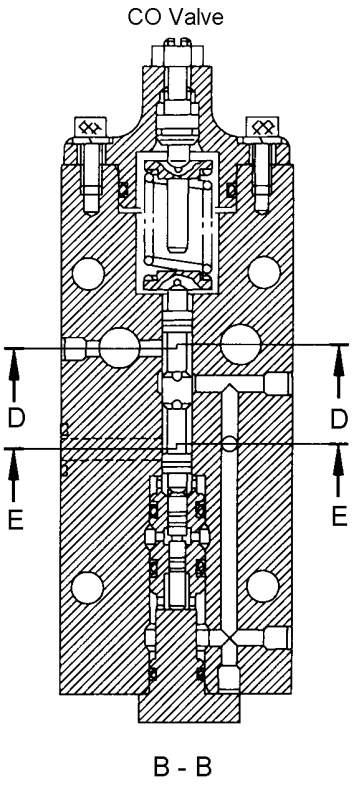
Various types of tires are available to suit the customers' needs, so it is important to select the correct tire to match the type of work and the bucket capacity.

Specifications

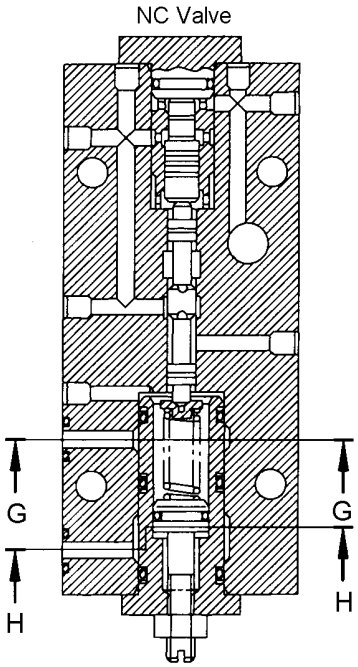
Tire type:	45/65-45-58PR
TRA code:	L5
Nominal wheel:	36.00 x 45WTB
Normal inflation pressure:	667 kPa (6.8 kg/cm^2)



A - A



B - B



C - C

CO VALVE
1. Plug
2. Cover
3. Seat
4. Spring
5. Seat
6. Spool
7. Piston
8. Sleeve
9. Plug

NC VALVE
10. Plug
11. Sleeve
12. Piston
13. Spool
14. Body
15. Seat
16. Spring
17. Plug
18. Cover

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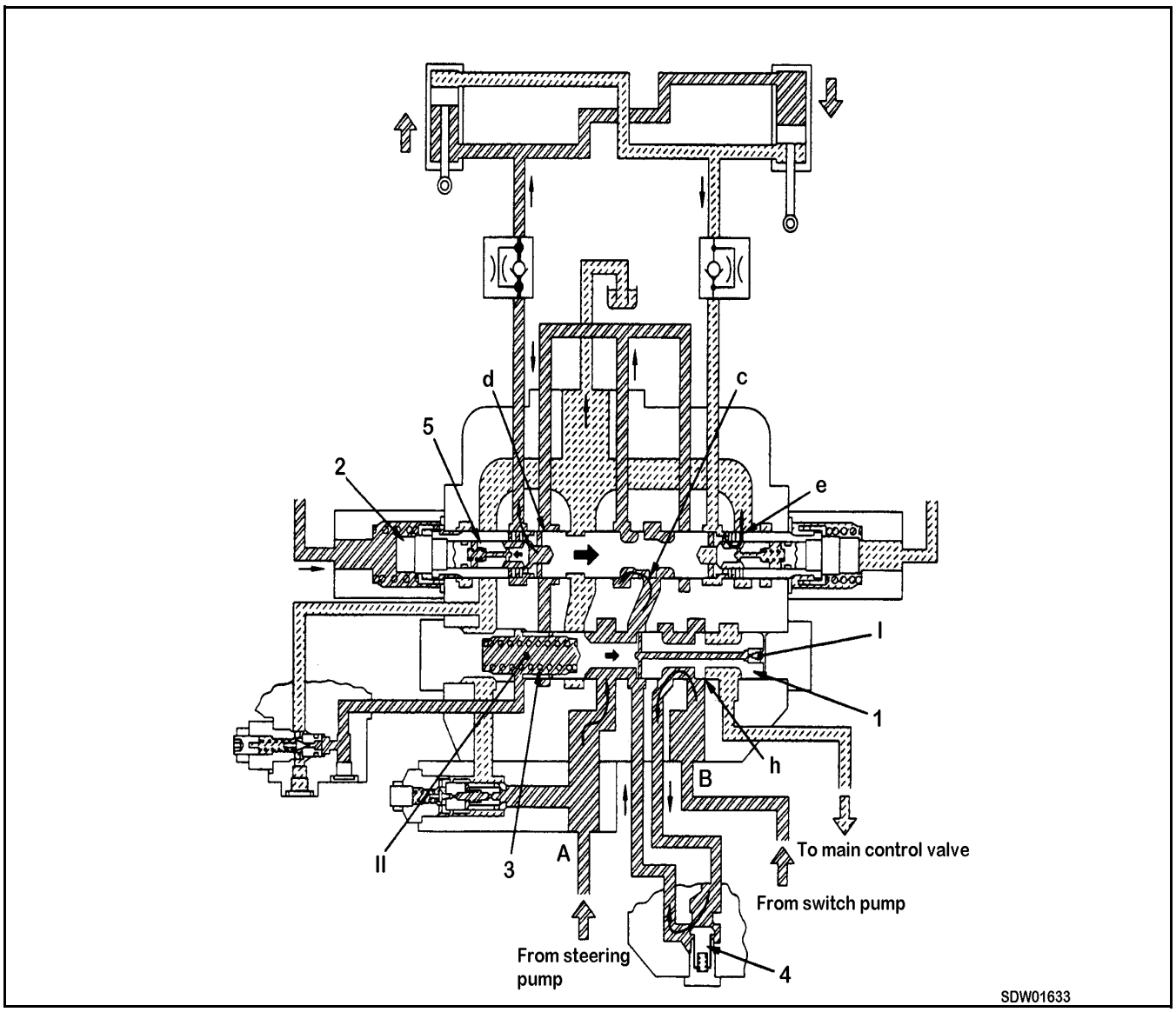
WHEN STEERING SPOOL IS OPERATED

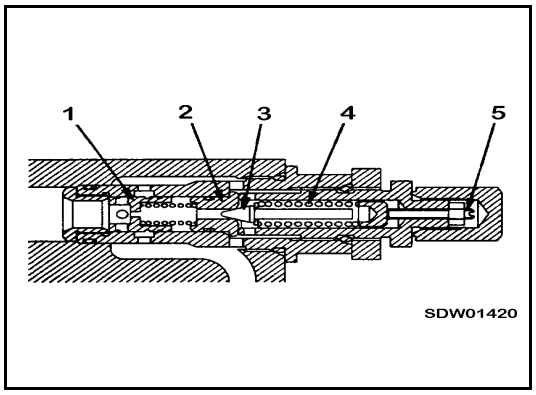
Engine running at low speed



- When the steering is operated, oil flows from the Orbit-Roll to steering spool (2) and pushes steering spool (2) to the right. The circuit between pressure receiving chamber (II) and the drain circuit is shut off, and at the same time, notch **c** opens.
- As a result, the pressure in pressure receiving chamber (II) rises, and demand spool (1) moves to the right until notch **h** closes.
- The passage from port **B** to the main control valve is shut off, so the oil from the switch pump pushes up pump merge divider check valve (4) and merges with the oil from the steering pump at port **A**.
- The merged oil passes through notches **c** and **d**, pushes load check valve (5), and flows to the cylinder. The return oil from the cylinder passes through notch **e** and flows to the drain circuit.
- When this happens, the pressure before passing through notch **c** is sent to pressure receiving chamber (I) and the pressure after passing through notch **c** is sent to pressure receiving chamber (II). Demand spool (1) is actuated so that the difference in pressure on both sides of notch **c** is kept constant. Therefore, an oil flow corresponding to the opening of notch **c** is supplied to the cylinder port. These pressure differences (control pressure) are set by spring (3).

GROUND DRIVEN STEERING

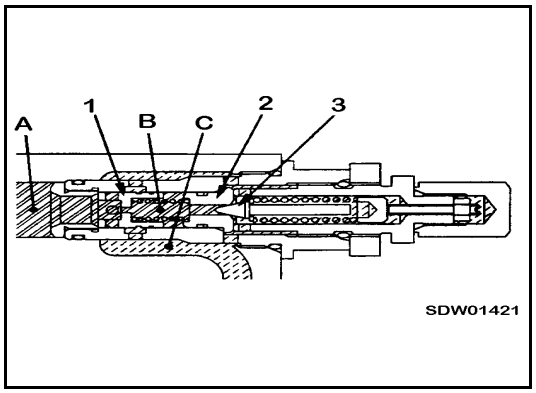
RELIEF VALVE



1. Main valve
2. Valve seat
3. Pilot poppet
4. Spring
5. Adjustment screw

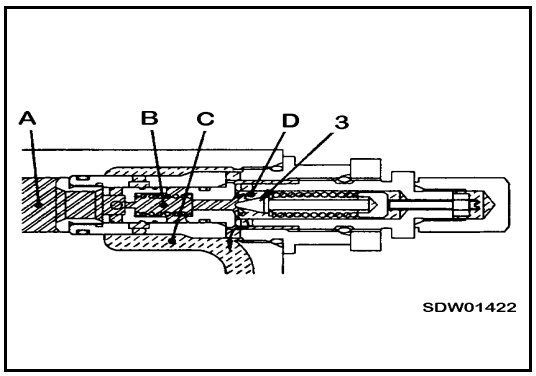
FUNCTION

Compared to the steering valve relief pressure of 320 kg/cm^2 (4551 psi), the rated pressure of the ground driven steering pump and diverter valve are both 210 kg/cm^2 (2987 psi). Therefore, to protect the ground driven steering pump and diverter valve, there is a relief valve in the piping from the diverter valve to the steering valve. When the ground driven steering is being operated, and the hydraulic pressure generated by the steering exceeds 210 kg/cm^2 (2987 psi) the relief valve is actuated.



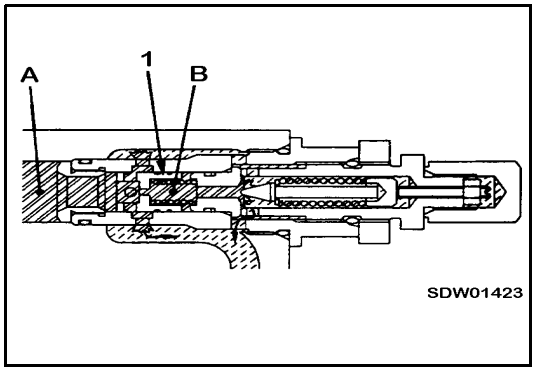
OPERATION

- Port **A** is connected to the pump circuit, and port **C** is connected to the drain circuit. The oil passes through the orifice in main valve (1) and fills port **B**. Pilot poppet (3) is in contact with valve seat (2).



- When the pressure inside port **A** and **B** reaches the pressure set by the poppet spring (set pressure), pilot poppet (3) opens and the hydraulic pressure at port **B** escapes from port **D** to port **C**. This lowers the pressure at port **B**.

- When the pressure at port **B** drops, the orifice of main valve (1) generates a difference in pressure between port **A** and port **B**. Main valve (1) is opened by the pressure at port **A** and the oil at port **A** is relieved.



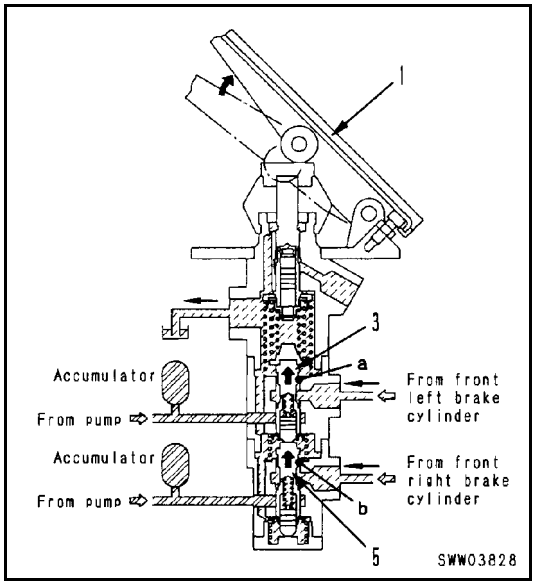
When brake is released

Upper

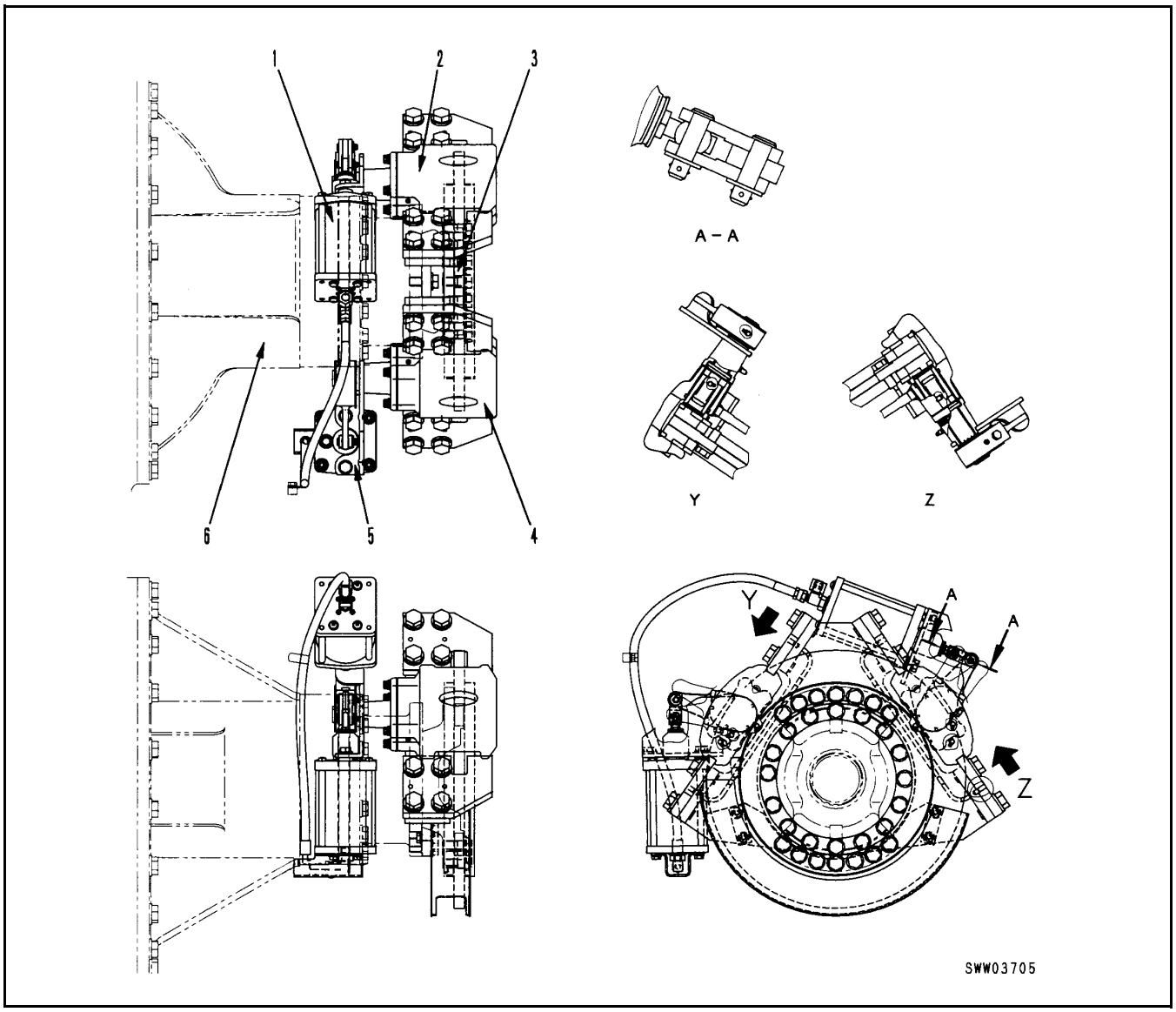
When pedal (1) is let back and the operating effort is removed from the top of the spool, spool (3) is moved up by the back pressure from the brake cylinder and the spool return spring. Drain port **a** is opened, and the oil from the brake cylinder flows to the brake oil tank return circuit, so the front left brake is released.

Lower

When the pedal is let back, upper spool (3) is moved up, and at the same time, spool (5) is moved by the back pressure from the brake cylinder and the spool return spring. Drain port **b** is opened, and the oil from the brake cylinder flows to the brake oil tank return circuit, so the front right brake is released.



PARKING BRAKE



1. Spring cylinder
2. Caliper
3. Spring cylinder
4. Disc
5. Caliper
6. Differential case

OUTLINE

- The parking brake is a disc type and is installed on the front axle.
- The force of the spring inside spring cylinder (1) is used to apply the brake mechanically; it is released by oil pressure.
- The parking brake caliper is fixed to the front differential case. The disc is installed to the differential yoke and rotates together with the coupling.

- The work equipment system consists of the hydraulic circuit and steering circuit. The hydraulic circuit controls the operation of the bucket and attachment.

- The oil from the hydraulic tank is sent from main pump (4), steering pump, and switch pump (7) through the steering valve to two main control valves (10). If the dump and lift spools of the main control valve are both in neutral, the oil passes through the drain circuit of the main control valve, is filtered by the filter inside the hydraulic tank, and returns to the tank.

- The dump or lift spool in PPC valve is activated by operating the work equipment control lever, causing each spool in the work equipment valve to be hydraulically activated. The oil then can flow from the work equipment valve to lift cylinder (9) or dump cylinder (1), thus operating the lift arm or the bucket.

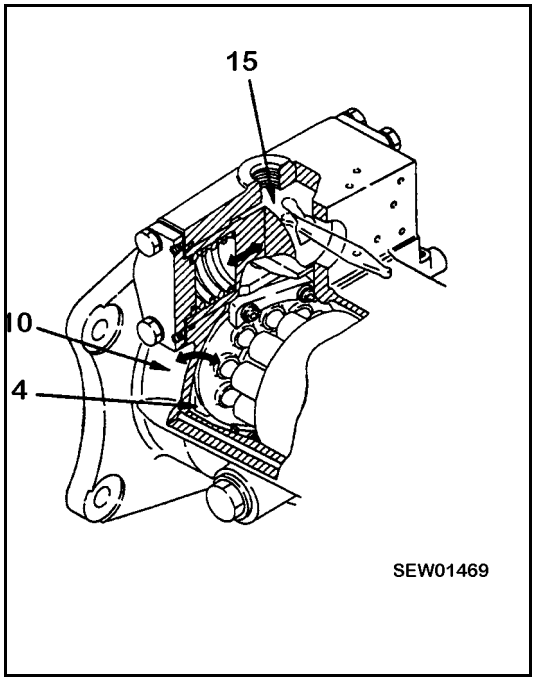
- The maximum pressure of the hydraulic circuit is regulated by the relief valve inside the main control valve. There are two safety valves (with suction valve) and an unloader valve in the dump cylinder circuit to protect the circuit.

- Even when engine is at rest, the lift arm can be lowered to the ground because accumulator (3) is provided in the circuit.

- The machine uses a pressurized, sealed type hydraulic tank which has a breather with a relief valve that acts to pressurize the tank and at the same time prevents negative pressure. This protects the pump from cavitation.

2. Control of discharge amount

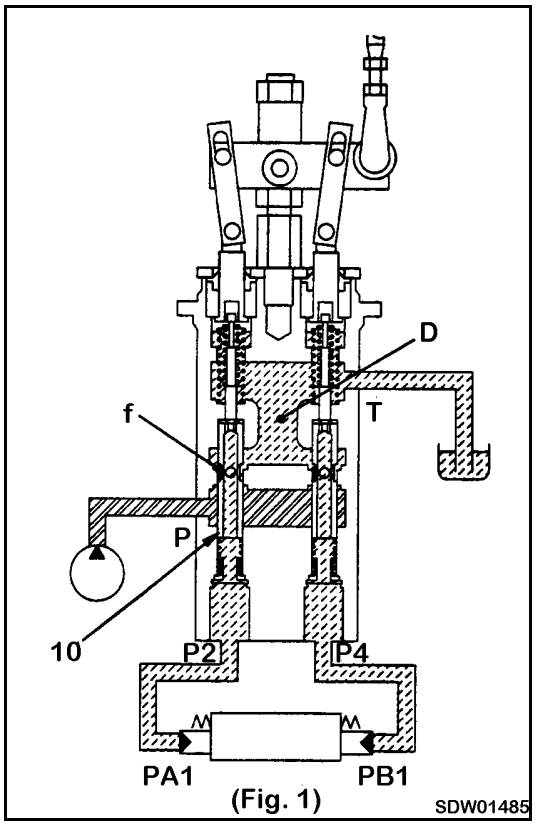
If swash plate angle α becomes larger, the difference in volumes **E** and **F** becomes larger and the discharge volume increases. Swash plate angle α is changed by servo piston (15). Servo piston (15) moves in a reciprocal movement ($\Leftrightarrow$) in accordance with the command from the servo valve. This straight line movement is transmitted through the rod of rocker cam (4), and rocker cam (4), which is supported by the cylindrical surface to cradle (10), slides in an oscillating movement along the cylindrical surface.



OPERATION

1. Control lever at "neutral" (Fig. 1)

Ports P_{A1}, P_2, P_{B1}, and P_4 are connected to drain chamber **D** through fine control hole (f) in spool (10).

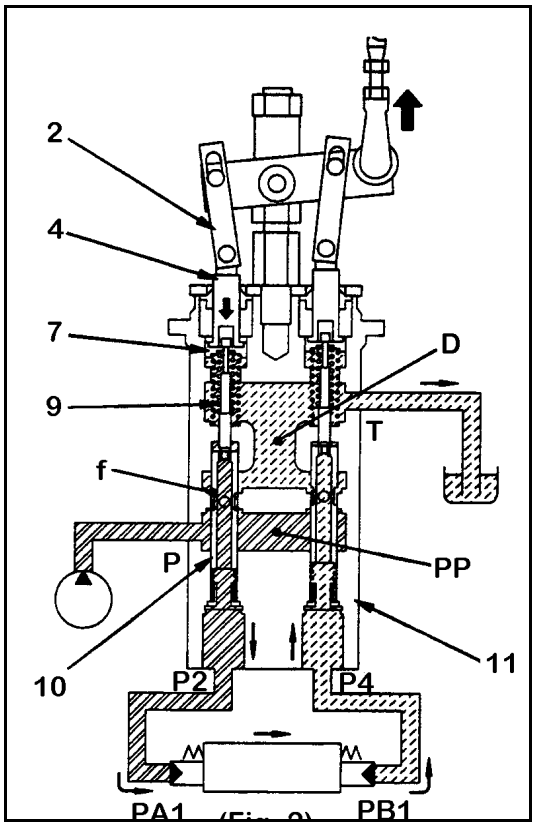


(Fig. 1)

2. Control lever operated slightly "fine control" (Fig. 2)

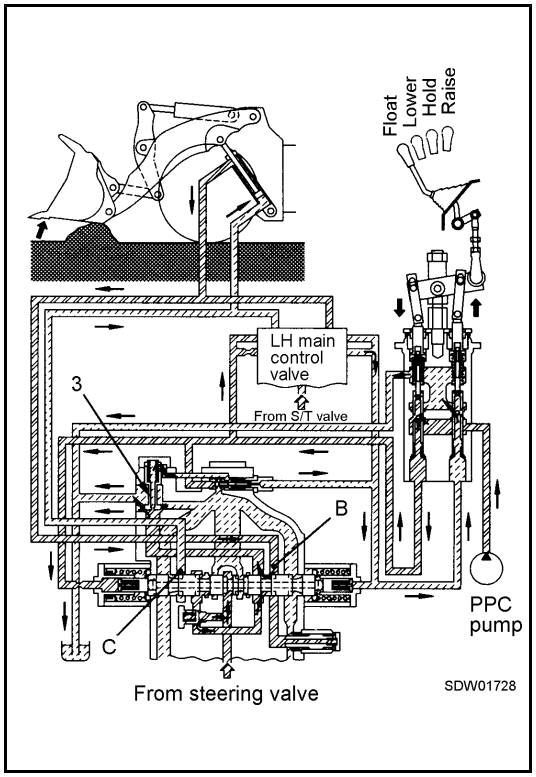
When piston (4) starts to be pushed by plate (2), retainer (7) is pushed. Valve (10) is also pushed by spring (9) and moves down. When this happens, fine control hole (f) is shut off from drain chamber **D**. At almost the same time it is connected to pump pressure chamber P_P, and the pilot pressure of the control valve is sent through fine control hole (f) to port P_2 and P_{A1}. When the pressure at port P_2 rises, valve (10) is pushed back. Fine control hole (f) is shut off from pump pressure chamber P_P. At almost the same time it is connected to drain chamber **D**, so the pressure at port P_2 escapes to drain chamber **D**.

Valve (10) moves up and down until the force of spring (9) is balanced with the pressure of port P_2. The position of valve (10) and body (11) (when fine control hole (f) is midway between drain chamber **D** and pump pressure chamber P_P) does not change until the head of valve (10) contacts the bottom of piston (4). Therefore, spring (9) is compressed in proportion to the travel of the control lever, so the pressure at port P_2 also rises in proportion to the travel of the control lever. The spool of the control valve moves to a position where the pressure of port P_{A1} (same as pressure at port P_2) and the force of the return spring of the control valve are balanced.



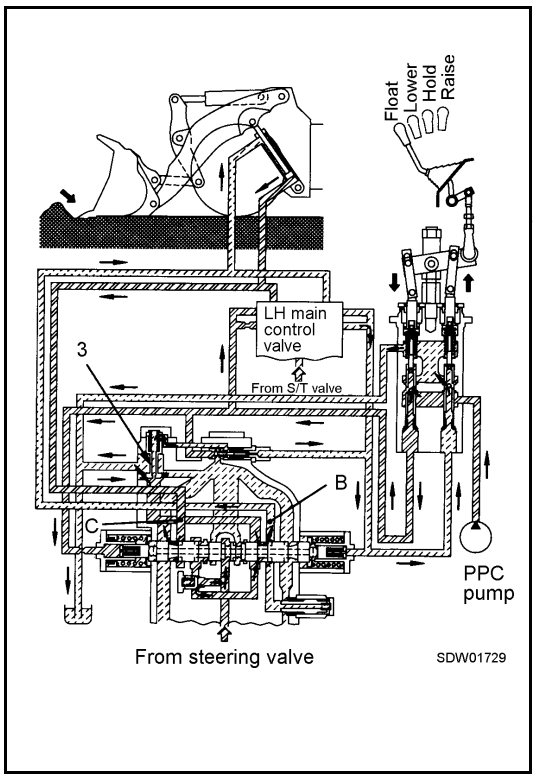
3. FLOAT position (pushed up)

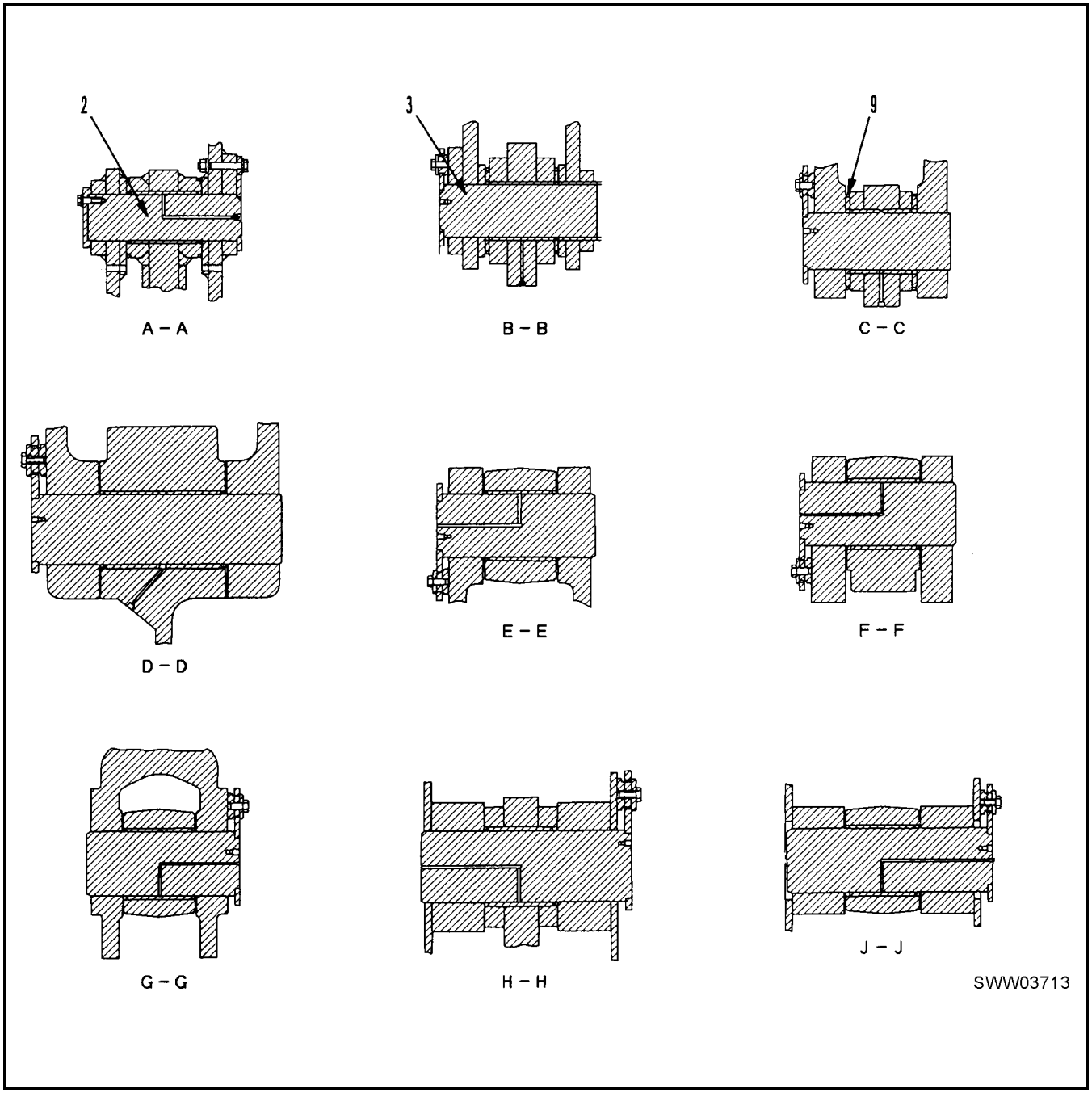
If the machine moves in reverse and the lift arm is pushed up, the pressure at the cylinder rod end becomes high. It passes through port **B** and is drained through unloader valve (3). A vacuum is formed at the cylinder bottom end, so oil flows in from port **C**.



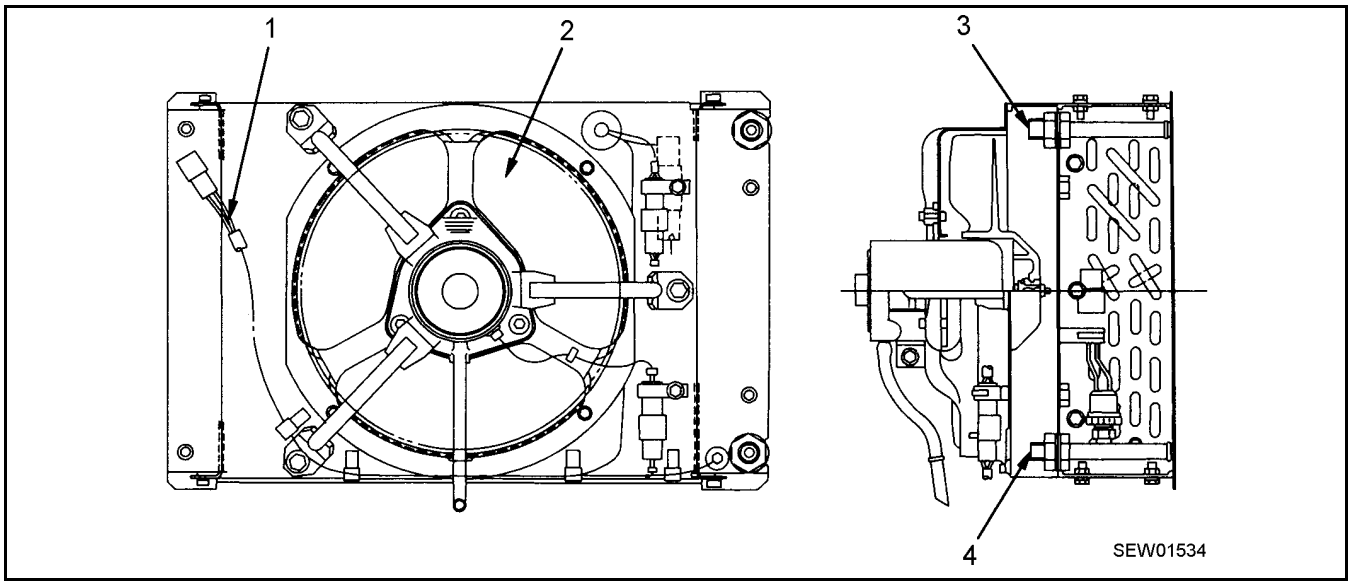
4. FLOAT position (lowering under own weight)

When the machine is moving in reverse and the lift arm comes down under its own weight, the pressure at the cylinder bottom end is high, and it is drained from port **C**. A vacuum is formed at the cylinder rod end, so oil flows in from port **B**.



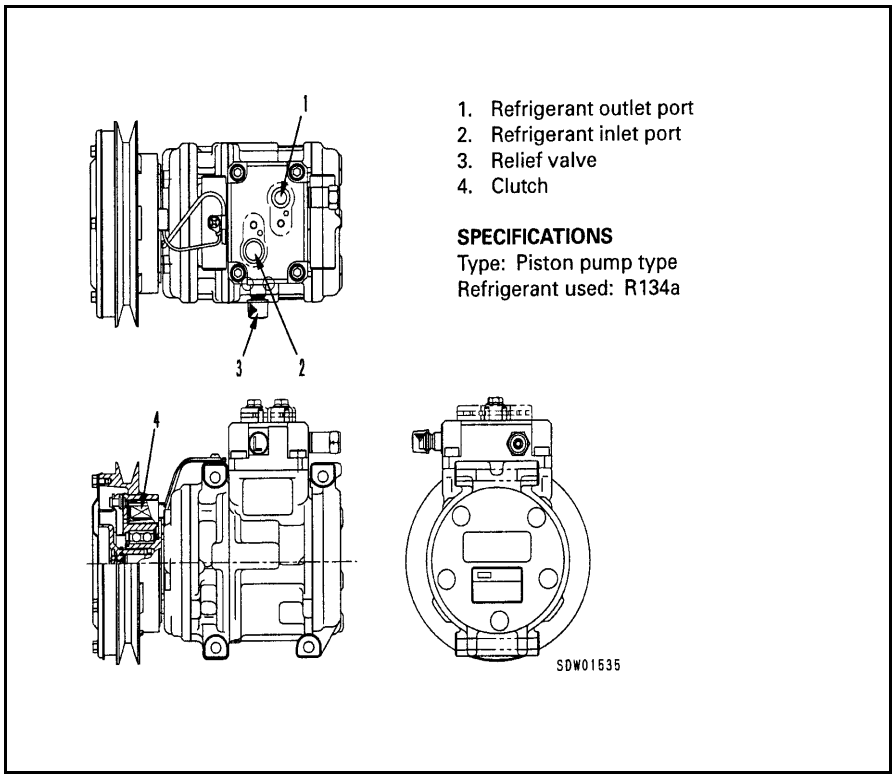

2
A – A
3
B – B
9
C – C
D – D
E – E
F – F
G – G
H – H
J – J
SWW03713

AIR CONDITIONER CONDENSER



1. Electric wiring
2. Fan
3. Refrigerant gas inlet port
4. Refrigerant gas outlet port

AIR CONDITIONER COMPRESSOR



1. Refrigerant outlet port
2. Refrigerant inlet port
3. Relief valve
4. Clutch

SPECIFICATIONS
Type: Piston pump type
Refrigerant used: R134a

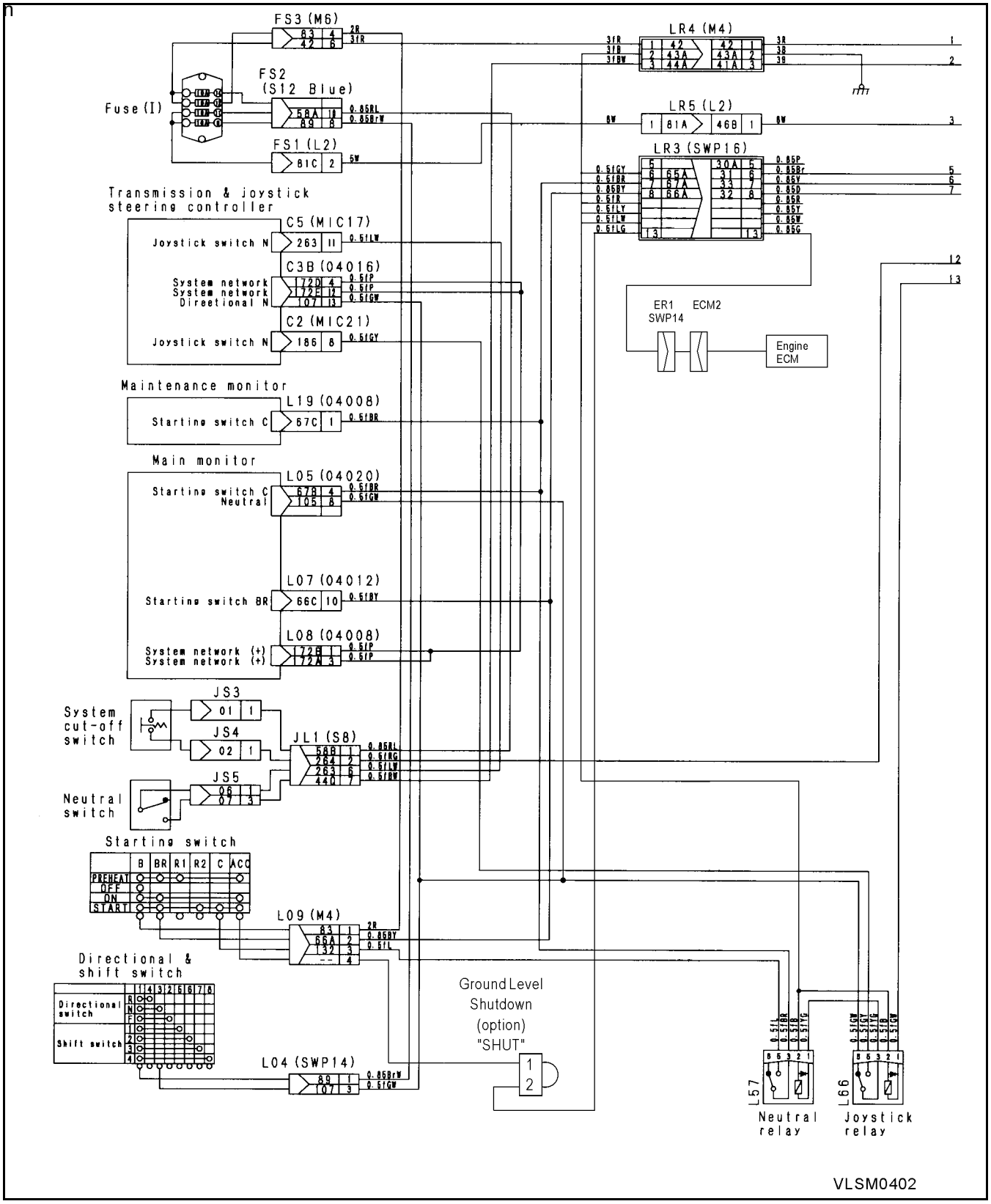
1. Refrigerant outlet port
2. Refrigerant inlet port
3. Relief valve
4. Clutch

Specifications
Type: Piston pump type
Refrigerant used: R134a

See Foldout 10-169. This page can be replaced with Foldout 10-169, Electric circuit diagram part 1 (sheet 5), found in Section 90 of this manual.

See Foldout 10-181. This page can be replaced with Foldout 10-181, Electric circuit diagram part 2 (sheet 4), found in Section 90 of this manual.

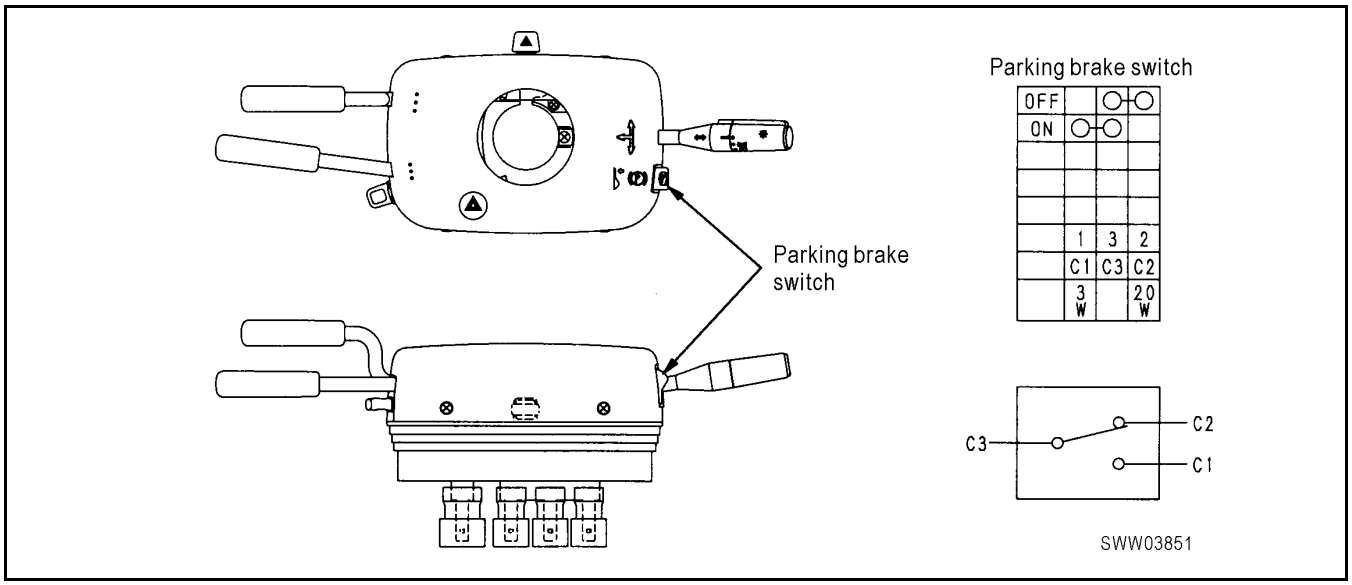
ENGINE START AND STOP CIRCUIT



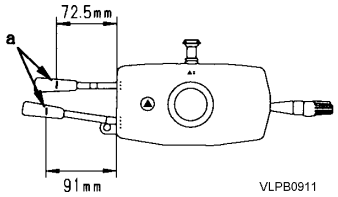
FUNCTION

1	Actuation and release of parking brake	Parking brake switch used (combination switch)
2	Emergency brake	The parking brake is automatically applied in the event of damage to the hydraulic circuit that causes pressure in the accumulator to drop. In this way, the parking brake acts as an emergency brake.
3	Parking brake safety	The brake cannot be released without first turning the starting switch and the parking brake switch to ON. It is dangerous if the parking brake can be released simply by turning the starting switch ON after the automatic parking brake has been applied. To prevent inadvertent release, the system is designed so that the brake cannot be released unless the starting switch first is turned to the ON position and the parking brake switch is turned ON.
4	Neutralizer	If the machine is driven with the parking brake still applied, the parking brake may seize and be damaged. Therefore, the caution lamp lights up and the caution buzzer sounds to warn the operator of this mistake in operation. At the same time, when the parking brake is applied, the transmission is shifted to neutral, so it is impossible for the machine to be driven. However, the braking distance will become longer if the transmission is shifted to neutral when the emergency brake is applied. It also may be necessary to move the machine if it stops in places where it is prohibited to stop (such as a railway crossing). To overcome this, the circuit is designed so the transmission is not shifted to neutral when the emergency brake is applied.

PARKING BRAKE SWITCH



STANDARD VALUE TABLE FOR CHASSIS

Machine model						WA900-3LC	
Category	Item			Measurement conditions	Unit	Standard value for new machine	Service limit value
Directional lever	Operating effort		N-FORWARD REVERSE	• Engine stopped • Hook push-pull scale to point **a** and measure. 	N (kg)	5.9 $^{-4.9}_{-2.9}$ (0.6) $^{-0.5}_{-0.3}$	16.7 (1.7)
	Travel		N-FORWARD, REVERSE		mm	35 ± 10	35 ± 20
Speed control lever	Operating effort		1st - 2nd		N (kg)	5.9 $^{-4.9}_{-2.9}$ (0.6) $^{-0.5}_{-0.3}$	16.7 (1.7)
			2nd - 3rd			5.9 $^{-4.9}_{-2.9}$ (0.6) $^{-0.5}_{-0.3}$	16.7 (1.7)
	Travel		1st - 2nd		mm	35 ± 10	35 ± 20
			2nd - 3rd			35 ± 10	35 ± 20
Work equipment control lever	Operating effort	Lift Arm	HOLD➢ RAISE	• Low idle • Hydraulic oil temperature: 45-55°C • Hook push-pull scale to center of lever knob and measure. • Measure maximum value.	N (kg)	Max. 23.5(2.4)	35.3 (3.6)
			RAISE➢HOLD			Max. 15.7 (1.6)	23.5 (2.4)
			HOLD➢LOWER			Max. 24.5 (2.5)	37.2 (3.8)
			LOWER➢HOLD			--	--
			LOWER➢FLOAT			Max. 34.3 (3.5)	51.9 (5.3)
			FLOAT➢HOLD			Max. 14.7 (1.5)	23.5 (2.3)
		Bucket	HOLD➢DUMP			Max. 23.5 (2.4)	35.3 (3.6)
			HOLD➢TILT			Max. 23.5 (2.4)	35.3 (3.6)
			TILT➢HOLD			Max. 14.7 (1.5)	23.5 (2.3)
	Travel	Lift Arm	HOLD➢RAISE	• Low idle • Hydraulic oil temperature: 45-55°C • Hook push-pull scale to center of lever knob and measure. • Measure maximum value.	mm	67 ± 15	67 ± 30
			HOLD➢LOWER			53 ± 15	53 ± 30
			HOLD➢FLOAT			67 ± 15	67 ± 30
		Bucket	HOLD➢DUMP			60 ± 15	60 ± 30
			HOLD➢TILT			60 ± 15	60 ± 30
Steering wheel	Play			• Engine stopped • Play in direction of turning	mm	Max. 20	20
	Operating effort			• Flat, horizontal straight, dry paved road surface • Hydraulic oil temperature: 45-55°C • Hook push-pull scale to steering wheel knob and measure. • Measure effort taken to turn steering wheel.	N (kg)	9.8 - 14.7 (1.0 - 1.5)	9.8 - 14.7 (1.0 - 1.5)
	Operating time		Low idle	• Hydraulic oil temperature: 45-55°C • Flat, horizontal, straight dry paved road surface • Left lock - right lock	sec.	Max. 6.8	6.8
			High idle			Max. 5.0	5.0

System	Name of component	Connector no.	Inspection method	Judgement table If condition is as shown in the table below, then it is normal	Measurement conditions
Main monitor	Power supply	L05	Measure voltage	Between (1), (2) - chassis: 20 - 30 V Between (1), (2) - (3): 20 - 30 V	1) Turn starter switch OFF. 2) Insert T-adapter 3) Turn starter switch ON
	Charge (Alternator)	L05	Measure voltage	Engine running (at above 1/2 throttle), Between (5) - (3): 28 ± 2V Starter switch ON, Between (5) - (3): Max 1 V ★ If the battery is old, or after starting in cold areas, the voltage may not rise for some time.	1)Turn starter switch OFF. 2) Insert T-adapter
	Engine water temperature sensor	E05 (male)	Measure resistance	Normal temperature (25°C), Between (1) - chassis: Approx. 2 kΩ 5°C, Between (1) - chassis: Approx. 4 kΩ	1) Turn starter switch OFF. 2) Disconnect connectors 3) Connect T-adapter.
	Directional switch (N)	L05	Measure voltage	Directional lever at N, Between (8) - (3): 20 - 30 V Directional lever not at N, Between (8) - (3): Max 1 V	1) Turn starter switch OFF. 2) Insert T-adapter 3) Turn starter switch ON
	Starer switch C terminal	L09 (male)	Measure voltage	Starter switch START, Between (3) - chassis: 20 - 30 V Starter switch OFF or ON, Between (3) - chassis: Max 1 V	1) Turn starter switch OFF. 2) Insert T-adapter
	Starer switch C terminal	L05	Measure voltage	Start engine, Between (4) - (3): 20 - 30 V Starter switch OFF or ON, Between (4) - (3): Max 1 V	1) Turn starter switch OFF. 2) Insert T-adapter
	Preheating switch ON	L05	Measure voltage	Starter switch ON, Between (19) - (3): ★20 - 30 V ➝1V Starter switch OFF, Between (19) - (3): Max 1 V ★ Voltage changes only when water temperature is below 0°C, and time taken to change differs according to water temperature	1) Turn starter switch OFF. 2) Insert T-adapter
	Preheating output	L06	Measure voltage	Starter switch ON, Between (4) - (16): ★ 1V ➝ 20 - 30 V Starter switch OFF, Between (4) - (16): Max 1 V ★ Voltage changes only when water temperature is below 0°C, and time taken to change differs according to water temperature	1) Turn starter switch OFF. 2) Insert T-adapter

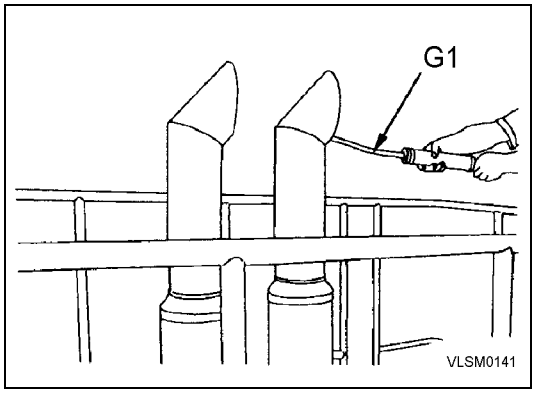
MEASURING EXHAUST GAS COLOR

- When measuring in the field when there is no air or power supply, use handy smoke checker **G1**; when recording official data, use smoke meter **G2**.

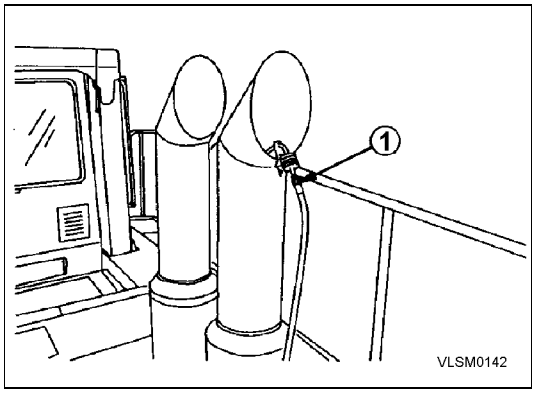
★ Raise the coolant temperature to the operating range before measuring.

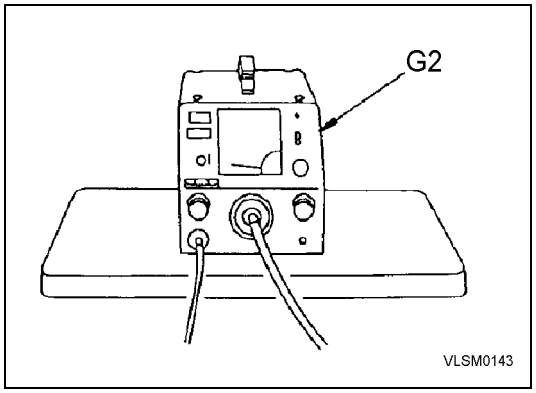
WARNING! When removing or installing the measuring equipment, be careful not to touch any high temperature part.

1. Measuring with handy smoke checker **G1**
   A. Fit filter paper in tool **G1**.
   B. Insert the exhaust gas intake port of tool **G1** into the exhaust pipe, accelerate the engine suddenly, and at the same time operate the handle of tool **G1** to catch the exhaust gas on the filter paper.
   C. Remove the filter paper and compare it with the scale provided to judge the condition.



2. Measuring with smoke meter G2
   A. Insert probe (1) into exhaust pipe, then tighten the clip to secure it to the exhaust pipe.
   B. Connect the probe hose, accelerator switch plug, and air hose to tool G2.
      ★ The pressure of the air supply should be less than 1.5 MPa (15 kg/cm²)
   C. Connect the power cord to the power supply.
      ★ When connecting the port, check first that the power switch of tool G2 is OFF.
   D. Loosen the cap nut of the suction pump, then fit the filter paper.
      ★ It the filter paper securely so that the exhaust gas does not leak
   E. Turn the per switch of tool G2 ON.
   F. Accelerate the engine suddenly, and at the same time, depress the accelerator pedal of the tool G2 and catch the exhaust gas color on the filter paper.
   G. Lay the filter paper used to catch the exhaust gas color on top of unused filter papers (10 sheets or more) inside the file paper holder, and read the indicated value.

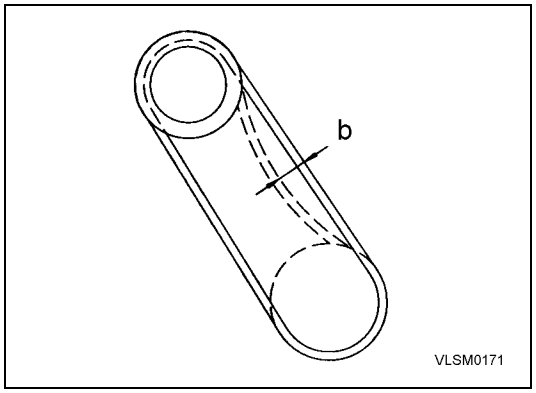




AIR CONDITIONER COMPRESSOR BELT TENSION

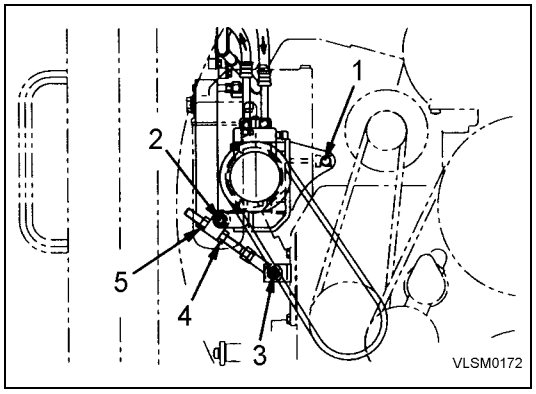
TESTING

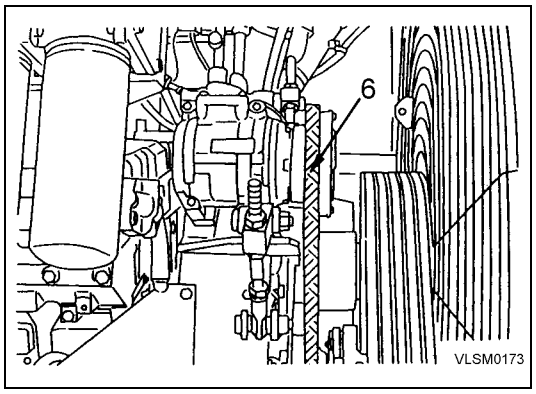
- Measure deflection **b** of the belt when it is pushed with a force of approximately 98N (approximately 10 kg at a point midway between the drive pulley and the air conditioner compressor pulley.
  - ★ Deflection **b** of belt (standard value): 9 - 12.5 mm



ADJUSTING

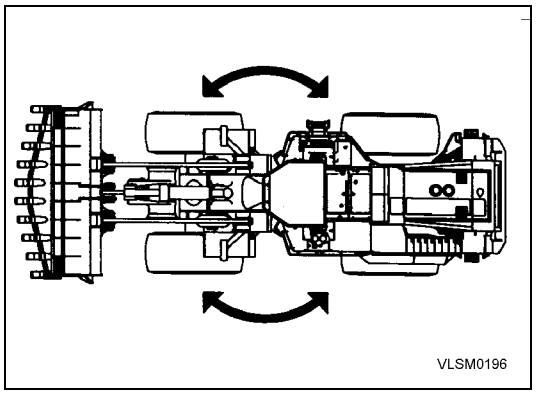
1. Loosen mount bolts and nuts (1), (2), (3), locknut (4).
2. Turn adjustment nut (5) to adjust the tension of air conditioner compressor belt (6).
3. When the position of the air conditioner compressor is correct, tighten locknut (4), mounting bolts and nuts (1), (2), (3) to secure it in position.
4. After adjusting the belt tension, repeat the testing procedure above to check that the deflection is adjusted within the standard range.





BLEEDING AIR FROM STEERING CIRCUIT

★ Bleed the air from the circuit as follows if the steering valve or steering cylinder have been removed and installed again.



1. Start the engine and run at idle for approximately 5 minutes.
2. Run the engine at low idle and turn to the left and right 4 - 5 times.
   ★ Operate the piston rod to approximately 100 mm before the end of its stroke. Be careful not to relieve the circuit.
3. Repeat Step 2 with the engine at full throttle.
4. Run the engine at a slow speed and operate the piston to the end of its stroke to relieve the circuit

MEASURING PARKING BRAKE SOLENOID OUTPUT PRESSURE

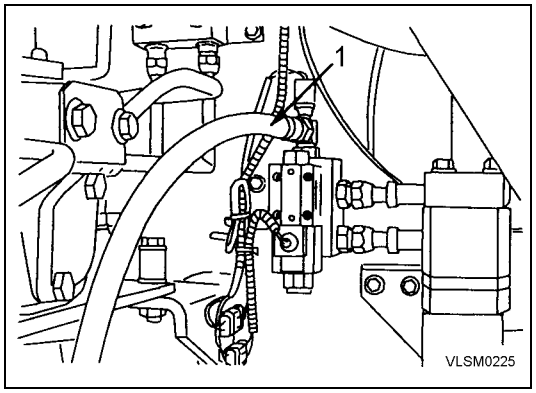
★ Brake oil temperature: 45 - 55°C

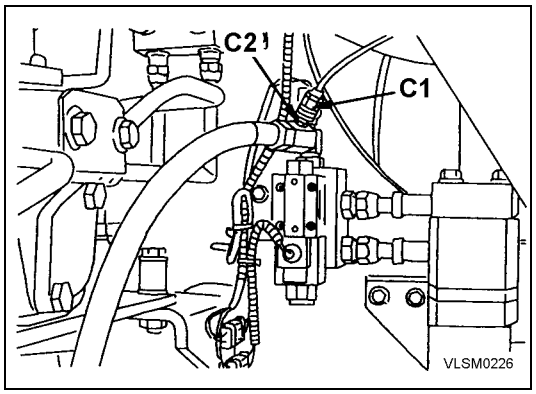
WARNING! Put blocks securely under the tires.

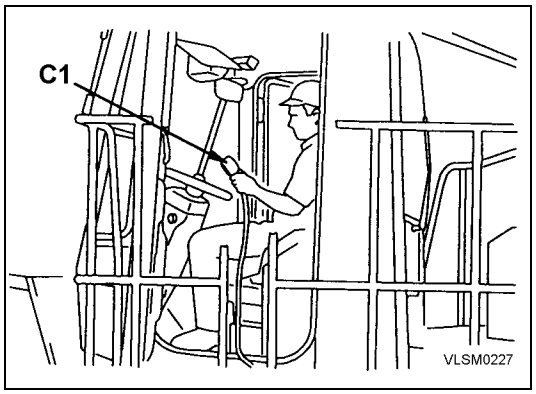
WARNING! Depress the brake pedal at least 100 times with the engine stopped to release the pressure inside the accumulator circuit.

1. Turn starting switch ON, then parking brake switch OFF to release brake.
2. Remove front frame right side cover.
3. Disconnect parking brake spring cylinder output hose (1) from parking brake solenoid valve.
4. Connect nipple **C2** and oil pressure gauge **C1** (39.2 MPa (400 kg/cm²)).
5. Start engine and after accumulator charged, turn parking brake switch ON
6. Measure oil pressure with the engine at a slow speed.

WARNING! After measuring parking brake oil pressure, depress the brake pedal at least 100 times with the engine stopped to release the pressure inside the accumulator circuit, and remove measuring tools after turning parking brake switch OFF.







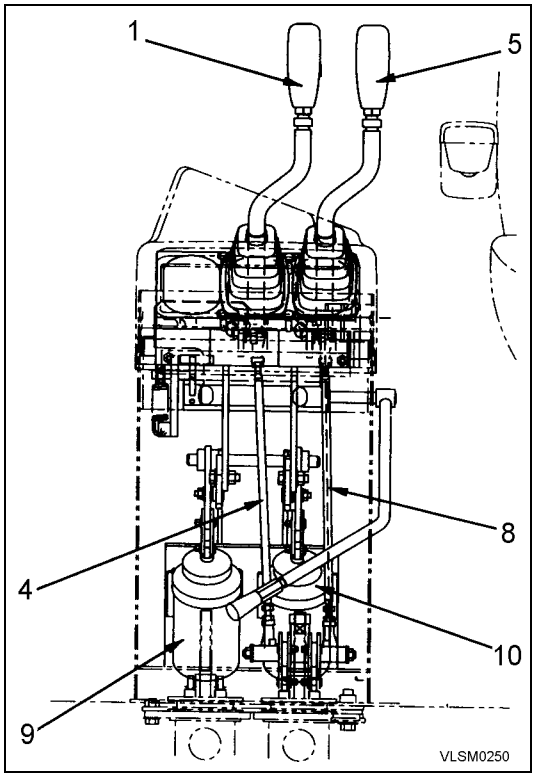
ADJUSTING WORK EQUIPMENT LEVER LINKAGE

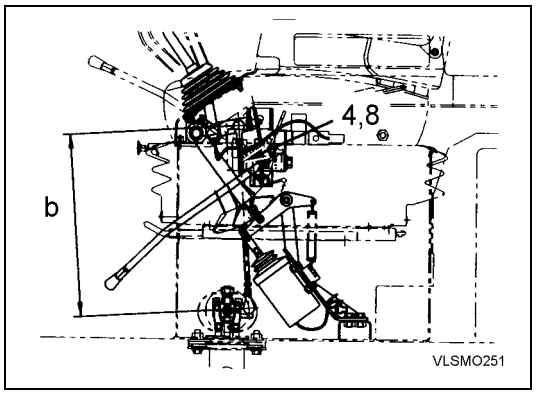
★ If the operating effort or travel of the work equipment control lever is not within the standard value, or the work equipment control lever, PPC valve assembly, or boom or bucket solenoids have been removed, adjust as follows.

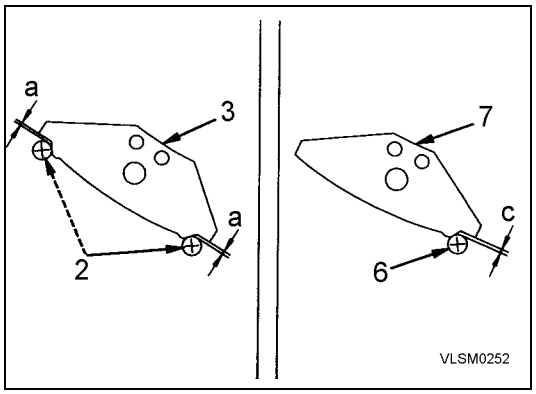
WARNING! Carry out the adjustment with the engine stopped.

★ Check if the operating effort of the work equipment lever is within the standard value.

1. Remove the side cover from the work equipment control lever.
2. Operate boom lever (1) and adjust rod (4) so that boom lever cam follower (2) enters the detent portion at both ends of cam (3) uniformly and clearance **a** is 0 - 1 mm.
   ★ Distance **b** between pins on both ends of rod (4): 337 mm (for reference)
3. Operate bucket lever (5) and adjust rod (8) so that bucket lever cam follower (6) enters the detent portion of cam (7) uniformly and clearance **c** is 0 - 1mm.
   ★ Distance **b** between pins on both ends of rod (8): 337 mm (for reference)







TROUBLESHOOTING

TABLE OF CONTENTS

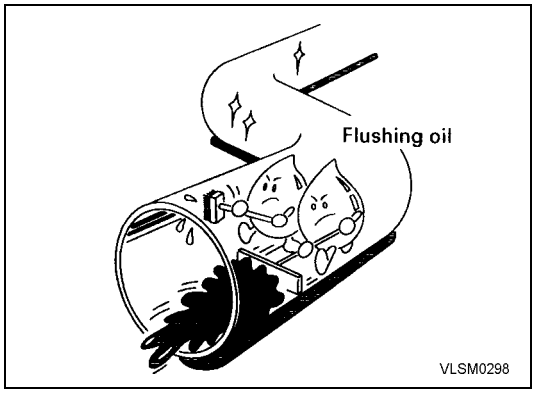
5. Change hydraulic oil when the temperature is high.

When hydraulic oil or other oil is warm, it flows easily. In addition, the sludge can also be drained out easily from the circuit together with the oil, so it is best to change the oil when it is still warm. When changing the oil, as much as possible of the old hydraulic oil must be drained out. (Drain the oil from the hydraulic tank; also drain the oil from the filter and from the drain plug in the circuit.) If any old oil is left, the contaminants and sludge in it will mix with the new oil and will shorten the life of the hydraulic oil.

6. Flushing operations

After disassembling and assembling the equipment, or changing the oil, use flushing oil to remove the contaminants, sludge, and old oil from the hydraulic circuit.

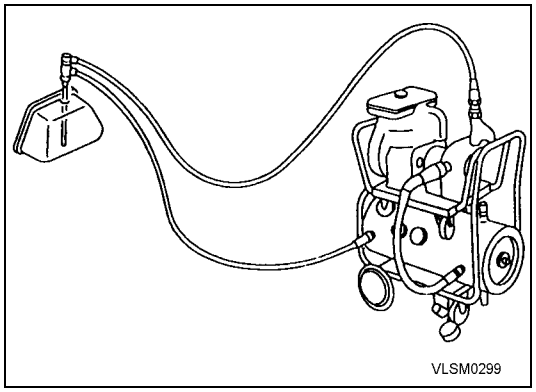
Normally, flushing is carried out twice: primary flushing is carried out with flushing oil, and secondary flushing is carried out with the specified hydraulic oil.



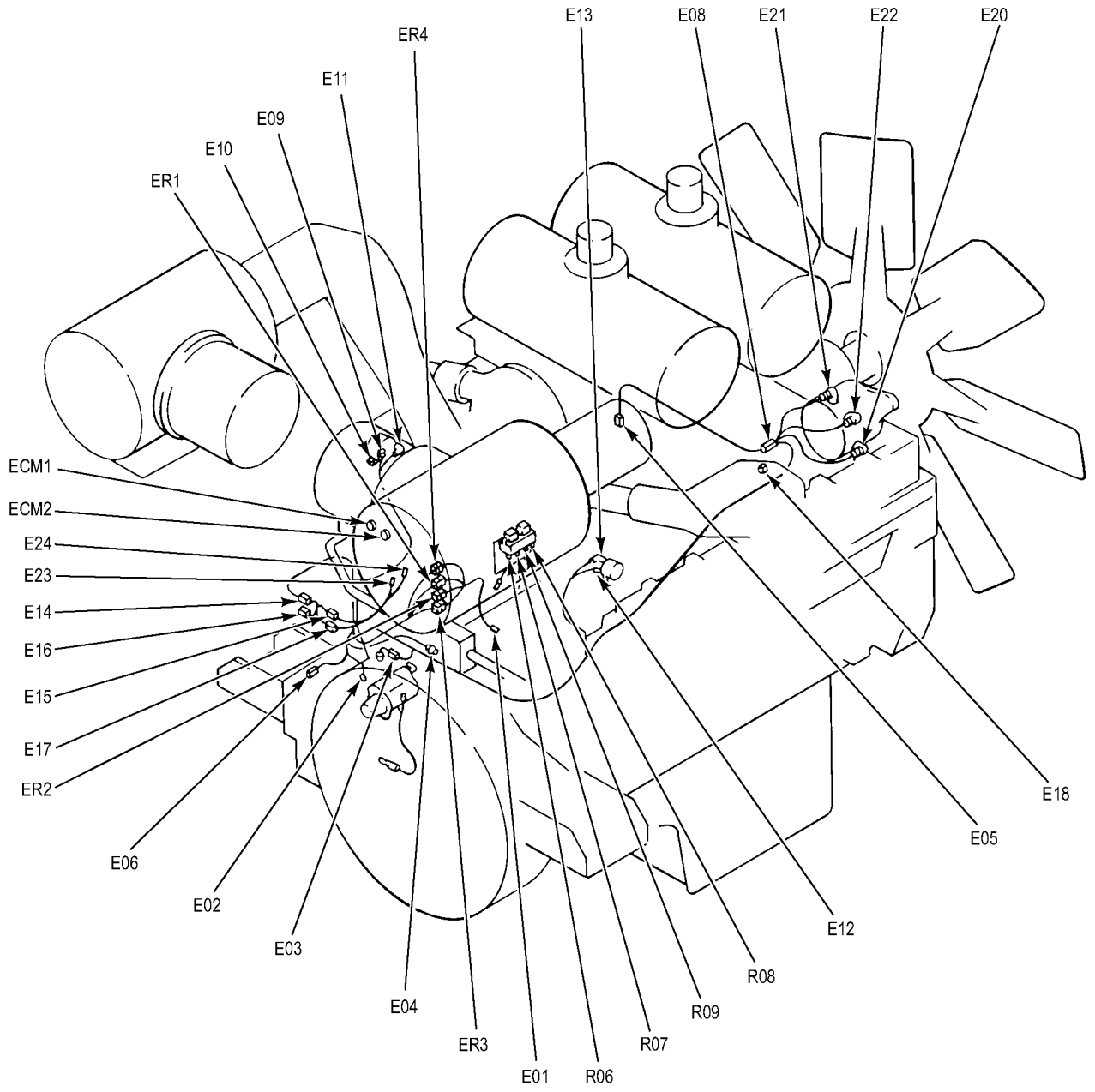
7. Cleaning operations

After repairing the hydraulic equipment (pump, control valve, etc.) or when running the machine, carry out oil cleaning to remove the sludge or contaminants in the hydraulic oil circuit.

The oil cleaning equipment is used to remove the ultra fine (about 3 mu) particles that the filter built into the hydraulic equipment cannot remove, so it is an extremely effective device.



CONNECTOR ARRANGEMENT DIAGRAM 3 OF 3



DETAIL-Y

VLSM0302

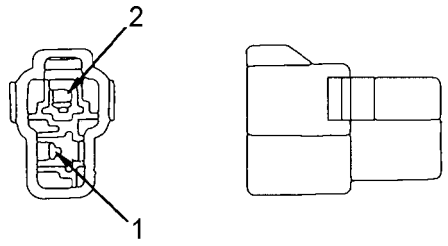
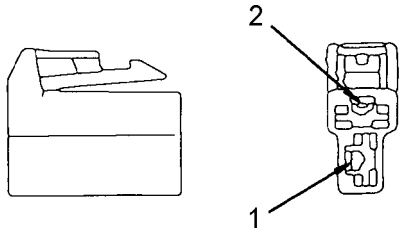
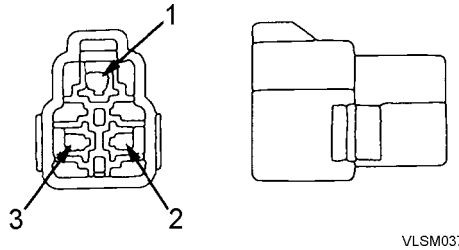
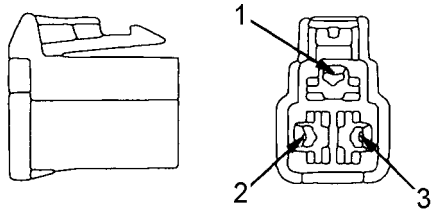
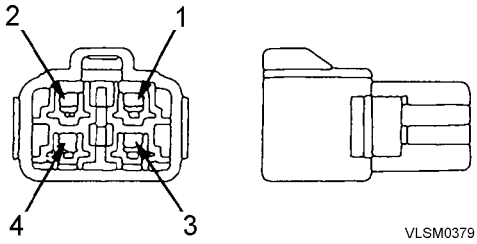
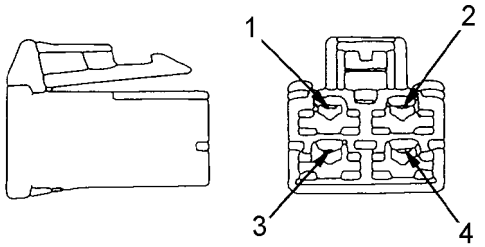
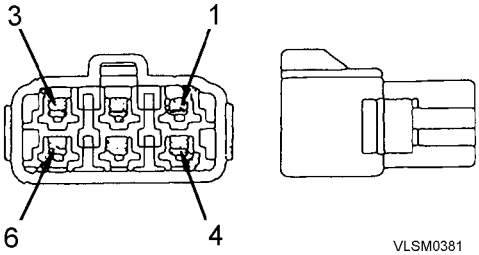
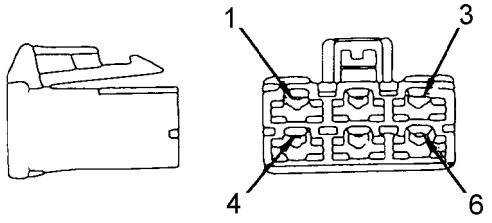
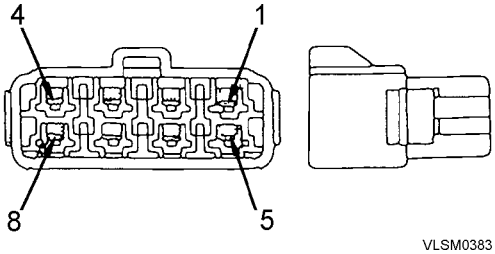
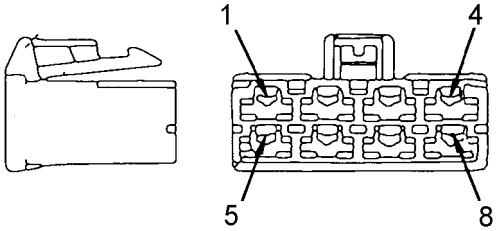
No.of pins	Automobile (KES1) connector	
	Male (female housing)	Female (male housing)
2	 VLSM0375	 VLSM0376
3	 VLSM0377	 VLSM0378
4	 VLSM0379	 VLSM0380
6	 VLSM0381	 VLSM0382
8	 VLSM0383	 VLSM0384

CHART OF ACTION AND FAILURE CODES AND RE-ENACTION

- After an error occurs, turn the starter switch OFF, and if the display goes out, it is possible to re-enact the problem as follows.
- For details of the method of displaying the action codes and failure codes, see METHOD OF DISPLAYING SELF DIAGNOSIS (ERROR CODE) AND SAVING TO MEMORY.
- Re-enaction marks.
  - ★ :Turn starter switch ON (with engine stopped)
  - ❒ :Start engine
  - ■ :Carry out operation to actuate actuator.

1. Transmission controller

(1) Transmission control system

Main monitor action code	Failure code	Item	Failed system		Re-enaction		Memory	Alarm buzzer
			Short circuit	Disconnection	Short circuit	Disconnection		
None	10	Back lamp relay	O	O	■	★	O	X
CALL	12	F solenoid	O	O	■	★	O	O
	13	R solenoid	O	O	■	★	O	O
	14	1st solenoid	O	O	■	★	O	O
	15	2nd solenoid	O	O	■	★	O	O
	16	3rd solenoid	O	O	■	★	O	O
E00	19	Joystick directional switch	O	O	★	★	O	X
CALL	20	Directional switch signal	O	O	★	★	O	O
None	21	Range switch signal	O	O	★	★	O	X
E00	22	Travel speed sensor	X	O	X	★	O	O
	23	Engine speed sensor	X	O	X	★	O	X

(2) Joystick control system

Main monitor action code	Failure code	Item	Failed system		Re-enaction		Memory	Alarm buzzer
			Short circuit	Disconnection	Short circuit	Disconnection		
None	56	Joystick caution relay output	O	O	★	■	O	X
E00	57	Steering right solenoid (detect when output)	O	O	■	■	O	O
	58	Steering left solenoid (detect when output)	O	O	■	■	O	O
	59	Steering right solenoid (short circuit on hot side)	O	X	★	★	O	O
	60	Steering left solenoid (short circuit on hot side)	O	X	★	★	O	O
	61	Steering solenoid cut relay output	O	O	★	■	O	O
	62	Joystick neutral switch abnormal	O	O	★	★	O	O
	63	Joystick potentiometer abnormal (other than 0.5 - 4.5V)	O	O	★	★	O	O

★ Send E59 and E60 signals at the same time because monitor cannot distinguish E59 and E60.

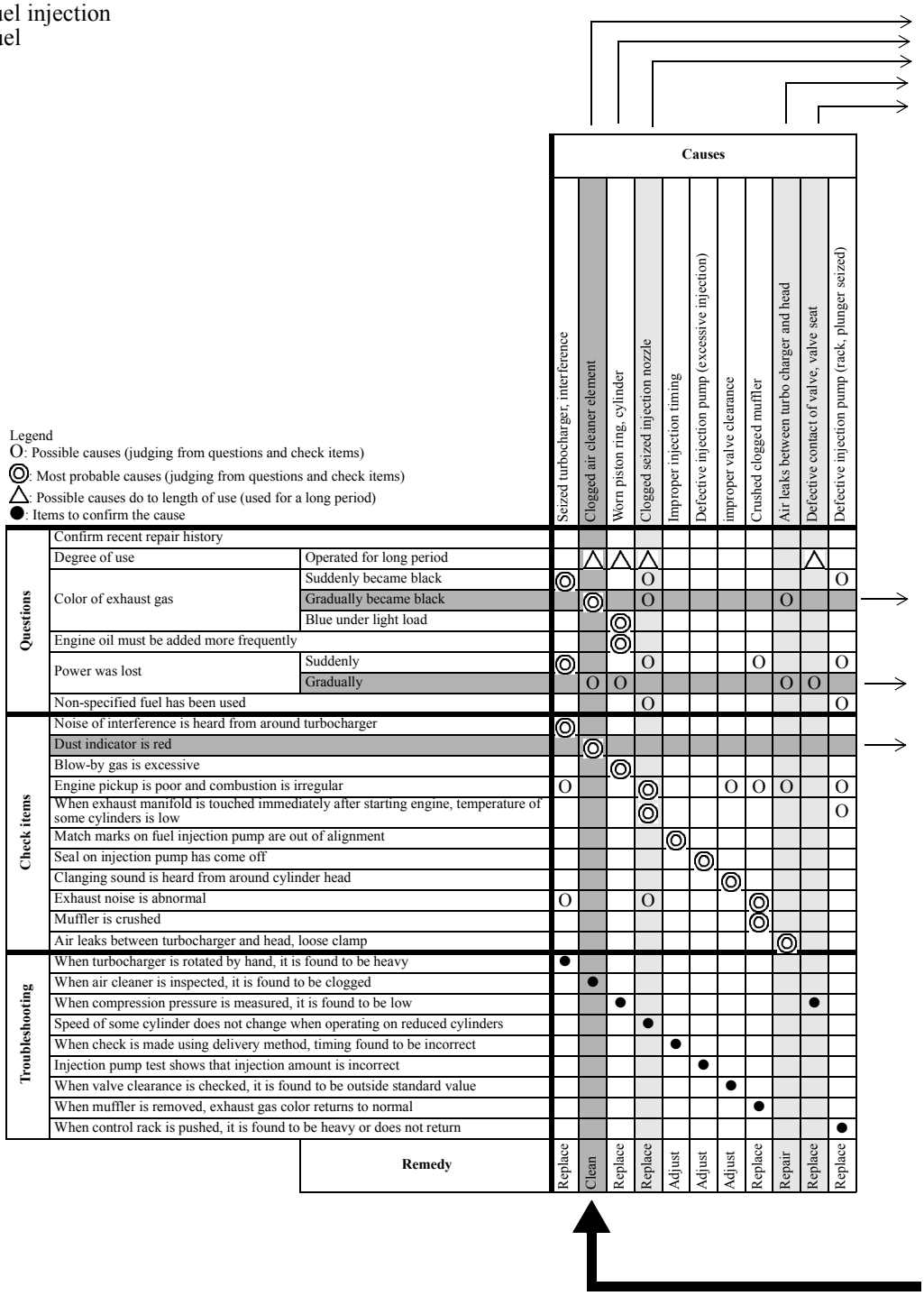
★ For E56, monitor cannot detect disconnection because E56 is normally closed.

- **Example of troubleshooting when exhaust gas is black**
  Let assume that [Clogged air cleaner] is taken to be the cause of the black gas. Three symptoms have causal relationship with this problem: [Exhaust gas slowly became black], [Power slowly became weaker], and [Dust indicator is red].
  If we look from these three symptoms to find the causes, we find that there is a relationship with five causes. Let us explain here the method of using this causal relationship to pin point the most probable cause.

S-7 Exhaust gas is black (incomplete combustion)

General causes why exhaust gas is black

- Insufficient intake of air
- Improper condition of fuel injection
- Excessive injection of fuel



S-6

Engine lacks output (No power)

(With V-type engine, for cases where there is injection for only one bank, go to troubleshooting S-2-(2) or S-4.)

General causes why engine lacks output
- Insufficient intake of air
- Insufficient supply of fuel
- Improper condition of fuel injection
- Improper fuel used
  (If non-specified fuel is used, output drops)
- Lack of output due to overheating
  - ★ If there is overheating and insufficient output, carry out troubleshooting for overheating.

Legend
O: Possible causes (judging from questions and check items)
◎: Most probable causes (judging from questions and check items)
△: Possible causes due to length of use (used for a long period)
●: Items to confirm the cause

			Causes											
			Clogged air cleaner element	Seized turbocharger, interference	Worn piston ring, cylinder	Clogged fuel filter, stainer	Clogged feed pump strainer	Clogged injection nozzle, defective spray	Seized injection pump plunger	Improper valve clearance	Defective contact of valve, valve seat	Clogged, leaking fuel piping	Clogged fuel tank air breather hole	Defective injection pump boost compensator
Questions	Confirm recent repair history													
	Degree of use	Operated for long period	△		△	△	△				△			
	Power was lost	Suddenly		◎										O
		Gradually	O		O	O	O	O			O			
	Engine oil must be added more frequently			◎										
	Replacement of filters has not been carried out according to operation manual		◎		◎	◎								
	Non-specified fuel has been used				◎	◎	◎	◎						
	Dust indicator caution lights up		◎											
Check items	Color of exhaust gas	Black	◎	◎										
		Blue under light load			◎									
	Noise of interference is heard from around turbocharger			◎										
	Blow-by gas is excessive				◎									O
	Engine pickup is poor and combustion is irregular			◎				O				O	O	
	High idle speed under no load is normal, but speed suddenly drops when load is applied					◎	◎						O	O
	When exhaust manifold is touched immediately after starting engine, temperature of some cylinders is low							◎	O					
	There is hunting from engine (rotation is irregular)					O	O					O	O	
	Clanging sound is heard from around cylinder head									◎				
	High idle speed of engine is low								O					
	Leakage from fuel piping												◎	
Troubleshooting	When air element is inspected, it is found to be clogged		●											
	When turbocharger is rotated by hand, it is found to be heavy			●										
	When compression pressure is measured it is found to be low				●						●			
	When fuel filter, strainer are inspected, they are found to be clogged					●								
	When feed pump strainer is inspected, it is found to be clogged						●							
	Stop fuel injection to one cylinder at a time, if there is no change in engine speed, that cylinder is not working							●						
	When valve clearance is checked, it is found to be outside standard value									●				
	When feed pump is operated, operation is too light or too heavy											●		
	When fuel cap is inspected, it is found to be clogged												●	
	When injection pump boost compensator is inspected, it does not work													●
	Remedy		Clean	Replace	Replace	Clean	Clean	Repair	Replace	Adjuast	Replace	Repair	Clean	Replace

S-16

Vibration is excessive

★ If there is abnormal noise together with the vibration, carry out troubleshooting for "Abnormal noise is made"

General causes why vibration is excessive

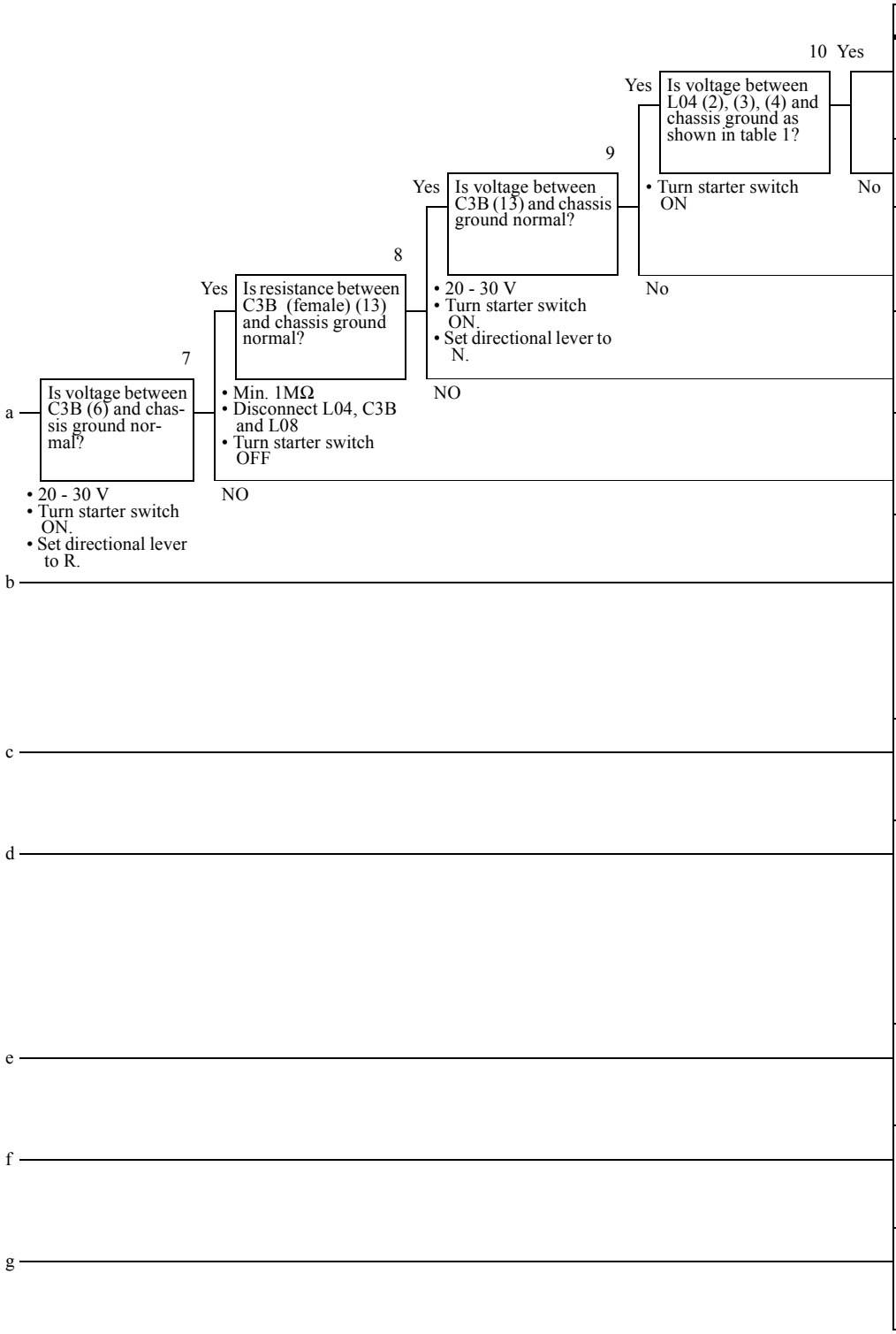
- Defective parts (abnormal wear, breakage)
- Improper alignment
- Abnormal combustion

Legend
O: Possible causes (judging from questions and check items)
◎: Most probable causes (judging from questions and check items)
△: Possible causes due to length of use (used for a long period)
●: Items to confirm the cause

			Causes										
			Worn connecting rod, main bearing	Worn balancer, cam bushing	Worn support pilot	Loose engine mounting bolts, broken cushion	Broken inside output shaft (damper)	Misalignment between engine and power train	Improper gear train backlash	Valve system (valve, rocker lever, etc.) stuck	Defective injection pump (excessive injection)	Defective vibration damper
Questions	Confirm recent repair history											
	Degree of use	Operated for long period	△	△	△	△						△
	Condition of vibration	Suddenly increased					O			O		
		Gradually increased	O	O	O	O						O
	Non-specified fuel has been used		O	O								
Check items	Metal particles are found in oil filter		◎	◎								
	Metal particles are found when oil is drained		◎	◎								
	Oil pressure is low at low idle		O	O								
	Vibration occurs at mid-range speed					O	O					
	Vibration follows engine speed				O	O	O	O	O			O
	Exhaust gas is black									◎	O	
Troubleshooting	Remove oil pan and inspect		●									
	Remove side cover and inspect			●								
	Check for worn support pilot, play				●							
	Inspect for loose engine mounting bolts, broken cushion					●						
	Inspect inside of output shaft (damper)						●					
	When radial runout, face runout are measured, they are found to be outside standard value							●				
	Remove front cover and inspect								●			
	Remove head cover and inspect									●		
	Injection pump test shows that injection amount is incorrect										●	
	Dent in vibration damper											●
	Remedy		Replace	Replace	Replace	Replace	Replace	Repair	Repair	Replace	Adjust	Replace

ELECTRICAL DIAGRAM FOR TANSMISSION CONTROLLER

See **foldout 20-409** in section 90 of this Shop Manual
Replace this page with foldout page if desired



Cause	Remedy
Defective transmission & joystick steering controller	Replace
Defective directional switch	Repair or replace
Defective contact or disconnection in wire harness between L04 (female) (3) and C3B (female) (13) or defective lever	Repair or replace
Short circuit with chassis ground in harness between L04 (female) (3) and C3B (female) (13),	Repair or replace
Defective contact or disconnection in wire harness between L04 (female) (4) and C3B (female) (6) or defective lever	Repair or replace
Short circuit with chassis ground in harness between L04 (female) (4) and C3B (female) (6), or short circuit of harness between L04 (female) (4) and C3B (female) (6) and harness between L04 (female) (3) and C3B (female) (13) with each other	Repair or replace
Defective contact or disconnection in wire harness between L04 (female) (2) and C3B (female) (5) or defective lever	Repair or replace
Short circuit with chassis ground in harness between L04 (female) (2) and C3B (female) (5), or short circuit of harness between L04 (female) (2) and C3B (female) (5) and harness between L04 (female) (3) and C3B (female) (13) with each other	Repair or replace
Defective contact or disconnection in wire harness between fuse I (9) and L04 (female) (1)	Repair or replace
Defective contact or disconnection in wire harness between L04 (female) (10) and chassis ground	Repair or replace
Short circuit with chassis ground in harness between FS2 (female) (8) and L04 (female) (1)	Repair or replace

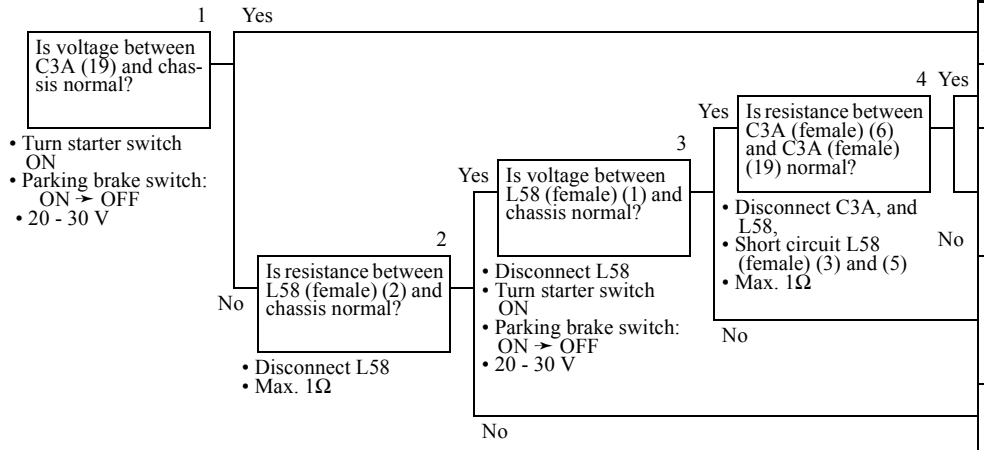
Table 1

Terminal	Directional lever position		
	F	N	R
Between L04 (2) - chassis	20 - 30 V	Max. 1 V	Max. 1 V
Between L04 (3) - chassis	Max. 1 V	20 - 30 V	Max. 1 V
Between L04 (4) - chassis	Max. 1 V	Max. 1 V	20 - 30 V

T-15

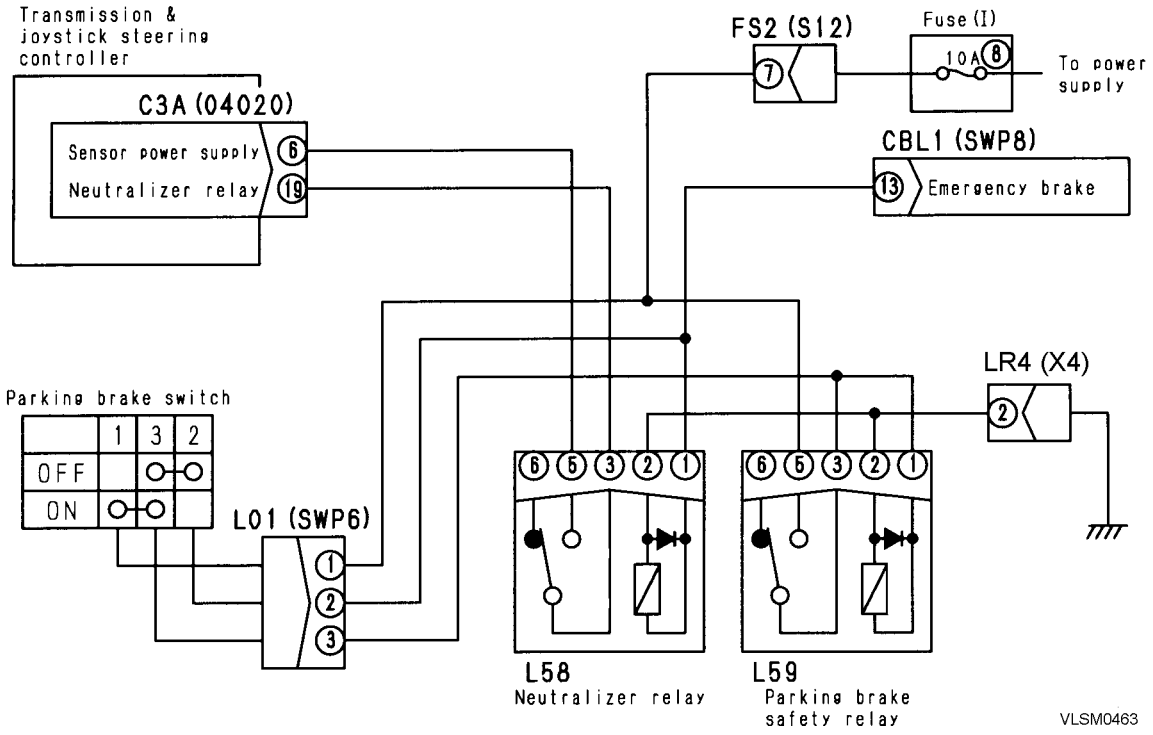
Neutralizer signal system

★ Check that the parking brake works normally.
★ Before carrying out troubleshooting, be sure that all the related connectors are properly inserted.
★ Always connect any disconnected connectors before going on to the next step.
★ Always turn the starter switch OFF before disconnecting the connector or connecting the T-adapter (or socket).



Cause	Remedy
Defective transmission & joystick steering controller	Replace
Defective neutralizer relay	Replace
Defective contact or disconnection in wire harness between C3A (female) (6) - L58 (female) (5), L58 (female) (3) - C3A (female) (19)	Repair or replace
Short circuit with chassis ground defective contact, or disconnection in wire harness between L58 (female) (1) and L01 (female) (2)	Repair or replace
Defective contact or disconnection in wire harness between L58 (female) (2) and chassis	Repair or replace

T-15 Related electrical circuit diagram



ELECTRICAL CIRCUIT DIAGRAM FOR MAIN MONITOR

See **foldout 20-505** (4 pages) in section 90 of this Shop Manual
Replace this page with foldout if desired

M-8

Abnormality in preheating system

★ Check for engine ECM fault codes to determine if ECM has identified sensor faults.

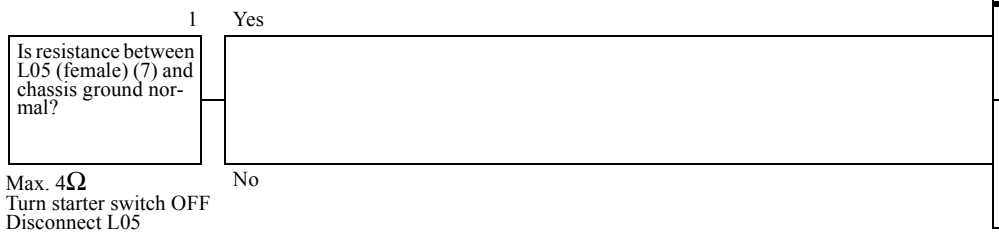
★ Before carrying out troubleshooting, be sure that all the related connectors are properly inserted.

★ Always connect any disconnected connectors before going on to the next step.

a) Does not carry out preheating

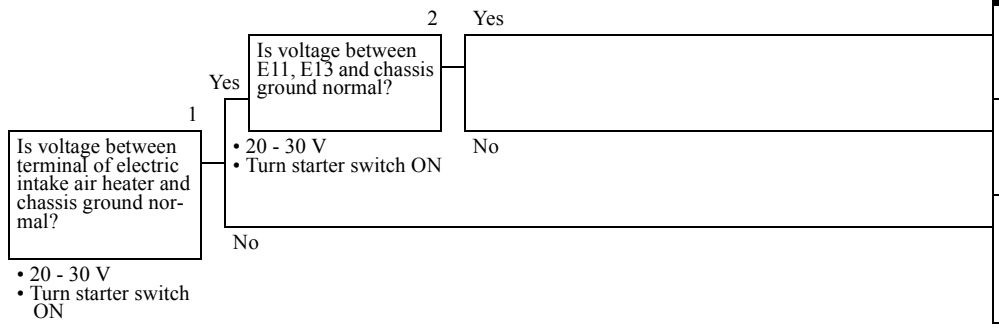
★ Check that the coolant water temperature is below 5°C.

(1) Monitor display also does not light up



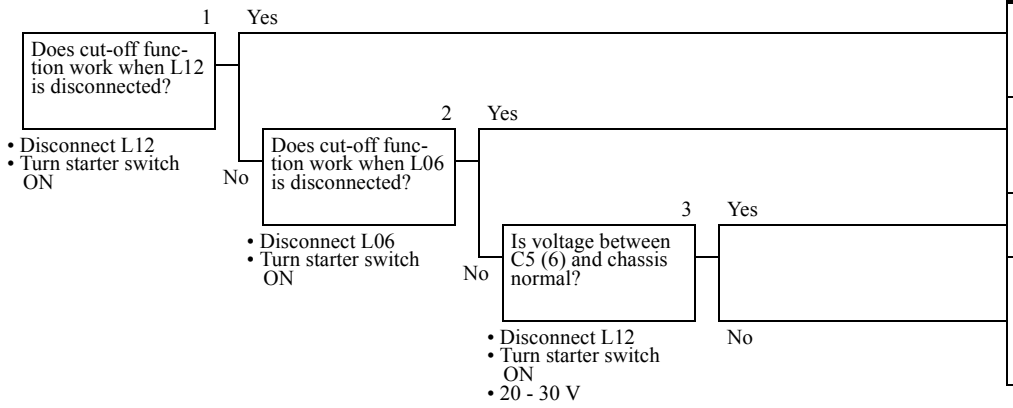
Cause	Remedy
Defective main monitor	Replace
Short circuit with power source in harness between L05 (female) (7) - E05 (female) (1)	Repair or replace

(2) Only monitor display lights up



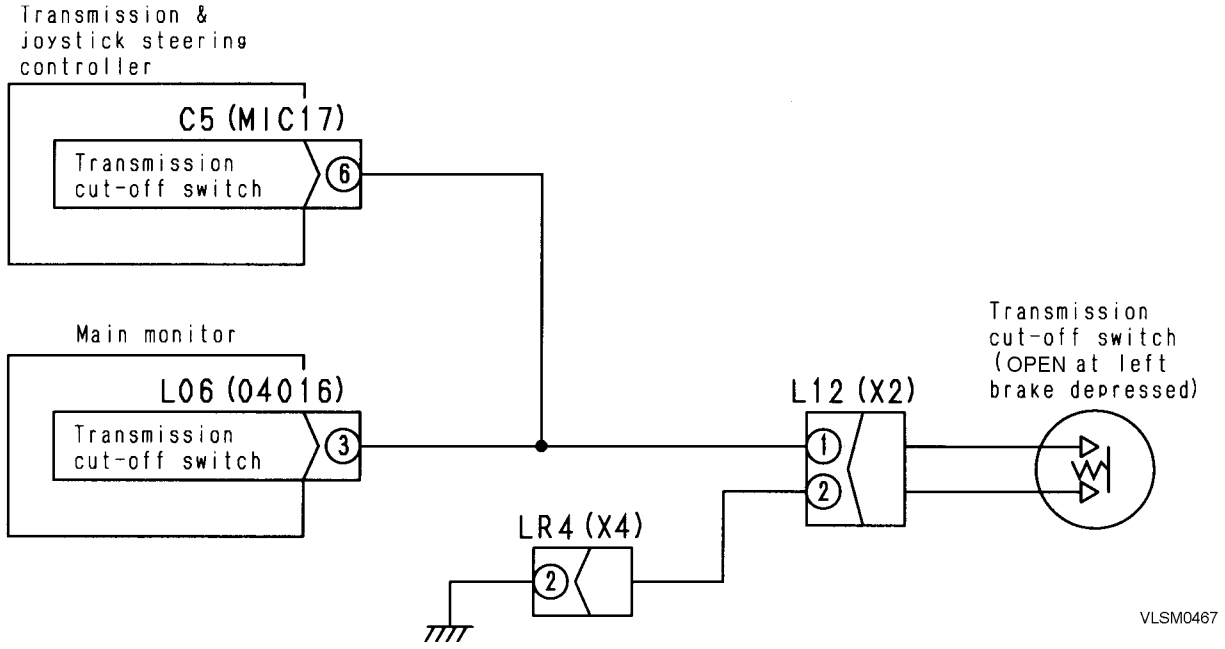
Cause	Remedy
Defective contact or disconnection in wire harness between E11, E13 and terminal B of starter	Repair or replace
Defective preheating relay	Replace
Defective electric intake air heater	Replace

e) Monitor display lights up (transmission cut-off switch turned ON), but cut-off function is not actuated



Cause	Remedy
Defective transmission cut-off switch	Replace
Defective main monitor	Replace
Defective transmission & joystick steering controller	Replace
Short circuit with chassis ground in harness between L06 (female) (3), - C5 (female) (6), L12 (female) (1)	Repair or replace

M-12 Related electrical circuit diagram



M-19

Condition of monitor switches is not stored in memory

★ Before carrying out troubleshooting, be sure that all the related connectors are properly inserted.

★ Always connect any disconnected connectors before going on to the next step.

1 Is voltage between L07 (10) and chassis ground normal?

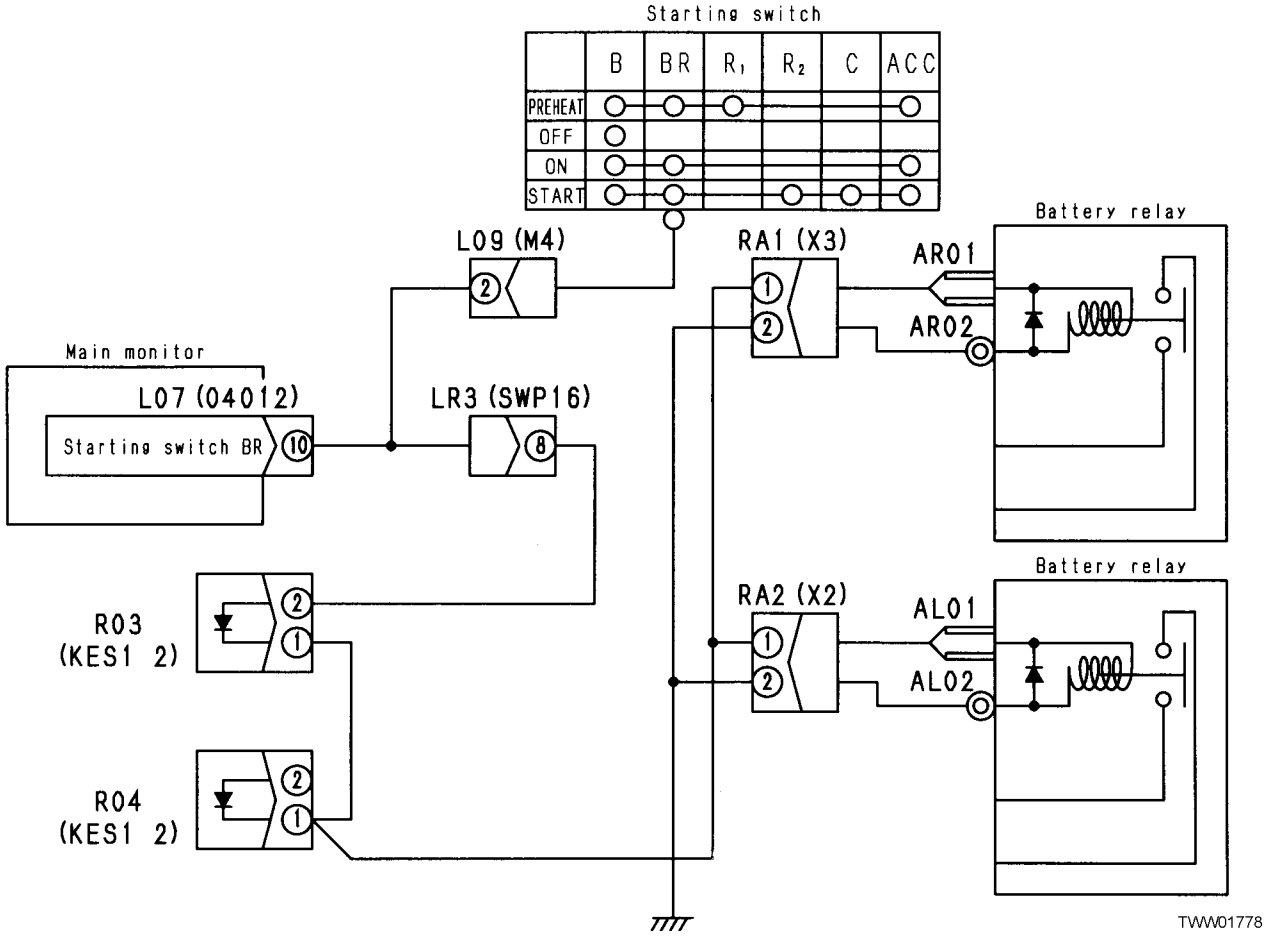
- 20 - 30 V
- Turn starter switch ON

Yes

No

Cause	Remedy
Defective main monitor	Replace
Defective contact or disconnection in wire harness between L07 (female) (10) and L09 (female) (2)	Repair or replace

M-19 Related electrical circuit diagram



K-2

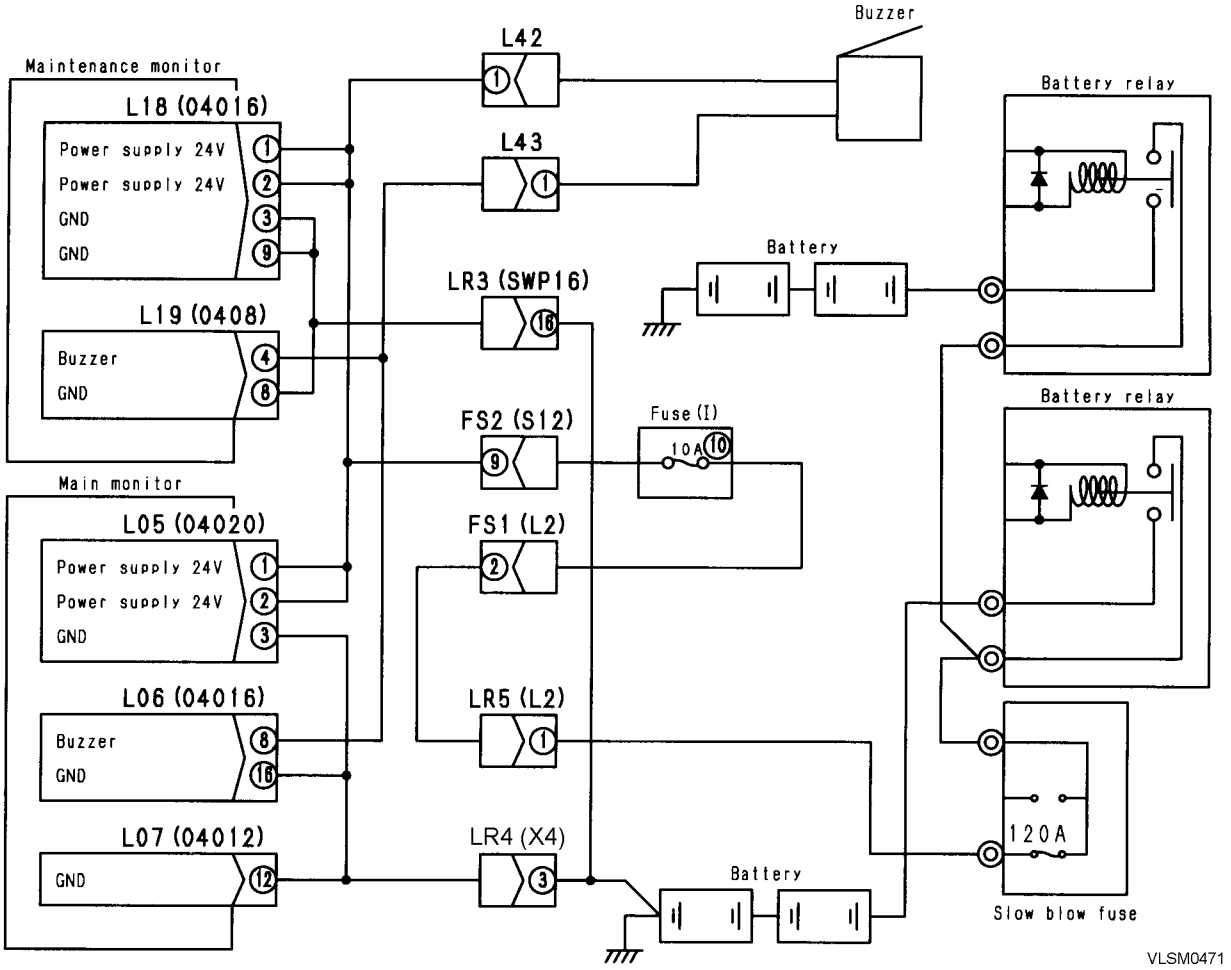
When starter switch is turned ON, all lamps on maintenance monitor light up but do not go out (even after 3 seconds)

★ Before carrying out troubleshooting, be sure that all the related connectors are properly inserted.

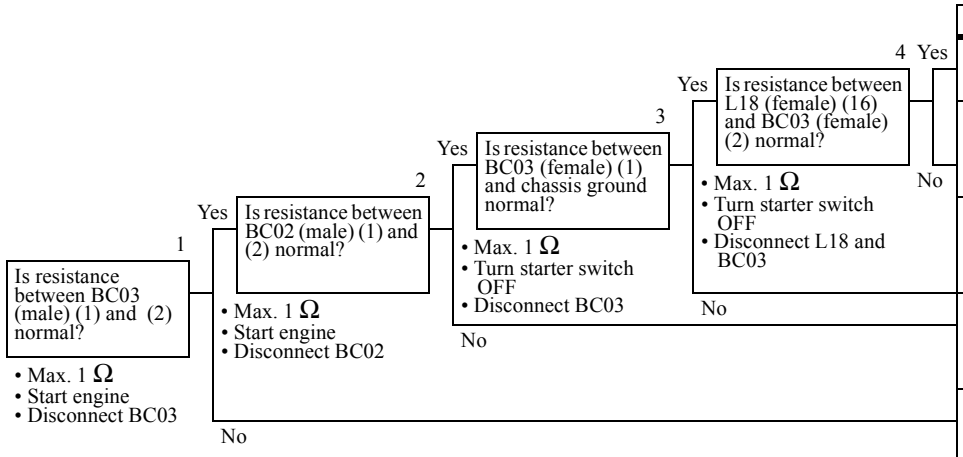
★ Always connect any disconnected connectors before going on to the next step.

Cause	Remedy
Defective monitor module of maintenance monitor	Replace

K-1, 2 Related electrical circuit diagram

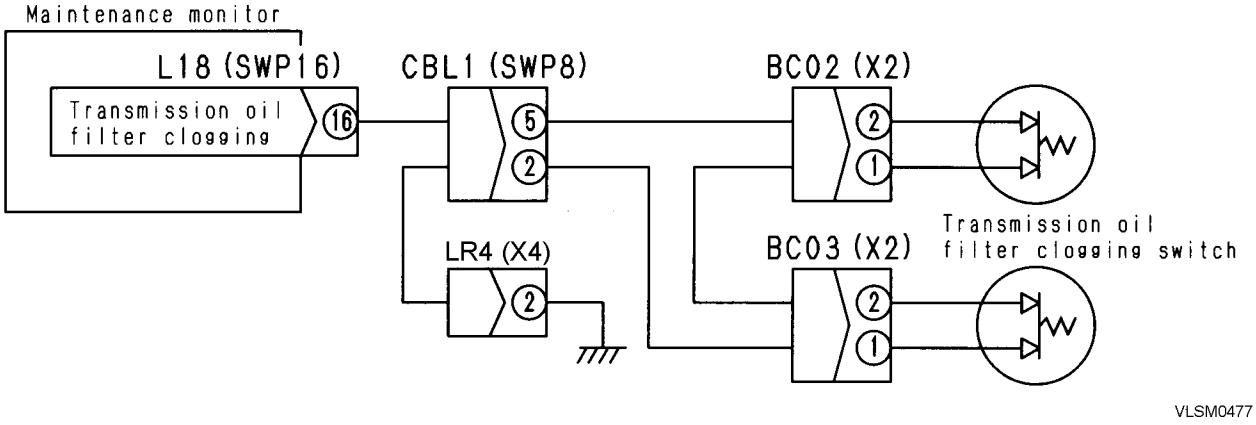


f) Transmission oil filter display flashes
(The transmission oil filter must not be clogged)

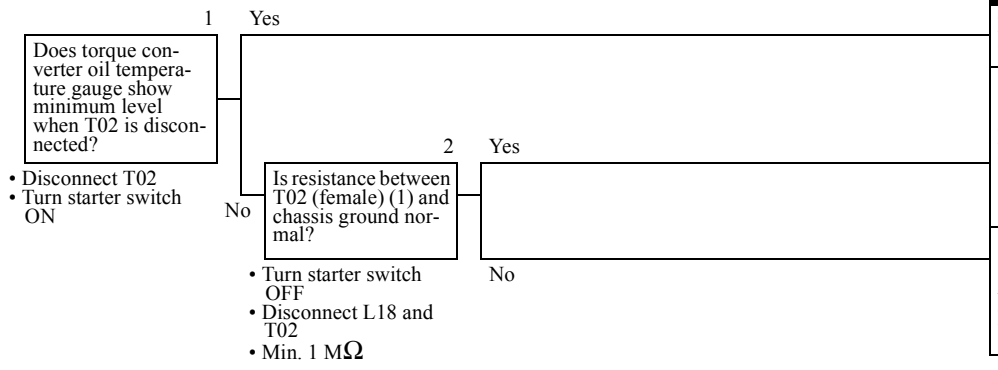


Cause	Remedy
Defective monitor module of maintenance monitor	Replace
Defective contact or disconnection in wire harness between L18 (female) (16) and BC03 (female) (2)	Repair or replace
Defective contact or disconnection in wire harness between BC03 (female) (1) and chassis ground	Repair or replace
Defective transmission oil filter sensor (BC02 side)	Replace
Defective transmission oil filter sensor (BC03 side)	Replace

K-5 f) Related electrical circuit diagram

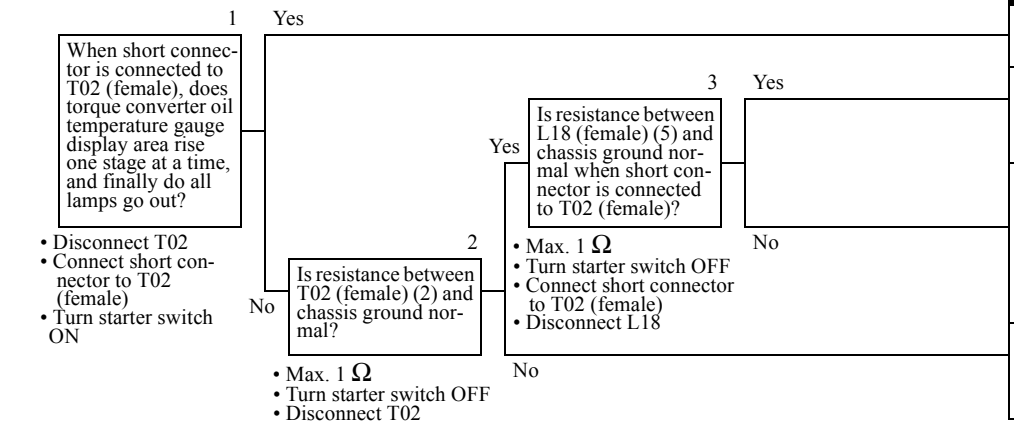


c) Abnormality in torque converter oil temperature gauge
(1) Nothing is displayed in display area



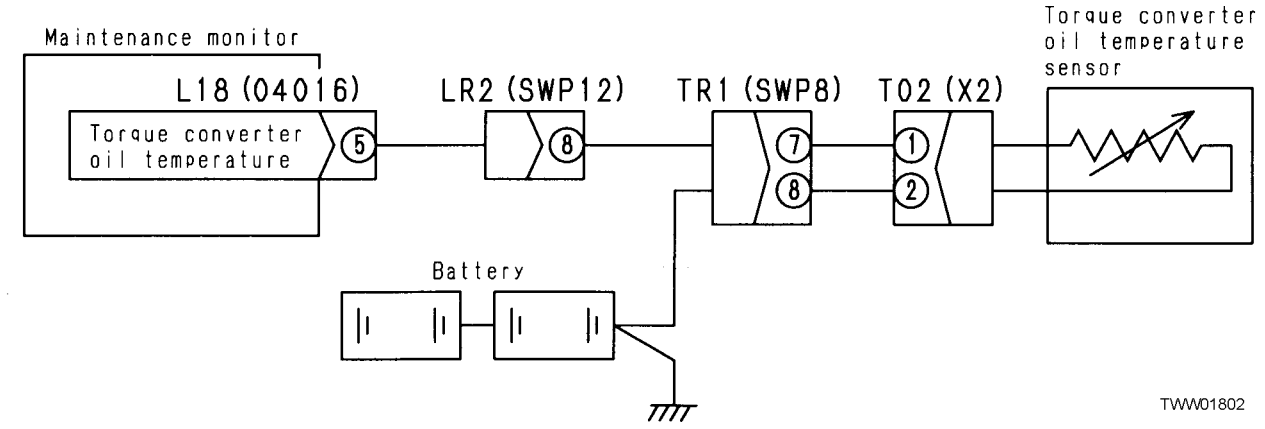
Cause	Remedy
Defective torque converter oil temperature sensor	Replace
Defective monitor module of maintenance monitor	Replace
Short circuit with chassis ground in wire harness between T02 (female) (1) - L18 (female) (5)	Repair or replace

(2) Display shows lowest level and does not move

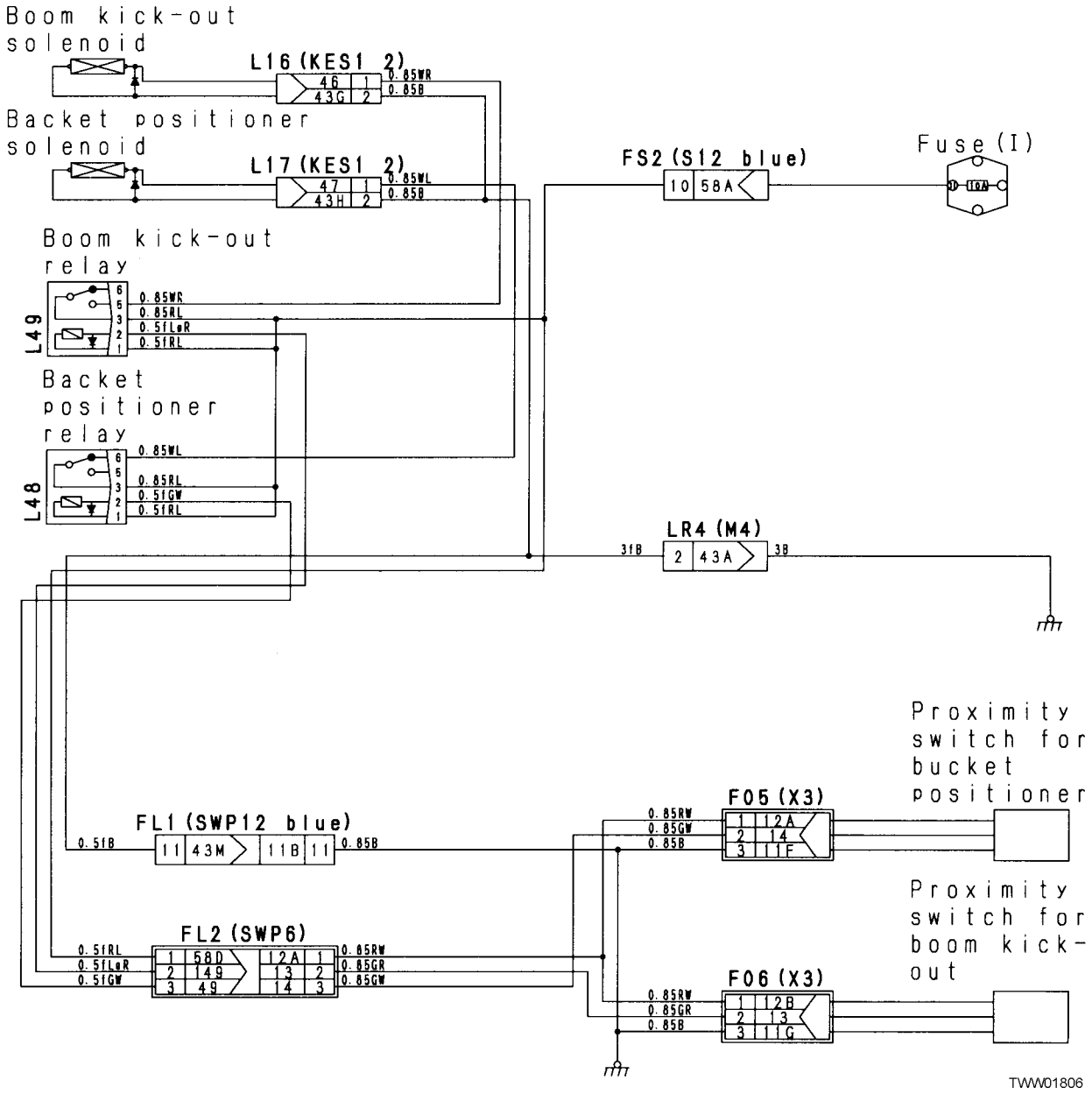


Cause	Remedy
Defective torque converter oil temperature sensor	Replace
Defective monitor module of maintenance monitor	Repair or replace
Defective contact or disconnection in wire harness between T02 (female) (1) and L18 (female) (5)	Repair or replace
Defective contact or disconnection in wire harness between T02 (female) (2) and chassis ground	Repair or replace

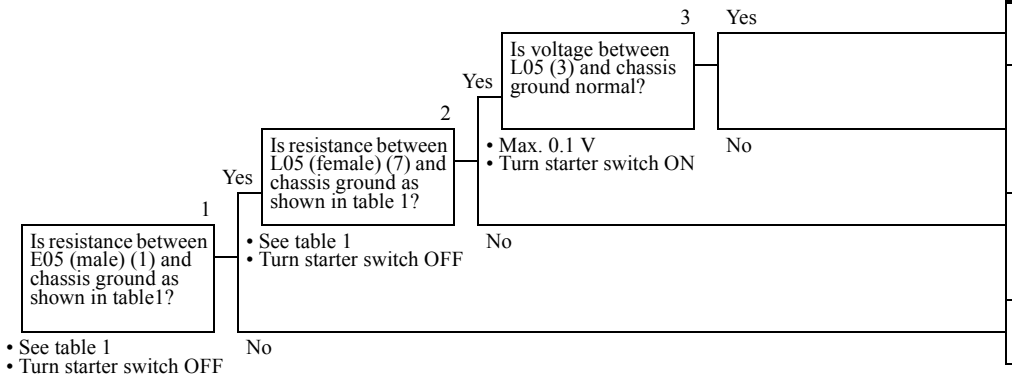
K-14c) Related electrical circuit diagram



ELECTRICAL DIA. - BOOM KICK-OUT / BUCKET POSITIONER



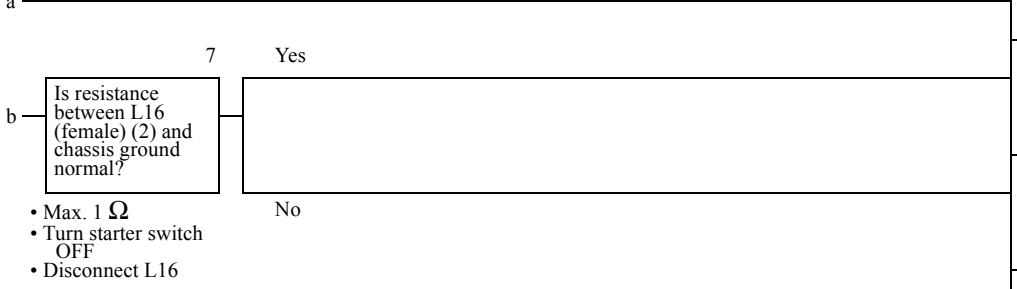
d) Preheating time becomes shorter, or there is variation



Cause	Remedy
Defective main monitor	Replace
Defective contact of wire harness between L05 (3) - and chassis ground	Repair or replace
Short circuit with chassis ground or defective contact of wire harness between L05 (female) (7) - E05 (female) (1)	Repair or replace
Defective engine coolant water temperature sensor	Replace

Table 1 (Tolerance ± 0.5 kΩ)

Temperature (°c)	-30	-20	0	20	40	60	80	90
Resistance value (kΩ)	19.5	12.1	5.11	2.39	1.21	0.695	0.381	0.295



	Cause	Remedy
a	Defective boom relay (L49)	Replace
b	Defective contact or disconnection in wire harness between L49 (female) (5) and L16 (female) (1)	Repair or replace
	Defective contact or disconnection in wire harness between L16 (female) (2) - chassis ground	Repair or replace
c	Defective contact or disconnection in wire harness between L49 (female) (2) - F06 (female) (2)	Repair or replace
d	Defective contact or disconnection in wire harness between fuse I (11) - L49 (female) (1), (3), between FS2 (10) - F06 (female) (1)	Repair or replace
e	Defective contact or disconnection in wire harness between F06 (female) (3) and chassis ground	Repair or replace
f	Defective boom kick-out solenoid	Replace
g	Defective boom proximity switch	Replace

H-2

Machine lacks power or speed (every speed range)

Checks before troubleshooting

- Is oil level in the transmission case correct?
- Are there any oil leaks at piping joints or valves?
- Does the parking brake or wheel brake drag?

Checks for abnormalities

- Engine high idle speed?
- Torque converter stall speed?
- Machine travel speed?
- Transmission clutch pressure (both high pressure and low pressure)?
- Pressure at outlet port of torque converter pump
- Pilot reducing pressure

The following symbols are used to indicate the action to be taken when a cause of failure is located.
X: Replace
A: Adjust
△: Repair
C: Clean

No.	Problems		Remedy	Air sucking up at suction side of torque converter pump	Torque converter pump defective	Drop in engine performance	Operation of transmission main relief valve defective	Modulating valve deteriorated, operation defective	Operation of pilot reducing valve defective	Oil leaks inside torque converter (seal ring defective, plug lose)	Operation of torque converter relied valve defective, or spring deteriorated	Operation of torque converter regulator valve defective, valve spring deteriorated	Damage to internal part of torque converter (turbine rivet defective)
			Causes	Torque converter pump		Engine				Torque converter			
				a	b	c	d	e	f	g	h	i	j
			Remedy	△	X	△	A △ X	△ X	X	△ X	△ X	△ X	X
1	Abnormal noise between pump and filter.			O	O								
2	Torque converter stall speed too high				O		O	O			O	O	O
3	Torque converter stall speed too low					O	O				O	O	
4	Transmission main relief pressure too low.						O						
5	Transmission modulating pressure too low	Low at every speed range.(item 2 abnormal)		O	O								
6		Indicator fluctuates violently		O									
7	Pilot Reducing pressure too low (item 5 and 6 normal)								O				
8	Relief pressure at torque converter too (items 5 and 7 normal)										O		
9	Torque converter regulator valve pressure (outlet port pressure) too low											O	
10	Iron or aluminum particles stuck to strainer of transmission case												O
11	Modulating pressure drops when oil temperature rises				O								

H-14

Wheel brakes do not work or braking effect is poor

Checking for abnormalities

- Measure the actual performance, and check if there is actually an abnormality or whether it is just the feeling of the operator. For details, see TESTING AND ADJUSTING, Measuring brake performance.

Ask the operator the following points

- Did the problem suddenly start? Yes = Related equipment broken.
- Was there any abnormal noise when this happened? Where did the noise come from?
- Did the problem gradually appear? Yes = Wear of related equipment, defective seal.

Checks before troubleshooting

- Is the oil level in the hydraulic tank correct? Is the type of oil correct?
- Is the brake pedal play correct?
- Is there any leakage of oil from the brake tubes?
- Is there any deformation of tubes?
- Is tire inflation pressure and tread pattern correct?

The following symbols are used to indicate the action to be taken when a cause of failure is located.
X: Replace
A: Adjust
△: Repair
C: Clean

No.	Problems	Remedy	Defective PTO	Air sucked in at suction end of pump	Defective brake pump	Defective accumulator charge valve	Defective piston seal or defective bleeding of gas from accumulator	Defective left brake valve	Defective right brake valve	Defective slack adjuster	Defective brake piston seal	Defective actuation of brake piston seal	Breakage inside brake	Wear of brake disc	Bleed the air from the brake circuit	Defective axle oil
		Causes	Brake pump			Charge valve	Accu mula-tor	Brake valve		Slack ad-juster	Wheel brake					Oth-ers
			a	b	c	d	e	f	g	h	i	j	k	l	m	n
			△ X	△	△ X	△ X	X	△ X	△ X	△ X	△ X	△ X	△ X	△ X	△	X
1	Brakes has no effect only when left brake pedal is depressed							O								
2	Left brake pedal is light when it is depressed		O	O	O	O		O	O		O				O	
3	Right brake pedal is light when it is depressed		O	O	O	O			O		O				O	
4	Left brake pedal is heavy when it is depressed							O								
5	Right brake pedal is heavy when it is depressed								O							
6	Abnormally large operating force is needed to obtain specified braking force						O	O	O	O		O				
7	Abnormal noise is heard from brake when brake is applied												O	O		O
8	Work equipment, steering also does not work		O		O											
9	Movement of work equipment, steering is slow			O	O	O										
10	Abnormal noise comes from around PTO		O													
11	Abnormal noise comes from around brake pump or hydraulic tank			O	O											
12	Many metal particles are found in oil drained from axle case													O		
13	When accumulator charge pressure is measured, pressure is found to be low			O	O	O										
14	Brakes stop having effect immediately when engine is stopped						O									
15	There is a time lag before brake takes effect									O					O	
16	When brake oil pressure is measured, it is found to be low										O					
17	When drop in brake piston pressure is measured, it is found to be excessive						O				O					
18	When wear of brake is measured, it is found to be excessive												O	O		
19	When air is bled from brake line, air comes out														O	

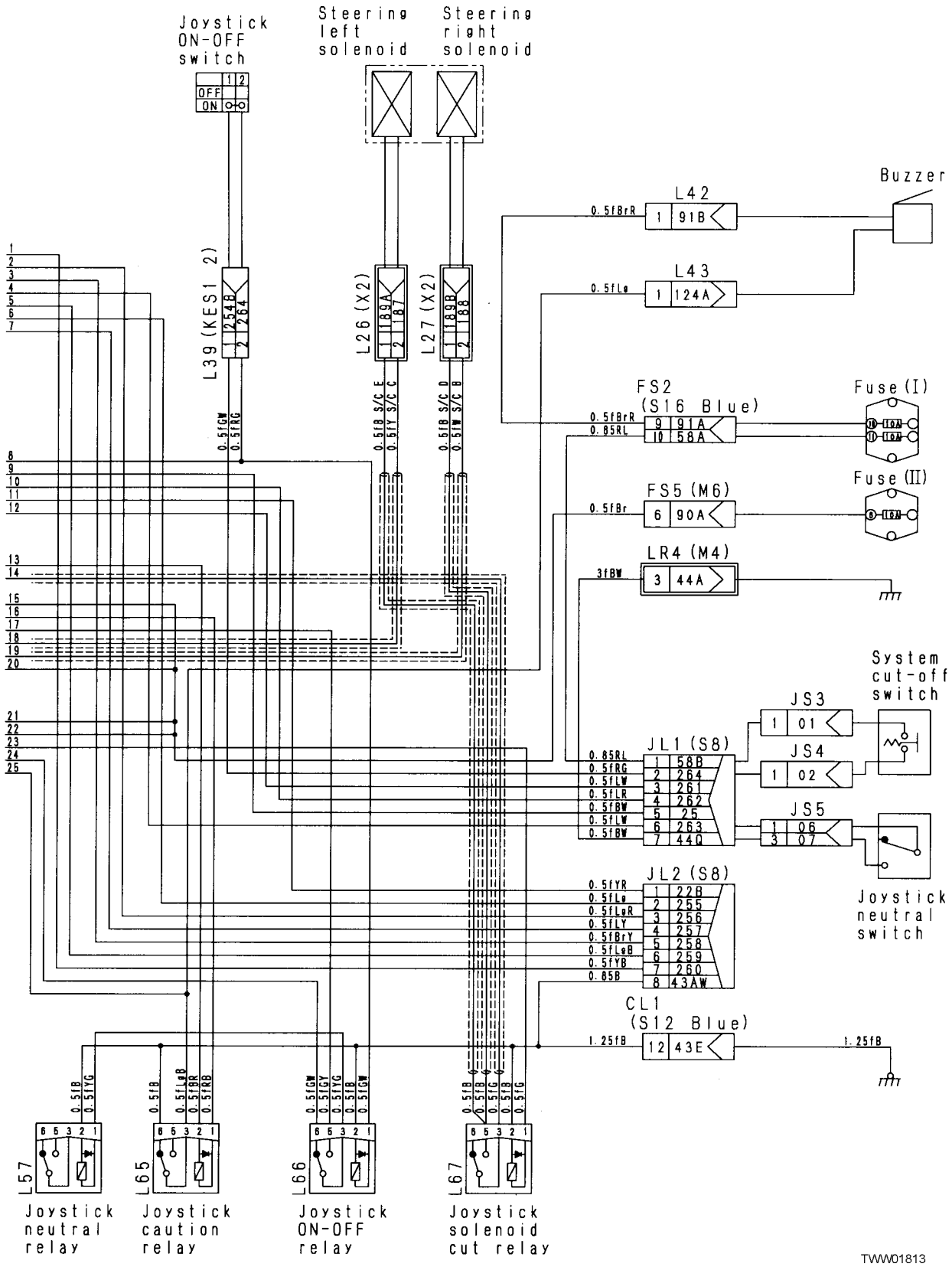
H-30

Boom and bucket levers do not move smoothly

Fault check
Using the standard value table, check whether or not the operating effort of the lever is great

The following symbols are used to indicate the action to be taken when a cause of failure is located.
X: Replace
A: Adjust
△: Repair
C: Clean

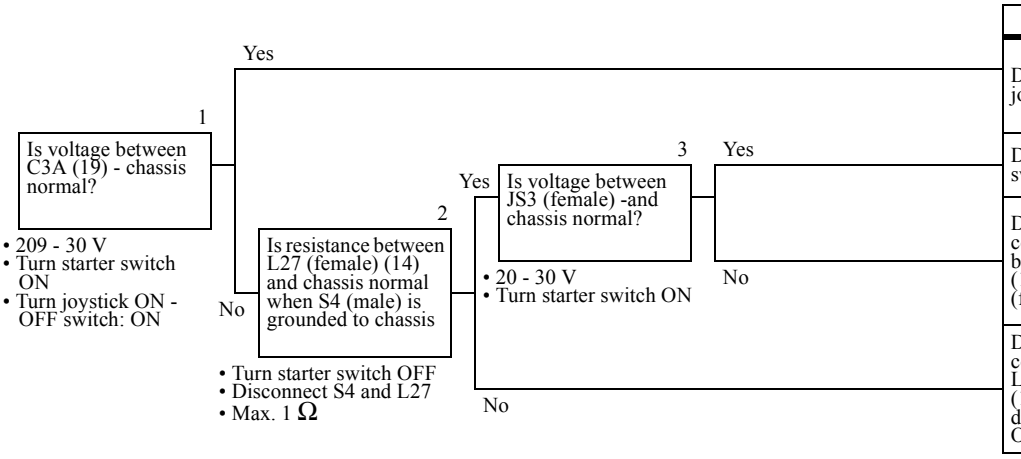
No.	Problems	Remedy	Seizure of control lever of rotating parts of link	Bent PPC valve spool	Incorrect clearance between PPC valve body and spool	Poor roundness of PPC valve body and spool	Foreign matter lodged in PPC valve	Distortion of valve body to non-uniform tightening of valve mounting bolts	Bent work equipment control valve spool	Sticking of detent of work equipment control valve spool	Incorrect clearance between work equipment control valve body and spool	Poor roundness of work equipment control valve body and spool	Foreign matter lodged in work equipment control valve spool
			Lever	PPC valve				Work equipment control valve					
			a	b	c	d	e	f	g	h	i	j	k
			△		△	△	C	△					C
			X	X	X	X	△	X	X	X	X.	X.	△
1	Movement of boom and bucket levers becomes sluggish when load is applied and oil pressure increase.				O	O		O			O	O	
2	Movement of boom and bucket levers becomes sluggish along with change in oil temperature.				O	O		O			O	O	
3	Movement of boom and bucket levers becomes partially sluggish irrespective of oil pressure and temperature.									O			
4	Movement of boom and bucket levers becomes generally sluggish irrespective of oil pressure and temperature.		O	O		O	O	O					O
5	Movement of boom and bucket levers does not become light even when the link of the control lever is disconnected at the valve connection part and the lever operated.		O										


Joystick ON-OFF switch
Steering left solenoid
Steering right solenoid
Buzzer
L42
L43
L39 (KES1 2)
L26 (X2)
L27 (X2)
FS2 (S16 Blue)
Fuse (I)
Fuse (II)
FS5 (M6)
LR4 (M4)
System cut-off switch
JS3
JS4
JS5
JL1 (S8)
JL2 (S8)
CL1 (S12 Blue)
L57
L65
L66
L67
Joystick neutral relay
Joystick caution relay
Joystick ON-OFF relay
Joystick solenoid cut relay
Joystick neutral switch
TWW01813

J-10

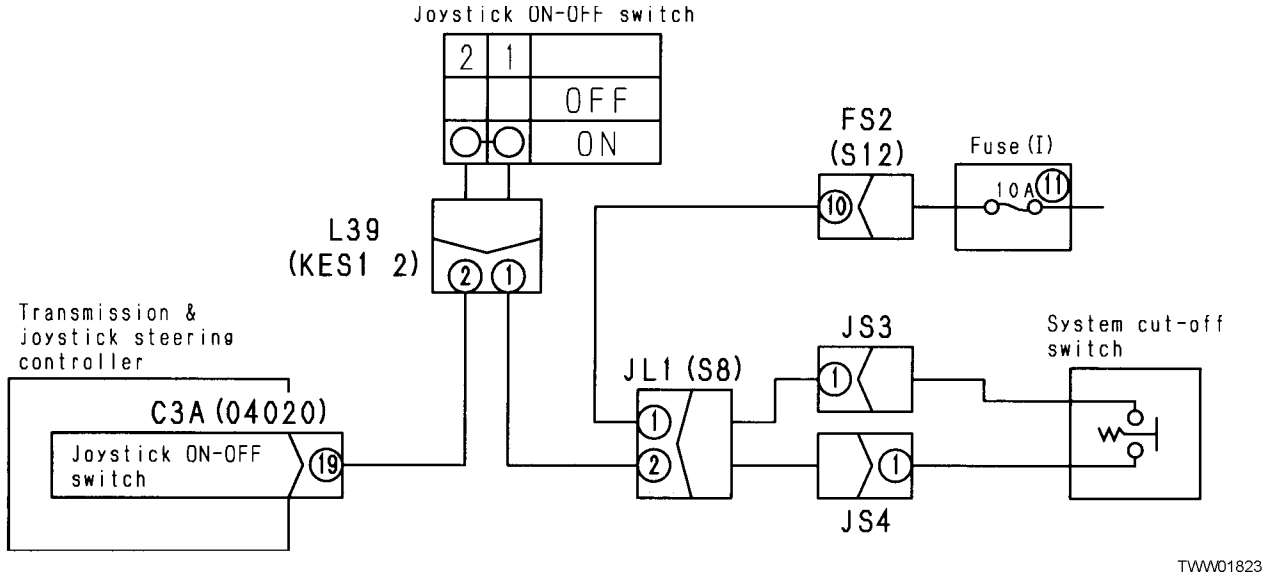
Abnormality in joystick steering ON-OFF circuit

- ★ Before carrying out troubleshooting, check that all related connectors are properly inserted
- ★ Check that fuse I (11) is normal.
- ★ Always connect any disconnected connectors before going on to the next step
- ★ When joystick steering lever is not being used, leave it at the neutral position and turn the joystick steering selector switch ON



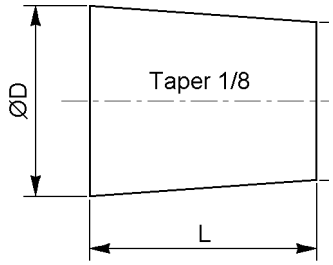
Cause	Remedy
Defective transmission & joystick steering controller	Replace
Defective system cut-off switch	Replace
Defective contact or disconnection in wire harness between fuse I (11) - FS2 (10) - L32 (1) - JS3 (female)	Repair or replace
Defective contact or disconnection in wire harness L27 (female) (14) - JS5 (1), (2) - S4 (male), or defective joystick ON - OFF switch	Replace switch or repair replace

J-10 Related electrical circuit diagram



3) If the part is not under hydraulic pressure, the following corks can be used:

Nominal number	Part Number	Dimensions		
		D	d	L
06	07049-00608	6	5	8
08	07049-00811	8	6.5	11
10	07049-01012	10	8.5	12
12	07049-01215	12	10	15
14	07049-01418	14	11.5	18
16	07049-01620	16	13.5	20
18	07049-01822	18	15	22
20	07049-02025	20	17	25
22	07049-02228	22	18.5	28
24	07049-02430	24	20	30
27	07049-02734	27	22.5	34



PRECAUTIONS WHEN CARRYING OUT INSTALLATION WORK

- Tighten all bolts and nuts (sleeve nuts) to the specified (KES) torque.
- Install the hoses without twisting or interference.
- Replace all gaskets, O-rings, cotter pins, and lock plates with new parts.
- Bend the cotter pin or lock plate securely.
- When coating with adhesive, clean the part and remove all oil and grease, then coat the threaded portion with two or three drops of adhesive.
- When coating with gasket sealant, clean the surface and remove all oil and grease, check that there is no dirt or damage, then coat uniformly with gasket sealant.
- Clean all parts, and correct any damage, dents, burrs, or rust.
- Coat rotating parts and sliding parts with engine oil.
- When press-fitting parts, coat the surface with anti-friction compound (LM-P).
- After fitting snap rings, check that the snap ring is fitted securely in the ring groove.
- When connecting wiring connectors, clean the connector to remove all oil, dirt, or water, then connect securely.
- When using eye bolts, check that there is no deformation or deterioration, screw them fully, and align the direction of the hook.
- When tightening split flanges, tighten uniformly in turn to prevent excessive tightening on one side.

★ After replacing or flushing the hydraulic tank oil, filter element, or strainer, or when removing and installing any hydraulic cylinder, hydraulic pump or any other hydraulic equipment or work equipment piping, always bleed the air as follows after completion of installation.

A. Run the engine at low idling, and extend and retract the steering, bucket, and lift arm cylinders 4 - 5 times without going to the end of this stroke. (Stop approximately 100 mm before the end of the stroke.)

B. Operate the steering, bucket, and lift arm cylinders 3 - 4 times to the end of the stroke, then stop the engine and bleed the air from the plugs at the top of the hydraulic tank filter.

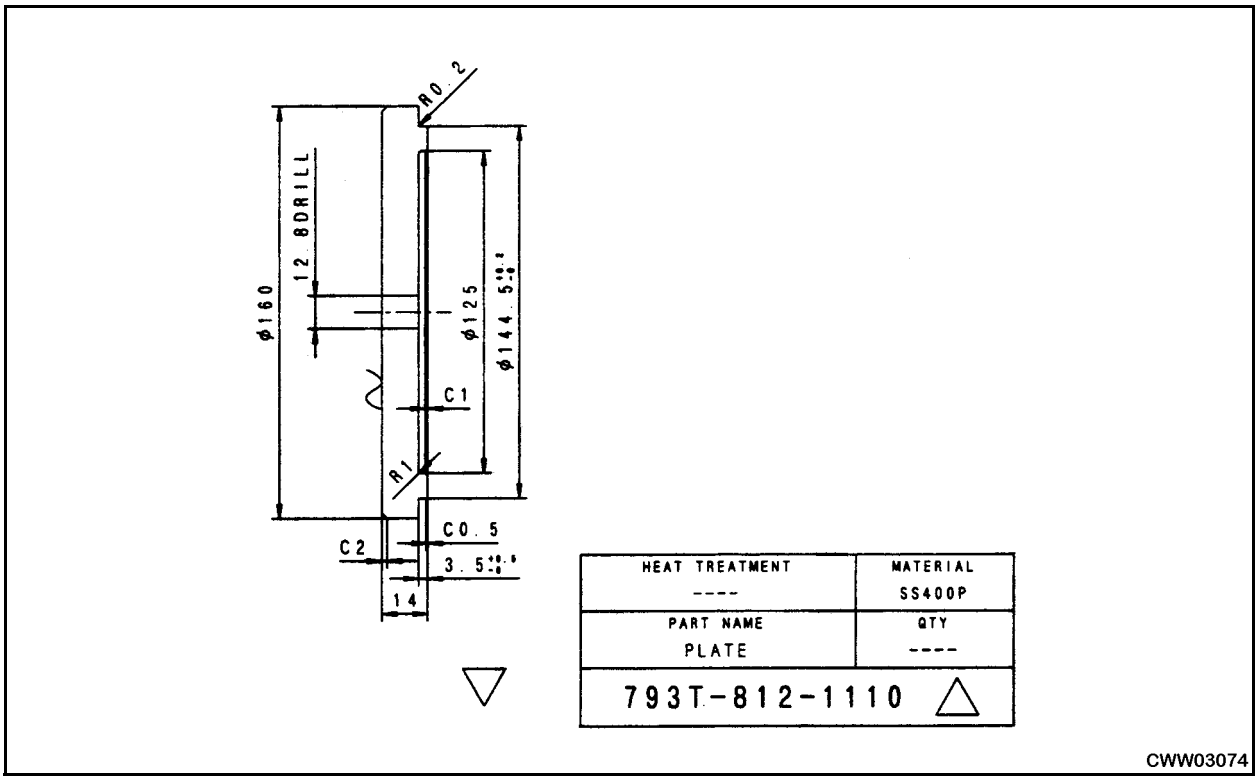
C. Raise the engine speed and repeat Step B to bleed the air. Repeat this procedure until no more air comes out from the plugs.

D. After completly bleeding the air, tighten the plugs.

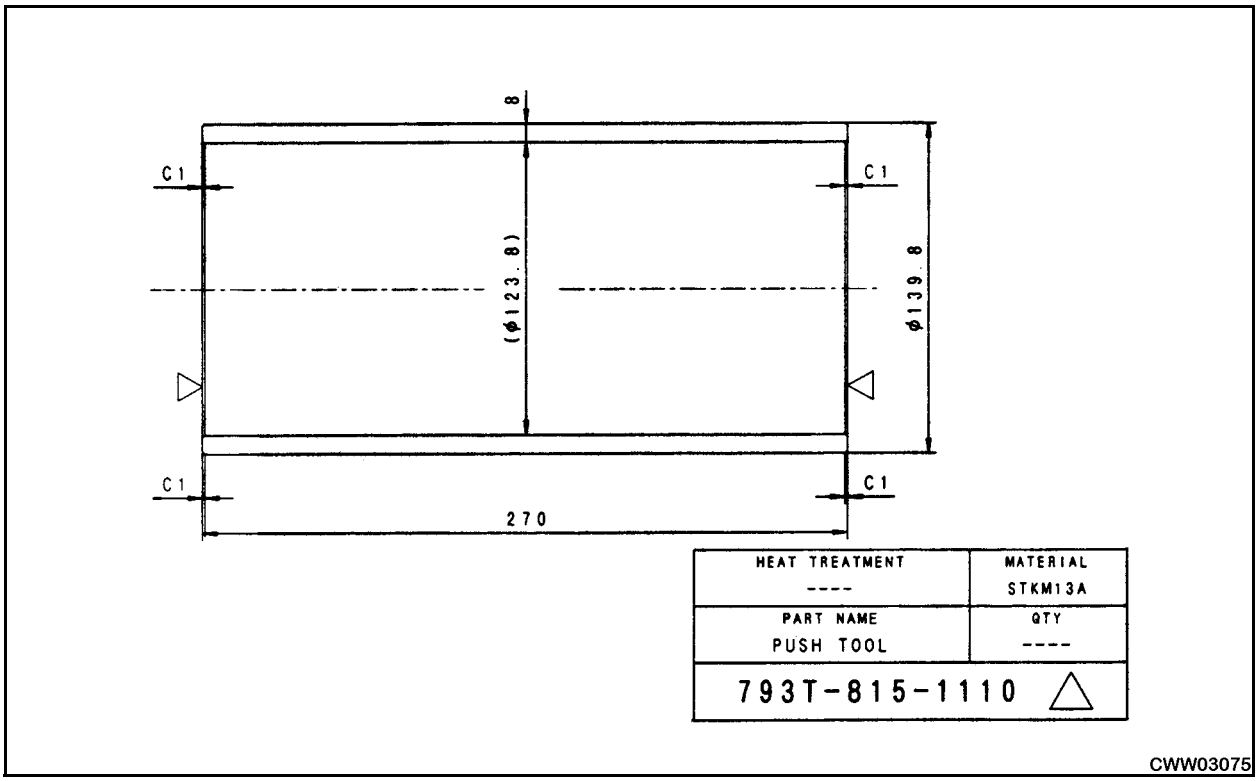
SKETCHES OF SPECIAL TOOLS

NOTE: Komatsu cannot accept any responsibility for special tools manufactured according to these sketches.

B2 PLATE

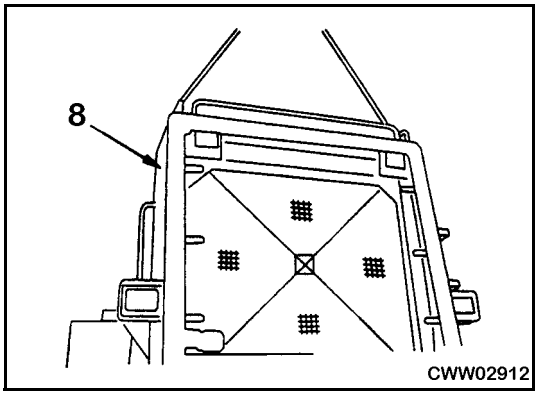


D2 PUSH TOOL

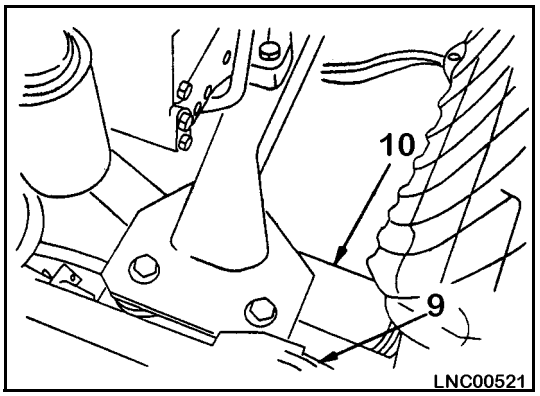


7. Sling radiator guard (8) temporarily, remove mount bolts, then lift off.

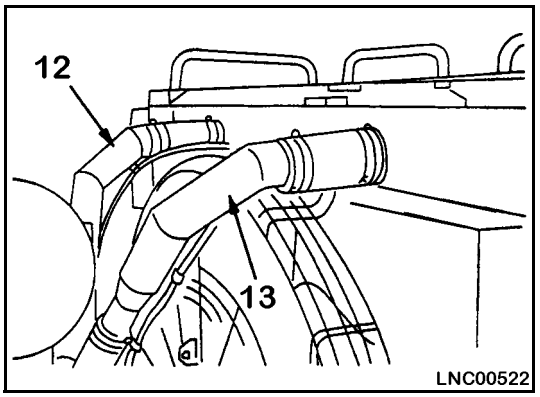
kg Radiator guard: Approximately 346 kg (762.79 lb)



8. Disconnect water drain hose (9) from radiator.
9. Loosen clamp of lower hose (10).

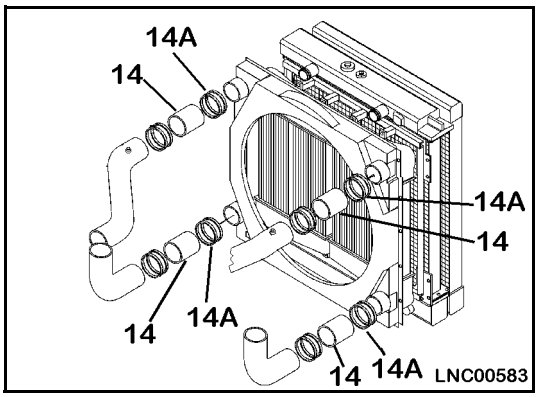


10. Loosen hose clamps of tubes (12) and (13).



11. Loosen hose clamps (14A).
    - ★ Disconnect hose (14) from after coolers.

NOTE: 2 EA. upper, 2 EA. lower; after cooler hoses

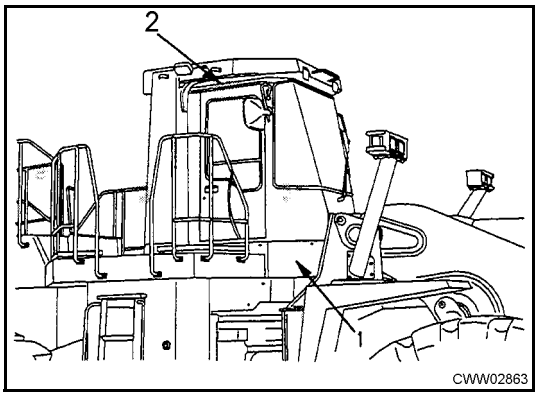


TORQUE CONVERTER AND TRANSMISSION

REMOVAL

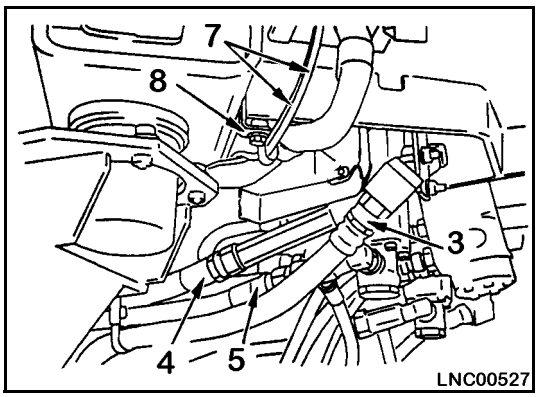
WARNING! Stop the machine on level ground and lower the work equipment completely to the ground, then put blocks under the wheels to prevent the machine from moving.

WARNING! Disconnect the cable from the negative (-) terminal of the battery.

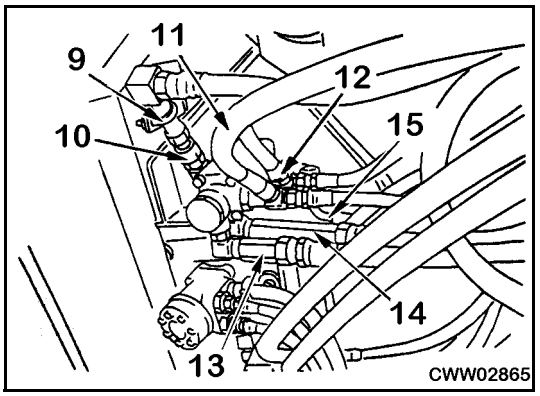


1. Remove front, rear, right and left side covers (1) under the cab.
2. Remove cab (2). For details, see CAB, REMOVAL.

kg Cab: 400 kg (881.84 lb)



3. Disconnect drain hose (3) of the right-hand brake valve.
4. Disconnect hoses (4) and (5) between the accumulator and right-hand brake valve.



5. Pull window washer hose (7) out of the floor frame, then disconnect clamp (8) and move it toward the frame.
6. Remove clamp (9), then disconnect left-hand brake drain tube (10).
7. Disconnect hoses (11) and) between the left-hand brake valve and slack adjuster.
8. Disconnect hoses (13) and (14) between the accumulator and left-hand brake valve.
9. Disconnect pilot hose (to shuttle valve) (15).

TORQUE CONVERTER

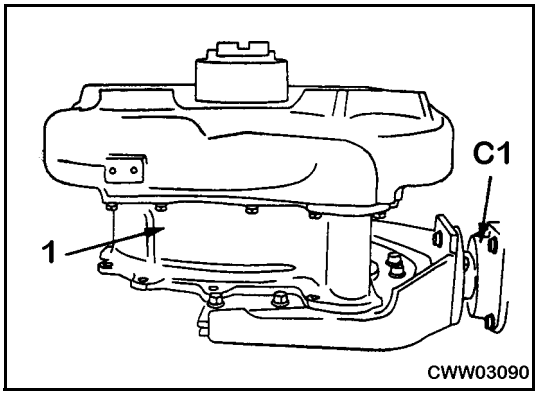
DISASSEMBLY

Preparatory work

- Remove torque converter and PTO assembly. For details, see TRANSMISSION, DISASSEMBLY.
- Set torque converter and PTO assembly (1) on tool **C1**.

kg

Torque converter, PTO assembly:
610 kg (1344.82 lb)

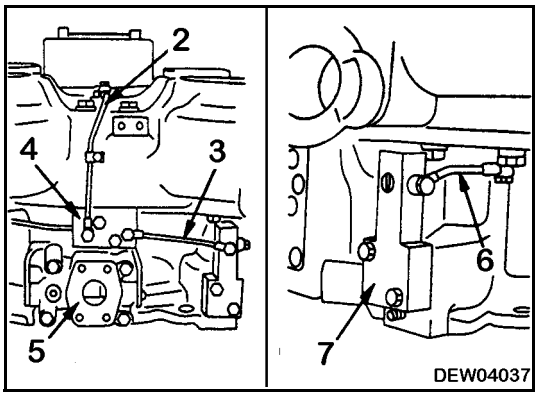


1. Valve

   A. Remove tubes (2) and (3), and block (4).

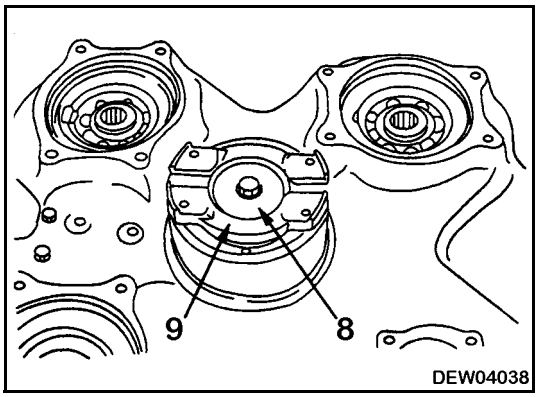
   B. Remove valve assembly (5).

   C. Remove tube (6) and block (7).



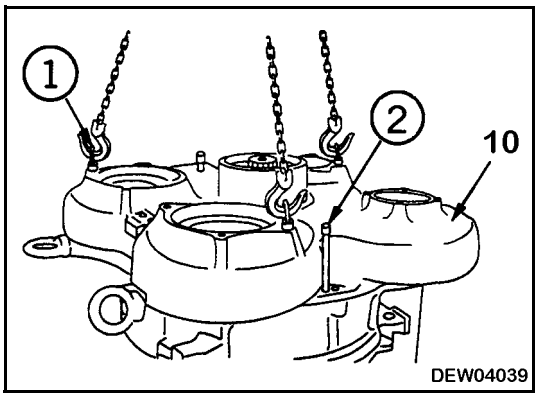
2. PTO

   A. Remove holder (8) and coupling (9).



   B. Using eyebolts ① (Dia. = 16 mm, Pitch 2.0 mm), sling PTO assembly temporarily.

   C. Screw in forcing screws ②, and lift off PTO assembly (10).



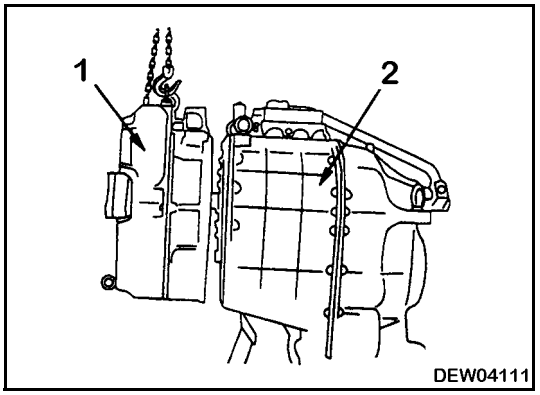
TRANSMISSION

DISASSEMBLY

1. Torque converter assembly

   Using eyebolts, remove torque converter assembly (1) from transmission assembly (2).

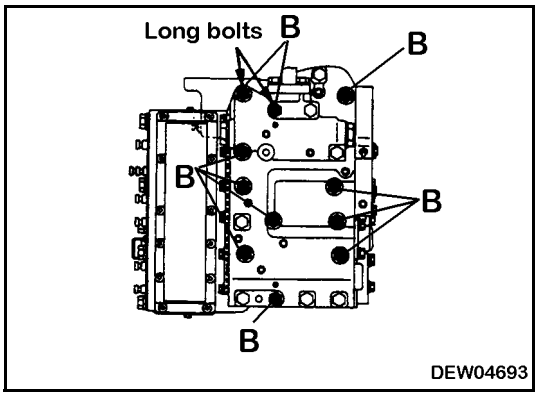
   kg Torque converter assembly: 650 kg (1433 lb)



2. Control valve assembly

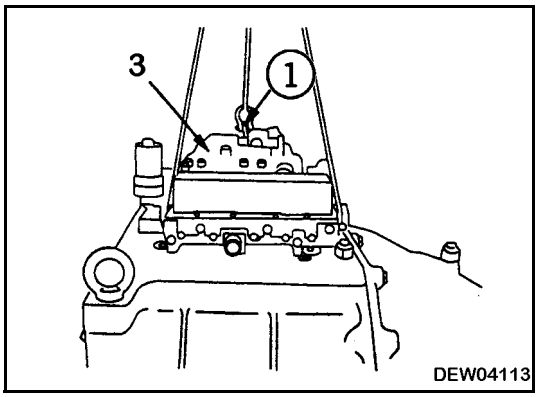
   A. Remove 11 mount bolts.

   ★ The length of the bolts is different, so check before removing.
   ★ Remove only the bolts marked B in the diagram.



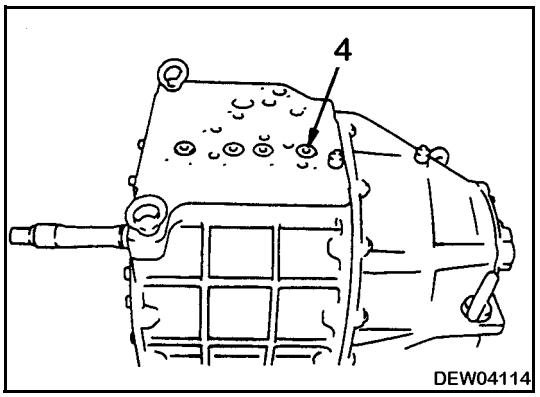
   B. Using eyebolts ① (Dia. = 10 mm, Pitch = 1.5 mm), lift off control valve assembly (3).

   kg Control valve assembly: 110 kg (242.50 lb)



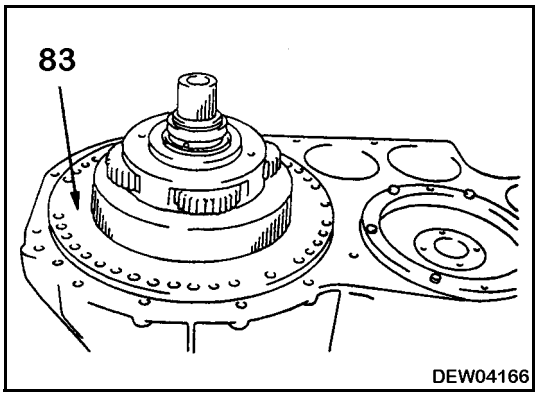
3. Sleeve

   Remove sleeve (4).



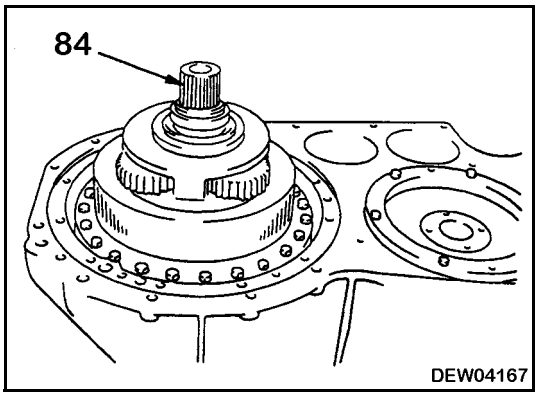
28. Plate

Remove plate (83).



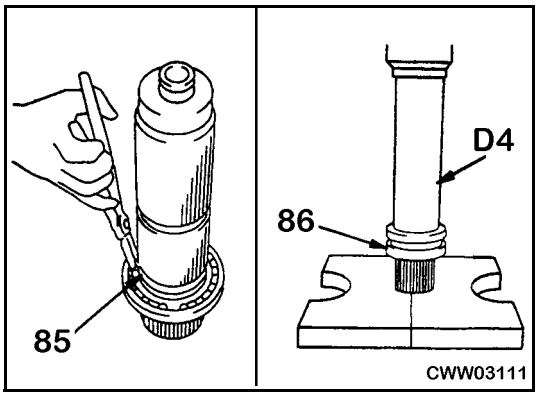
29. Shaft assembly

A. Remove shaft assembly (84).



B. Remove snap ring (85).

C. Set in press, then using push tool **D4** (inside diameter: 80 mm, Length: 400 mm), remove bearing (86).

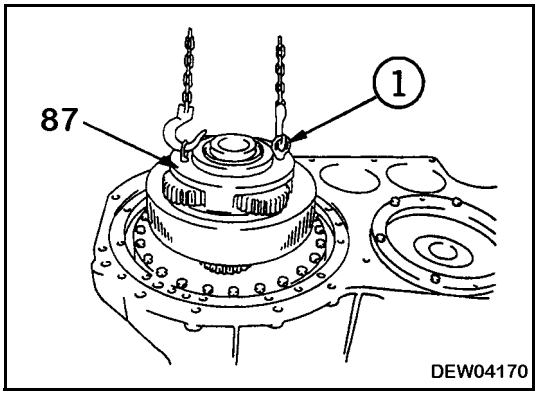


30. No. 4 ring gear, carrier assembly

A. Using eyebolts ① (Dia. = 10 mm, Pitch = 1.5 mm), lift off ring gear and carrier assembly (87).

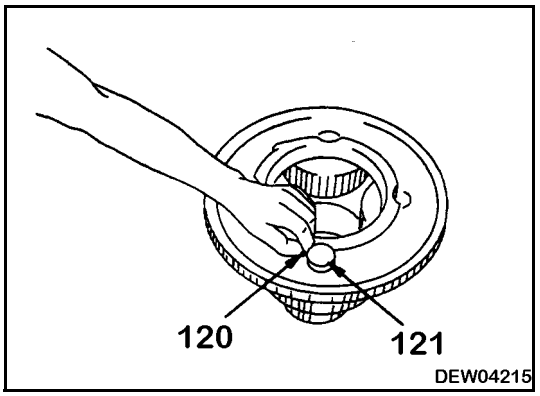
kg

Ring gear, carrier assembly: 80 kg (176.37 lb)



ii. Fit ball (120) and push in pin (121).

❇ Be careful not to forget the ball when installing to the shaft.

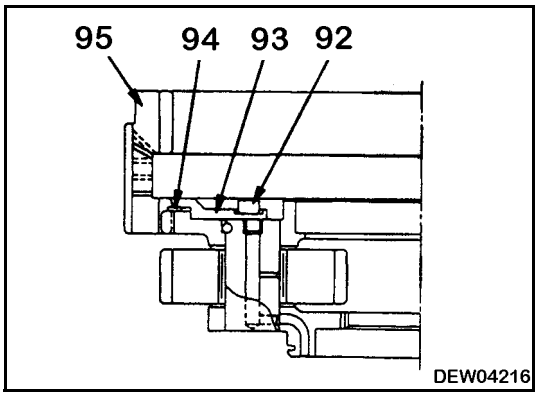


iii. Fit snap ring (94) to ring gear (95), and install ring gear.

iv. Fit retainer (93) and tighten with mount bolts (92).

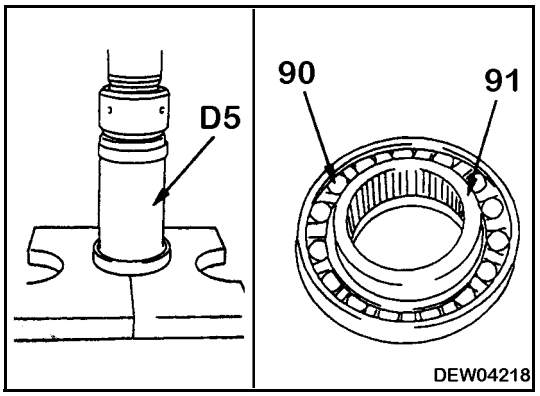
❇ Check that the snap ring installed to the ring gear is set securely between the retainer and the carrier.

N·m Mount bolt: 66.2 ± 7.4 Nm (45.87 ± 5.45 lbf ft)



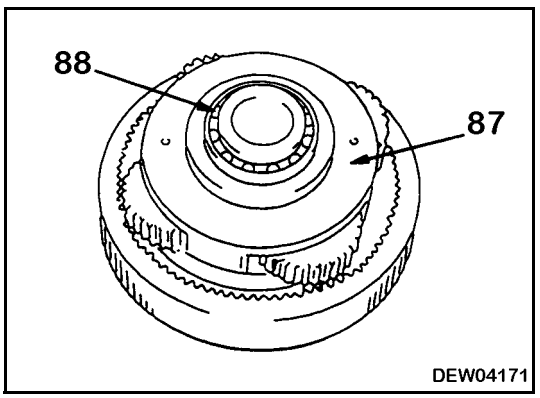
v. Set in press, then using push tool **D5** (inside diameter: 103 mm), press fit collar (91) in bearing (90).

❇ Install a seal ring on the collar.



vi. Install bearing assembly (88) to ring gear and carrier assembly (87).

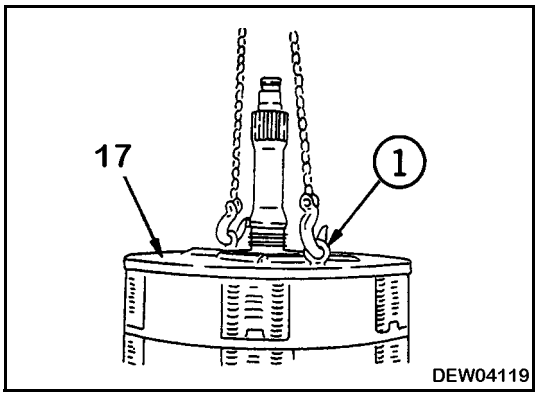
❇ Install seal rings to the ring gear and carrier assembly.



36. Plate

Using eyebolts ① (Dia. = 10 mm, Pitch = 1.5 mm), raise plate (17) and install.

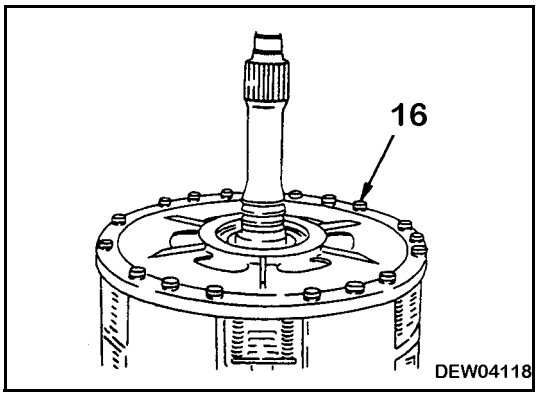
★ When installing, check through the clearance between the plate and the piston that spring (18) has not fallen over.



37. Tie bolts

Install 17 tie bolts (16).

N·m Tie bolt: 373 ± 20 Nm (275.11 ± 14.75 lbf ft)



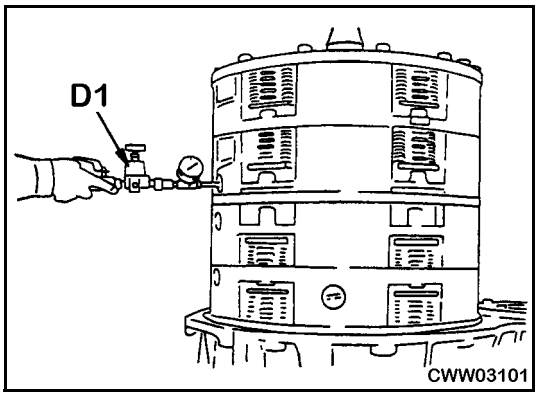
38. Piston operation check

Using tool **D1**, check stroke of each piston.

★ Air pressure: 0.3 - 0.5 MPa (42.67 - 71.11 psi)

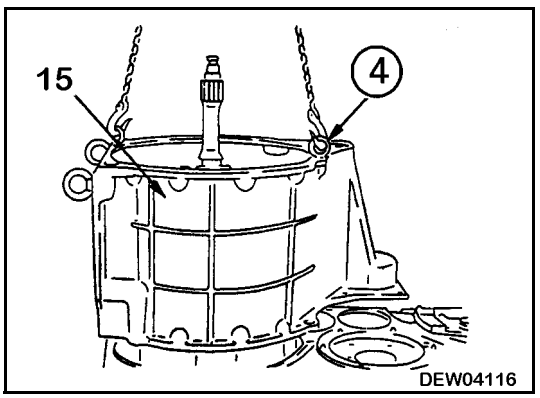
Unit: mm

Piston	Standard stroke
No. 1	7.6
No. 2	8.6
No. 3	7.0
No. 4	7.2



39. Transmission case

A. Fit O-ring, then using eyebolts ④ (Dia. = 12 mm, Pitch = 1.75 mm), raise transmission case (15) and install.



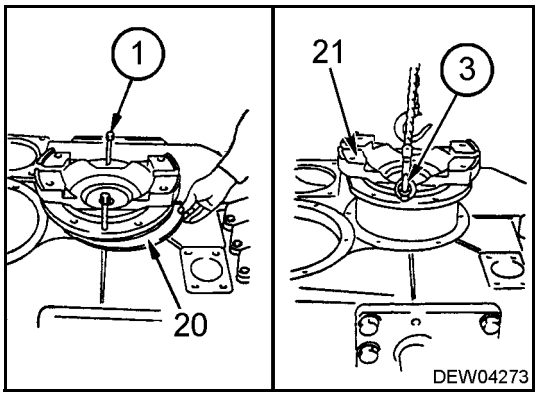
C. Screw in forcing screws ① (Dia. = 12 mm, Pitch = 1.75 mm) and remove fitting portion of cage.

★ Check the number and thickness of shims (20), and keep in a safe place.

D. Using eyebolts ③ (Dia. = 12 mm, Pitch 1.75 mm), lift off coupling and cage assembly (21).

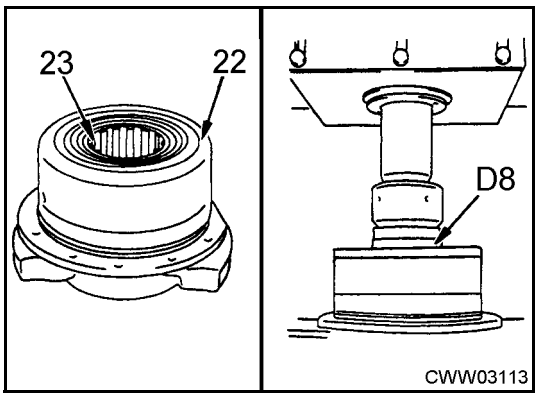
kg

Coupling, cage assembly: 55 kg (121.25 lb)



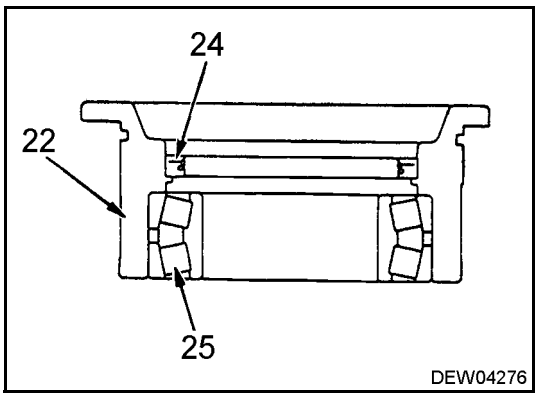
E. Disassemble coupling and cage assembly as follows.

i. Set in press, then using push tool **D8** (outside diameter: 135 mm), remove coupling (23) from cage (22).

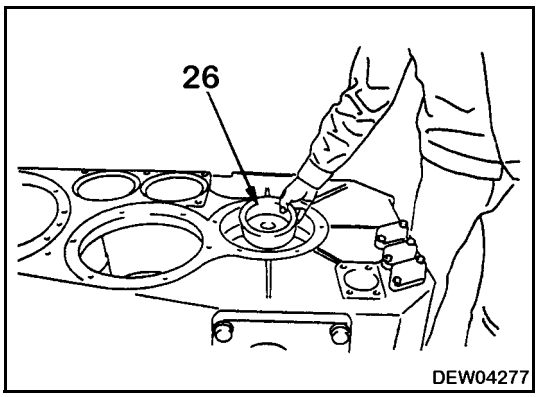


ii. Remove oil seal (24) from cage (22).

iii. Remove bearing (25) from cage (22).



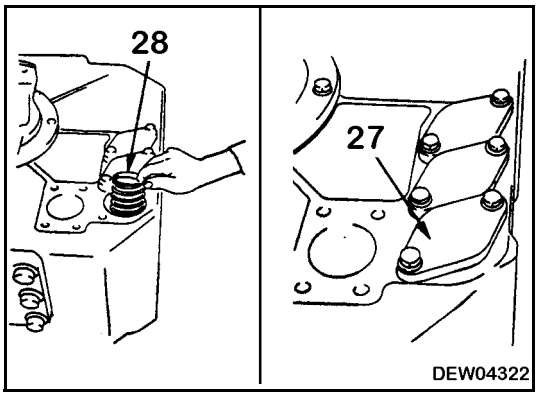
F. Remove collar (26)



C. Install spring (28).

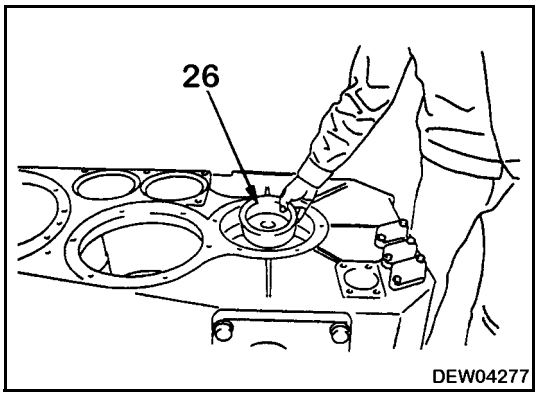
★ Insert the spring securely in the groove at the top of the strainer.

D. Fit O-ring and install cover (27).



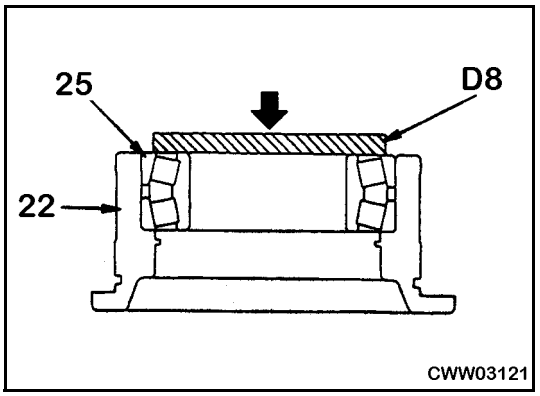
10. Coupling, cage assembly

A. Install collar (26).

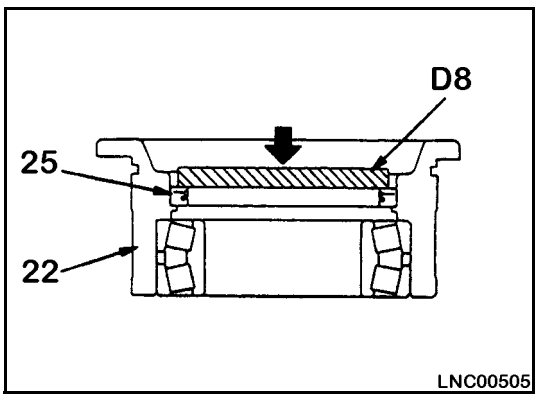


B. Assemble coupling and cage assembly as follows.

i. Set in press, then using push tool **D8** (outside diameter: 220 mm), press fit bearing (25) in cage (22).



ii. Using push tool **D8** (outside diameter: 195 mm), install oil seal (24) in cage (22).



Oil seal: Grease (G2-LI)

CENTER SUPPORT
REMOVAL

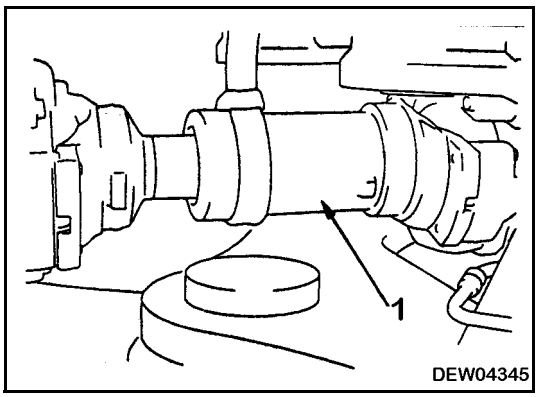
WARNING! Stop the machine on level ground and turn the steering wheel fully to the left lock. Lower the work equipment to the ground and stop the engine. Then apply the parking brake and put blocks under the wheels.

1. Drive shaft

   A. Lift off center drive shaft (1).

   ※1

   kg Center drive shaft: 186 kg (410.06 lb)

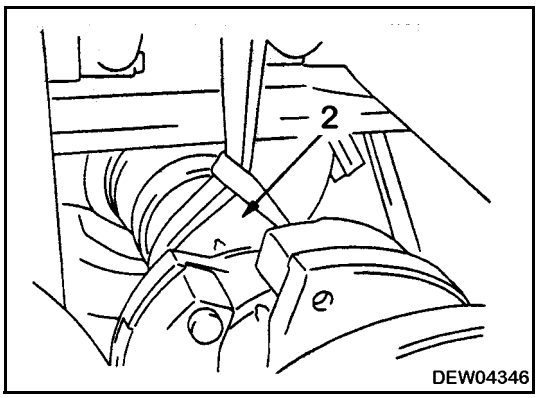


   B. Lift off front drive shaft (2).

   ※2

   ★ Move the drive shaft towards the front differential, move the center support end to the side and remove the pilot portion at the differential end.

   kg Front drive shaft: 173 kg (381.4 lb)



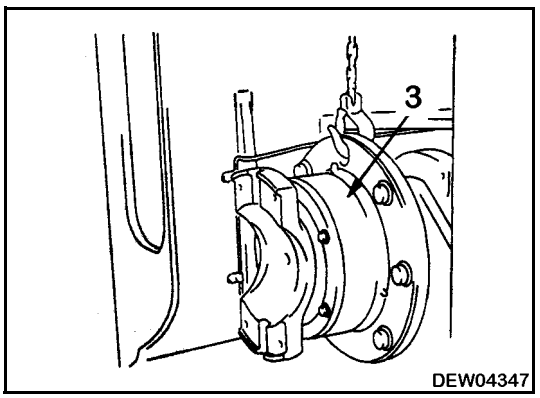
2. Center support

   Sling center support (3) temporarily, remove mount bolts, then lift off.

   ※3

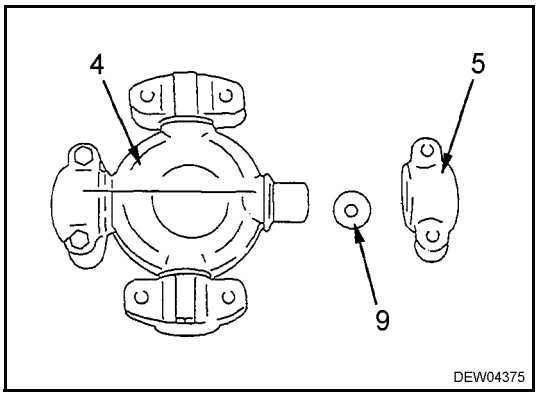
   ★ If there are shims inserted between the center support and frame, check the number of shims and use as a guide when assembling.
   ★ When lifting off, be careful not to damage the steering cylinder rod.

   kg Center support: 169 kg (372.58 lb)



B. Assemble Delrin washer (9) and bearing cap (5) to bearing assembly (4).

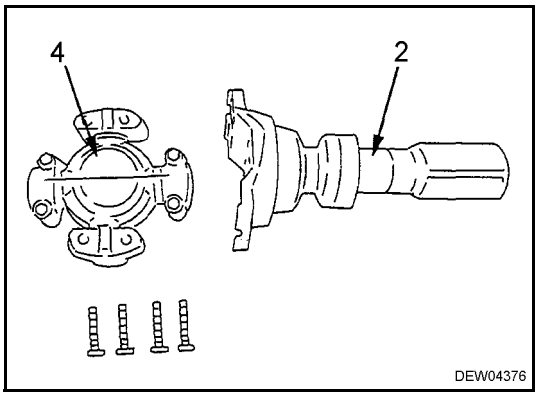
WARNING! Do not weld the strap. The heat when welding will damage the bearing.



C. Assemble bearing assembly (4) to splined yoke (2).

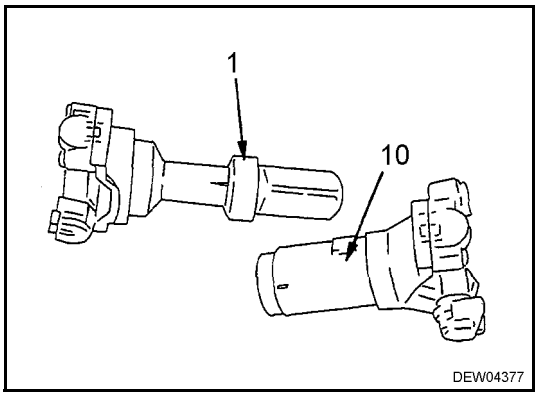
★ Align the match marks carefully.
★ Wipe the mount face of the bearing cap with a clean cloth.

N·m Mount bolt: 385 ± 41 Nm (283.96 ± 30.24 lbf ft)



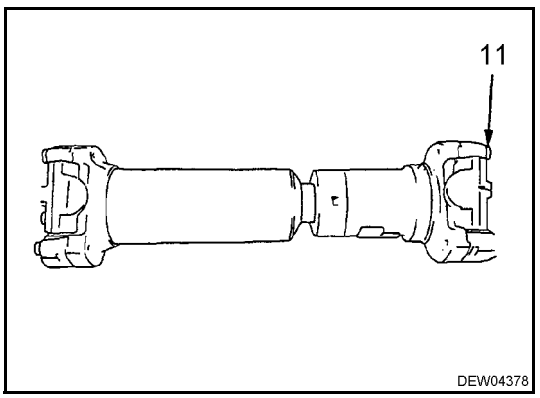
D. Align match marks, insert splined yoke in sleeve yoke (10), and secure with retainer (1).

★ Check that the yokes are facing in the same direction.
★ If the spline is worn, replace the whole drive shaft assembly.



4. Upper drive shaft

N·m Bearing cap mount bolt (11):
214 ± 7 Nm (157.83 ± 5.16 lbf ft)



INSTALLATION

- Carry out installation in the reverse order to removal.

※1

N·m Undercover mount bolt:
490 - 608 Nm (361.40 - 448.43 lbf ft)

※2

N·m Counterweight mount bolt:
1510 - 1910 Nm (1113.72 - 1408.74 lbf ft)

※3

N·m Fuel tank mount bolt:
1510 - 1910 Nm (1113.72 - 1408.74 lbf ft)

※4

N·m Hub nut: 736 - 912 Nm (542.84 - 672.65 lbf ft)

※5

N·m Rear drive shaft: 343 - 427 Nm (252.98 - 314.93 lbf ft)

※6

★ Bleed air from the rear brake. For details, see TESTING AND ADJUSTING, Bleeding air from each portion.

※7

Thrust washer: Lubricant (G2-LI)

N·m Thrust washer mount bolt:
824 - 1030 Nm (607.75 - 759.68 lbf ft)

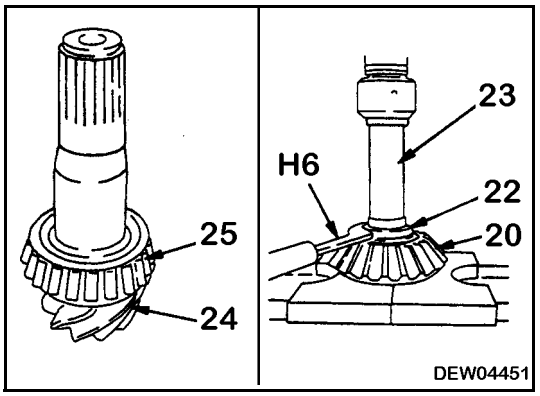
N·m Thrust cover:
824 - 1030 Nm (607.75 - 759.68 lbf ft)

D. Assemble pinion gear (24) and bearing (25) in shaft.

E. Fit lock plate and tighten lock nut (22) with wrench **H6**.

★ Bend the lock plate securely.

N·m Lock nut: 981 ± 98 Nm (723.54 ± 72.28 lbf ft)



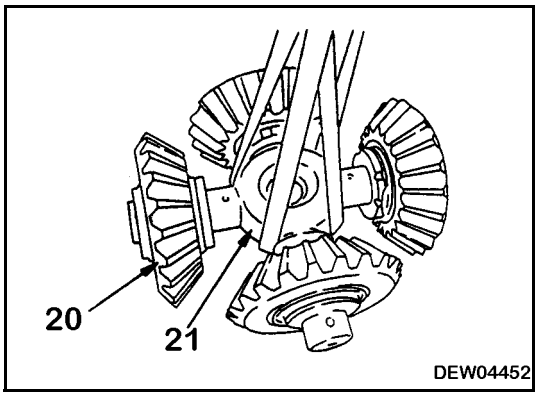
4. Assemble differential gear case assembly as follows.

A. Assemble pinion gear assembly (20) in cross shaft (21), and install to case.

★ Align the notch in the pinion gear with the cross shaft dowel pin when installing.

B. Install bevel gear (19).

★ Move the bevel gear and check that the pinion gear assembly rotates smoothly.



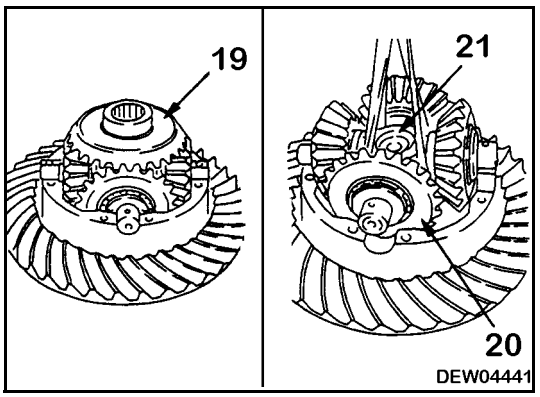
C. Install thrust and bearing to case.

★ Align the thrust with the dowel pin when installing.

D. Install case, and tighten mount bolts.

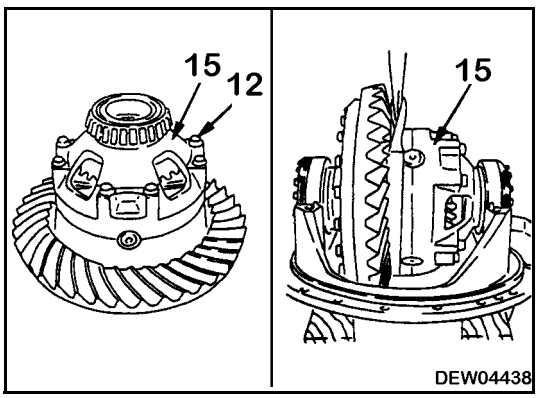
Mount bolt: Adhesive (LT-2)

N·m Mount bolt: 932 ± 98 Nm (687.40 ± 72.28 lbf ft)



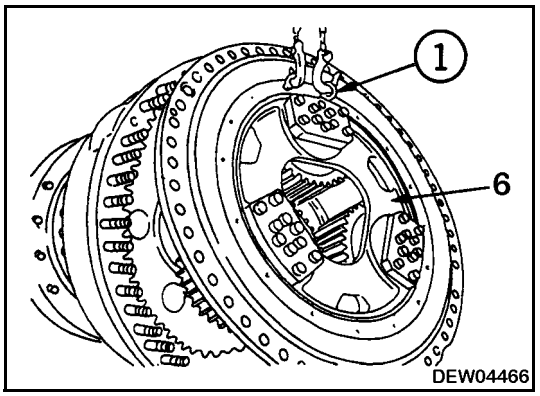
5. Tighten nut (12) temporarily, and put differential gear case assembly (15) in differential case.

★ Align the nut with the groove in the differential case, then check that it rotates smoothly by hand.



4. Fit O-ring, then using eyebolts ① (Dia. = 12 mm, Pitch = 1.75 mm), raise carrier case assembly (6), align tooth faces of planetary gear and ring gear, then set in mounting position and tighten 3 hexagonal bolts.

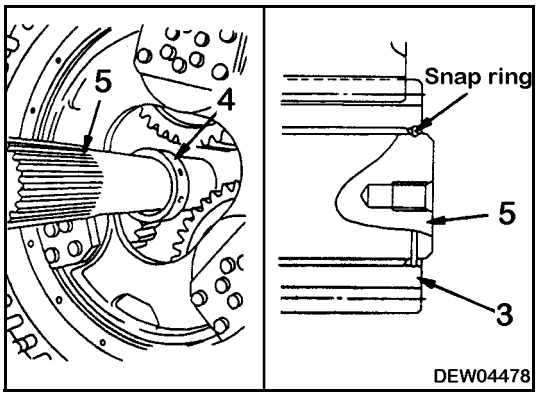
   ★ When installing the carrier case assembly, insert a bar in the casting hole at the bottom of the case to adjust the balance when installing.



5. Raise torque shaft (5) and set in mounting position temporarily.

6. Align spline and push torque shaft (5) in mounting position of differential assembly.

   ★ Leave the torque shaft protruding approximately 150 mm, install the snap ring to the sun gear, then push in completely.



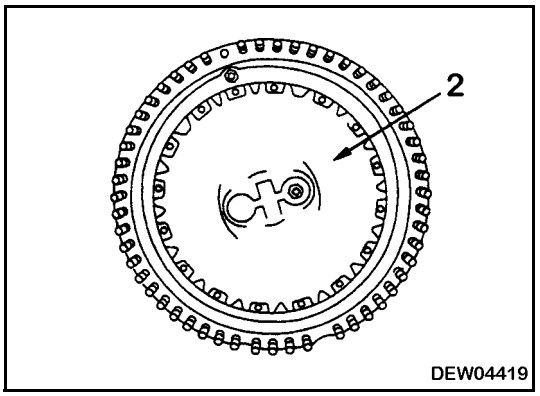
7. Install retainer (4) and sun gear (3), and secure with snap ring.

   ★ When aligning the tooth faces of the sun gear and carrier gear, raise the torque shaft slightly to align.

8. Fit O-ring and install final case cover (2).

9. Tighten drain plug of final case, and add oil until it flows out from level plug.

   Final drive case: Approximately 360 L (95.10 gal)

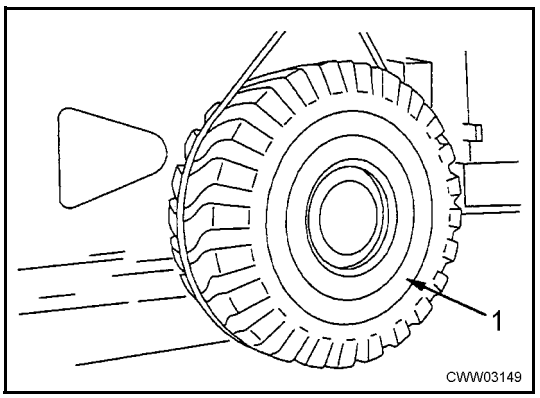


10. Raise wheel assembly (1), install to wheel hub, then temporarily tighten nuts.

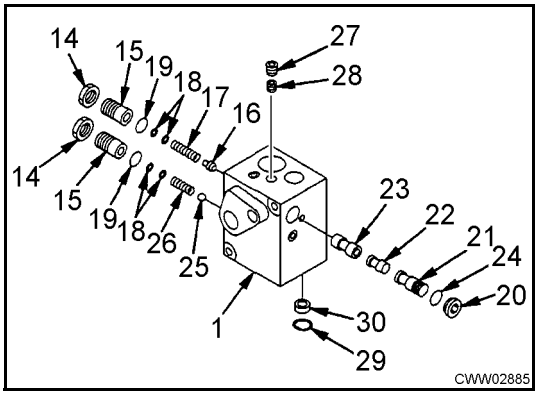
    Jack up machine with work equipment, remove stand from under axle, then lower machine.

11. Tighten wheel nuts fully.

    N·m Wheel nut: 824 ± 88 Nm (607.75 ± 64.90 lbf ft)



ASSEMBLY



1. Insert filter (30) in valve body (1), then install snap ring (29).
2. Install orifice (28) to valve body (1).

   Orifice: Loctite # 4241

   Orifice: 3.14 - 3.9 Nm (2.31 - 2.87 lbf ft)
3. Install plug (27).

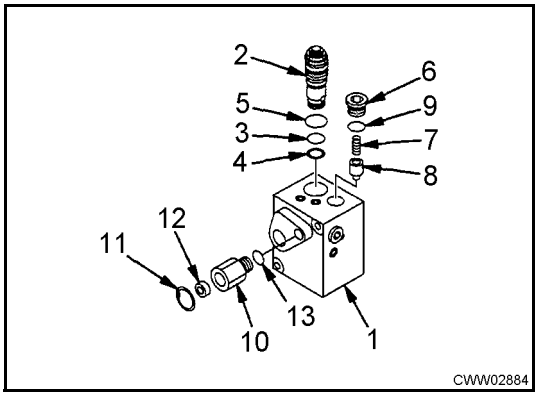
   Plug: ThreeBond # 1305
4. Install O-ring (19) to adjustment screw (15), then set shim (18), spring (26) and ball (25), and install them to valve body (1).
5. Install locknut (14) to adjustment screw (15).

   Locknut: 9.8 - 11.8 Nm (7.22 - 8.70 lbf ft)
6. Install valve seat (23), piston (22) and retainer (21) to valve body (1). Install O-ring (24) to plug (20), then install them.

   Plug: 30.4 - 37.3 Nm (22.42 - 27.51 lbf ft)
7. Assemble O-ring (19) to adjustment screw (15).

   Set shim (18) and spring (17) and retainer (16), then install them to valve body (1).
8. Install locknut (14) to adjustment screw (15).

   Locknut: 9.8 - 11.8 Nm (7.22 - 8.70 lbf ft)



9. Insert filter (12) in bushing (10), then install snap ring (11).
10. Install O-ring (13) to bushing (10), then install them to valve body (1).

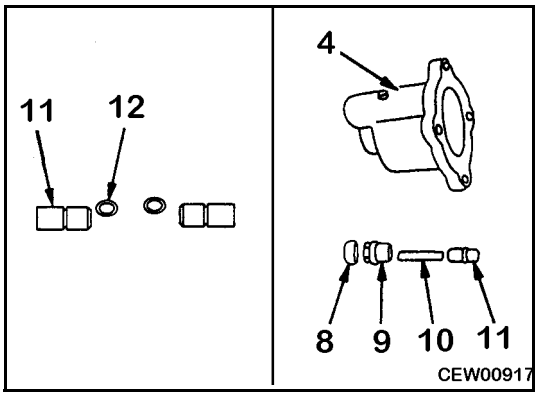
    Bushing: 29.4 - 39.2 Nm (21.68 - 28.91 lbf ft)
11. Assemble spring (7) to spool (8), then insert them in valve body (1).

ASSEMBLY

1. Poppet

   A. Fit O-ring (12) to poppet (11).

   B. Install poppet (11), spring (10), plug (9) and cover (8), then assemble into the cylinder (4).

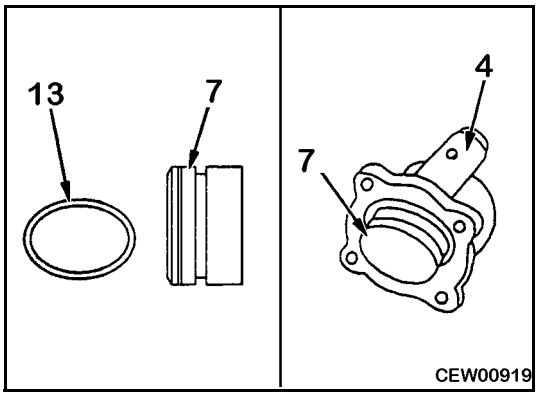


2. Piston

   A. Fit O-ring (13) to piston (7).

   B. Insert piston (7) into cylinder (4).

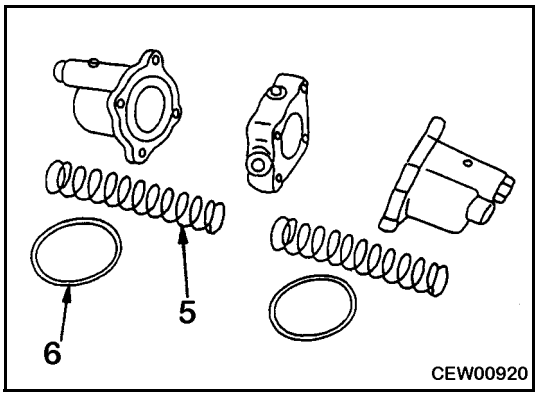
      ★ Confirm that the piston moves smoothly.



3. Cylinder

   A. Install O-ring (6) and spring (5) to cylinder.

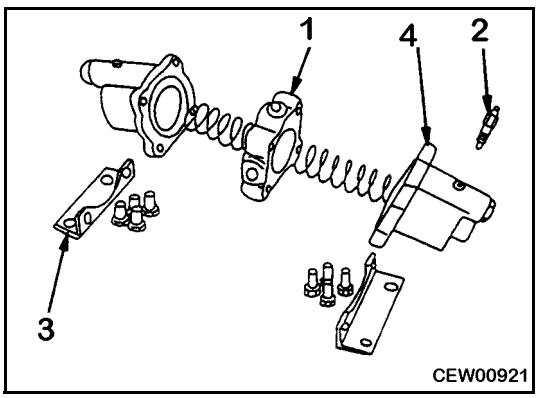
      ★ Spring installation load: 43.1 N (9.68 lbf)



   B. Install cylinders (4) and bracket (3) to body (1).

4. Bleeder

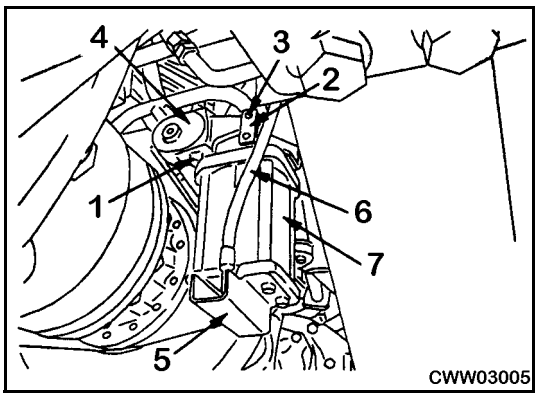
   Install bleeder (2).



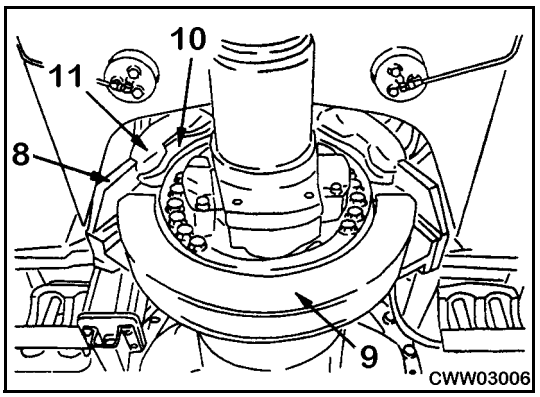
PARKING BRAKE CALIPERS
REMOVAL

WARNING! Stop the machine on level ground and lower the work equipment completely to the ground, then put blocks under the wheels to prevent the machine from moving.

1. Release the parking brake and turn adjustment bolt (1) counterclockwise to set the yoke free.
2. Pull out pin (3), then disconnect the yoke from adjuster (4).
3. Remove cover (5).
4. Apply the parking brake, then disconnect hose (6).
   - ★ Before disconnecting the hose, check that no pressure is remaining in the brake cylinder.



5. Remove the mount bolt, then remove spring cylinder (7).
6. Remove plate (8). ※1
7. Remove cover (9). ※2
   - ★ After removing the plate, remove pad (10).
   - ★ Sling the calipers so that they will not fall.



8. Remove parking brake calipers (11).
   - ★ The parking brake calipers must be removed by two workers.

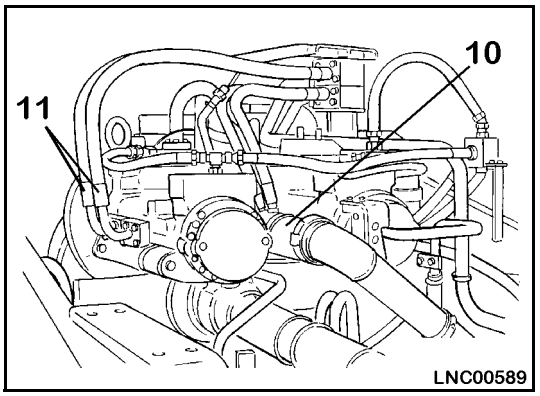
kg Parking brake caliper: 40 kg (88.18 lb)

4. Switch pump

   A. Disconnect suction tube (10).

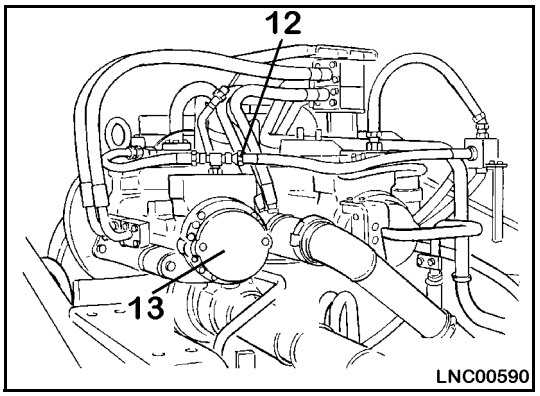
   B. Disconnect hose (11) of the steering valve.

   C. Disconnect drain hose (12).



   D. Remove mount bolts (13), then sling and remove switch pump.

kg Switch pump: Approximately 160 kg (352.74 lb)



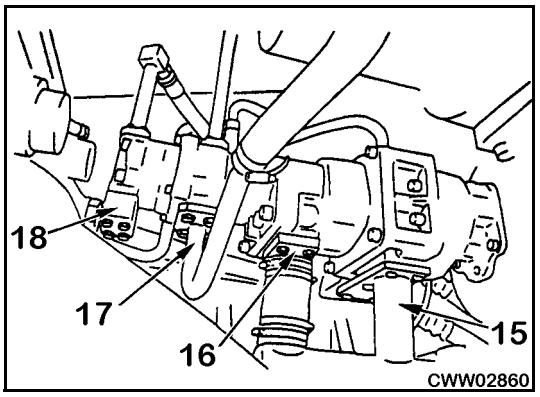
5. 4-units - torque converter (T/C), transmission (T/M), PPC, brake pump

   ★ Remove the switching pump in advance.

   A. Disconnect suction tubes (15) and (16) of the T/C and T/M pumps.

   B. Disconnect suction tube (17) of the PPC pump.

   C. Disconnect suction tube (18) of the brake pump.



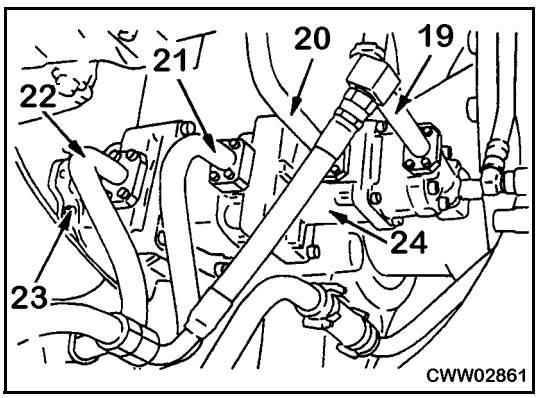
   D. Disconnect tube (19) of the accumulator charge valve.

   E. Disconnect tube (20) of the PPC.

   F. Disconnect tubes (21) and (22) of the T/C and T/M pumps.

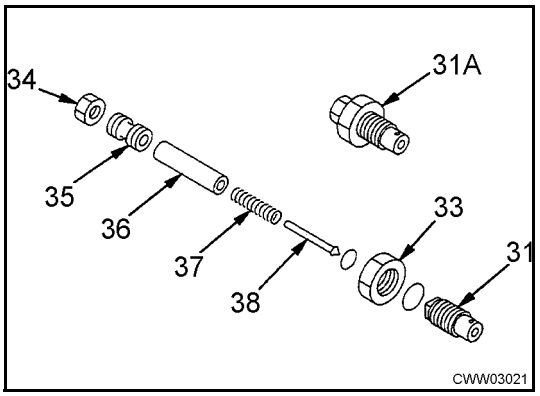
   G. Remove mount bolts (23), sling and remove the 4-unit pump (24).

kg 4-unit pump: 60 kg (132.27 lb)



13. Remove nut (33) from holder (31A).

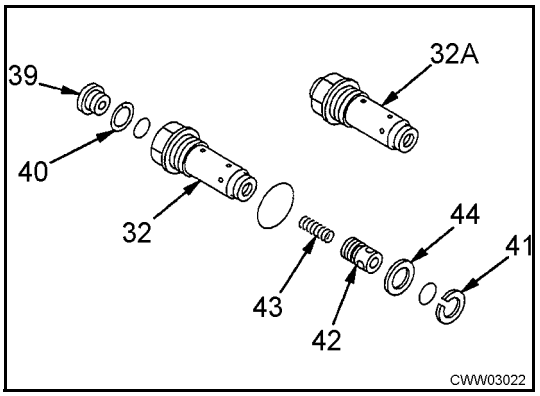
14. Remove nut (34) from holder (31A), then remove screw (35), retainer (36), spring (37) and puppet (38).



15. Remove seat (39) and backup ring (40) from sleeve (32A).

16. Remove snap ring (41) from sleeve (32A), then remove valve (42), spring (43) and backup ring (44).

    ★ If sleeve (32) or valve (42) has any trouble, replace as a set, since those parts are not supplied independently.



INSTALLATION

- Carry out installation in the reverse order to removal.

※1

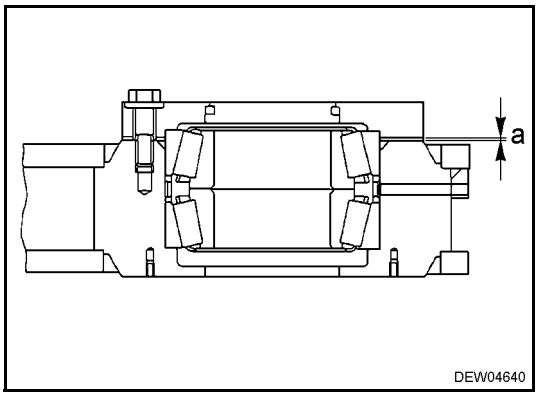
★ When connecting each hose, do not twist it.
★ Be careful not to let dirt, dust, water, etc. get into hoses.
★ Charge with new Freon gas (Rl34a) by using tool **X1**.

※2

N·m Mounting nut: 245 - 309 Nm (180.70 - 227.90 lbf ft)

- Bleeding air
  Bleed air from the brake circuit, steering circuit and PPC circuit. For details, see TESTING AND ADJUSTING, Bleeding air from each portion.

★ Tighten the six mount bolts of the retainer, and measure clearance **a** between the retainer and hinge at four places. Then, select shims so that clearance **a** will be 0.08 - 0.18 mm less than the measured value.
★ The thickness of the shims must not exceed the clearance measured at the four places.
★ After selecting shims, tighten the retainer to the specified torque.



Mount bolt (For adjusting shims):
78.5 ± 7.9 Nm (57.89 ± 5.82 lbf ft)

Mount bolt: 549 ± 59 Nm (404.92 ± 43.51 lbf ft)

★ Press fit so that the lip of the dust seal is facing outside.

Dust seal lip face: Lubricant (G2-LI)

- Refilling with oil
  Add oil through the oil filler of the hydraulic tank to the specified level.

Hydraulic oil: Approximately 550 L (145.29 gal)

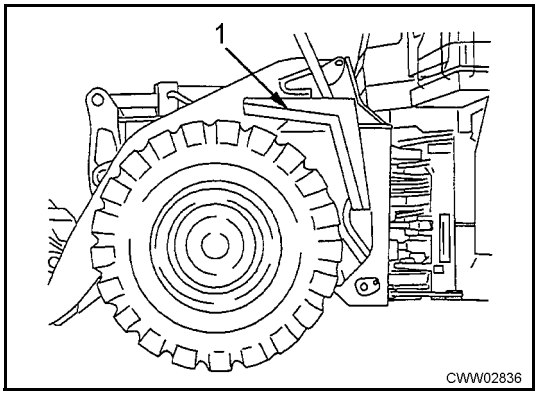
★ Before starting the engine, bleed air from the piston pump circuit. For details, see TESTING AND ADJUSTING.
★ After bleeding air, run the engine to circulate the hydraulic oil through the system. Then, check the oil level again.

- Bleeding air
  Bleed air from the brake system.
  ★ For the air bleeding procedure, see TESTING AND ADJUSTING.

- Charging with gas
  ★ Charge the air conditioner with gas (R134a).
  ★ Standard quantity of gas to be supplied: 1.5 - 1.6 kg (3.30 - 3.52 lb)
  ★ Before charging with the gas, be sure to evacuate the system by the repeated evacuation method.
  ★ Do not start the compressor before charging the system with the gas.
  ★ Check that proper quantity of the gas is supplied.
  ★ Check the quantity of the compressor oil. (Standard quantity of oil: 150 +14/-0 CC ND-OIL8)

LIFT CYLINDER

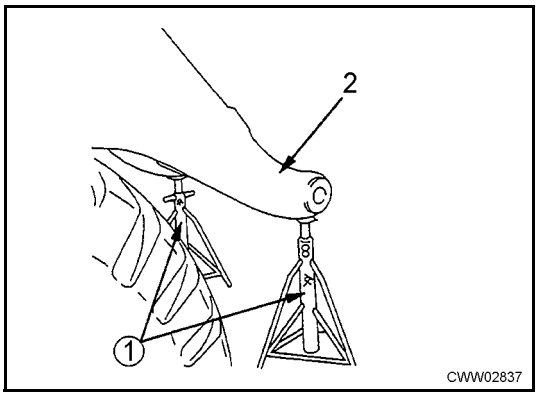
REMOVAL



WARNING! Stop the machine on level ground and install the safety bar to the frame, then put blocks under the wheels to prevent the machine from moving.

1. Remove the bucket. For details, see BUCKET, REMOVAL.
2. Remove fender (1).

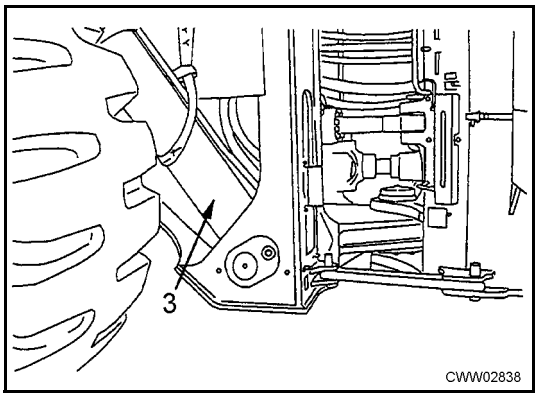
kg Fender: 200 kg (440.92 lb)



3. Raise the lift arm until the pin on the cylinder head side can be pulled out, then set stand ①.

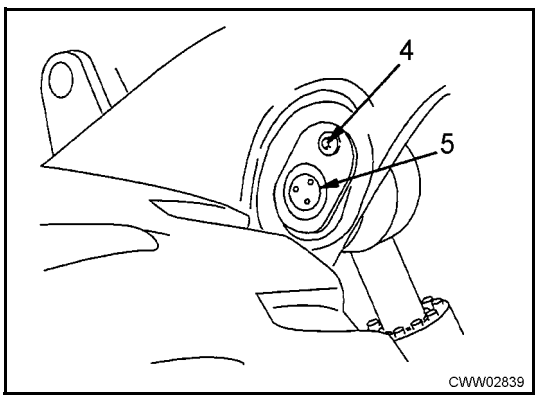
WARNING! After stopping the engine, lower the lift arm slowly to eliminate the load on the lift cylinder.

WARNING! Loosen the cap of the hydraulic tank slowly to release the pressure from the hydraulic tank.



4. Temporarily sling lift cylinder (3).

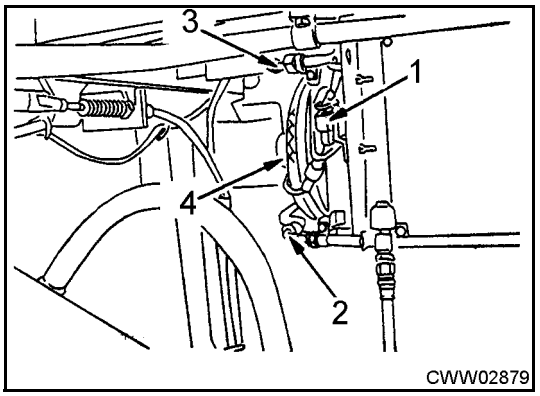
★ Be careful not to damage the tubes.



5. Remove lock bolt (4), then pull out pin (5).

AIR CONDITIONER CONDENSER

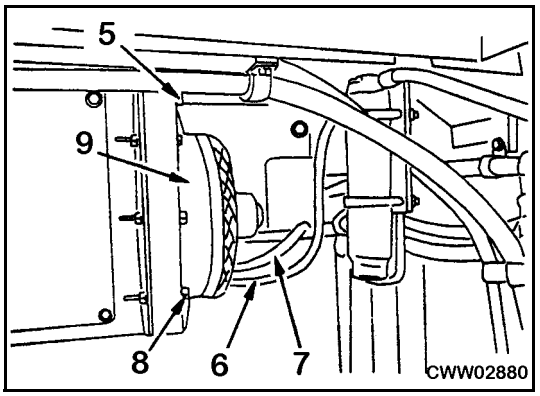
REMOVAL



WARNING! Stop the machine on level ground and put blocks under the wheels to prevent the machine from moving.

WARNING! Disconnect the cable from the negative (-) terminal of the battery.

1. Collect the Freon gas (R134a). For details, see AIR CONDITIONER COMPRESSOR, REMOVAL.



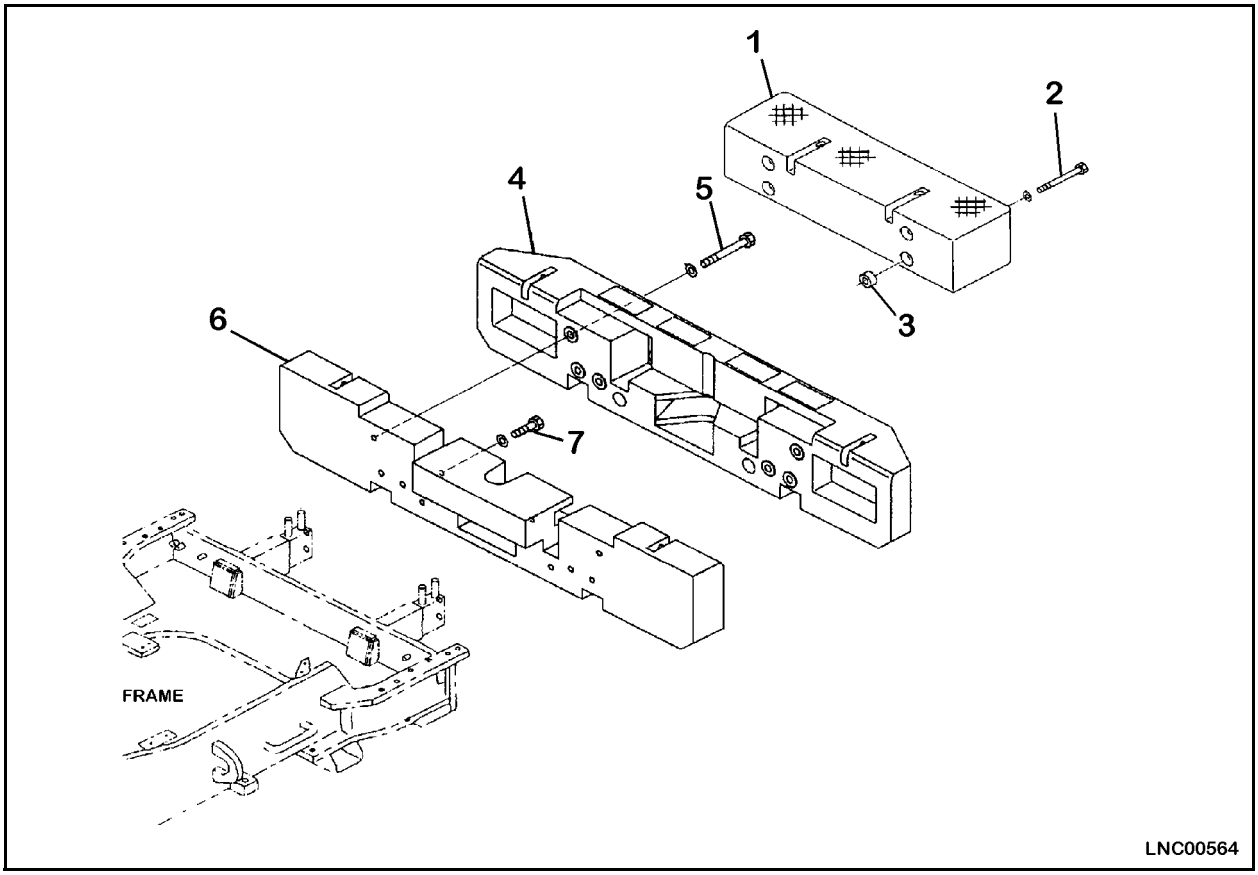
2. Right-hand condenser
   A. Disconnect connectors (1).
      ★ Connectors: CN-B10, CN-B11
   B. Disconnect hose (2) between both condensers.

      ※1

   C. Disconnect hose (3) of the air conditioner compressor.
      ★ Since the adapter is brittle, apply two spanners to it to disconnect each hose.
   D. Remove the mount bolts, then remove right-hand condenser (4).
3. Left-hand condenser
   A. Disconnect connectors (5).
      ★ Connectors: CN-B12, CN-B13
   B. Disconnect hose (6) between the right-hand condenser and receiver tank.

      ※1

   C. Disconnect hose (7) between both condensers.
      ★ Since the adapter is brittle, apply two spanners to it to disconnect each hose.
   D. Remove the mount bolts (8), then remove left-hand condenser (9).



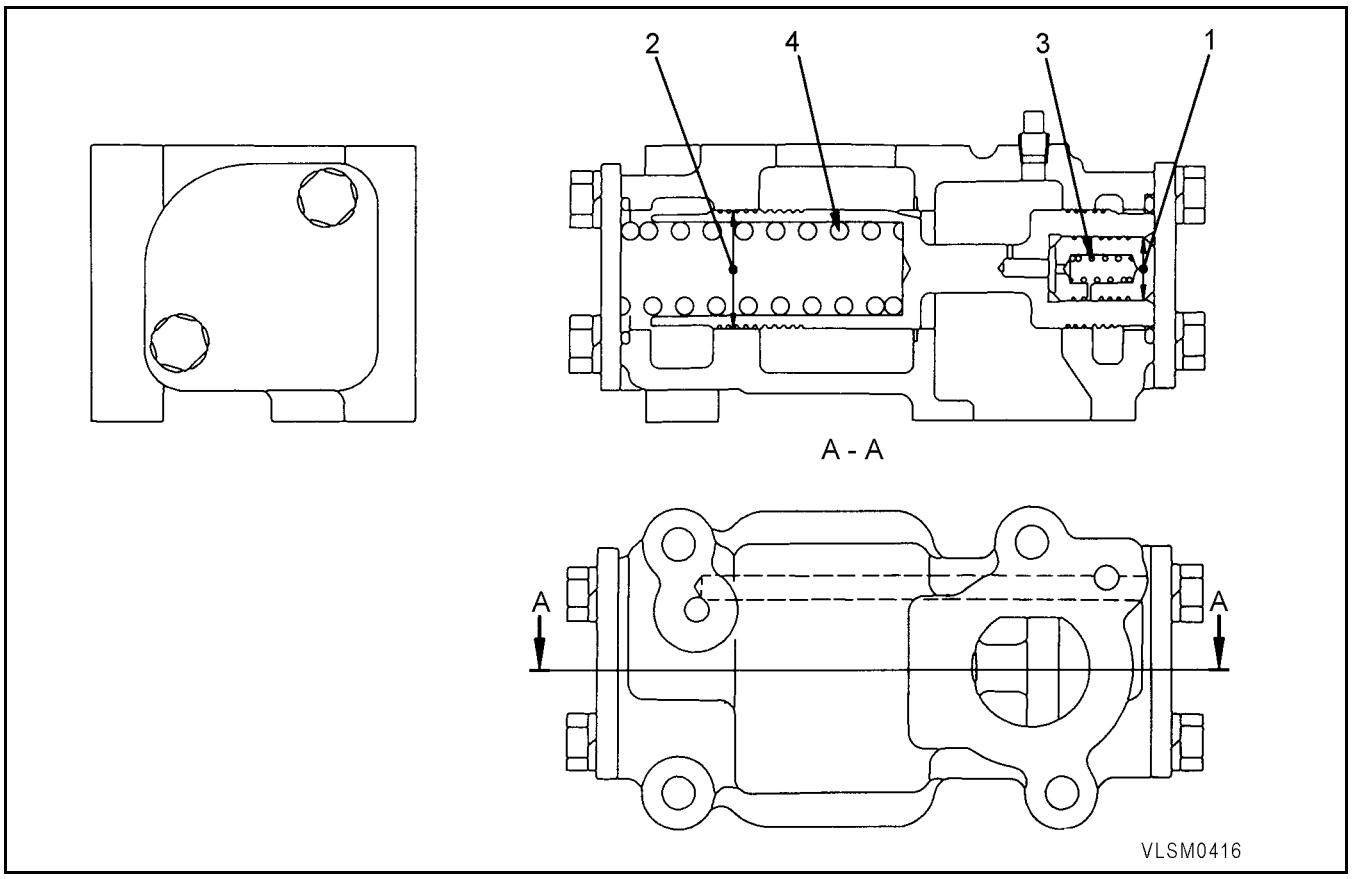
INSTALLATION

- Carry out the installation in reverse order of removal.

※1

N·m Bolts: 1530 - 1920 Nm (1128.47 - 1416.12 lbf ft)

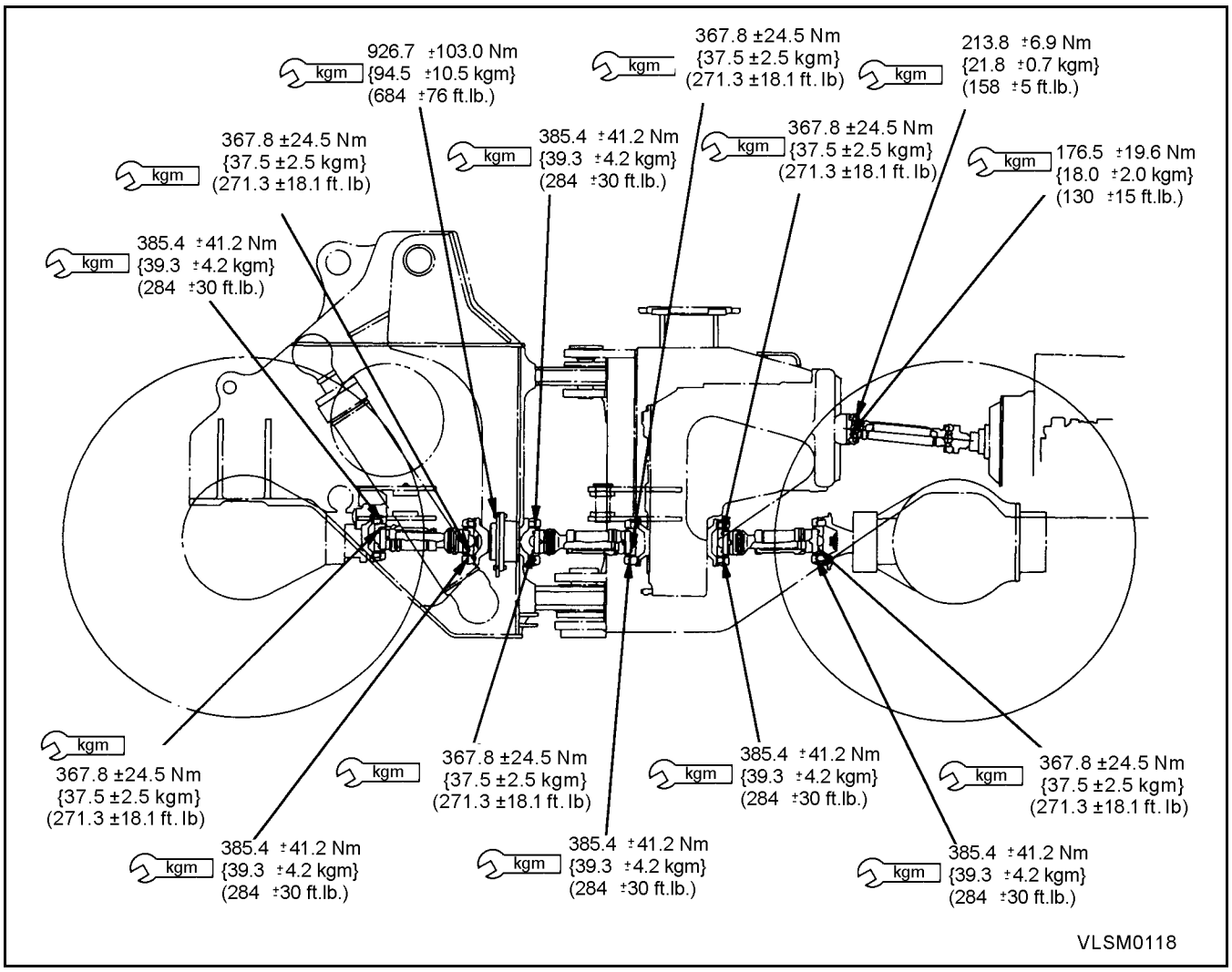
REGULATOR VALVE



Unit: mm

	Check item	Criteria					Remedy
1	Clearance between poppet and spool	Standard size	Tolerance		Standard clearance	Clearance limit	Replace
			Shaft	Hole			
		22	-0.020 -0.030	+0.021 0	0.020 - 0.051	0.08	
2	Clearance between spool and body	40	-0.035 -0.045	+0.016 0	0.035 - 0.061	0.08	
3	Poppet spring	Standard size			Repair limit		
		Free length	Installation length	Installation load	Free length	Installation load	
		43.9	21	2.28 kg (5 lb)	42	2.1 kg (4.7 lb)	
4	Spool spring	172	92	11 kg (24 lb)	167	10.0 kg (22 lb)	

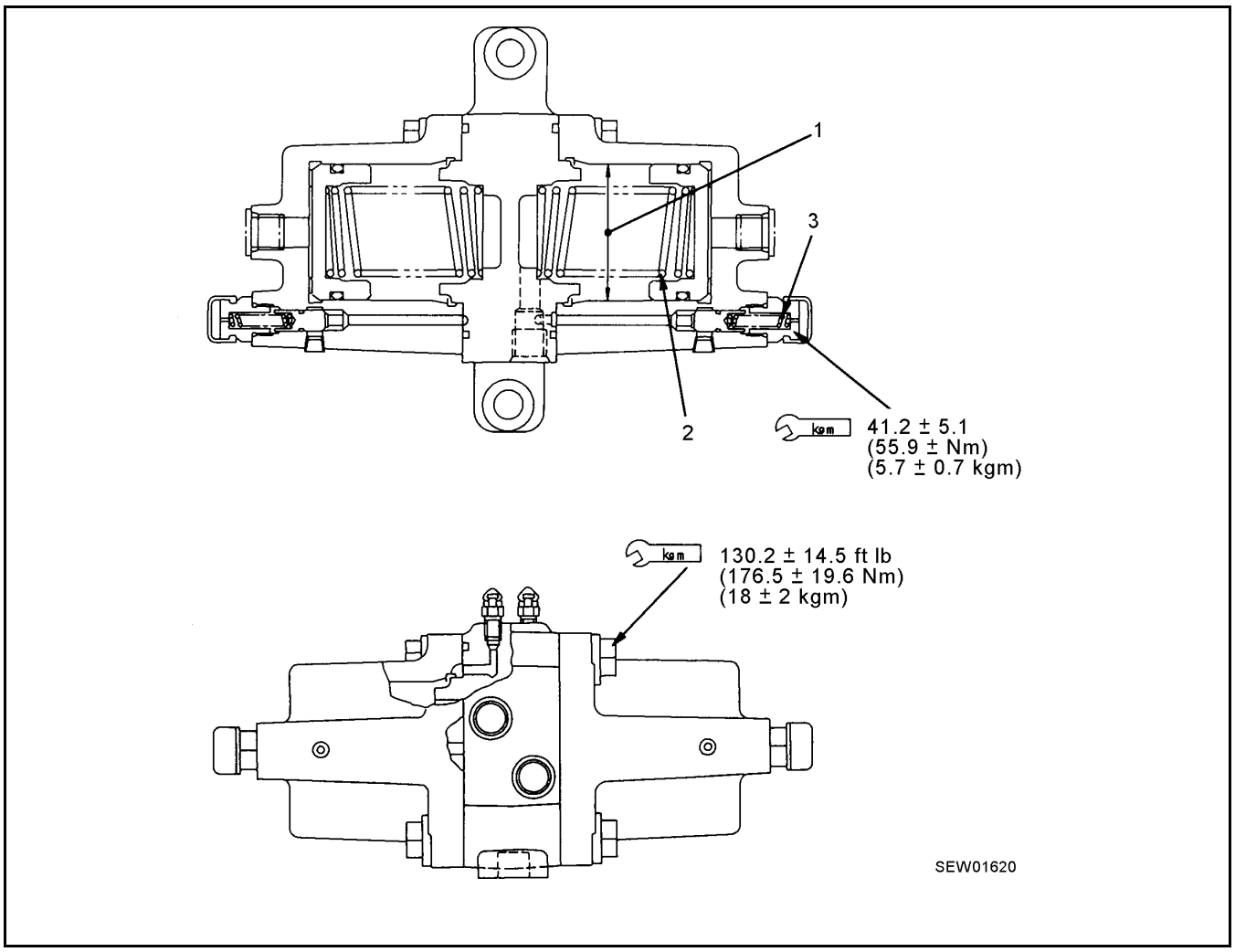
DRIVE SHAFT


926.7 ±103.0 Nm
{94.5 ±10.5 kgm}
(684 ±76 ft.lb.)
367.8 ±24.5 Nm
{37.5 ±2.5 kgm}
(271.3 ±18.1 ft. lb)
213.8 ±6.9 Nm
{21.8 ±0.7 kgm}
(158 ±5 ft.lb.)
367.8 ±24.5 Nm
{37.5 ±2.5 kgm}
(271.3 ±18.1 ft. lb)
385.4 ±41.2 Nm
{39.3 ±4.2 kgm}
(284 ±30 ft.lb.)
367.8 ±24.5 Nm
{37.5 ±2.5 kgm}
(271.3 ±18.1 ft. lb)
176.5 ±19.6 Nm
{18.0 ±2.0 kgm}
(130 ±15 ft.lb.)
385.4 ±41.2 Nm
{39.3 ±4.2 kgm}
(284 ±30 ft.lb.)
kgm
367.8 ±24.5 Nm
{37.5 ±2.5 kgm}
(271.3 ±18.1 ft. lb)
367.8 ±24.5 Nm
{37.5 ±2.5 kgm}
(271.3 ±18.1 ft. lb)
385.4 ±41.2 Nm
{39.3 ±4.2 kgm}
(284 ±30 ft.lb.)
367.8 ±24.5 Nm
{37.5 ±2.5 kgm}
(271.3 ±18.1 ft. lb)
385.4 ±41.2 Nm
{39.3 ±4.2 kgm}
(284 ±30 ft.lb.)
385.4 ±41.2 Nm
{39.3 ±4.2 kgm}
(284 ±30 ft.lb.)
385.4 ±41.2 Nm
{39.3 ±4.2 kgm}
(284 ±30 ft.lb.)
VLSM0118

Unit: mm

	Check item	Criteria					Remedy
1	Clearance between lower hinge pin and bushing	Standard size	Tolerance		Standard clearance	Clearance limit	Replace
			Shaft	Hole			
		146.05	-0.043 -0.068	+0.070 0	0.043 - 0.138	-	
2	Clearance between lower hinge pin and spacer (small)	146.05	+0.043 -0.068	+0.063 0.131	0.043 - 0.131	1.0	
3	Clearance between lower hinge pin and bearing	146.05	+0.043 +0.068	+0.0250	-0.043 - -0.093	-	
4	Clearance between lower hinge pin and spacer (large)	146.05	-0.043 -0.068	+0.063 0	0.043 - 0.131	1.0	
5	Clearance between lower hinge pin and spacer (large) and bushing	206.0	-0.050 -0.122	+0.07 0	0.050 - 0.199	-	
6	Clearance between front frame and upper hinge bearing	234.95	+0.025 0	-0.067 -0.113	-0.138 - -0.067	-	
7	Clearance between upper hinge pin and rear frame	127	-0.043 -0.068	+0.063 0	0.043 - 0.131	-	
8	Clearance between upper hinge pin and bearing	127	-0.043 -0.068	+0.025 0	0.043 - 0.093	-	
9	Clearance between front frame and lower hinge bearing	304.8	+0.025 0	-0.078 -0.130	-0.155 - -0.078	-	
10	Clearance between rear frame and bushing	170	-0.043 -0.068	+0.063 0	0.043 - 0.131	-	
11	Clearance at press-fitted part of seal of upper hinge pin	146.05	+0.310 +0.210	+0.0630	-0.310 -0.147	-	
12	Clearance at press-fitted part of seal of lower hinge pin	210	+0.260 +0.160	+0.072 0	-0.260 - -0.088	-	
13	Clearance between lower hinge bushing and frame (upper)	161.0	+0.186 +0.146	+0.063 0	-0.186 - -0.083	-	
14	Clearance between lower hinge bushing and frame (lower)	226.0	+0.242 +0.196	+0.072 0	-0.242 - -0.124	-	
15	Height of lower hinge spacer (small)	Standard size		Tolerance		Repair limit	
		73		±0.1		-	
16	Height of lower hinge spacer (large)	155.5		±0.1		-	
17	Thickness for lower hinge and retainer	32		±0.8		-	
18	Shim thickness for lower hinge and retainer	1.93					Adjust
19	Shim thickness for lower hinge and retainer	2.20					
20	Shim thickness for upper hinge and retainer	2.31					

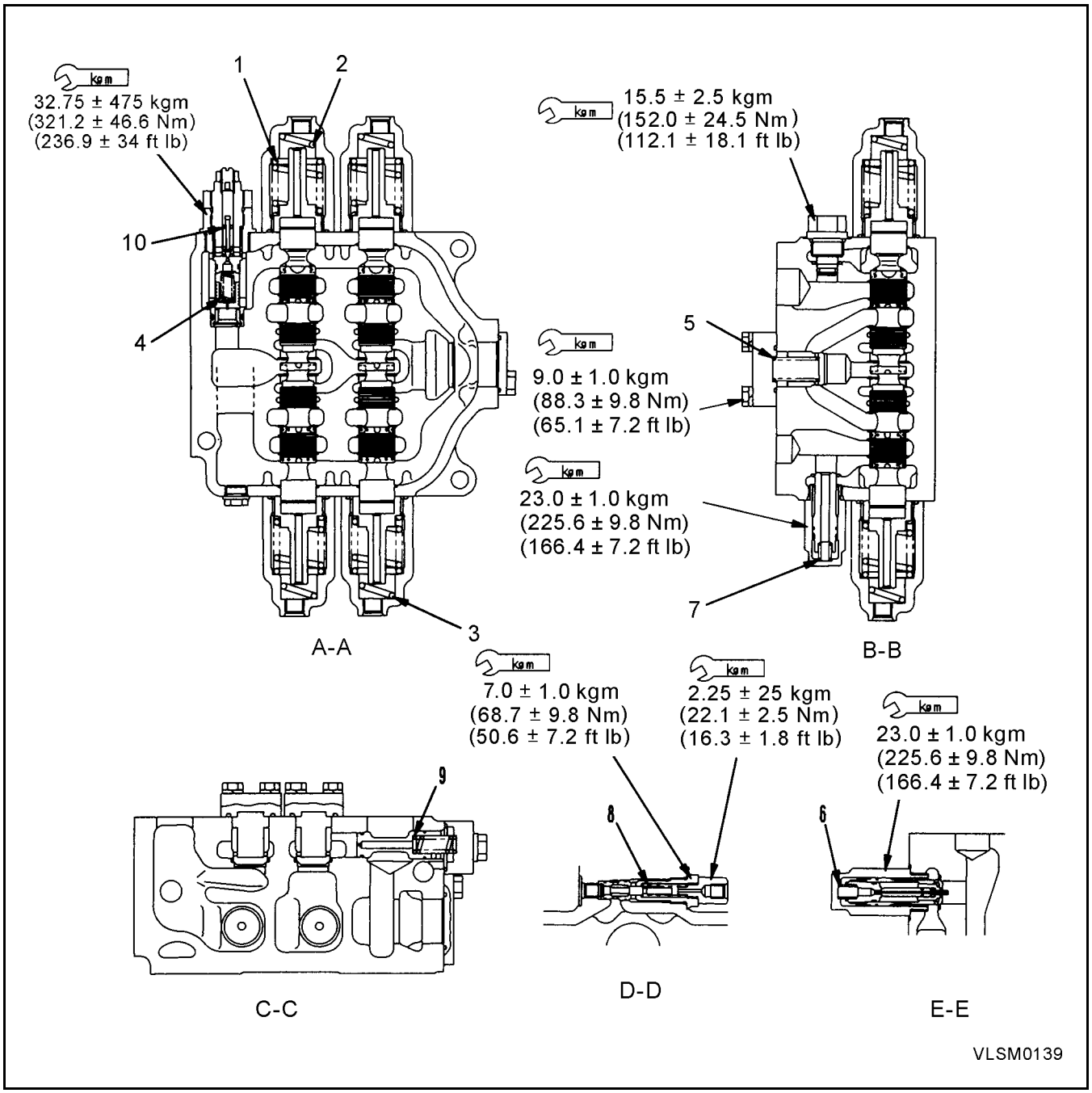
SLACK ADJUSTER



Unit: mm

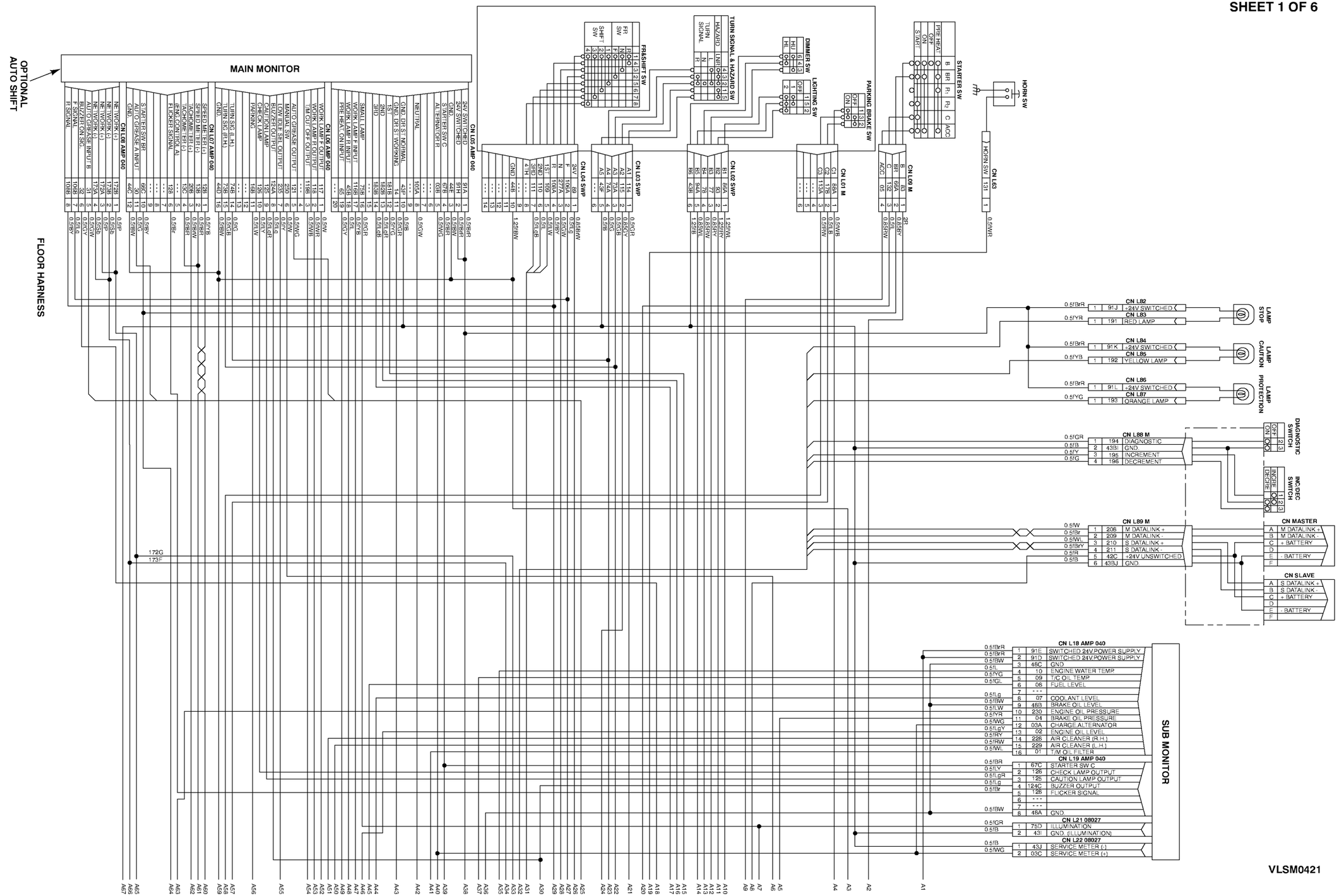
	Check item	Criteria					Remedy
1	Clearance between body and piston	Standard size	Tolerance		Standard clearance	Clearance limit	Replace
			Shaft	Hole			
		80	-0.030 -0.076	+0.074 0	0.030 - 0.150	0.250	
2	Slack adjuster spring	Standard size			Repair limit		
		Free length	Installation length	Installation load	Free length	Installation load	
		246	88	12 kg (117.7 N) (26.5 lb)	-	-	
3	Check valve spring	44.8	38	12.6 kg (123.6 N) (27.8 lb)	-	-	

MAIN CONTROL VALVE

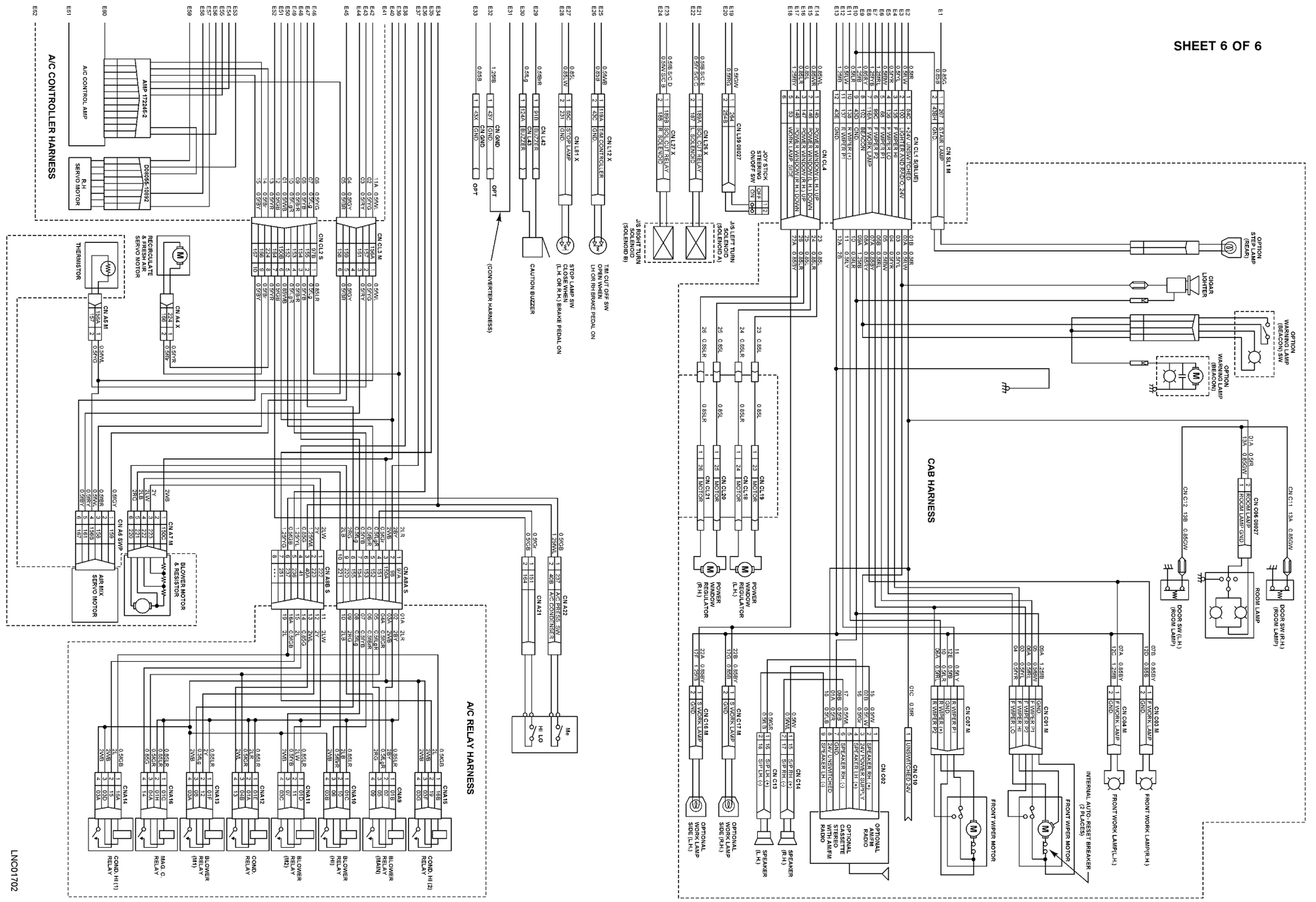


ELECTRICAL CIRCUIT DIAGRAM (1 OF 2)

SHEET 1 OF 6



SHEET 6 OF 6


CAB HARNESS
A/C RELAY HARNESS
A/C CONTROLLER HARNESS
CN SL1 M
CN CL4 S(BLUE)
CN CL1 S
CN CL2 S
CN A22
CN A21
CN A8A S
CN A8B S
CN L12 X
CN L39 98027
CN L81 X
CN L42
CN L43
CN L26 X
CN L27 X
CN GND
OPT
CN A6 M
CN A4 X
CN A5 M
CN A7 M
CN A4 S(VP
CN C19
CN C18
CN C20
CN C21
CN C11
CN C12
CN 096 98027
CN C01 M
CN C02
CN C07 M
CN C04 M
CN C03 M
CN C14
CN C13
CN C17 M
CN C16 M
CN A1A
CN A1B
CN A2A
CN A2B
CN A3A
CN A3B
CN A4A
CN A4B
CN A5A
CN A5B
CN A6A
CN A6B
CN A7A
CN A7B
CN A8A
CN A8B
CN A9
CN A10
CN A11
CN A12
CN A13
CN A14
CN A15
CN A16
STAIR LAMP
LIGHTER AND ACC O 24V
F WIPER LO
F WIPER HI
F WIPER P1
F WIPER P2
ROOM LAMP
BEACON
R WIPER P1
R WIPER P2
GND
POWER WINDOW LH UP
POWER WINDOW LH DOWN
POWER WINDOW RH UP
POWER WINDOW RH DOWN
WORK LAMP 02P,F
JOY STICK STEERING ON/OFF SW
OPTION WARNING LAMP (REAR)
CIGAR LIGHTER
OPTION WARNING LAMP (BEACON) SW
OPTION WARNING LAMP (BEACON)
DOOR SW (L.H.) (ROOM LAMP)
DOOR SW (R.H.) (ROOM LAMP)
ROOM LAMP
FRONT WORK LAMP(R.H.)
FRONT WORK LAMP(L.H.)
INTERNAL AUTO-RESET BREAKER (2 PLACES)
FRONT WIPER MOTOR
OPTIONAL AM/FM RADIO
OPTIONAL CASSETTE STEREO WITH AM/FM RADIO
SPEAKER (R.H.)
SPEAKER (L.H.)
OPTIONAL WORK LAMP SIDE (R.H.)
OPTIONAL WORK LAMP SIDE (L.H.)
JS RIGHT TURN SOLENOID (SOLENOID B)
JS LEFT TURN SOLENOID (SOLENOID A)
STOP LAMP SW CLOSE WHEN (LH OR R.H.) BRAKE PEDAL ON
TRM CUT OFF SW OPEN WHEN LH OR RH BRAKE PEDAL ON
CAUTION BUZZER
(CONVERTER HARNESS)
A/C CONTROL AMP
AMP 172246-2
R.H SERVO MOTOR
DX0455-10932
AIR MIX SERVO MOTOR
BLOWER MOTOR & RESISTOR
RECIRCULATE & FRESH AIR SERVO MOTOR
THERMISTOR
COND. HI (1) RELAY
MAG. C RELAY
BLOWER RELAY (M1)
COMP. RELAY
BLOWER RELAY (M2)
BLOWER RELAY (HI)
BLOWER RELAY (MAIN)
COND. HI (2) RELAY
LUNSWITCHED 24V
24V POWER SUPPLY
SPEAKER RH (+)
SPEAKER RH (-)
SPEAKER LH (+)
SPEAKER LH (-)
SIP RH (+)
SIP RH (-)
SIP LH (+)
SIP LH (-)
F WORK LAMP
R WORK LAMP
GND
24V UNSWITCHED
R WIPER P1
R WIPER P2
R WIPER (+)
R WIPER (-)
F WIPER P1
F WIPER P2
F WIPER HI
F WIPER LO
LNC01702

FOLDOUT 20-217 CONNECTOR ARRANGEMENT DIAGRAM (1OF 3)