

SW651 Series

SHOP MANUAL

SAKAI®

PREFACE

To make a machine working to maximum efficiency over a long period of time without any machine troubles, correct OPERATION, PREVENTIVE MAINTENANCE, TROUBLE-SHOOTING and REPAIR are of vital importance.

This shop manual provides instructions, for the most part, on GENERAL INFORMATION, STRUCTURE/FUNCTION, CHECKING/ADJUSTMENT and TROUBLE-SHOOTING for the SAKAI SW651 Series Vibrating Rollers .

This manual is designed to serve as a guide for the operator and maintenance personnel to acquire correct information and repair procedure on these machines in order to give a correct decision on problems which the machines will confront, thus leading to quality repair. Fully understand the contents of the manual and make the best of it.

We will make utmost efforts to make this manual more useful for you through revisions.

Your opinions and advices will be particularly welcome and will be carefully considered.

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SPECIFICATIONS

SPECIFICATIONS

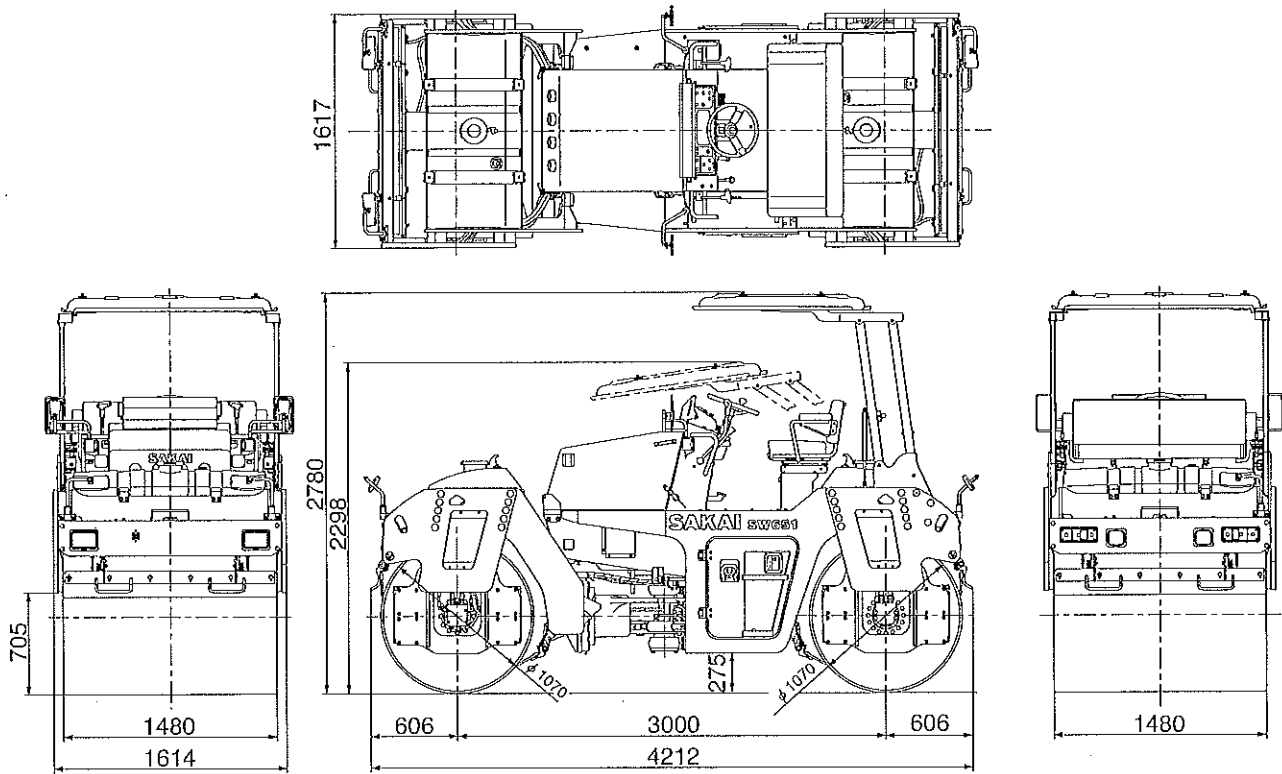
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SPECIFICATIONS

1. External Views and Specifications

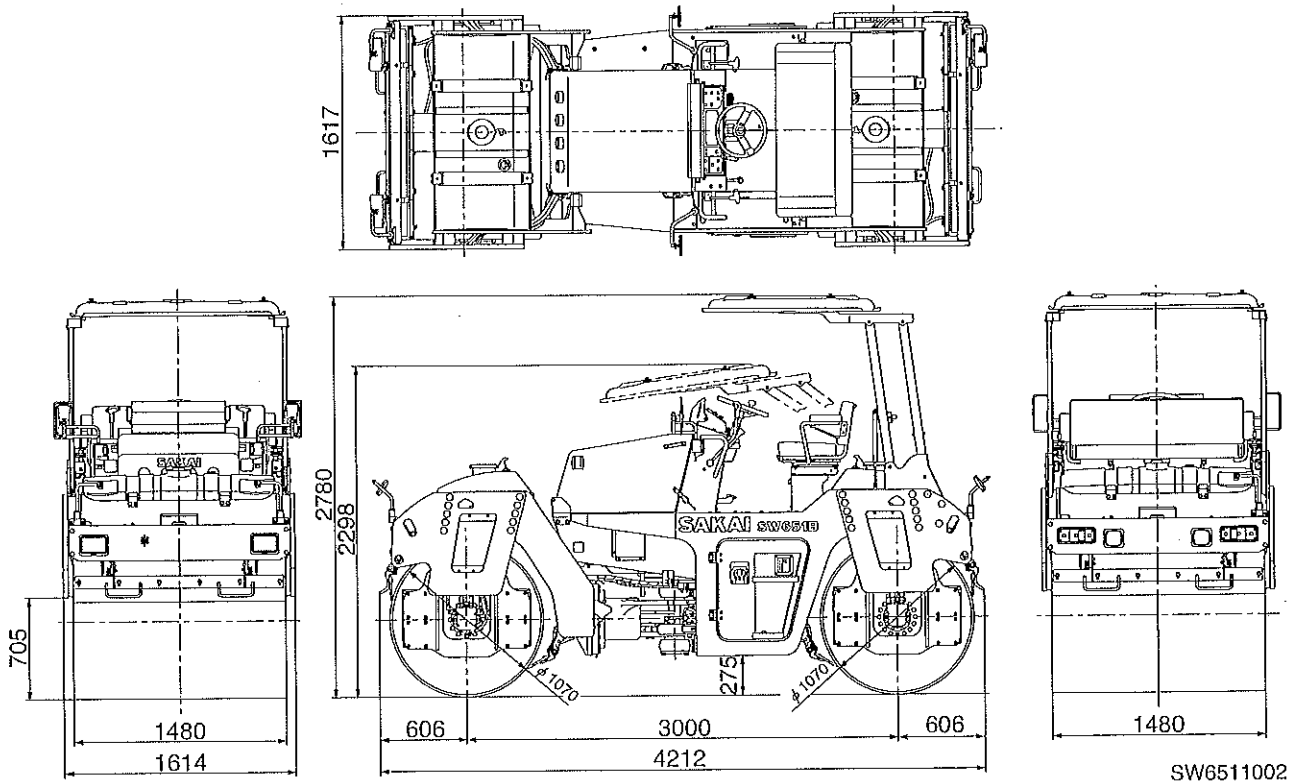
1-1. SW651



SW6511001

Model	SW651	Vibrating power:	Low	High
Weight:		Frequency	67 Hz (4,020 vpm)	50 Hz (3,000 vpm)
Overall weight	7,100 kg (15,660 lbs)	Centrifugal force	62 kN (6,300 kgf)	69 kN (7,000 kgf)
Empty weight	6,500 kg (14,330 lbs)			
Dimension:		Gross weight	19 degrees	
Overall length	4,210 mm (165")	Rolling width	1,480 mm (58")	
Overall width	1,615 mm (64")	Minimum turning radius	5.0 m (197")	
Overall height	2,780 mm (109")	Engine:		
Wheelbase	3,000 mm (118")	Model	HINO "W04D-H" Diesel Engine	
Wheel		Total displacement	4.009 L(4,009 cc) {245 cu.in}	
Front	Roll (dia. x width) 1,070 x 1,480 mm (42" x 58")	Rated output	56 kW (76 PS)/2,050 min ⁻¹ (rpm) (75 HP/2,050 rpm)	
Rear	Roll (dia. x width) 1,070 x 1,480 mm (42" x 58")	Max. torque	265 N•m (27.0 kgf•m)/1,600 min ⁻¹ (rpm) (195 ft•lbs/1,600 rpm)	
Performance:		Tank capacity:		
Travel speed (forward/reverse)	0 ~ 12 km/h (0 ~ 7.5 mile/h)	Fuel tank	120 liters (32 gal)	
		Hydraulic tank	42 liters (11 gal)	
		Sprinkler tank	300 liters x 2 (79 gal x 2)	

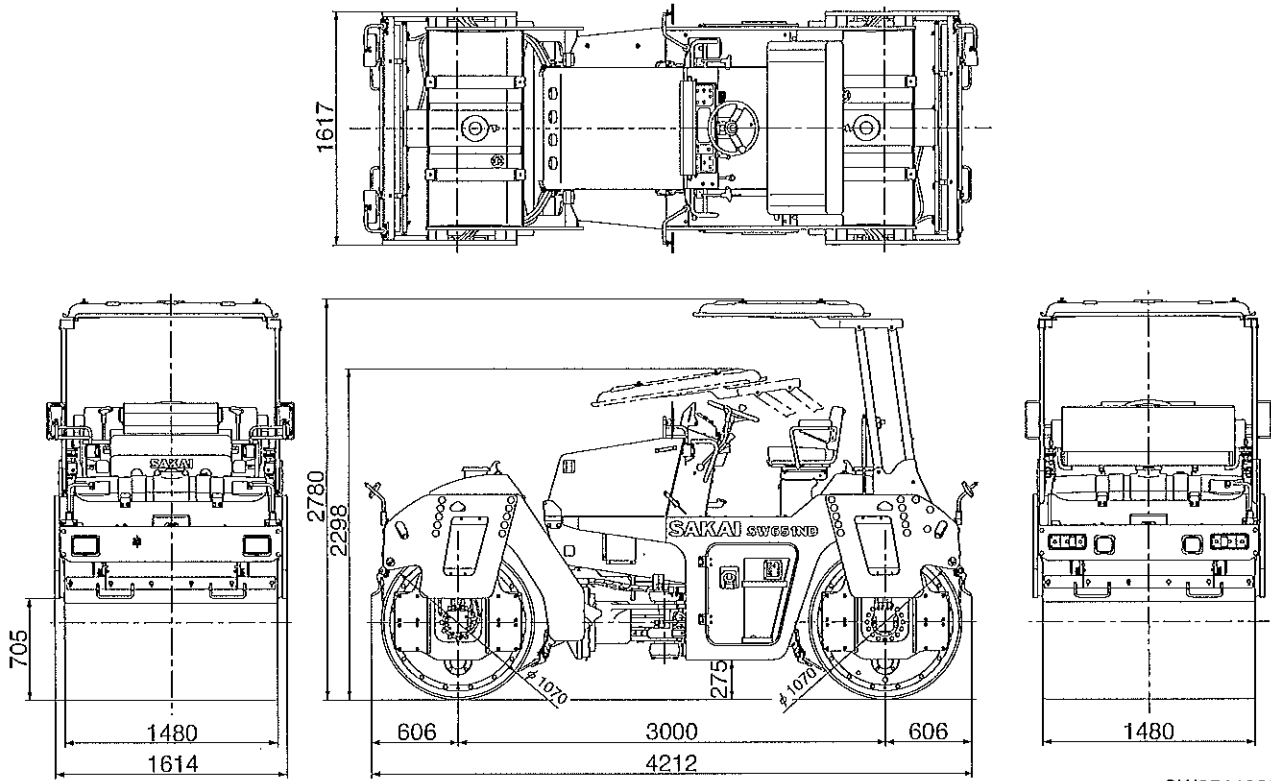
1-2. SW651B



Model	SW651B	Vibrating power:	Low	High
Weight:		Frequency	67 Hz (4,020 vpm)	50 Hz (3,000 vpm)
Gross weight	8,000 kg (17,640 lbs)	Centrifugal force	61 kN (6,200 kgf)	67 kN (6,800 kgf)
Empty weight	7,400 kg (16,310 lbs)			
Dimension:		Gross weight	16 degrees	
Overall length	4,210 mm (165")	Rolling width	1,480 mm (58")	
Overall width	1,615 mm (64")	Minimum turning radius	5.0 m (197")	
Overall height	2,780 mm (109")	Engine:		
Wheelbase	3,000 mm (118")	Model	HINO "W04D-H" Diesel Engine	
Wheel		Total displacement	4.009 L(4,009 cc) {245 cu.in}	
Front	Roll (dia. x width) 1,070 x 1,480 mm (42" x 58")	Rated output	56 kW (76 PS)/2,050 min ⁻¹ (rpm) (75 HP/2,050 rpm)	
Rear	Roll (dia. x width) 1,070 x 1,480 mm (42" x 58")	Max. torque	265 N•m (27.0 kgf•m)/1,600 min ⁻¹ (rpm) (195 ft•lbs/1,600 rpm)	
Performance:		Tank capacity:		
Travel speed (forward/reverse)	0 ~ 12 km/h (0 ~ 7.5 mile/h)	Fuel tank	120 liters (32 gal)	
		Hydraulic tank	42 liters (11 gal)	
		Sprinkler tank	300 liters x 2 (79 gal x 2)	

SPECIFICATIONS

1-3. SW651ND



SW6511003

Model	SW651ND	Vibrating power:	Ordinary	Horizontal
Weight:		Frequency	67 Hz (4,020 vpm)	50 Hz (3,000 vpm)
Gross weight	7,400 kg (16,310 lbs)	Centrifugal force	68 kN	124 kN
Empty weight	6,800 kg (14,990 lbs)		(6,900 kgf)	(12,600 kgf)
Dimension:		Gross weight	18 degrees	
Overall length	4,210 mm (165")	Rolling width	1,480 mm (58")	
Overall width	1,615 mm (64")	Minimum turning radius	5.0 m (197")	
Overall height	2,780 mm (109")	Engine:		
Wheelbase	3,000 mm (118")	Model	HINO "W04D-H" Diesel Engine	
Wheel		Total displacement	4.009 L(4,009 cc) {245 cu.in}	
Front	Roll (dia. x width) 1,070 x 1,480 mm (42" x 58")	Rated output	56 kW (76 PS)/2,050 min ⁻¹ (rpm) (75 HP/2,050 rpm)	
Rear	Roll (dia. x width) 1,070 x 1,480 mm (42" x 58")	Max. torque	265 N•m (27.0 kgf•m)/1,600 min ⁻¹ (rpm) (195 ft•lbs/1,600 rpm)	
Performance:		Tank capacity:		
Travel speed (forward/reverse)	0 ~ 12 km/h (0 ~ 7.5 mile/h)	Fuel tank	120 liters (32 gal)	
		Hydraulic tank	42 liters (11 gal)	
		Sprinkler tank	300 liters x 2 (79 gal x 2)	

STRUCTURE & OPERATION

STRUCTURE & OPERATION

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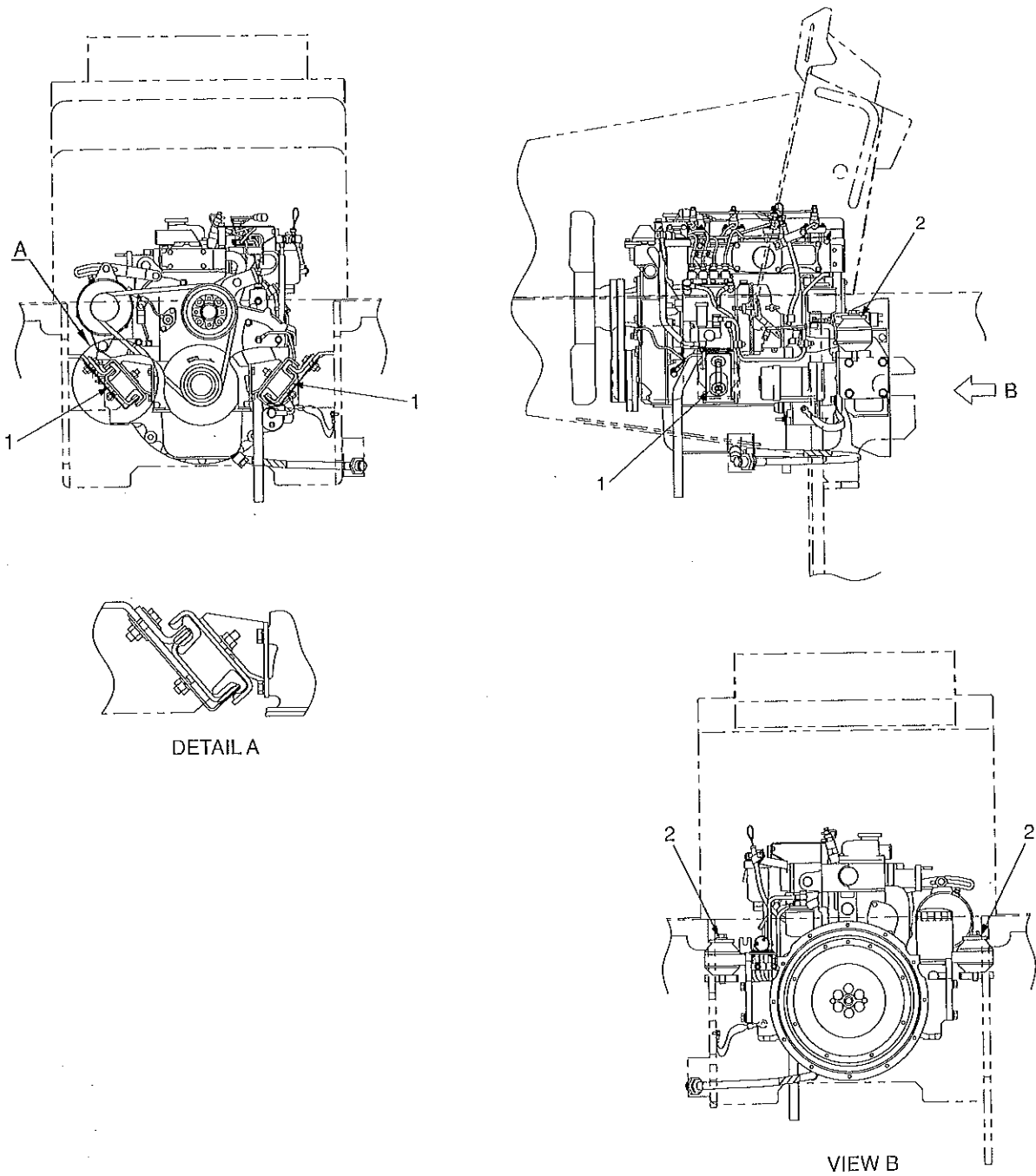
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1. Engine-related Units

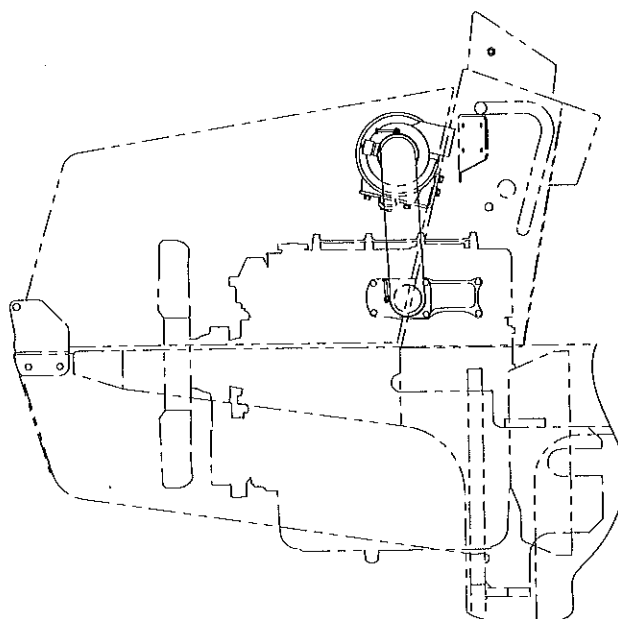
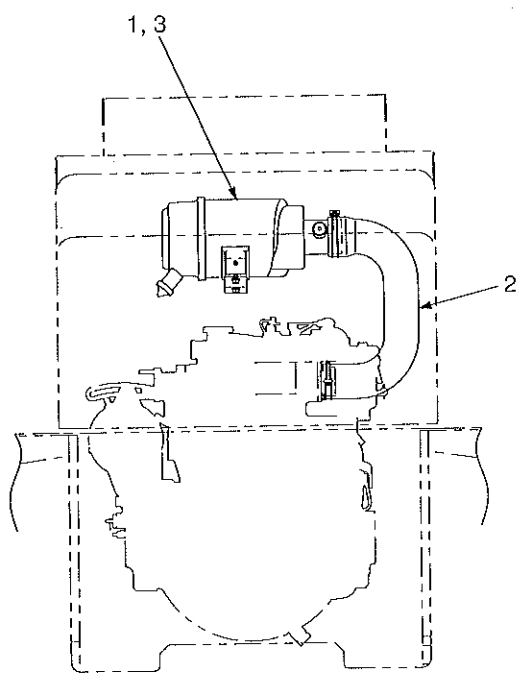
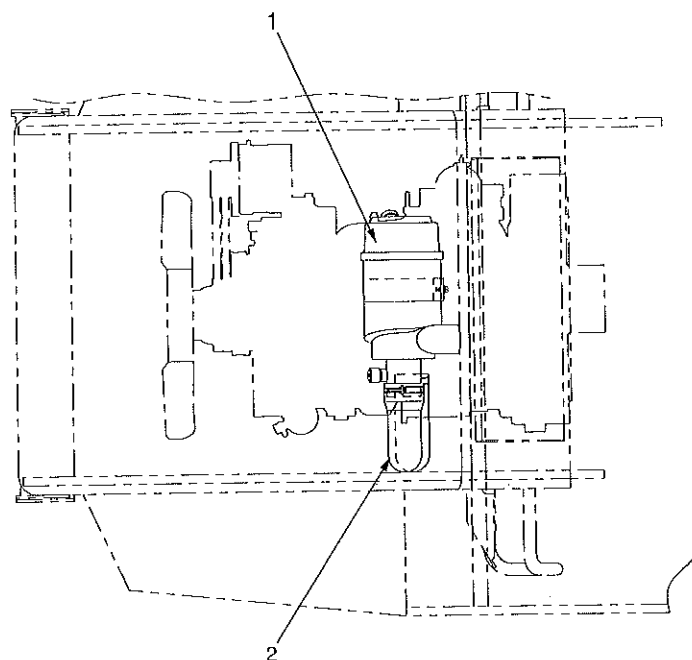
1-1. Engine mount



- 1. Engine mount (front)
- 2. Engine mount (rear)

SW6512001

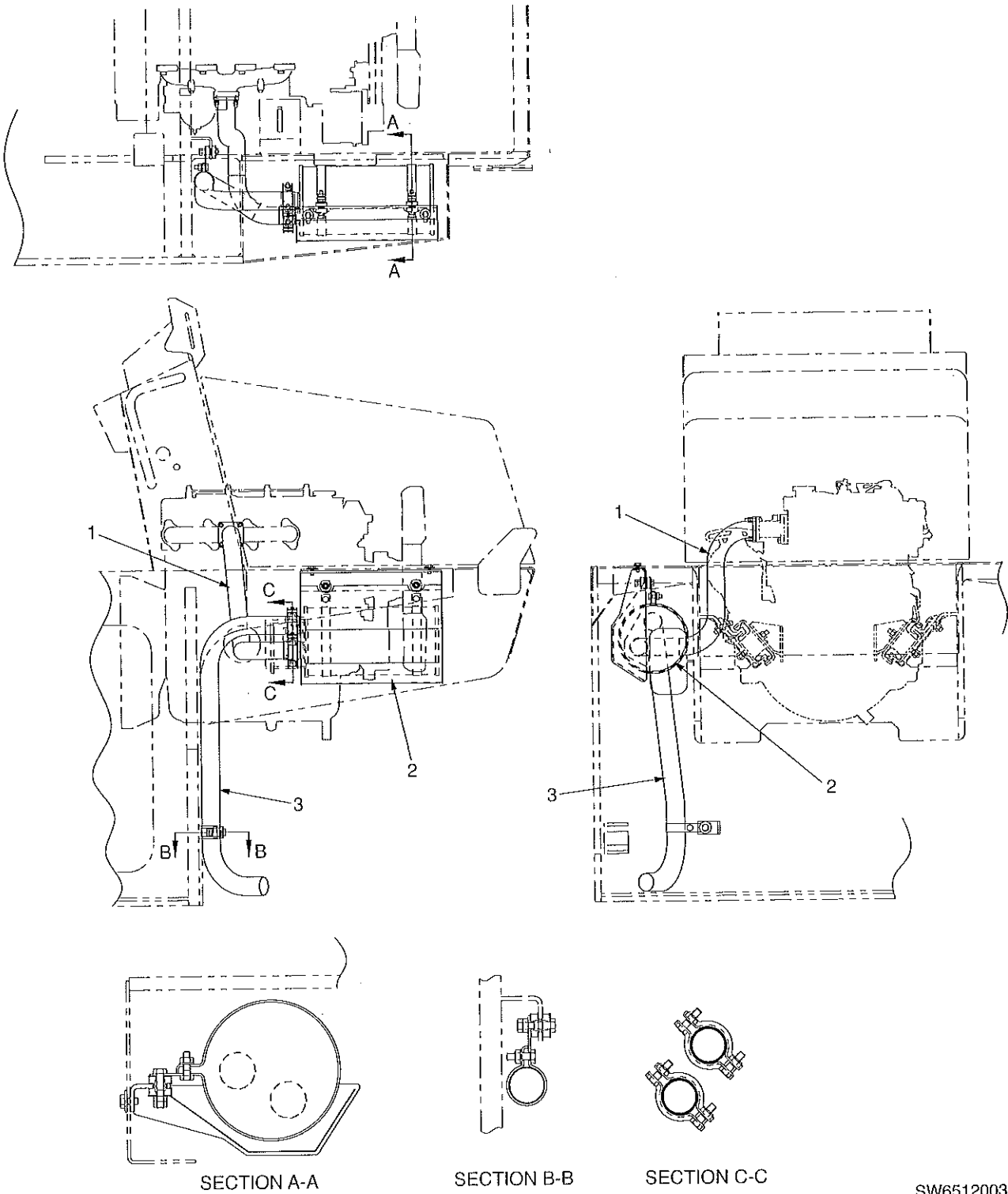
1-2. Intake system



SW6512002

- 1. Air cleaner
- 2. Intake hose
- 3. Dust indicator

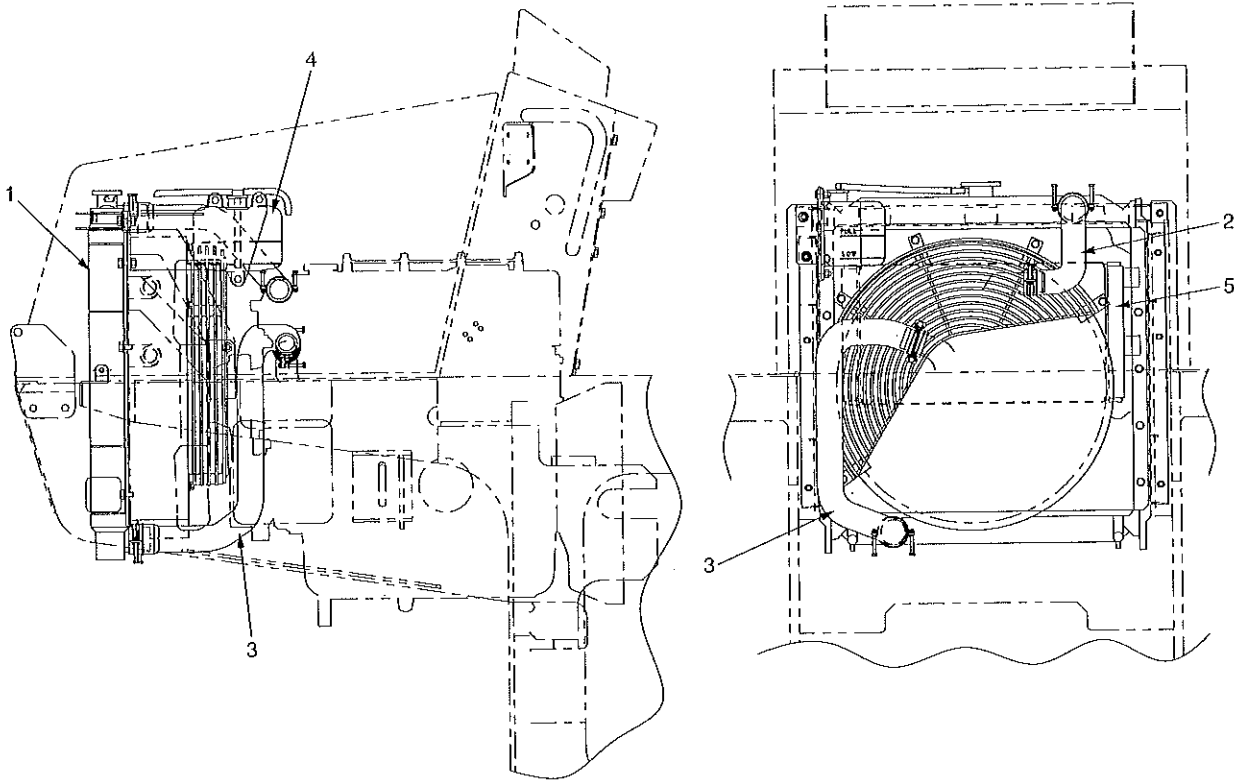
1-3. Exhaust system



SW6512003

- 1. Exhaust pipe
- 2. Muffler
- 3. Exhaust pipe

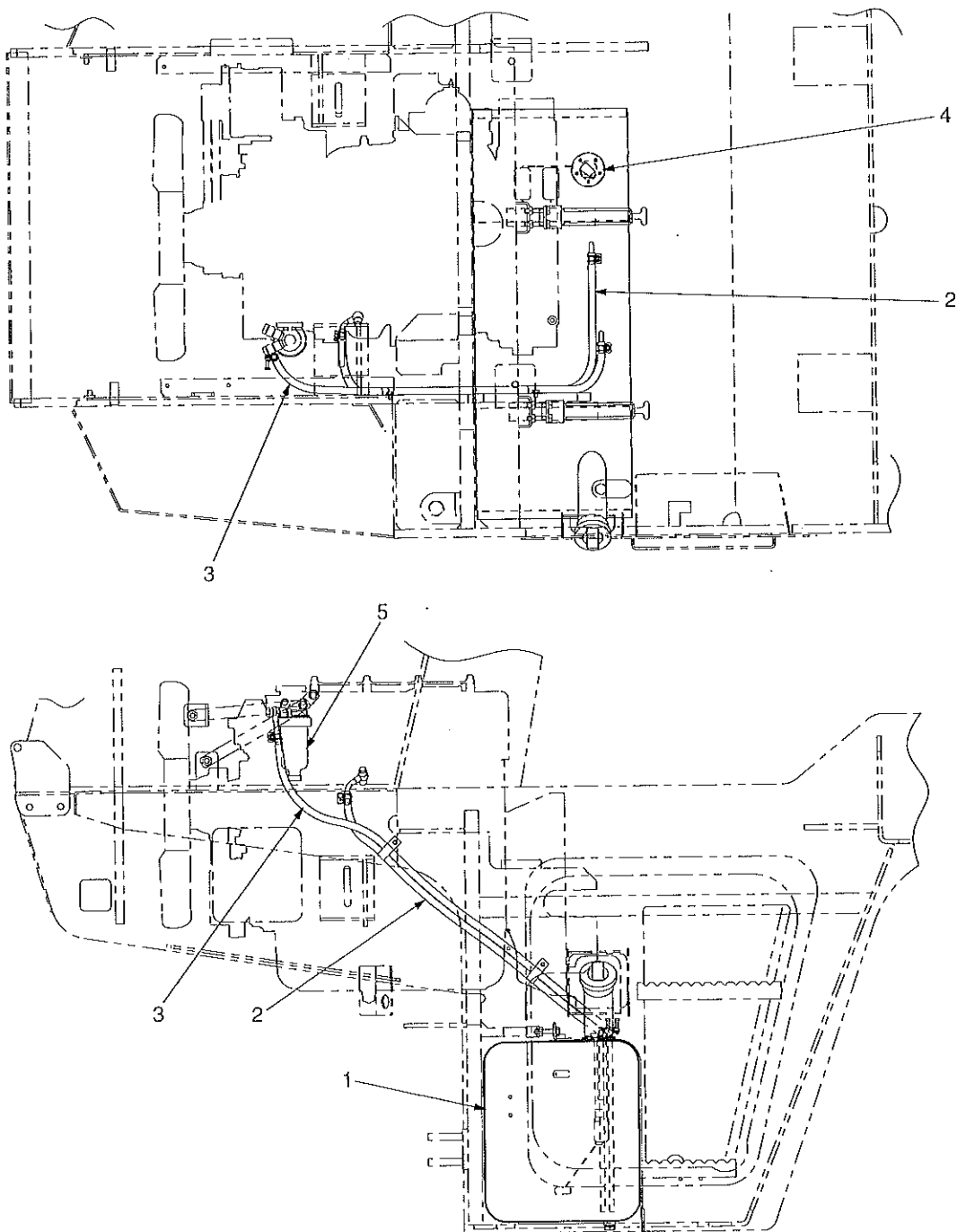
1-4. Cooling piping & radiator



SW6512004

1. Radiator
2. Radiator inlet hose
3. Radiator outlet hose
4. Sub-tank
5. Oil cooler

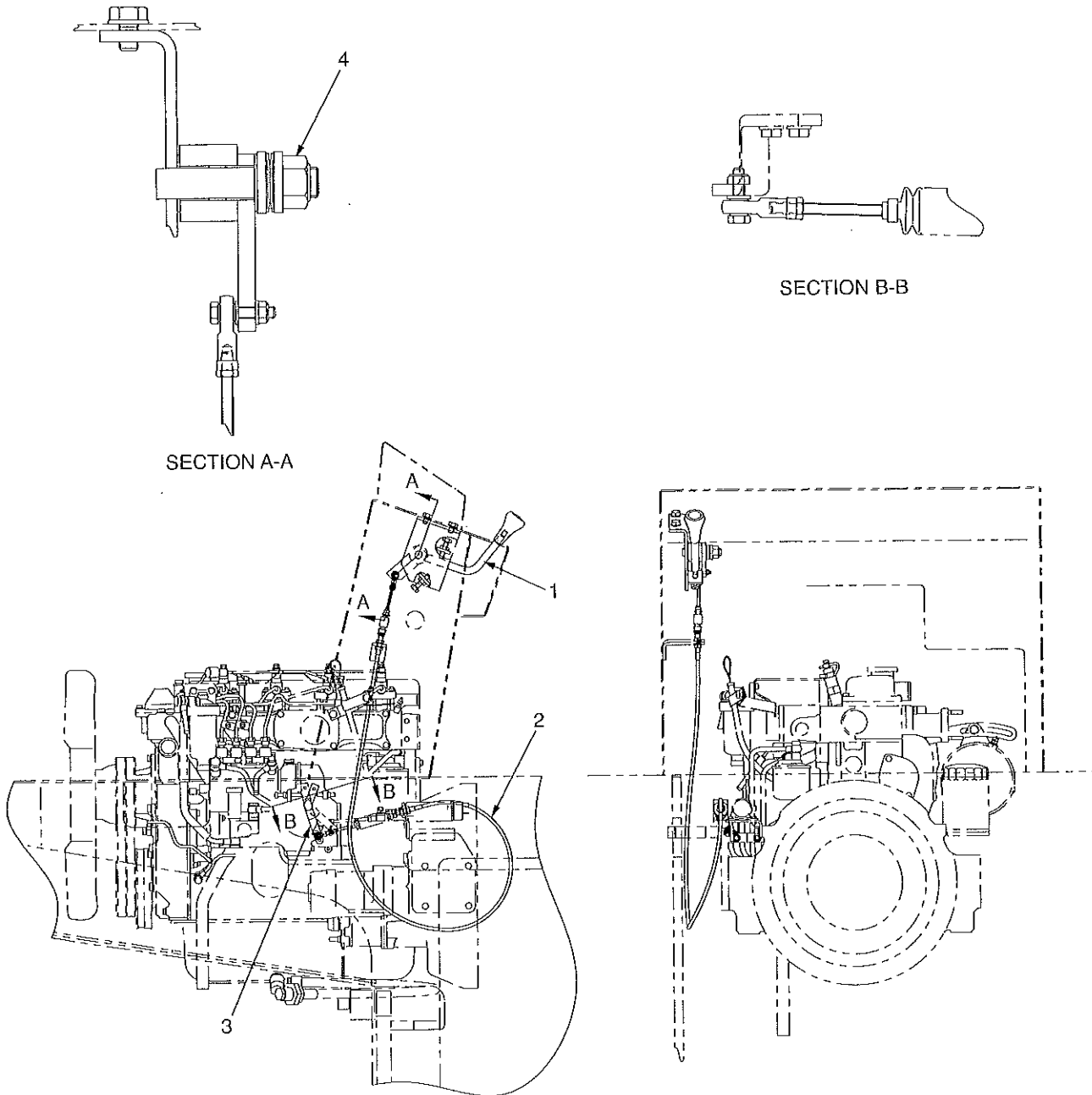
1-5. Fuel piping & fuel tank



SW6512005

- 1. Fuel tank
- 2. Suction hose
- 3. Return hose
- 4. Fuel gauge
- 5. Sedimenter

1-6. Fuel controls



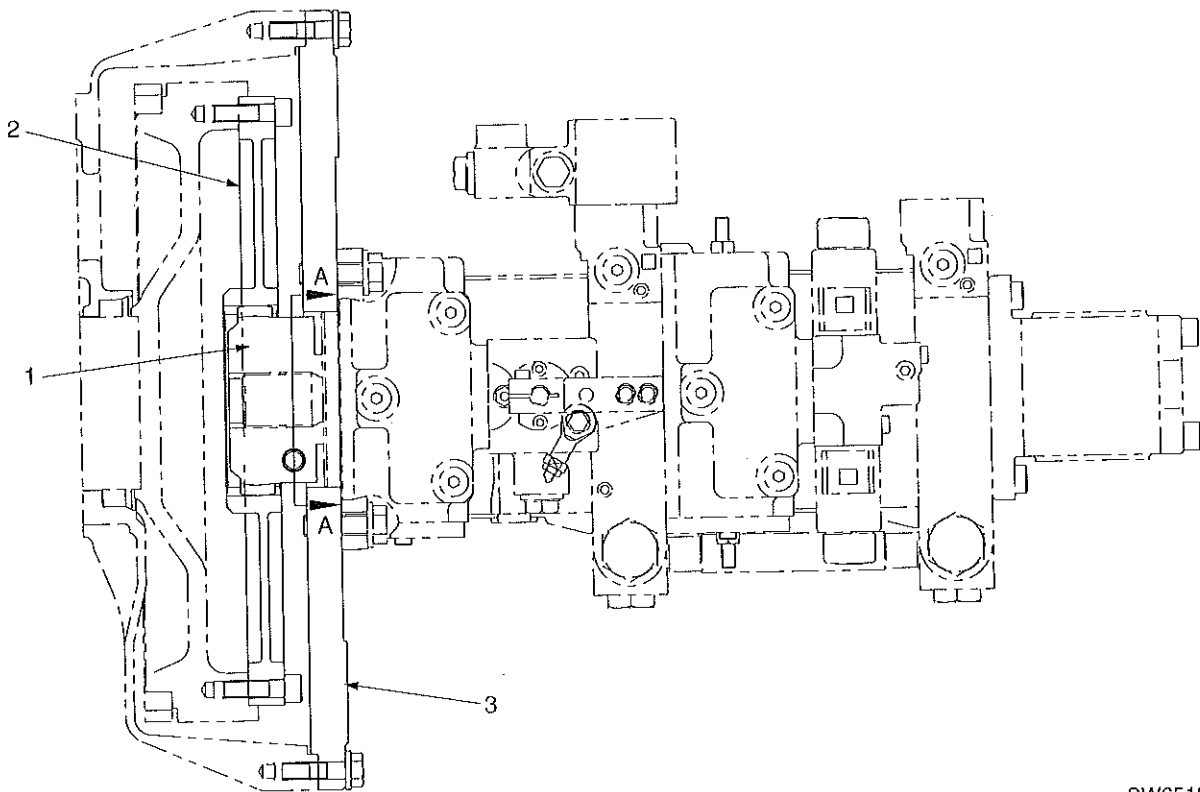
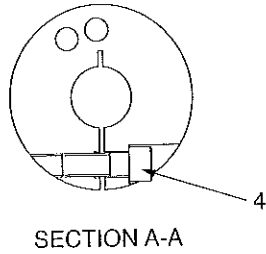
1. Throttle lever
2. Throttle cable
3. Control lever (injection pump)
4. Nut for adjusting control performance

SW6512006

2. Description and Operation of Hydraulic System

2-1. Construction and operation of hydraulic pump

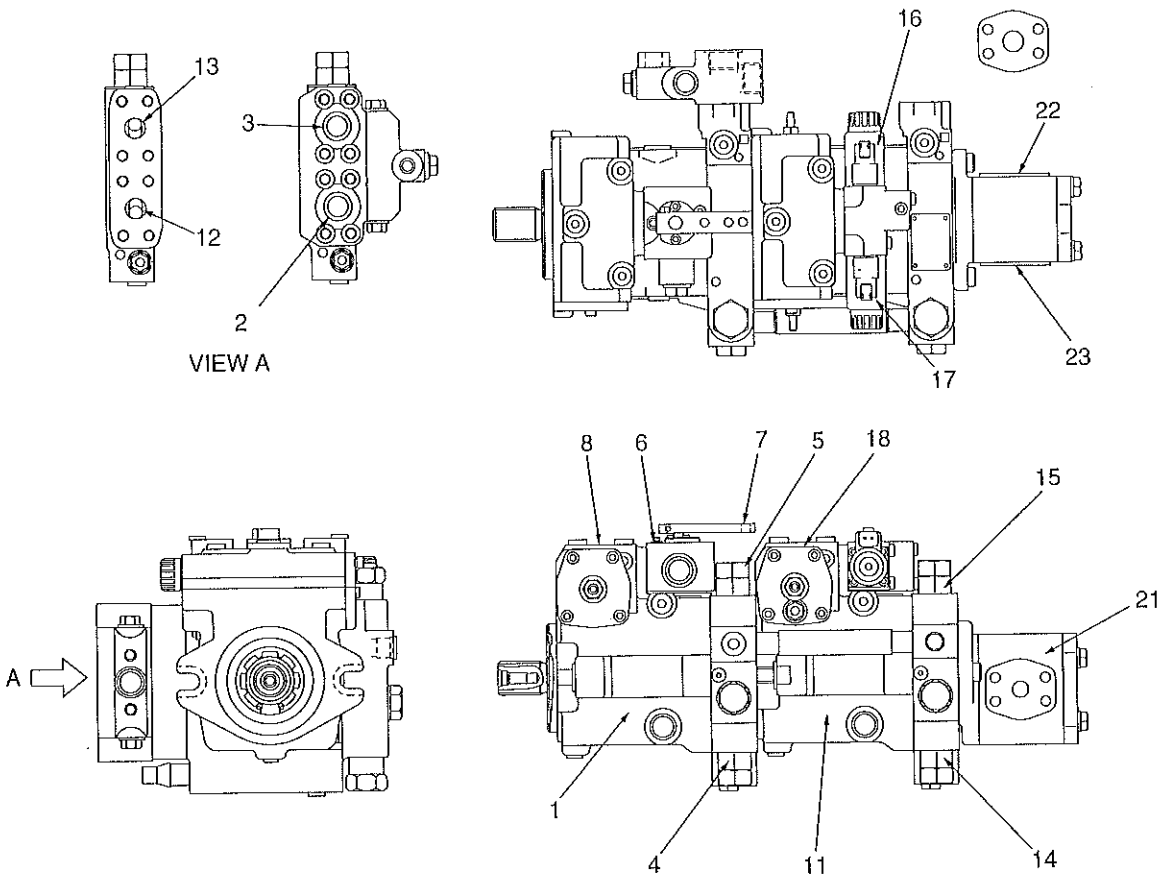
2-2-1. Coupling



SW6512007

- 1. Hub
- 2. Flange
- 3. Flange
- 4. Hub fixing bolt

2-1-2. Pump ass'y (Propulsion+Vibrator drive+Steering)



SW6512008

1. Propulsion pump

- 2. Port A1
- 3. Port B1
- 4. High-pressure relief valve (A)

- 5. High-pressure relief valve (B)
- 6. Forward-reverse control valve
- 7. Forward-reverse control lever

- 8. Servo piston

11. Vibrator drive pump

- 12. Port A2
- 13. Port B2
- 14. High-pressure relief valve (A)

- 15. High-pressure relief valve (B)
- 16. Amplitude selector valve (a)
- 17. Amplitude selector valve (b)

- 18. Servo piston

21. Steering pump

- 22. Suction port
- 23. Discharge port

Specifications

Model:AA10VG45HW

Propulsion pump

- Displacement: 0 ~ 46cm³/rev(cc/rev)
- Setting pressure of circuit : 30.5MPa (4416psi) {311kgf/cm²}
- Setting pressure of charge circuit : 1.9MPa (284psi) {20kgf/cm²}

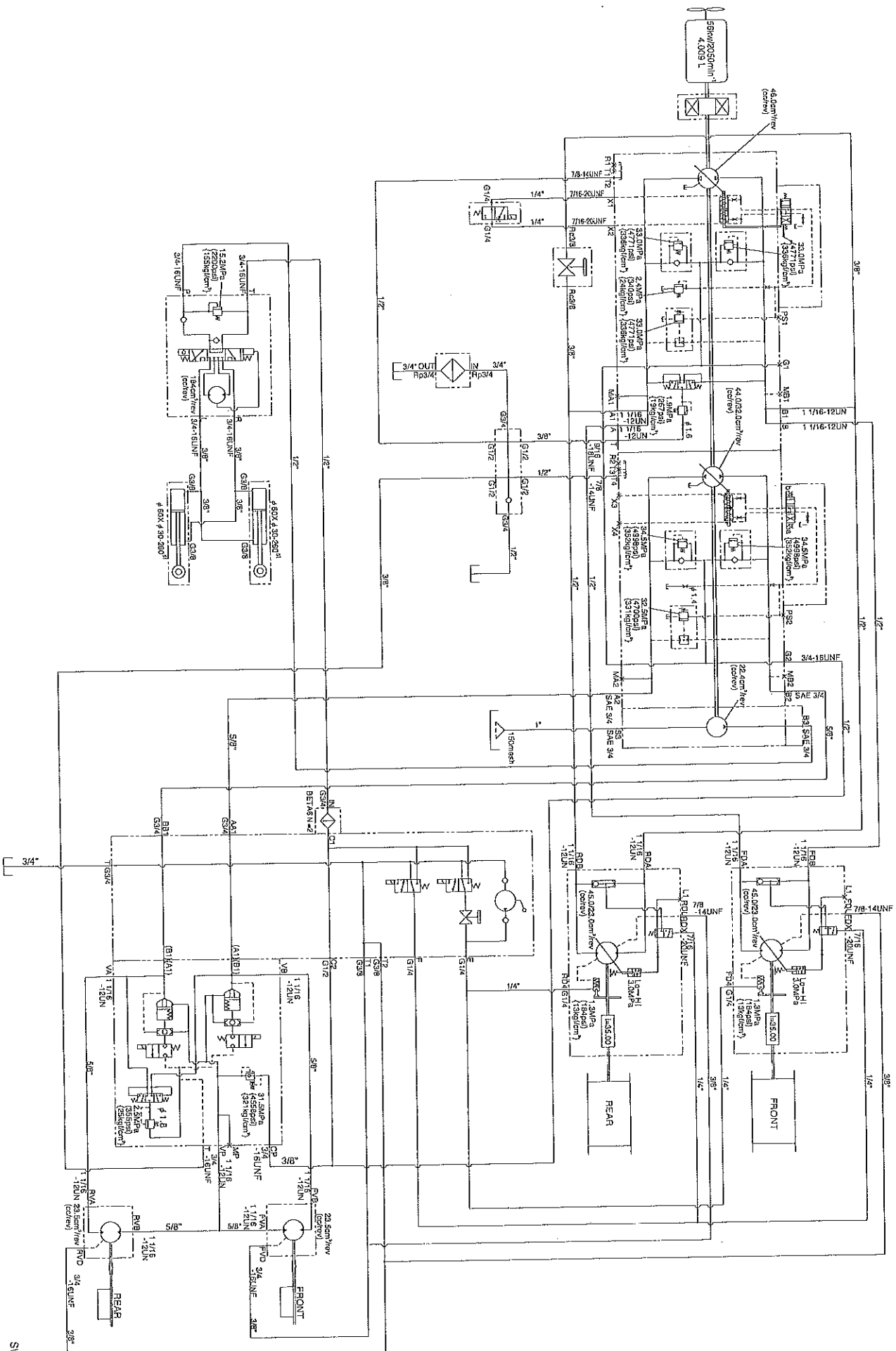
Vibrator drive pump

- Displacement (Port A side): 0 ~ 32cm³/rev(cc/rev)
- Displacement (Port B side): 0 ~ 44cm³/rev(cc/rev)
- Setting pressure of circuit : 32.5MPa (4714psi) {332kgf/cm²}

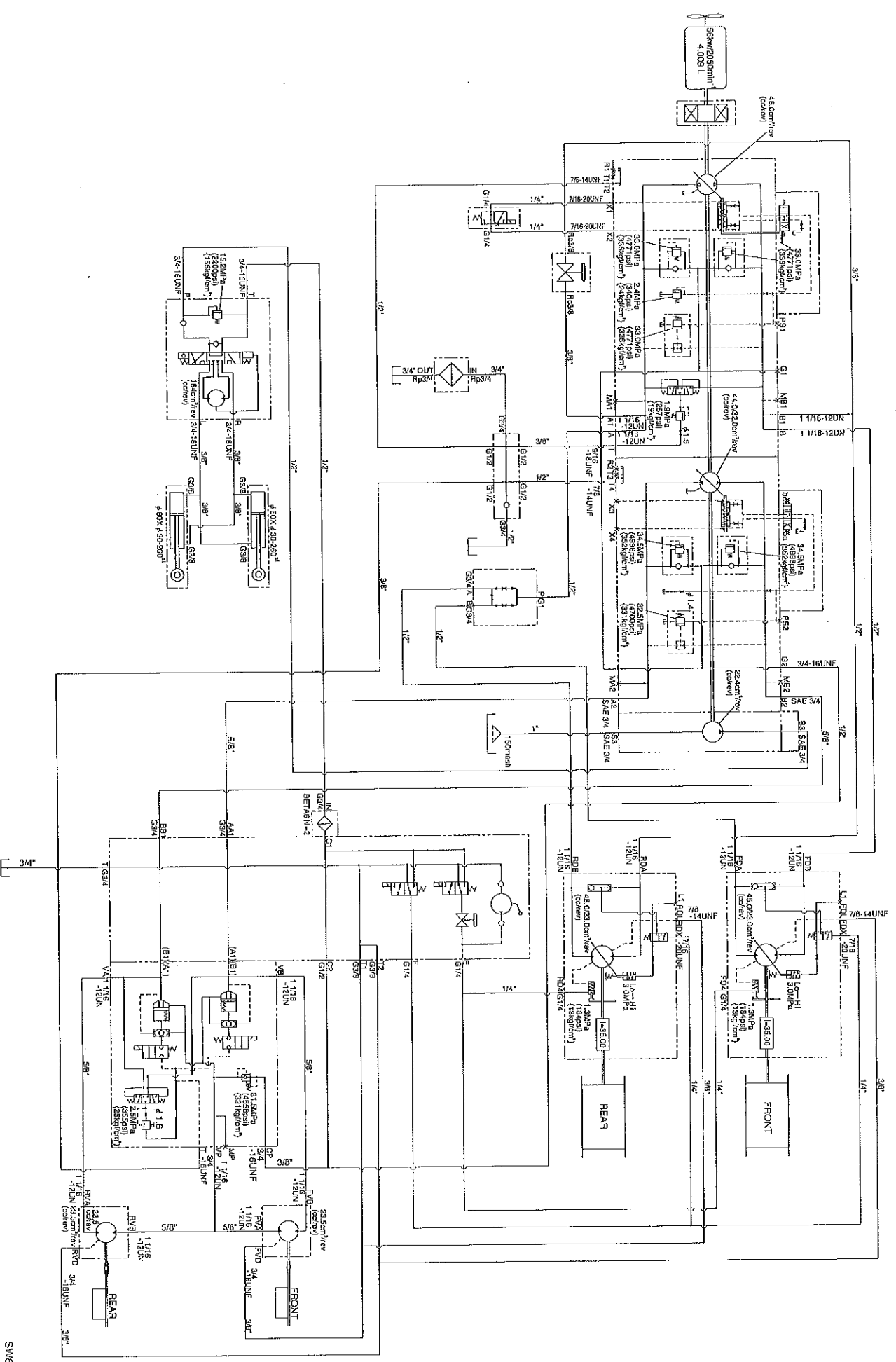
Steering pump

- Displacement: 22.4cm³/rev(cc/rev)
- Setting pressure of circuit : 15.5MPa (2243psi) {158kgf/cm²}

2-1-3. Hydraulic circuit (SW65T, SG51ND)

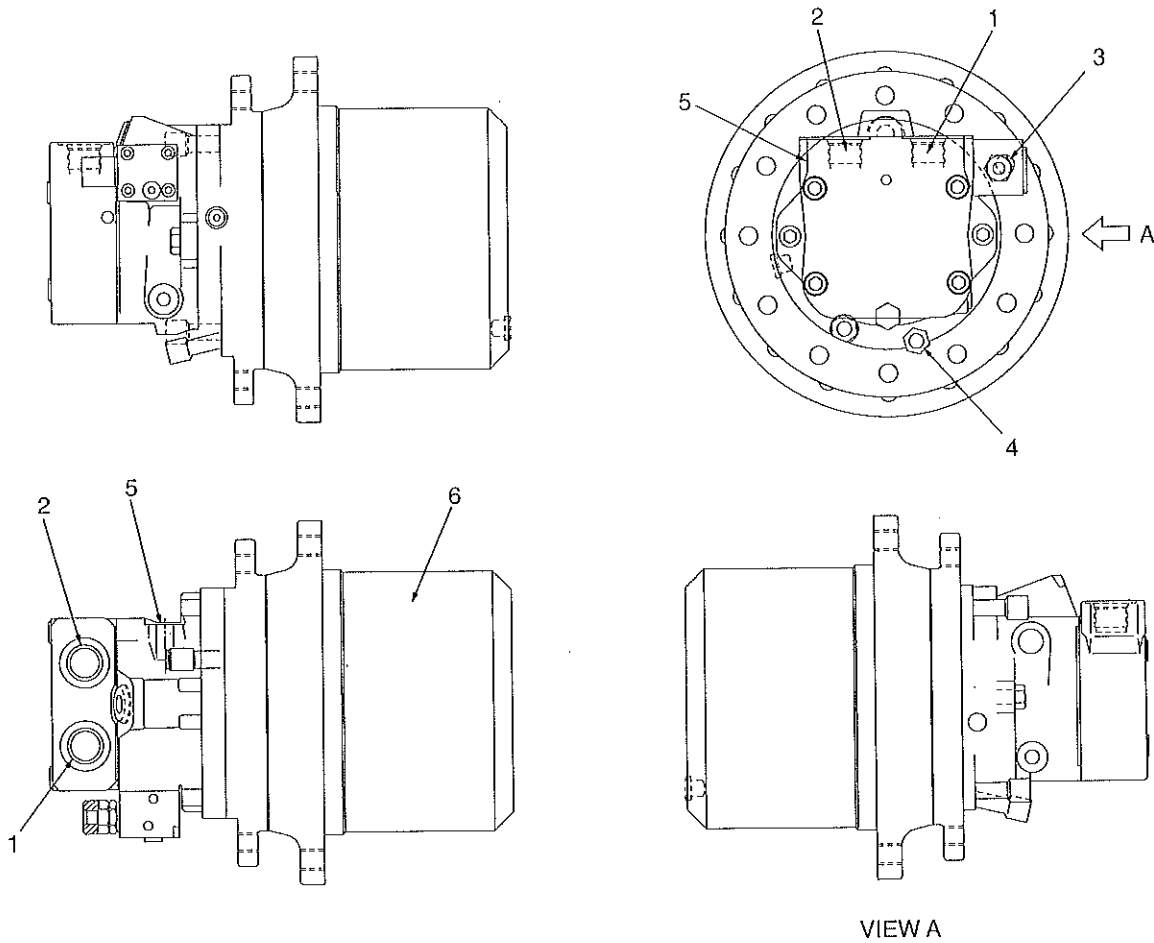


2-1-4. Hydraulic circuit (SW651B)



2-2. Propulsion line

2-2-1. Propulsion motor



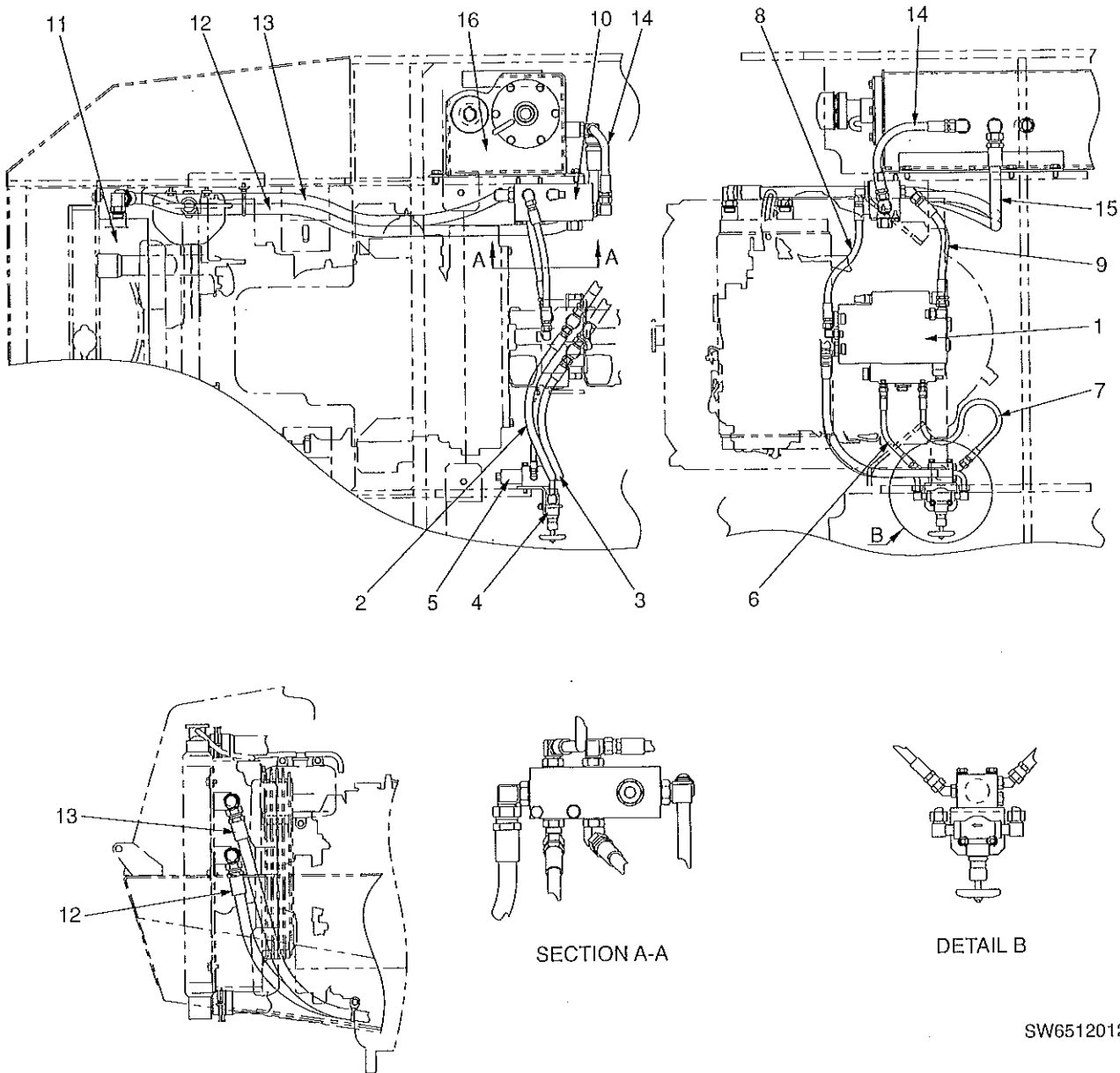
SW6512011

1. Port A
2. Port B
3. High/Low speed switching port
4. Drain port
5. Drain port
6. Gear reducer

Specifications

- Model : MT705C2-H
- Displacement : 23/45cm³/rev(cc/rev)
- Setting pressure of circuit : 30.5MPa (4416psi) {311kgf/cm²}
(To be set on pump side)

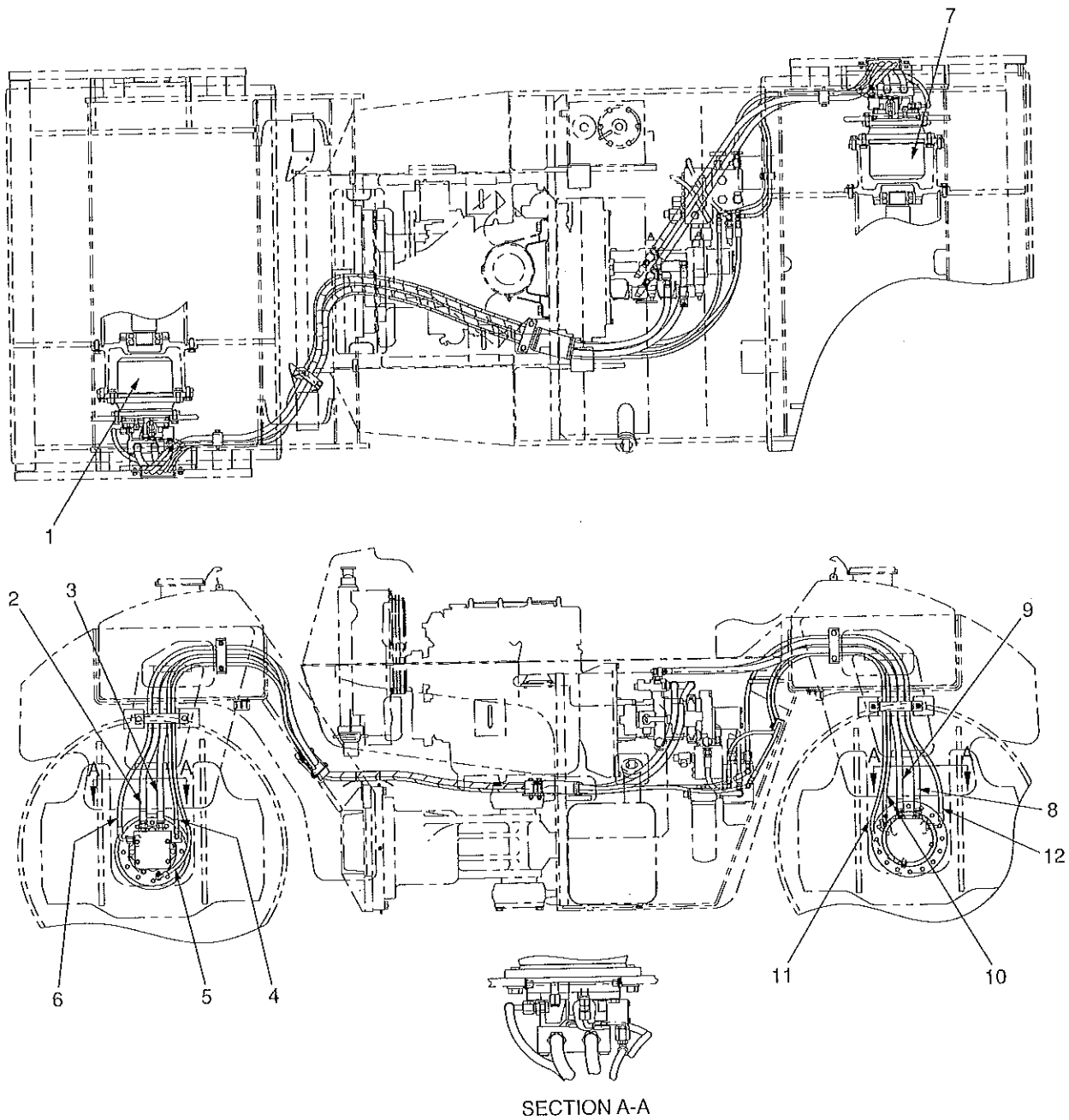
2-2-2. Hydraulic piping (I)



- | | | |
|---------------------------------|-----------------------------|------------------------------|
| 1. Propulsion pump | 7. Hose (servo by-pass) | 13. Hose (oil cooler outlet) |
| 2. Hose (unloading) | 8. Hose (cooling circuit) | 14. Hose (return circuit) |
| 3. Hose (unloading) | 9. Hose (cooling circuit) | 15. Hose (return circuit) |
| 4. Unloading valve | 10. Block | 16. Hydraulic oil tank |
| 5. Servo by-pass solenoid valve | 11. Oil cooler | |
| 6. Hose (servo by-pass) | 12. Hose (oil cooler inlet) | |

SW6512012

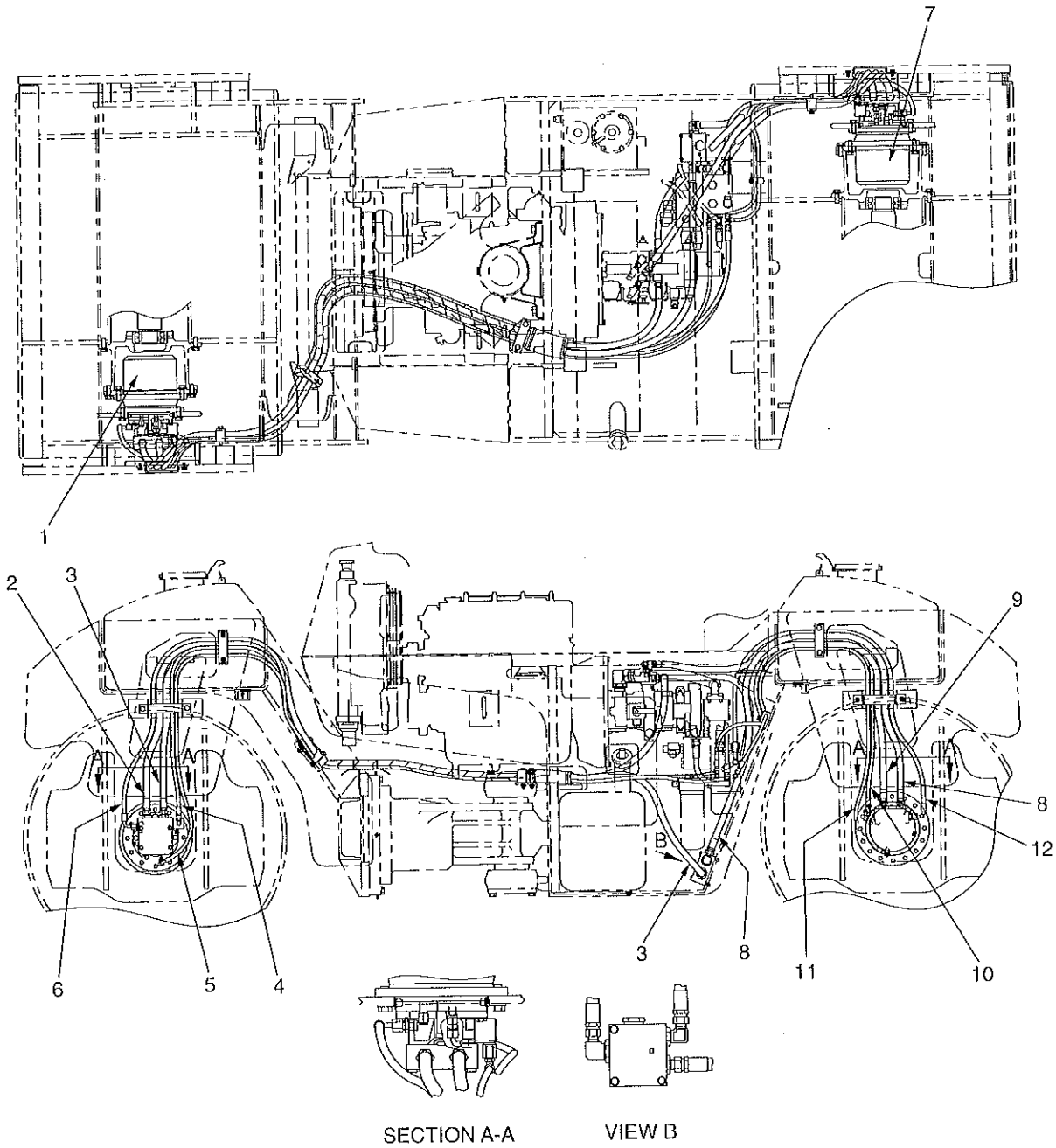
2-2-3. Hydraulic piping [II] (SW651, SW651ND)



SW6512013

- | | |
|---------------------------------------|---------------------------------------|
| 1. Propulsion motor (front) | 7. Propulsion motor (rear) |
| 2. High-pressure hose (motor DB port) | 8. High-pressure hose (motor DB port) |
| 3. High-pressure hose (motor DA port) | 9. High-pressure hose (motor DA port) |
| 4. Hose (high/low speed switching) | 10. Hose (high/low speed switching) |
| 5. Hose (brake release) | 11. Hose (brake release) |
| 6. Hose (drain circuit) | 12. Hose (drain circuit) |

2-2-4. Hydraulic piping (Ⅲ) (SW651B)

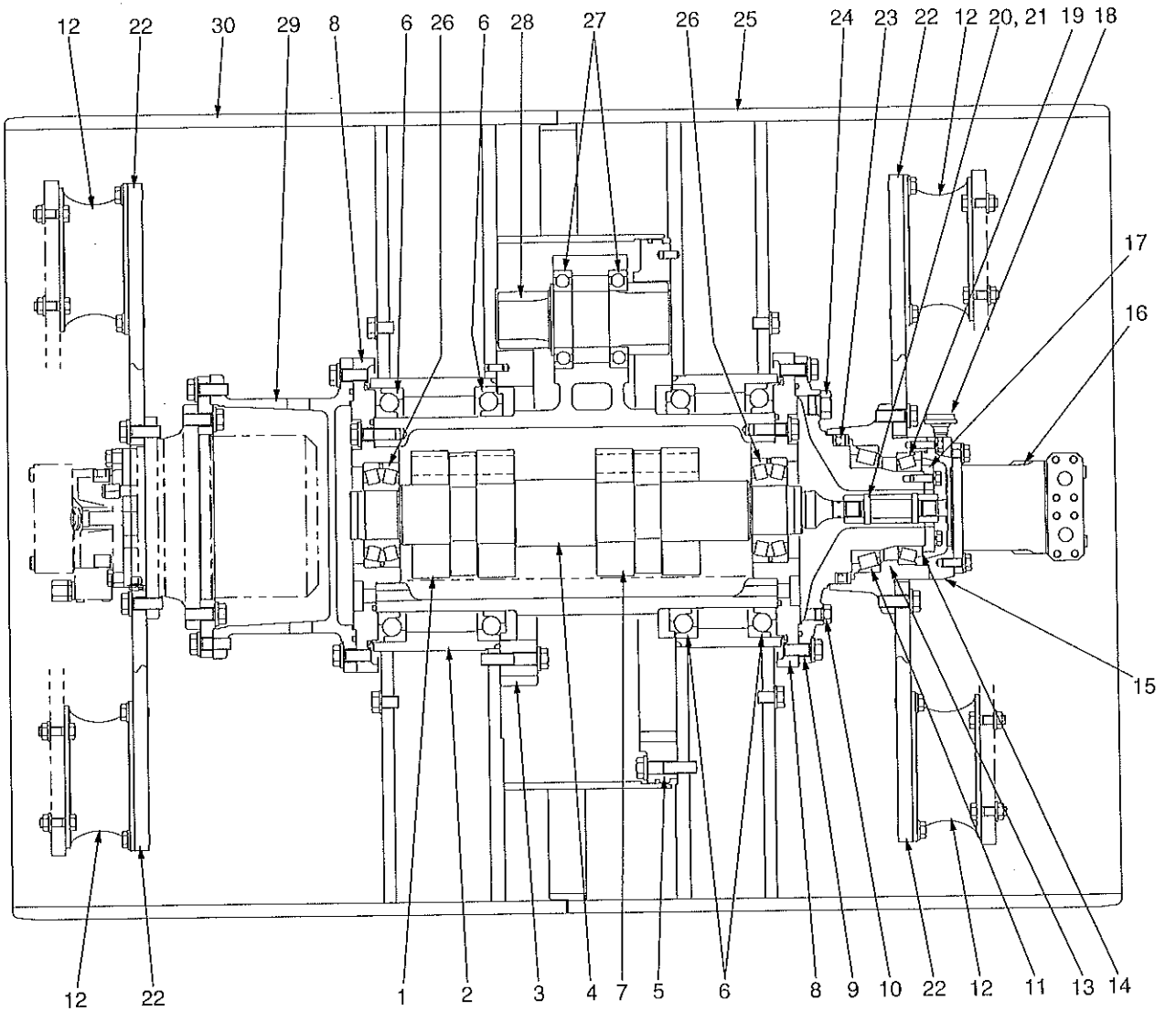


- 1. Propulsion motor (front)
- 2. High-pressure hose (motor DB port)
- 3. High-pressure hose (motor DA port)
- 4. Hose (high/low speed switching)
- 5. Hose (brake release)
- 6. Hose (drain circuit)

- 7. Propulsion motor (rear)
- 8. High-pressure hose (motor DB port)
- 9. High-pressure hose (motor DA port)
- 10. Hose (high/low speed switching)
- 11. Hose (brake release)
- 12. Hose (drain circuit)

SW6512014

2-2-5. Split drum (SW651B)



SW6512015

- | | | | |
|------------------|--------------------------|--------------------------|----------------------|
| 1. Weight | 9. Axle shaft | 17. Cover | 25. Drum |
| 2. Case | 10. Plug | 18. Breather | 26. Roller bearing |
| 3. External gear | 11. Taper roller bearing | 19. Taper roller bearing | 27. Ball bearing |
| 4. Shaft | 12. Damper | 20. Coupling | 28. Shaft |
| 5. Internal gear | 13. Housing | 21. Spring pin | 29. Propulsion motor |
| 6. Ball bearing | 14. Shim | 22. Disc | 30. Drum |
| 7. Weight | 15. Flange | 23. Oil seal | |
| 8. Disc | 16. Vibrator motor | 24. Plug | |

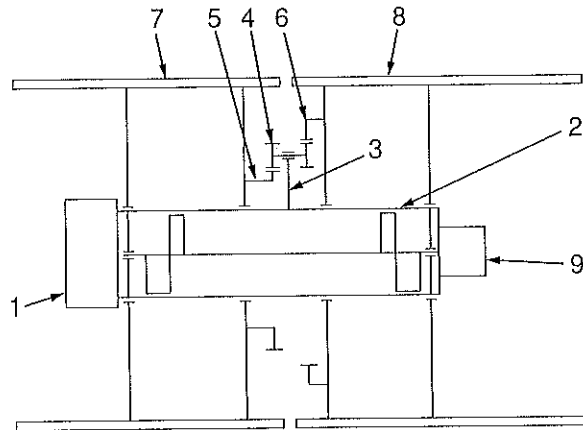
2-2-6. Description and operation of split drum (SW651B)

Description:

- Made up of propulsion motor (1), case (2), carrier (3), pinion (4), external gear (5), internal gear (6), drums (7), (8) and vibrator drive motor (9).

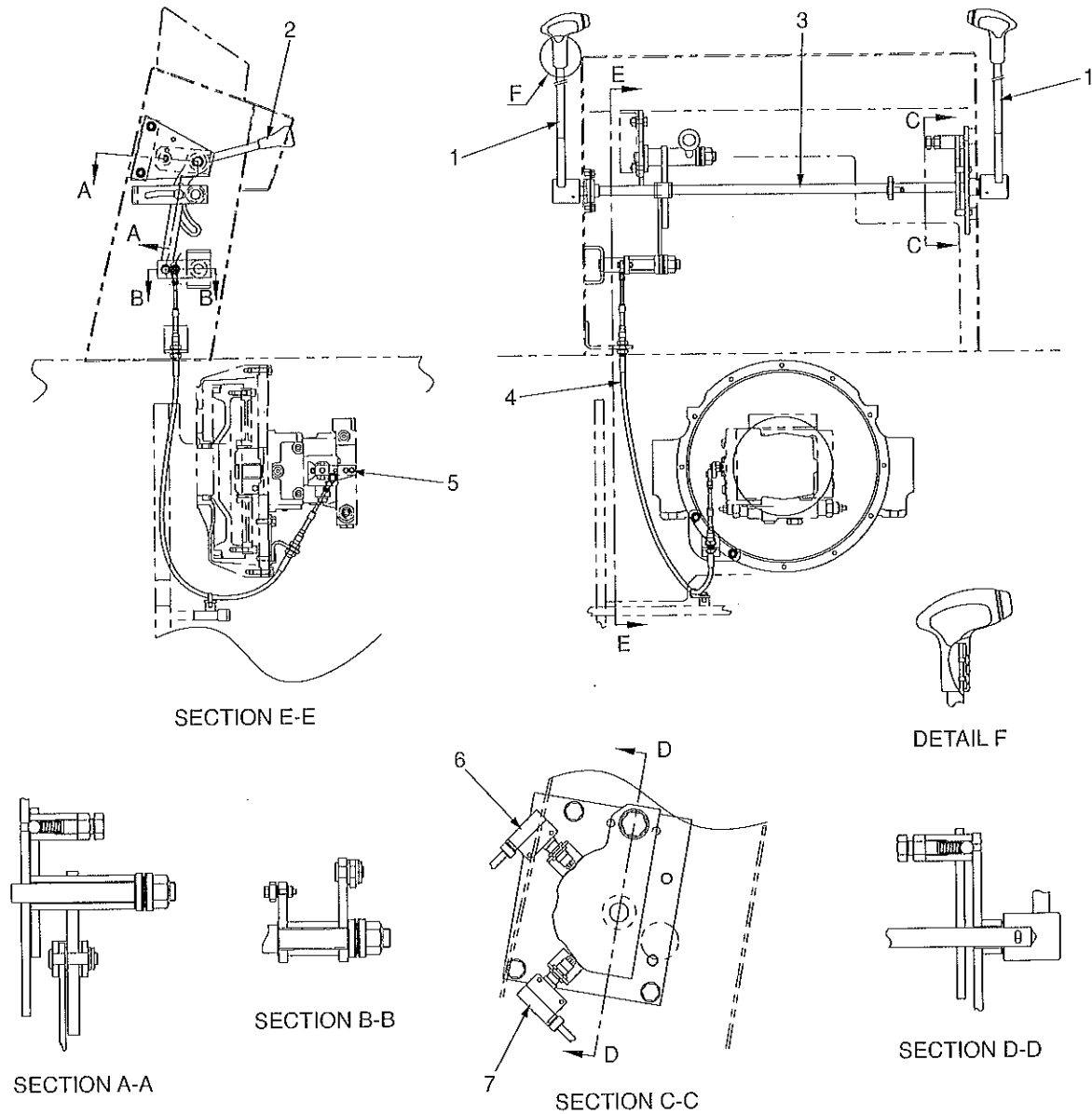
Operation:

- Rotation of propulsion motor (1) rotates case (2). Carrier (3) which is the integral part of case (2) drives pinion (4).
- One end of pinion (4) is in engagement with external gear (5), while the other end engages with internal gear (6). External gear (5) and internal gear (6) are an integral part of drums (7) and (8) respectively. With the rotation of carrier (3), pinion (4), external gear (5) and internal gear (6) rotate as one body along with carrier (3). This makes drums (7) and (8) turn at the same speed, since external gear (5) and internal gear (6) are an integral part of drum (7) and drum (8) respectively.
- When making turns, the inside drum turns slower than the outside drum. When the inside drum rotation slows down than that of carrier (3), pinion (4) which is in engagement with external gear (5) or internal gear (6) rotates around its shaft. This makes the outside drum rotate faster than carrier (3). As a result, the outside drum rotates faster than the inside one.



SW7502030

2-2-7. Propulsion controls

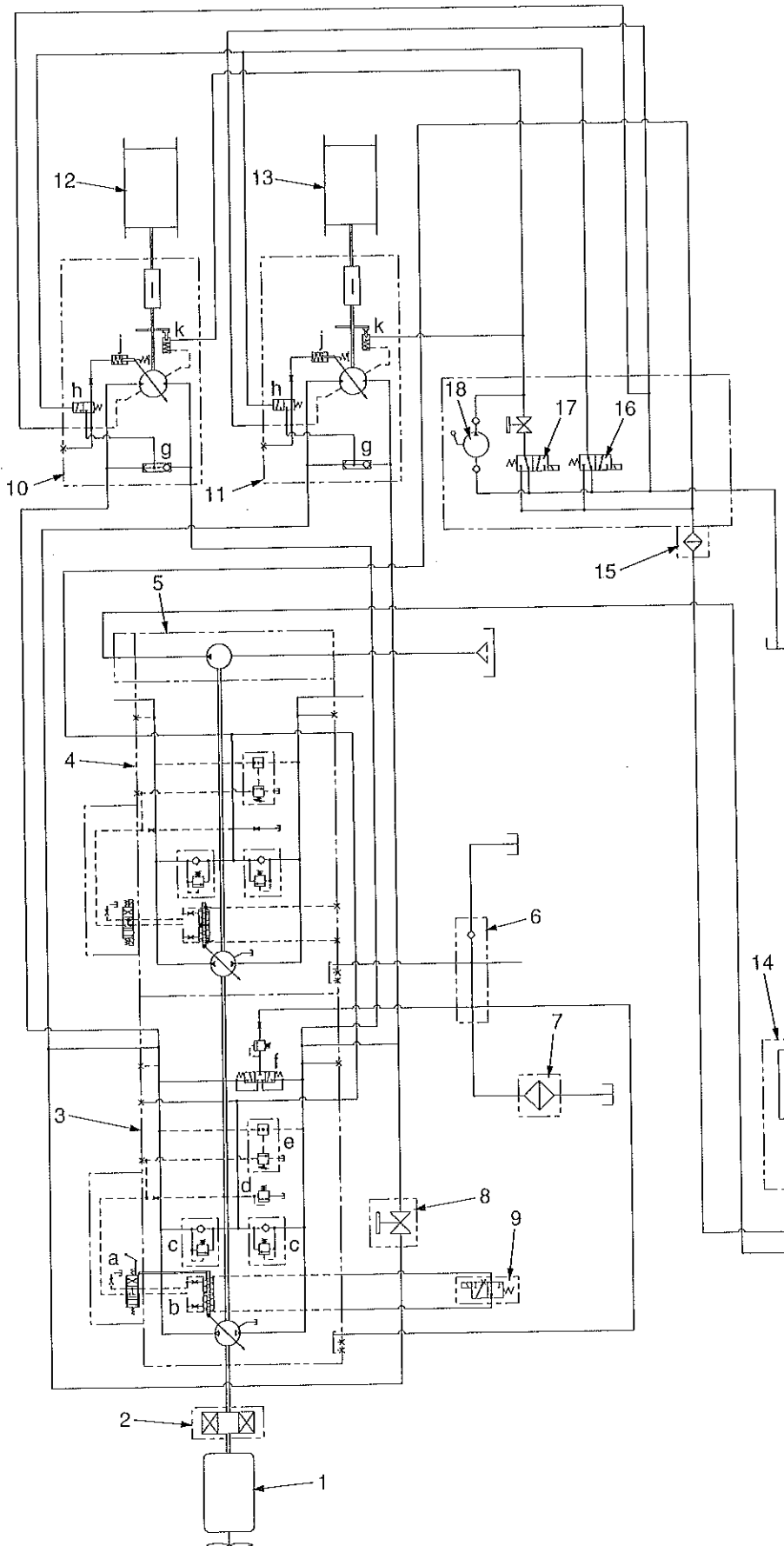


SW6512016

- 1. Forward-reverse (F-R) lever
- 2. Speed shift lever
- 3. Shaft
- 4. Control cable (forward-reverse)

- 5. Forward-reverse lever (propulsion pump)
- 6. Micro-switch (interlock)
- 7. Micro-switch (back buzzer)

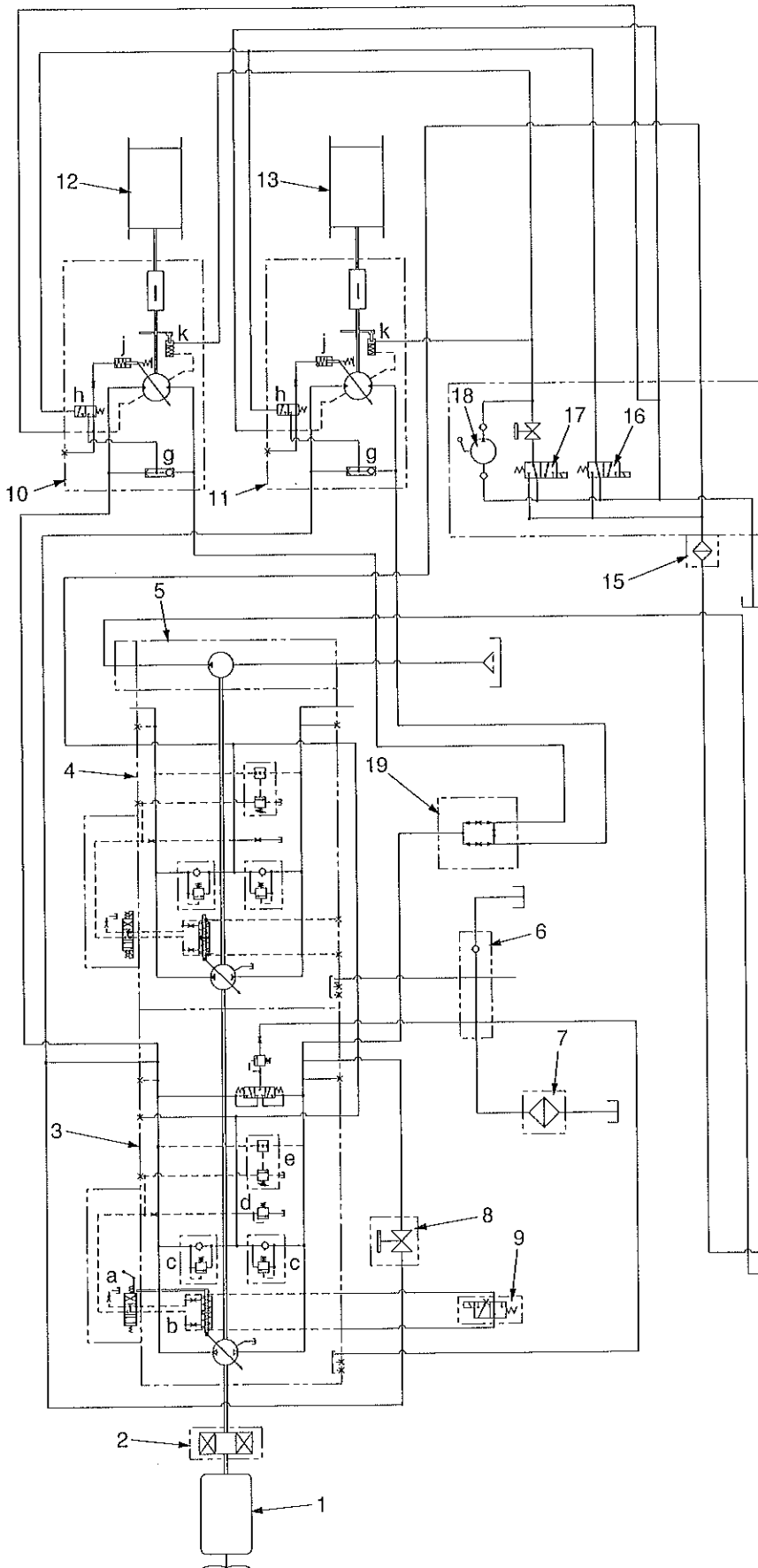
2-2-8. Propulsion circuit (SW651, SW651ND)



1. Engine
2. Coupling
3. Propulsion pump
 - a. Forward-reverse valve
 - b. Servo piston
 - c. Relief valve (safety)
 - d. Charge relief valve
 - e. Relief valve (main)
 - f. Flushing valve
4. Vibrator drive pump
5. Steering pump
6. Block (drain circuit)
7. Oil cooler
8. Unloader valve
9. Servo by-pass solenoid valve
10. Propulsion motor (Front)
 - g. Shuttle valve
 - h. High/low speed switching valve
 - j. High/low speed switching piston
11. Propulsion motor (Rear)
 - g. Shuttle valve
 - h. Speed shift valve
 - j. Speed shift piston
 - k. Brake piston
 - l. Gear reducer
12. Front drum
13. Rear drum
14. Orbitrol (steering valve)
15. Line filter
16. High/low speed switching solenoid valve
17. Brake release solenoid valve
18. Hand pump

SW6512017

2-2-9. Propulsion circuit (SW651B)



1. Engine
2. Coupling
3. Propulsion pump
 - a. Forward-reverse valve
 - b. Servo piston
 - c. Relief valve (safety)
 - d. Charge relief valve
 - e. Relief valve (main)
 - f. Flushing valve
4. Vibrator drive pump
5. Steering pump
6. Block (drain circuit)
7. Oil cooler
8. Unloader valve
9. Servo by-pass solenoid valve
10. Propulsion motor (Front)
 - g. Shuttle valve
 - h. High/low speed switching valve
 - j. High/low speed switching piston
 - k. Brake piston
 - l. Gear reducer
11. Propulsion motor (Rear)
 - g. Shuttle valve
 - h. Speed shift valve
 - j. Speed shift piston
 - k. Brake piston
 - l. Gear reducer
12. Front drum
13. Rear drum
14. Orbitrol (steering valve)
15. Line filter
16. High/low speed switching solenoid valve
17. Brake release solenoid valve
18. Hand pump
19. Valve (Port A side of pump)

SW6512018

2-2-10. Description and operation of propulsion system

- ◆ See the hydraulic circuit on pages 2-020 to 2-021.

Description of propulsion system

Made up of propulsion pump (3), front propulsion motor (10), front drum (12), rear propulsion motor (11), rear drum (13) high/low speed switching solenoid valve (16) and brake release solenoid valve (17).

Basic function of propulsion pump and propulsion motor

- Propulsion pump

A piston pump is used which allows adjusting the travel speed by varying inclination of the swash plate to change the piston stroke, and switching forward-reverse travel by reversing the discharge port with the control of servo valve.

- Propulsion motor

A piston motor is used which allows switching high/low speed travel by varying displacement volume of the motor (or varying piston stroke).

Operation (It is assumed that the machine is traveling forward.)

★ Parking brake has been released.

- ◆ Assemblies such as pump assembly and motor assembly are indicated by numbers such as (1) and (2), while component parts in the assemblies are shown by small letters such as (a) and (b).
- Both front and rear motors are hydraulically connected in parallel.
- When forward-reverse lever (F-R lever) is shifted to "Forward", forward-reverse valve of the pump functions to allow the servo piston (b) to tilt the swash plate of the pump in the "forward" travel direction.
- This allows the oil to discharge from the propulsion pump to forward travel circuit (port A) and the oil is discharged and divided at the pump outlet to enter in the "forward travel port" of propulsion motor.

★ Port B is assigned for front motor and port B is for rear motor.

- The divided oil fed into the forward travel ports of the motor drives the motor, flows out of the port on opposite side, and merges at the inlet of the pump returning to suction port of the pump.

NOTE: Because the propulsion circuit is a closed loop circuit (HST), the "discharge port" differs from forward to reverse travel.

Release of parking brake

- When the brake release solenoid valve (17) is energized, the valve actuates allowing the oil in the charge circuit to discharge out of the valve to flow into the brake release port of the propulsion motor.
- The oil entered in the motor moves the brake piston to release the brake.

Circuit protection against high pressure

- The high-pressure relief valve (c) fitted in the propulsion pump (4) relieves pressure if circuit pressure exceeds the set pressure of the valve, thus protecting the circuit.
- The cut-off valve (d) is also fitted in the circuit.

When an abrupt heavy load is applied, the valve (d) actuates after the high-pressure relief valve (c) to control inclination angle of the pump, thus protecting the circuit.

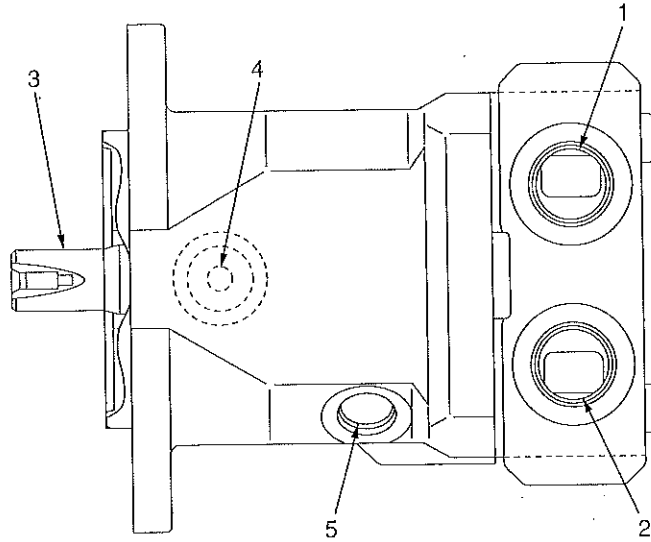
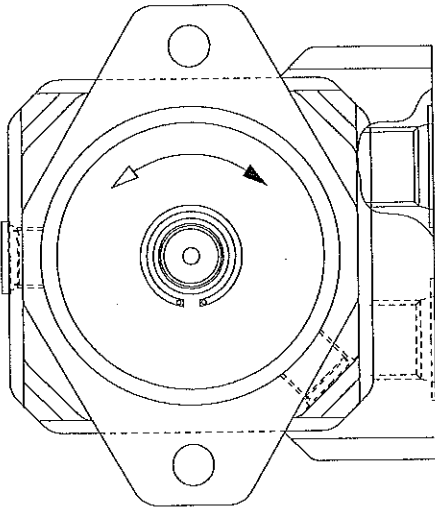
- ★ **This is to prevent the high-pressure relief valve (c) from generation of heat in case where the valve keeps on relieving pressure.**

Charge circuit

- Since the propulsion circuit is of a closed circuit, oil is to be supplied from outside.
- In the charge circuit, oil discharged from the steering pump (5) flows into the orbitrol (14) and entire oil is supplied to the propulsion pump via line filter (11) whether the steering is operated or not.
- In addition, the charge relief valve (d) in the pump adjusts pressure in the circuit.

2-3. Vibrating system

2-3-1. Vibrator motor



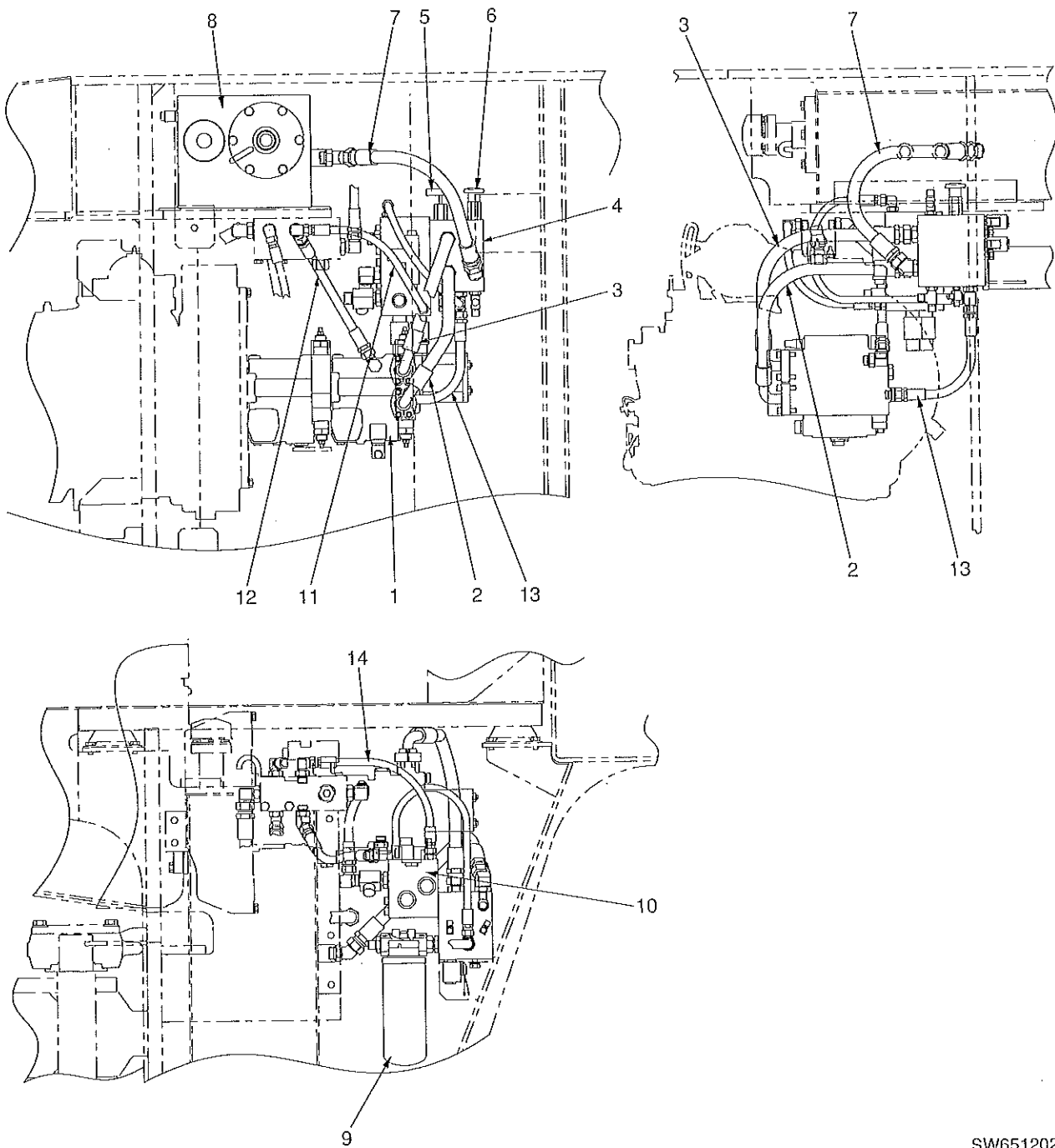
SW6512019

1. Port A
2. Port B
3. Output shaft
4. Drain port
4. Drain port

Specifications

- Model : A10EM23
- Displacement : 23.5cm³/rev(cc/rev)
- Circuit set pressure : 32.5MPa (4714psi) {332kgf/cm²}

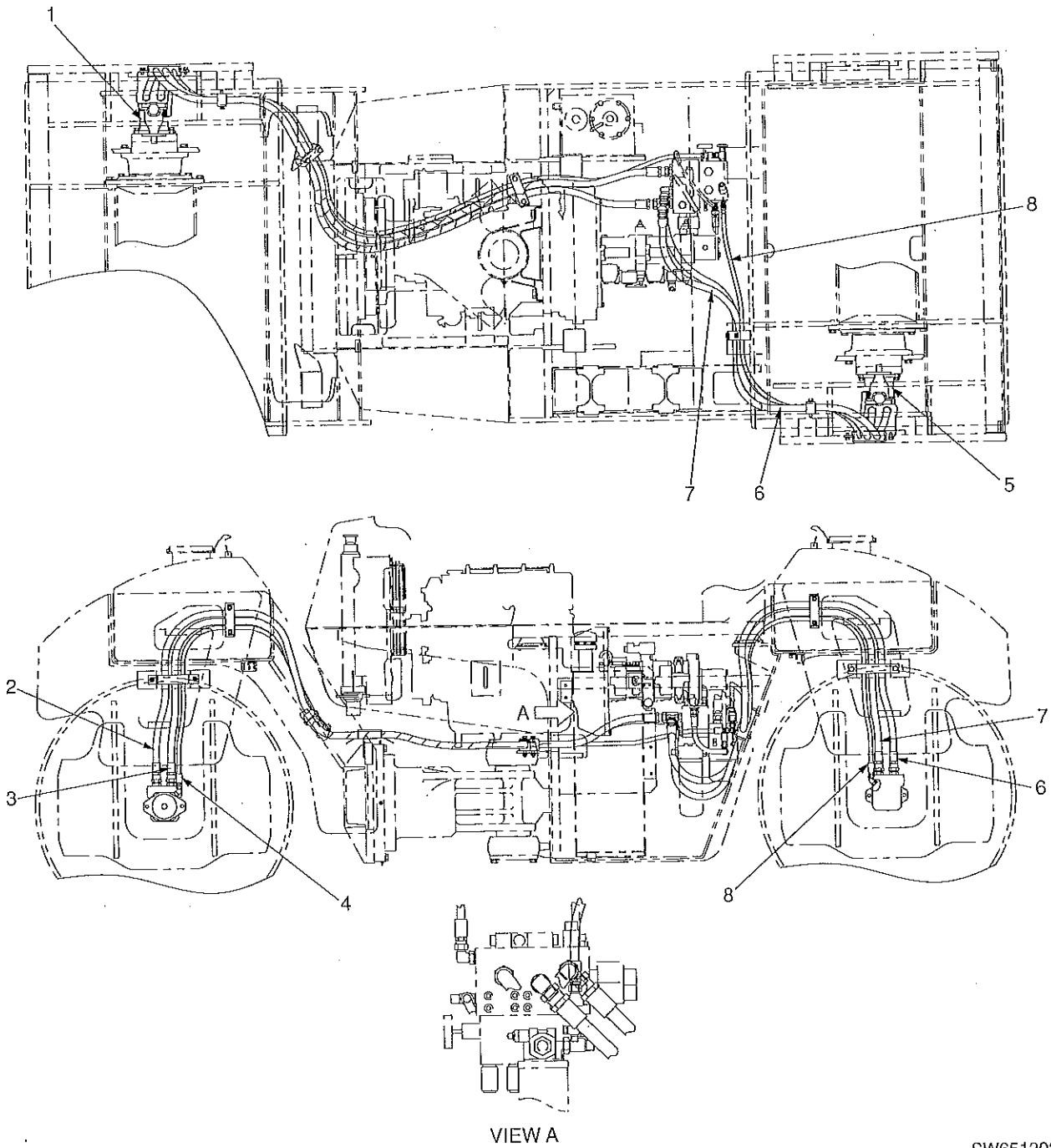
2-3-2. Hydraulic piping [I]



SW6512020

- | | |
|---|------------------------------------|
| 1. Vibrator drive pump | 8. Hydraulic oil tank |
| 2. High-pressure hose (port B2 of pump) | 9. Line filter |
| 3. High-pressure hose (port A2 of pump) | 10. Valve (for amplitude control) |
| 4. Block | 11. Hose (drain) |
| 5. Stop valve | 12. Hose (drain) |
| 6. Hand pump (for releasing brake) | 13. Hose (drain) |
| 7. Hose (suction) | |

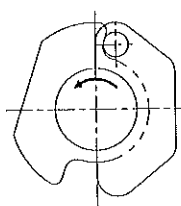
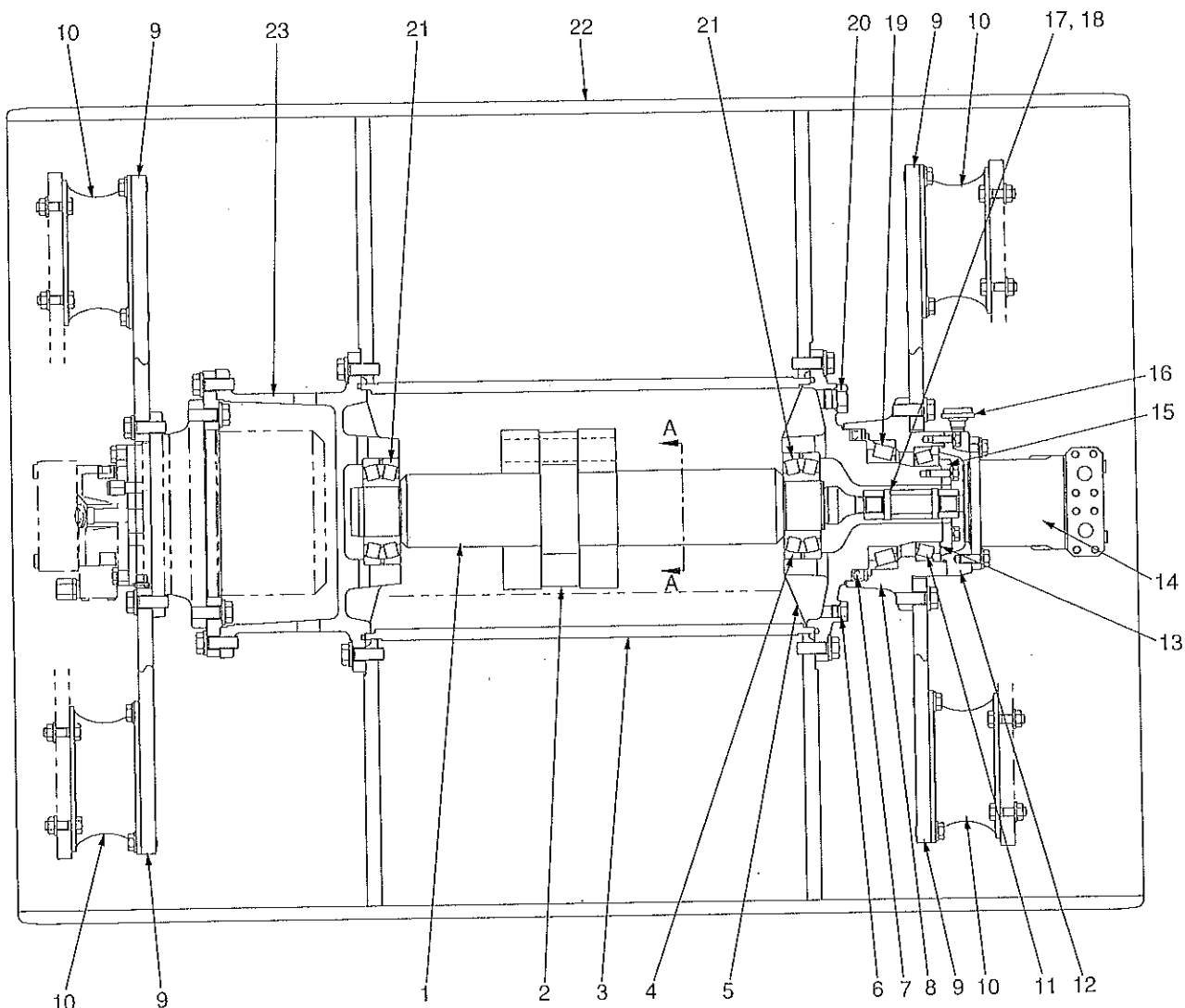
2-3-3. Hydraulic piping (II)



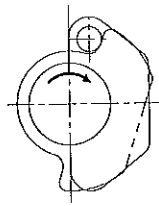
1. Vibrator motor (front)
2. High-pressure hose (port A of motor)
3. High-pressure hose (port AB of motor)
4. Hose (drain)
5. Vibrator motor (rear)
6. High-pressure hose (port A of motor)
7. High-pressure hose (port AB of motor)
8. Hose (drain)

SW6512021

2-3-4. Vibrator (SW651)



When rotating counter-clockwise
(amplitude: LOW)



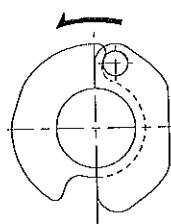
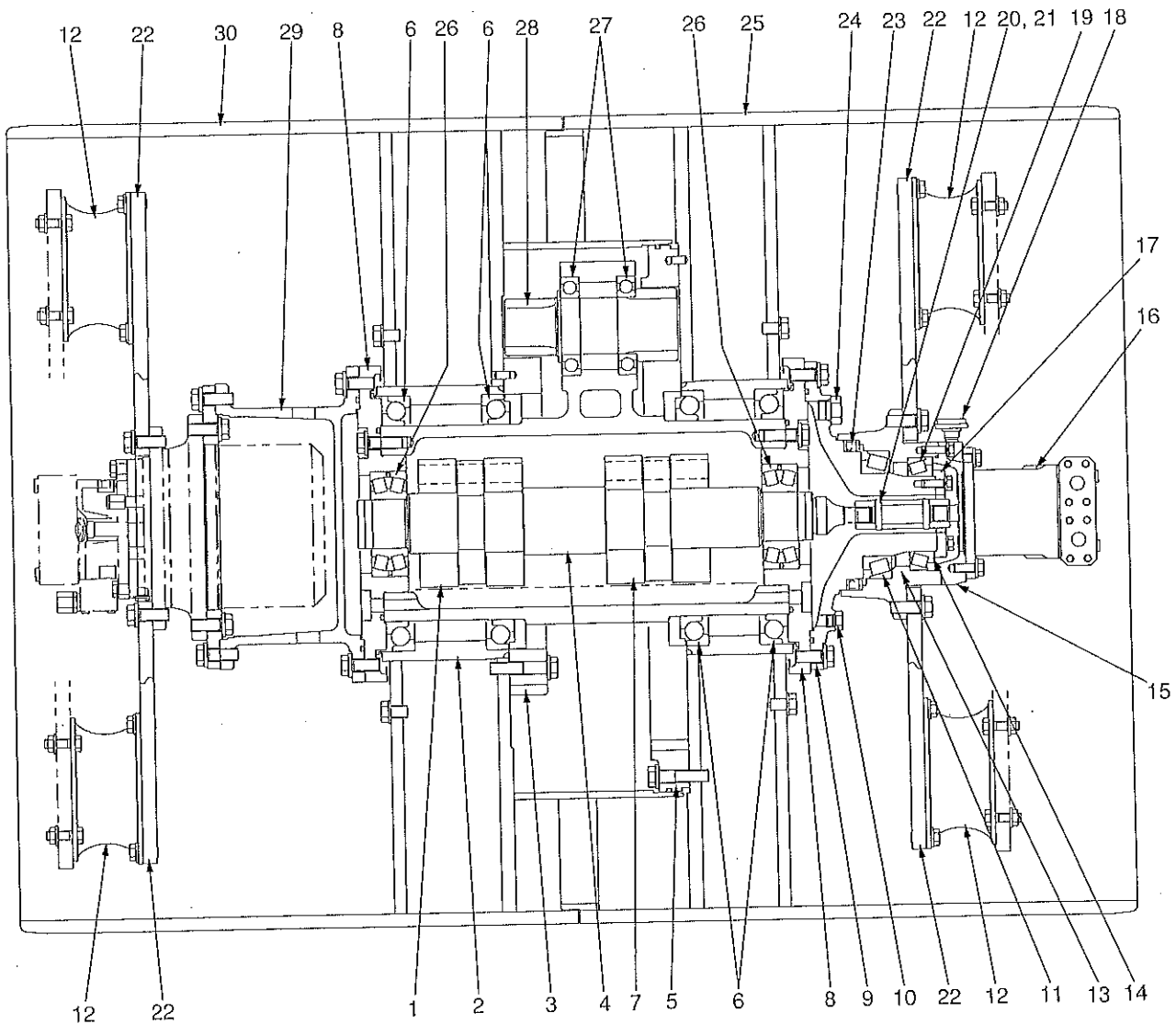
When rotating clockwise
(amplitude: HIGH)

SECTION A-A

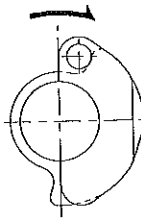
SW6512022

- | | | |
|-------------------------|--------------------------|--------------------------|
| 1. Vibrator shaft | 9. Disc | 17. Coupling |
| 2. Movable weight | 10. Damper | 18. Spring pin |
| 3. Case | 11. Taper roller bearing | 19. Taper roller bearing |
| 4. Taper roller bearing | 12. Flange | 20. Plug (fill) |
| 5. Axle shaft | 13. Shim | 21. Roller bearing |
| 6. Plug (drain) | 14. Vibrator motor | 22. Drum |
| 7. Oil seal | 15. Cover | 23. Propulsor motor |
| 8. Housing | 16. Breather | |

2-3-5. Vibrator (SW651B)



When rotating counter-clockwise
(amplitude: LOW)



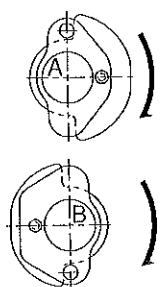
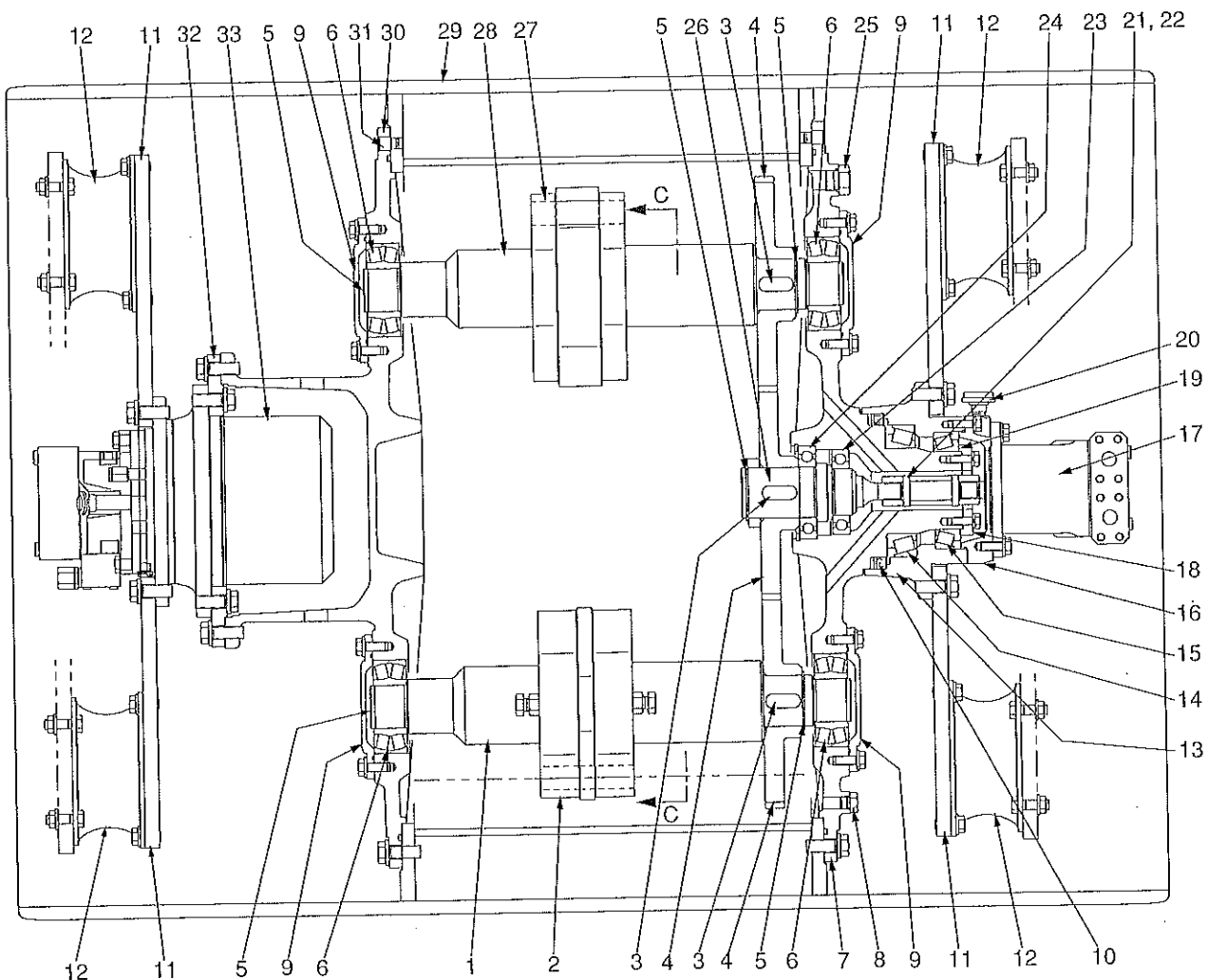
When rotating clockwise
(amplitude: HIGH)

SECTION A-A

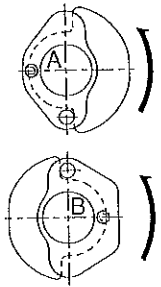
SW6512023

- | | | |
|------------------|--------------------------|----------------------|
| 1. Weight | 11. Taper roller bearing | 21. Spring pin |
| 2. Case | 12. Damper | 22. Disc |
| 3. External gear | 13. Housing | 23. Oil seal |
| 4. Shaft | 14. Shim | 24. Plug |
| 5. Internal gear | 15. Flange | 25. Drum |
| 6. Ball bearing | 16. Vibrator motor | 26. Roller bearing |
| 7. Weight | 17. Cover | 27. Ball bearing |
| 8. Disc | 18. Breather | 28. Shaft |
| 9. Axle shaft | 19. Taper roller bearing | 29. Propulsion motor |
| 10. Plug | 20. Coupling | 30. Drum |

2-3-6. Vibrator (SW651ND)



SECTION C-C
When weight is rotated clockwise
(horizontal vibration)



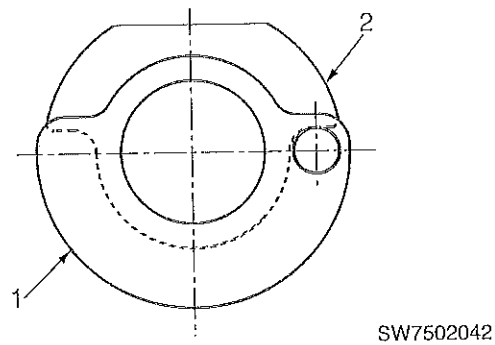
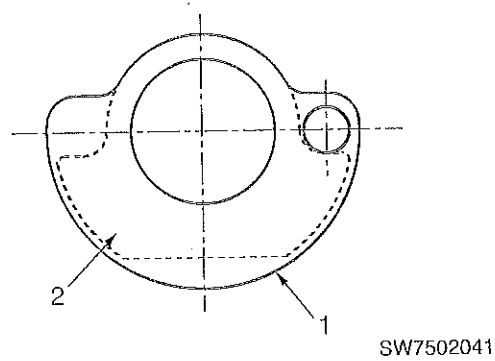
SECTION C-C
When weight is rotated counter-clockwise
(normal vibration)

SW6512024

- | | | | |
|-------------------|--------------------------|--------------------|----------------------|
| 1. Vibrator shaft | 10. Oil seal | 17. Vibrator motor | 26. Shaft |
| 2. Weight | 11. Disc | 18. Cover | 27. Weight |
| 3. Key | 12. Damper | 19. Shim | 28. Vibrator shaft |
| 4. Gear | 13. Housing | 20. Breather | 29. Drum |
| 5. Ring | 14. Taper roller bearing | 21. Coupling | 30. Housing |
| 6. Roller bearing | 15. Taper roller bearing | 22. Spring pin | 31. Pin |
| 7. Axle shaft | 16. Flange | 23. Ball bearing | 32. Disc |
| 8. Plug (drain) | | 24. Ball bearing | 33. Propulsion motor |
| 9. Cover | | 25. Plug (fill) | |

2-3-7. Vibration generating mechanism (SW651, SW651B)

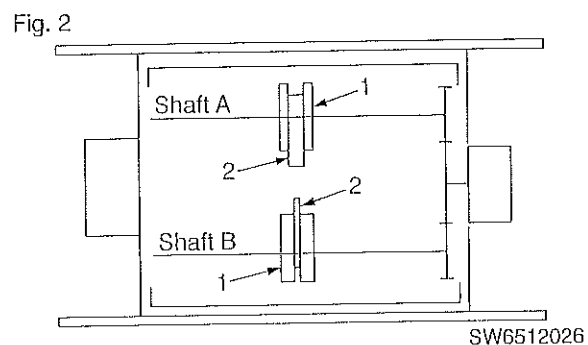
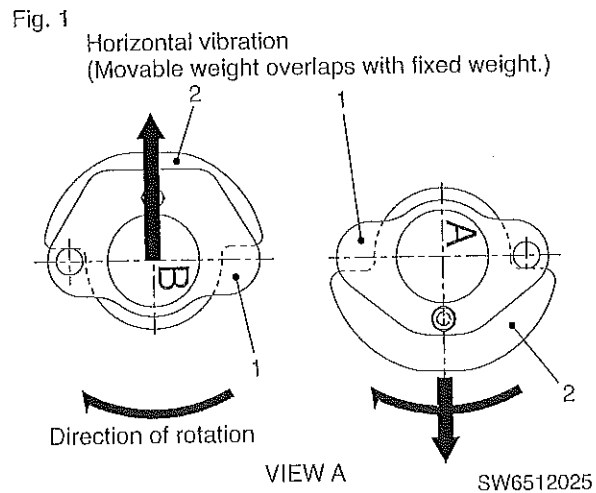
- It is constructed so that vibratory force varies when rotating clockwise and counter-clockwise viewed from the vibrator motor.
- The vibratory shaft has two kinds of masses; fixed mass (1) and movable ones (2).
- When the vibratory shaft rotates clockwise viewed from the vibrator motor, the relative position between the two kinds of masses is as shown in Fig.SW7502041. The centrifugal forces generated by the two kinds of masses act in the same direction. This gives bigger vibratory forces.
 - ◆ The lever in the HIGH position provides this bigger vibratory force.
- If the vibrator shaft rotates in the counter-clockwise direction, the two kinds of masses turn together with their relative location as illustrated in Fig.SW7502042. The centrifugal forces produced by the fixed mass and movable masses act in the reverse directions with each other. This creates smaller vibratory forces.
 - ◆ The lever set to the LOW position provides this smaller vibratory forces.



2-3-8. Mechanism for switching horizontal and normal vibration (SW651ND)

Construction:

- 2 sets of vibratory shaft have been fitted (refer to Fig. 1)
- 2 sets of shaft have been fitted in parallel and they rotate in synchronization with rotation of the roll simultaneously.
- Since 2 sets of shaft have been meshed by gears, mutual phases are not changed.
- The weight consists of fixed weight (1) and movable weight (2), and 2 kinds of weight rotate as follows:
 - ① When the shaft rotates clockwise viewed from the vibrator motor, the movable weight (2) overlaps with the fixed weight (1) for rotation by which the total mass of the two increases.
 - ② When the shaft rotates counter-clockwise viewed from the vibrator motor, the movable weight (2) shifts to the opposite side of the fixed weight (1) for rotation by which the total mass of the two decreases.



Operation:

On horizontal vibration

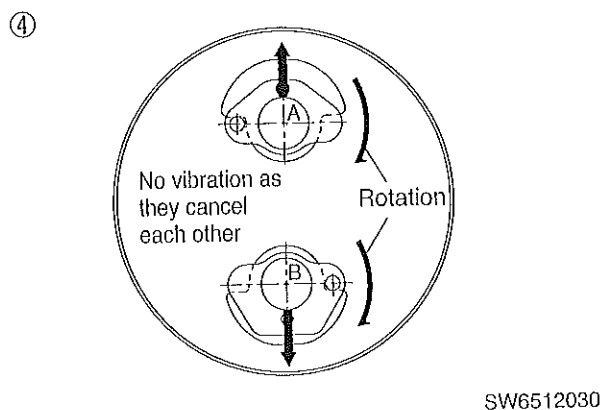
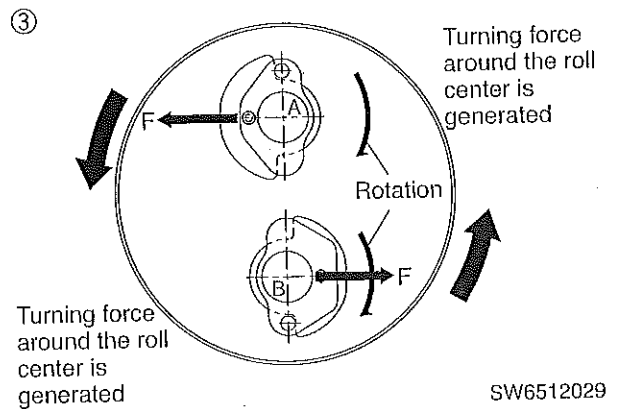
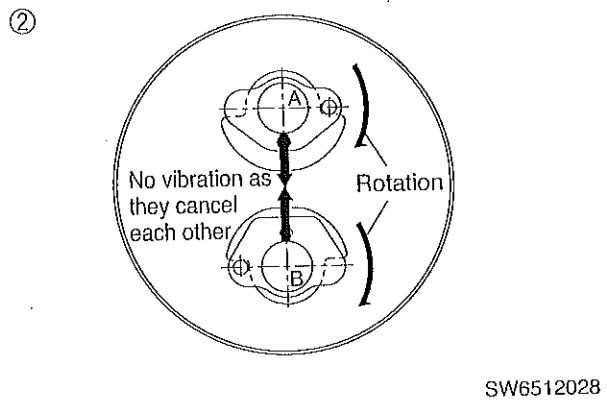
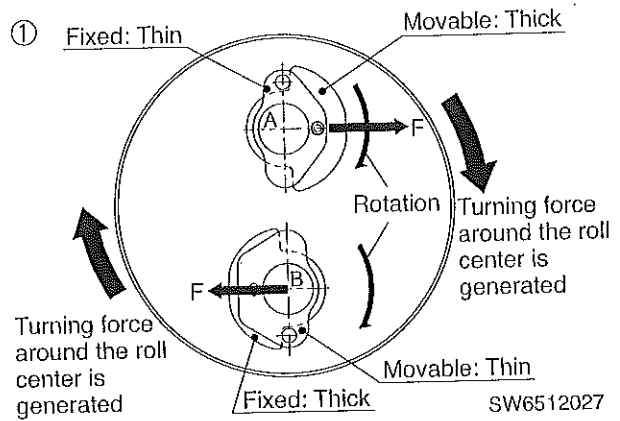
When the shaft rotates clockwise viewed from the vibrator motor:

- Since 2 sets of vibratory shaft rotate along with rotation of the roll to be combined in lateral direction, total mass increases. In vertical direction on the other hand, they cancel each other resulting the total mass becomes zero (0).
- Operation of [① through ④] in the figure on the right will be carried out at a single revolution of the shaft.

Shaft A and B have been designed so that the same centrifugal force (F) are to be generated.

Turning force around the roll center is generated by the centrifugal force (F) and the roll creates rotational vibration in the direction of circumference.

★ Horizontal vibration is generated by repetition of operation [① through ④] illustrated in the figure.



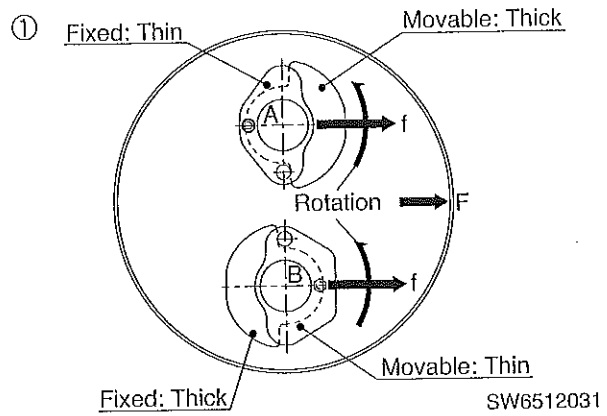
On normal vibration

When the shaft rotates counter-clockwise viewed from the vibrator motor:

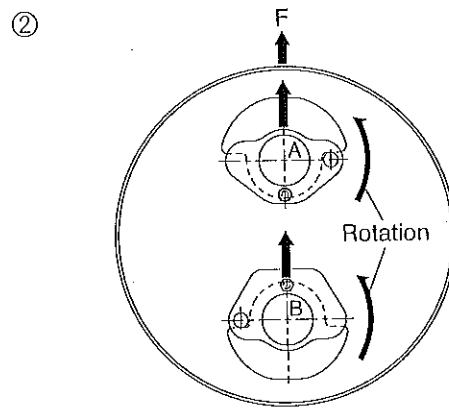
- Operation of [① through ④] in the figure on the right will be carried out at a single revolution of the shaft.
- Although the movable weight (2) shifts to the opposite side of the fixed weight (1) and mass of the fixed weight decreases, total mass increases as 2 sets of vibratory shaft rotate in the same direction by which vibratory force is generated in all circumference.

★ Vibration is generated in all circumference by repetition of operation [① through ④] illustrated in the figure.

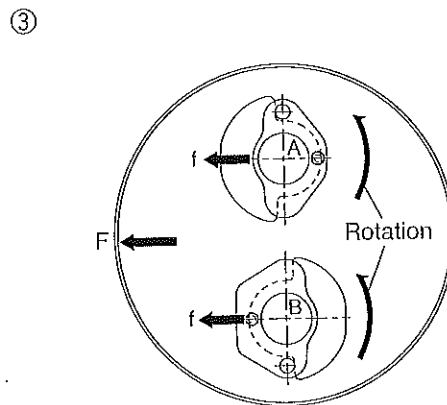
Fixed: Fixed weight
 Movable: Movable weight
 Thick: Thicker side of weight
 Thin: Thinner side of weight



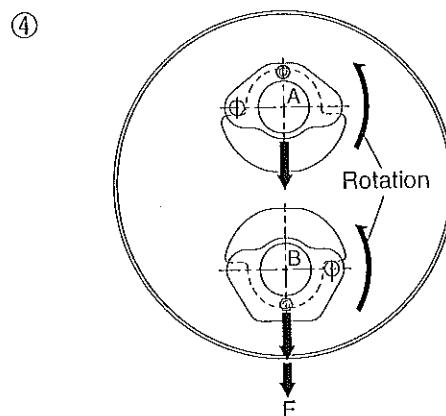
SW6512031



SW6512032

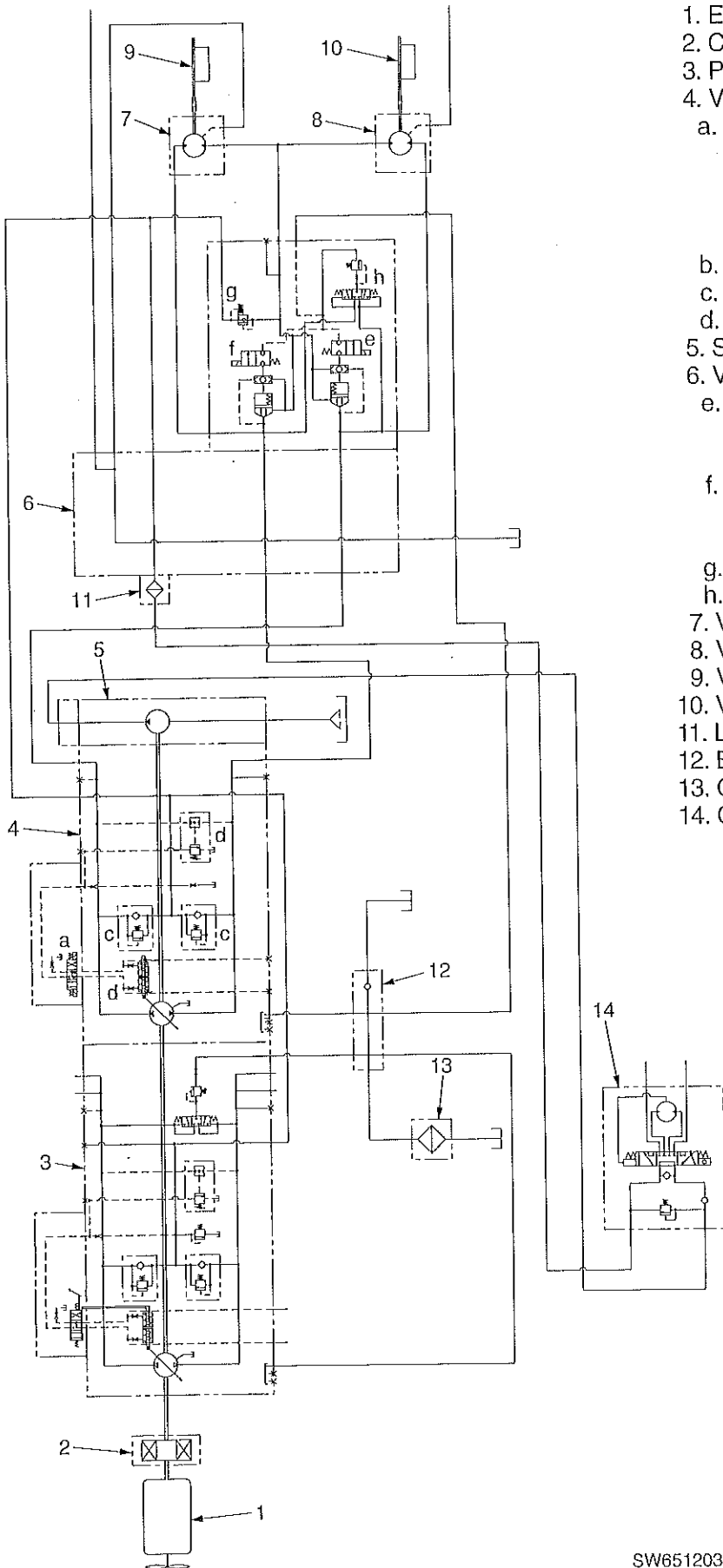


SW6512033



SW6512034

2-3-9. Vibrator circuit



1. Engine
2. Coupling
3. Propulsion pump
4. Vibrator drive pump
 - a. Vibration control solenoid valve
 - SW651, SW651B: Switching amplitude
 - SW651ND: Switching horizontal and normal vibration
 - b. Servo piston
 - c. Relief valve (safety)
 - d. Relief valve (main)
5. Steering pump
6. Vibration control valves
 - e. Solenoid valve for switching vibratory wheel (Used on front wheel vibration)
 - f. Solenoid valve for switching vibratory wheel (Used on rear wheel vibration)
 - g. Relief valve
 - h. Flushing valve
7. Vibrator motor (front)
8. Vibrator motor (rear)
9. Vibrator (front)
10. Vibrator (rear)
11. Line filter
12. Block (drain circuit)
13. Oil cooler
14. Orbitrol (steering valve)

2-3-10. Description and operation of vibrating system

Description

The vibrating system is made up of the vibrator drive pump (4), the vibration control valves (6), the front vibrator motor (7), the front vibrator (9), the rear vibrator motor (8), the rear vibrator (10), the vibration control solenoid valve (a) is built in the vibrator drive pump (4), and the solenoid valves (e), (f), for switching vibratory wheel, the relief valve (g), and the flushing valve (h) are built in the vibration control valves (6).

Basic function of vibrator drive pump and vibrator motor

• Vibrator drive pump

A piston pump is used in the vibrator drive pump.

Discharge port of the pump is reversed by energizing the vibration control solenoid valve (a) or (b) allowing the amplitude to be switched in three levels, Lo-Neutral-Hi.

★ Horizontal to and from normal vibration is switched for model SW651ND.

• Vibrator motor

A fixed displacement piston motor is used in the vibrator motor whose displacement per rotation will not be changed.

Operation

By changing discharge port of the pump, vibration is to be switched as follows:

• When discharging from port [B2] of the pump:

- ◆ SW651, SW651B: Amplitude is switched to "Lo".
- ◆ SW651ND: Vibration is switched to "Normal".

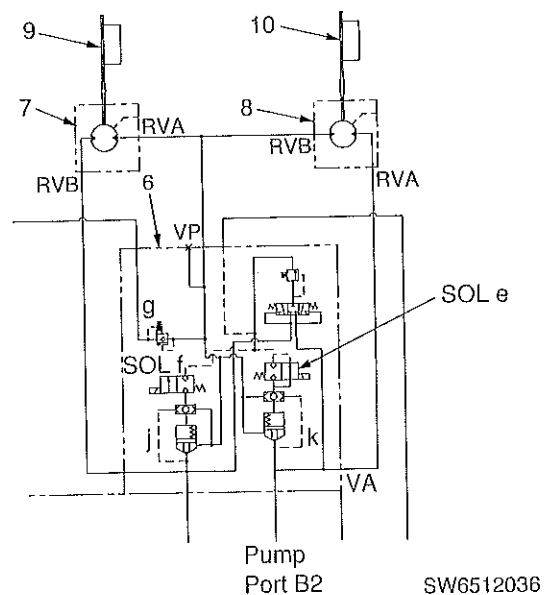
• When discharging from port [A2] of the pump:

- ◆ SW651, SW651B: Amplitude is switched to "Hi".
- ◆ SW651ND: Vibration is switched to "Horizontal".

Switching vibratory wheel

Control of a solenoid in the vibration control valves (6) allows the vibratory wheel to be switched as follows:

- 1) When vibrating both front and rear wheels:
Not energize the solenoid valves (e) and (f) for switching vibratory wheel.
- 2) When vibrating only front wheel:
Energize the solenoid valve (e) only.
- 3) When vibrating only rear wheel:
Energize the solenoid valve (f) only.



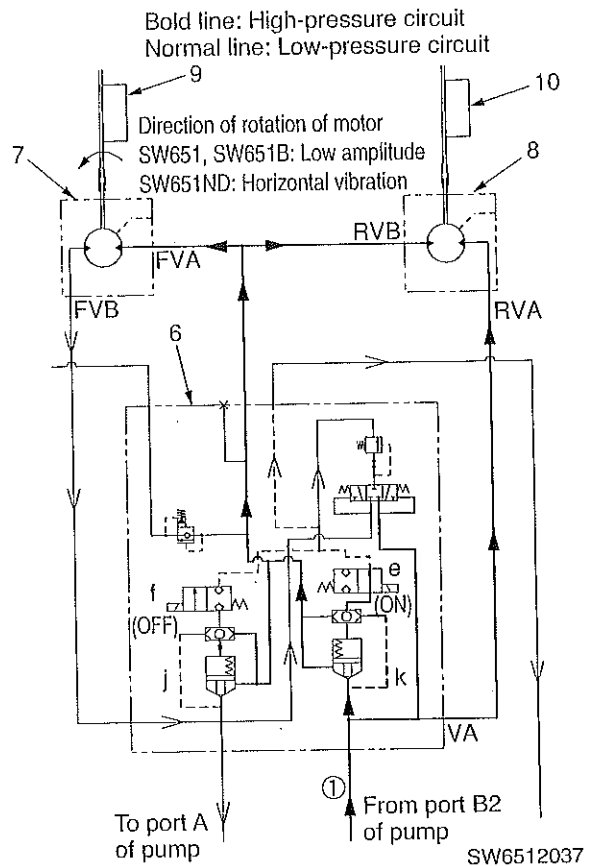
Oil flow when switching vibratory wheel

- It is explained by assuming that oil is discharged from port [B2].

Vibrating front wheel only:

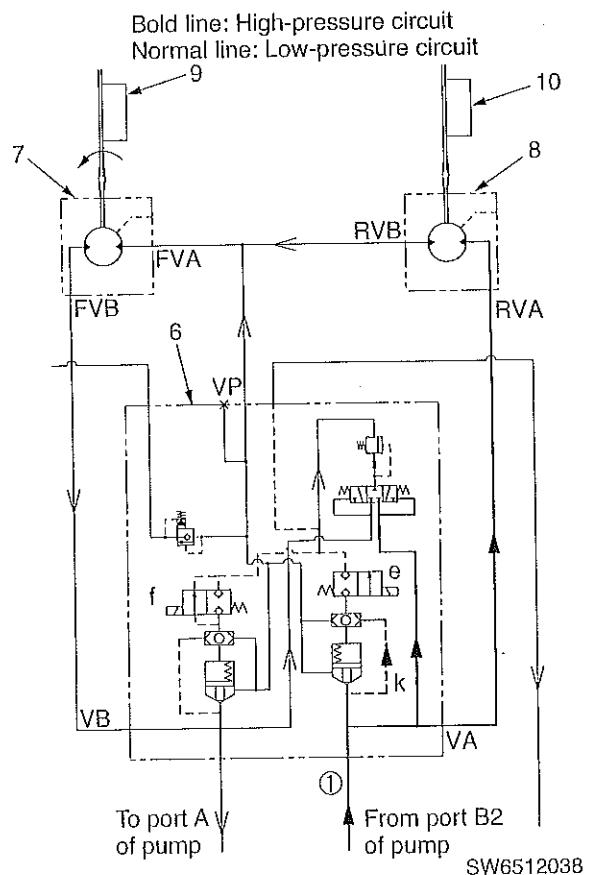
Energize the solenoid valve (e).

- ◆ SW651, SW651B: Amplitude is switched to "Lo".
- ◆ SW651ND: Vibration is switched to "Normal".
- Oil entered in the port ① of valve for switching vibratory wheel flows from the port VA into the port RVA of rear wheel motor.
- On the other hand, oil passes through the valve (j) and flows out of the port VP to act on the ports FVA and RVA of the motor by energizing the solenoid valve (e).
- Since the ports FVA and RVA of the rear motor are of the same pressure, the rear wheel motor will not be rotated so that the front motor only rotates (front wheel vibrates).



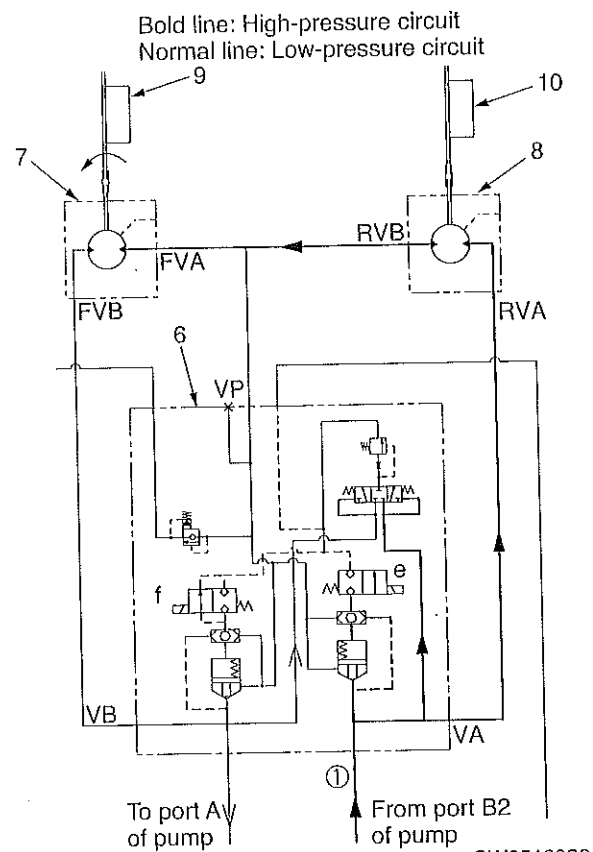
Vibrating rear wheel only:

- Energize the solenoid valve (f).
- Oil entered in the port ① of valve for switching vibratory wheel (flows from the port VA into the port RVA of rear wheel motor.
- On the other hand, energizing the solenoid valve (f) allows not only the valve (j) but also the port VP to be turned in low pressure circuit and oil flows from the port RVA, RVB, FVB, and to VB in this order so that the rear motor only rotates (rear wheel vibrates).



Vibrating both front and rear wheels:

- Both solenoid valves (e) and (f) are not energized.
- Oil entered in the port ① of valve for switching vibratory wheel flows from the port VA into the port RVA of rear wheel motor.
- Since the solenoid valve (e) is not energized, rear wheel and front wheel are connected in series and oil flows from the port RVA, RVB, FVA, FVB, and to VB in this order so that both front and rear motors rotate (front and rear wheels vibrate).
- ◆ In case where oil is discharged from the port A2 of pump, oil flows in reverse order of that illustrated above.



Pressure adjustment in circuit

Relief valve in vibrator drive pump

- The high-pressure relief valve (c) is fitted in the vibrator drive pump (4) to protect the circuit by relieving the circuit pressure when it reaches the set pressure for the valve.
- The cut-off valve (d) is also fitted in the circuit which actuates after the high-pressure relief valve (c) when an abrupt heavy load is applied allowing to control inclination angle of the pump (or reducing discharge of pump), thus protecting the circuit.

★ This is to prevent the high-pressure relief valve (c) from generation of heat in case where the valve keeps on relieving pressure.

Relief & suction valve in the valve for switching vibratory wheel

• Function as relief valve

When something is wrong with the rotation of vibrator motor, it operates to protect the circuit.

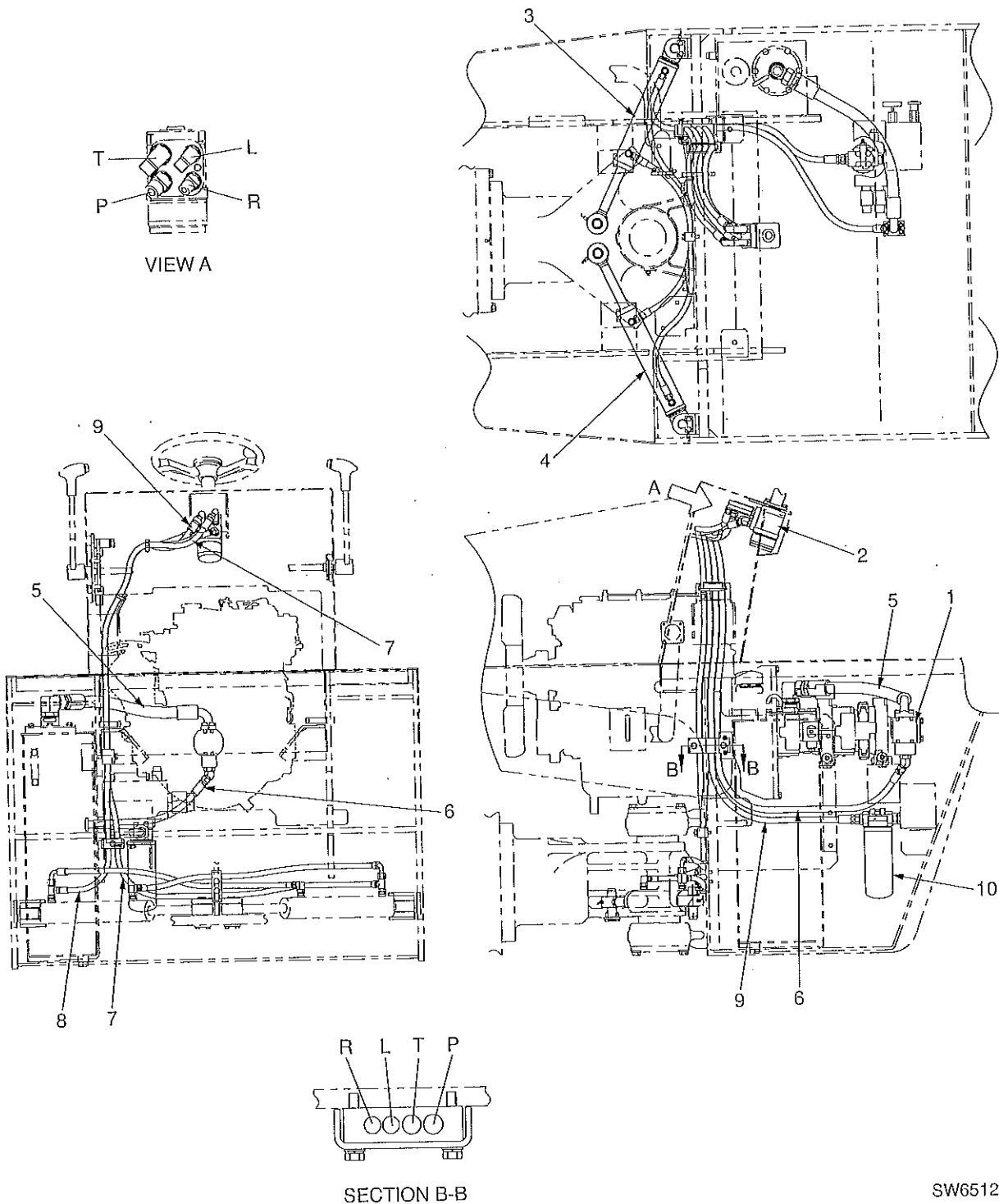
• Function as relief valve

It operates as a suction valve when the vibration motor has stopped.

★ It prevent the motor circuit from becoming negative pressure as the suction valve has sucked the oil up from the charge circuit.

2-4. Steering system

2-4-1. Steering piping

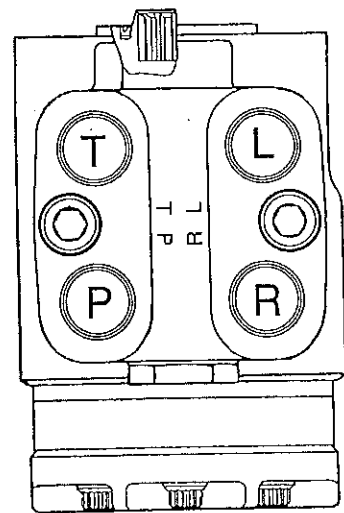
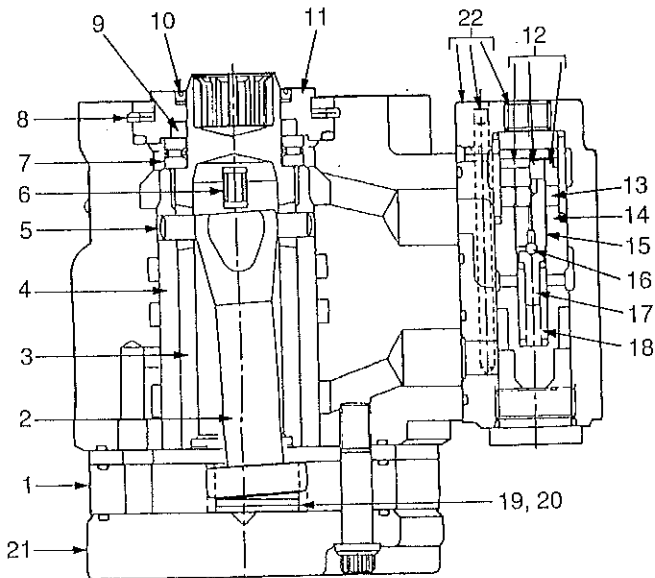
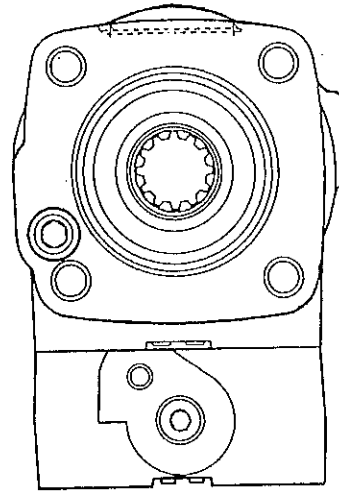


1. Steering pump
2. Steering valve (Orbitrol)
3. Steering cylinder (right)
4. Steering cylinder (left)
5. Suction hose

6. Discharge hose
7. High pressure hose (right turn)
8. High pressure hose (left turn)
9. Hose (charge circuit)
10. Line filter (charge circuit)

SW6512040

2-4-2. Steering valve (Orbitrol)



SW6512041

- | | |
|---------------------|------------------------|
| 1. Geroler set | 12. Filter sub ass'y |
| 2. Drive | 13. Lock nut |
| 3. Spool | 14. Spool |
| 4. Sleeve | 15. Valve seat |
| 5. Pin | 16. Ball |
| 6. Centering spring | 17. Ball guide |
| 7. Thrust needle | 18. Inner valve spring |
| 8. Retaining ring | 19. Spacer |
| 9. Oil seal | 20. Spacer |
| 10. Dust seal | 21. End cap |
| 11. Seal gland bush | 22. Housing ass'y |

Specifications

- Valve system : Open center non-load reaction
- Displacement : 184cm³/rev (cc/rev)
- Relief valve setting : 15.2 MPa (220psi) {155 kgf/cm²}

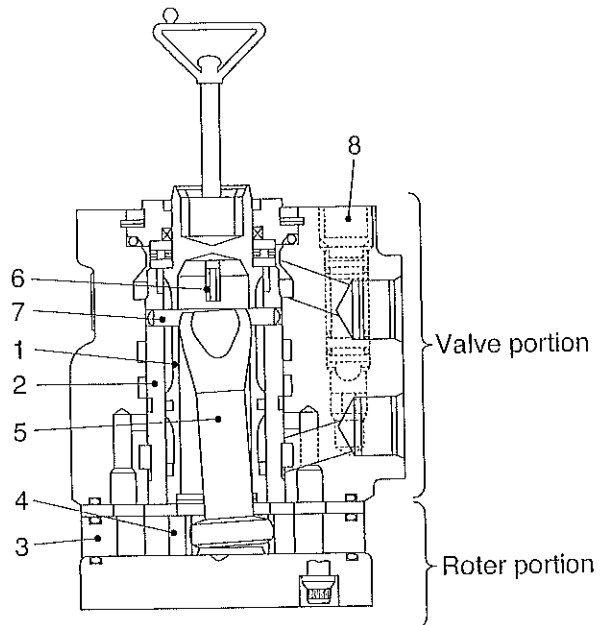
2-4-3. Description and operation of Orbitrol

Orbitrol is of load sensing type in which oil from the pump is fed into the steering cylinder in proportion to the speed at which the steering wheel is rotated.

Structure

* Valve portion

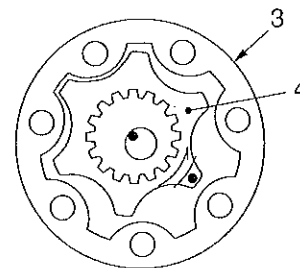
- The valve portion is a rotary direction control valve made up of spool (1) and sleeve (2). The steering wheel is spline fitted to spool (1).
- When the steering wheel is stationary (not rotated), spool (1) and sleeve (2) stay in the neutral position due to center spring (6) with the oil grooves in spool (1) not aligned with oil ports in sleeve (2). Oil flow to the steering cylinder is blocked.
- When the steering wheel is rotated, the circuits to the steering cylinder are opened with the oil grooves in spool (1) communicating with the oil ports in sleeve (2). Oil is fed into the steering cylinder.



SV4002042

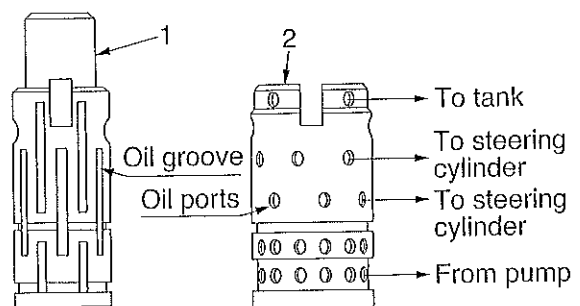
* Rotor portion

- A kind of inscribed gear. When the valve (mechanism consisting of spool and sleeve) is open, it acts as a hydraulic motor.
- Rotary motion of rotor (4) is delivered to the valve portion through drive shaft (5). The opening of the valve is controlled by the speed of the steering wheel rotation.



SV4002043

- | | |
|-----------|---------------------|
| 1. Spool | 5. Drive shaft |
| 2. Sleeve | 6. Centering spring |
| 3. Stator | 7. Cross pin |
| 4. Rotor | 8. Check valve |



SV4002044

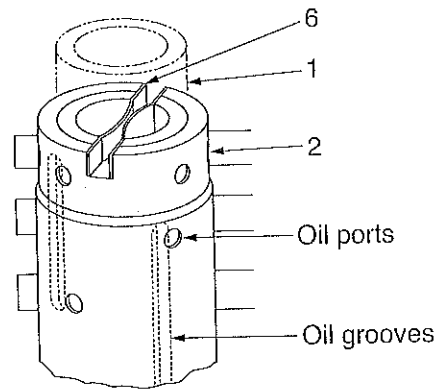
Operation

*** Neutral (Steering wheel is stationary)**

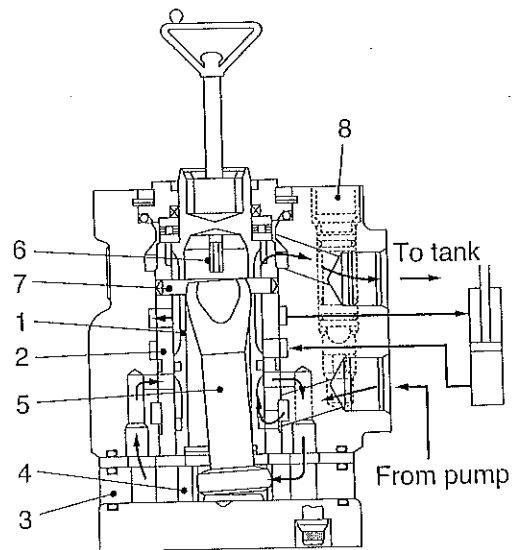
- Spool (1) and sleeve (2) have a slot into which centering spring (6) consisting of a set of plate springs is assembled.
- When the steering wheel is stationary, centering spring (6) keeps spool (1) and sleeve (2) in the neutral position.
- * This steering valve (Orbitrol) is of a load sensing, non-load reaction and normal-closed type. In the neutral position, the oil grooves in the spool do not lead to the oil holes in the sleeve to shut off the oil flow to the steering cylinder.

*** When making turns (Steering wheel is operated)**

- * In neutral, the oil ports in the valve portion are all closed. Oil in the rotor is trapped to keep the rotor in a fixed condition. Sleeve (2) connects to rotor (4) through cross pin (7) and drive shaft (5) and is also in a fixed condition.
- When the steering wheel starts rotating, rotating effort is conveyed to spool (1), pressing centering spring (6) assembled in the slot. This aligns the oil groove in spool (1) with the oil ports in sleeve (2) to open the hydraulic circuits.
- As a result, the whole four ports (to pump, tank and cylinders) open to let oil flow. Rotor (4) rotates.

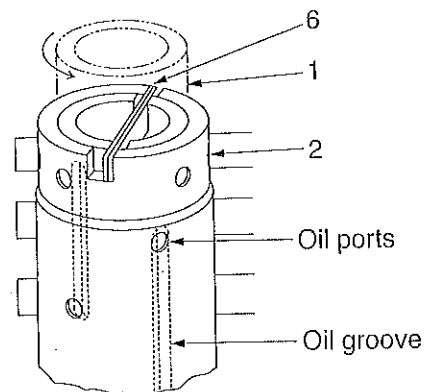


SV4002045



SV4002046

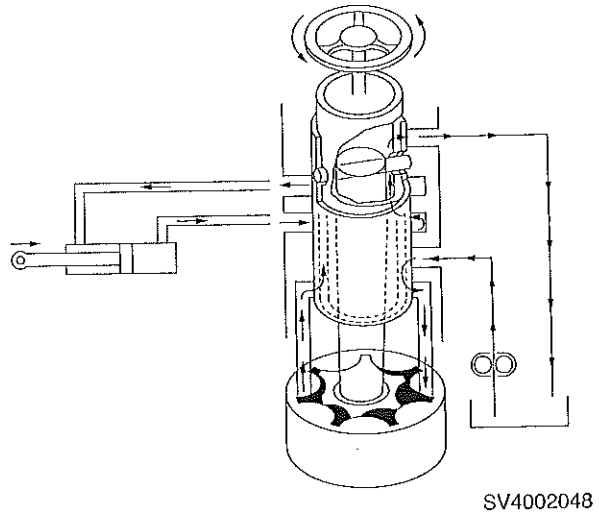
- | | |
|-----------|---------------------|
| 1. Spool | 5. Drive shaft |
| 2. Sleeve | 6. Centering spring |
| 3. Stator | 7. Cross pin |
| 4. Rotor | 8. Check valve |



SV4002047

Function of feedback mechanism

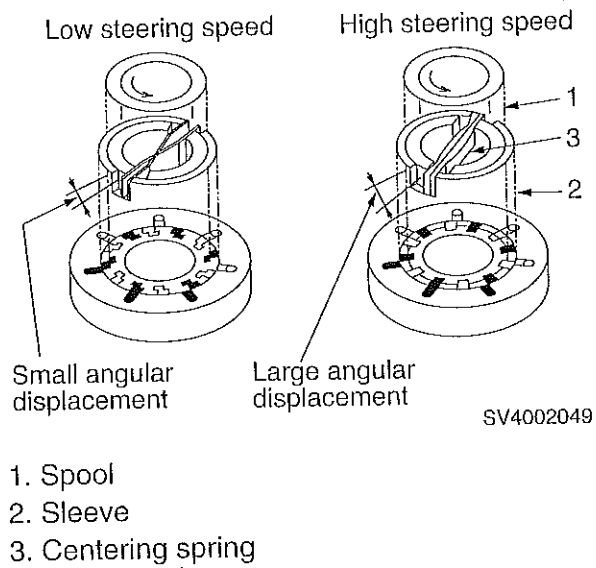
- By the operation of the steering wheel, the sleeve slightly rotates around the spool due to the centering spring. Oil flow from the pump gets into the steering valve (Orbitrol) and turns the rotor. Oil is displaced from the rotor and fed into the steering cylinders.
- As a result, the sleeve starts rotating after a short delay following the spool movement. This makes the spool turn continuously. The steering wheel is able to rotate and the machine continues to make a turn.
- Stopping the rotation of the steering wheel stops the rotation of the spool instantly. However, as long as there is a deviation in position in rotating direction between the spool and sleeve, oil continues to flow into Orbitrol. The rotor continues rotation. This rotation makes sleeve to restore the neutral position in which oil ports are blocked. Finally, the centering spring returns the spool and sleeve to the perfect neutral position to block the oil flow.



Steering wheel rotating speed and flow control

* In the steering mechanism, flow rate of oil into the steering cylinders depends on the rotating speed of the steering wheel.

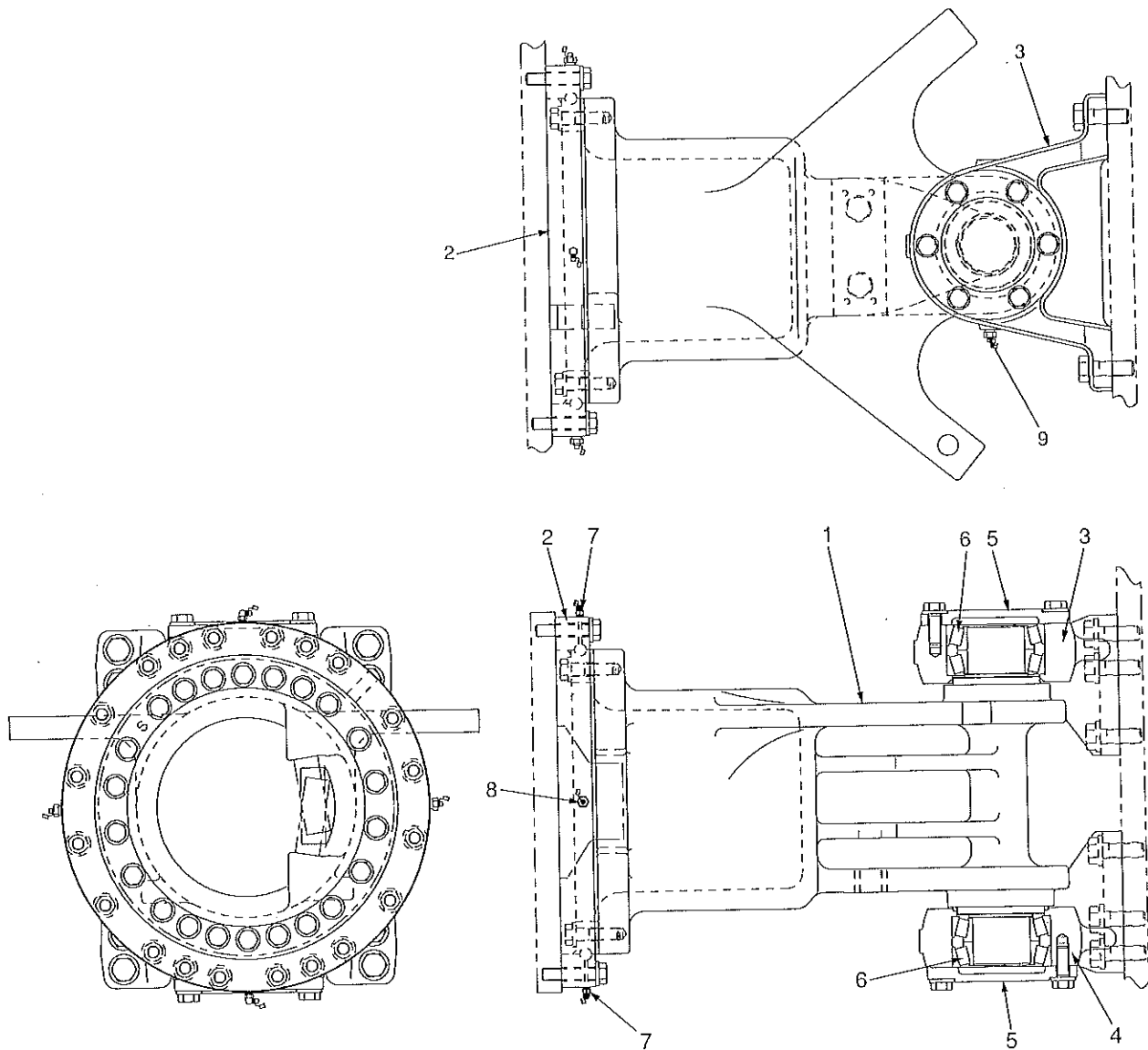
- The steering valve (Orbitrol) controls oil flow by varying the angular displacement. While the steering wheel is being rotated, sleeve (2) chases the rotation of spool (1) to close the oil ports.
- With increasing speed of the steering wheel rotation, the angular displacement between the spool and sleeve increases. Flow increases.



Pump flow and force to operate the steering wheel

- With sufficient pump flow, force required to operate the steering wheel is equal to sliding resistance of sleeve (2) and rotor. The steering wheel is very light to rotate.
- If the pump flow is insufficient, the angular displacement between the spool and sleeve is at maximum. In spite of wide opening of oil ports, flow from the pump to the rotor is small. The rotor rotates slowly.
- This makes spool rotating speed greater than rotor speed to provide maximum angular displacement. The spool rotates the rotor via the cross pin and drive shaft. At this time, the rotor acts as a hydraulic pump. The steering wheel is heavy to rotate.

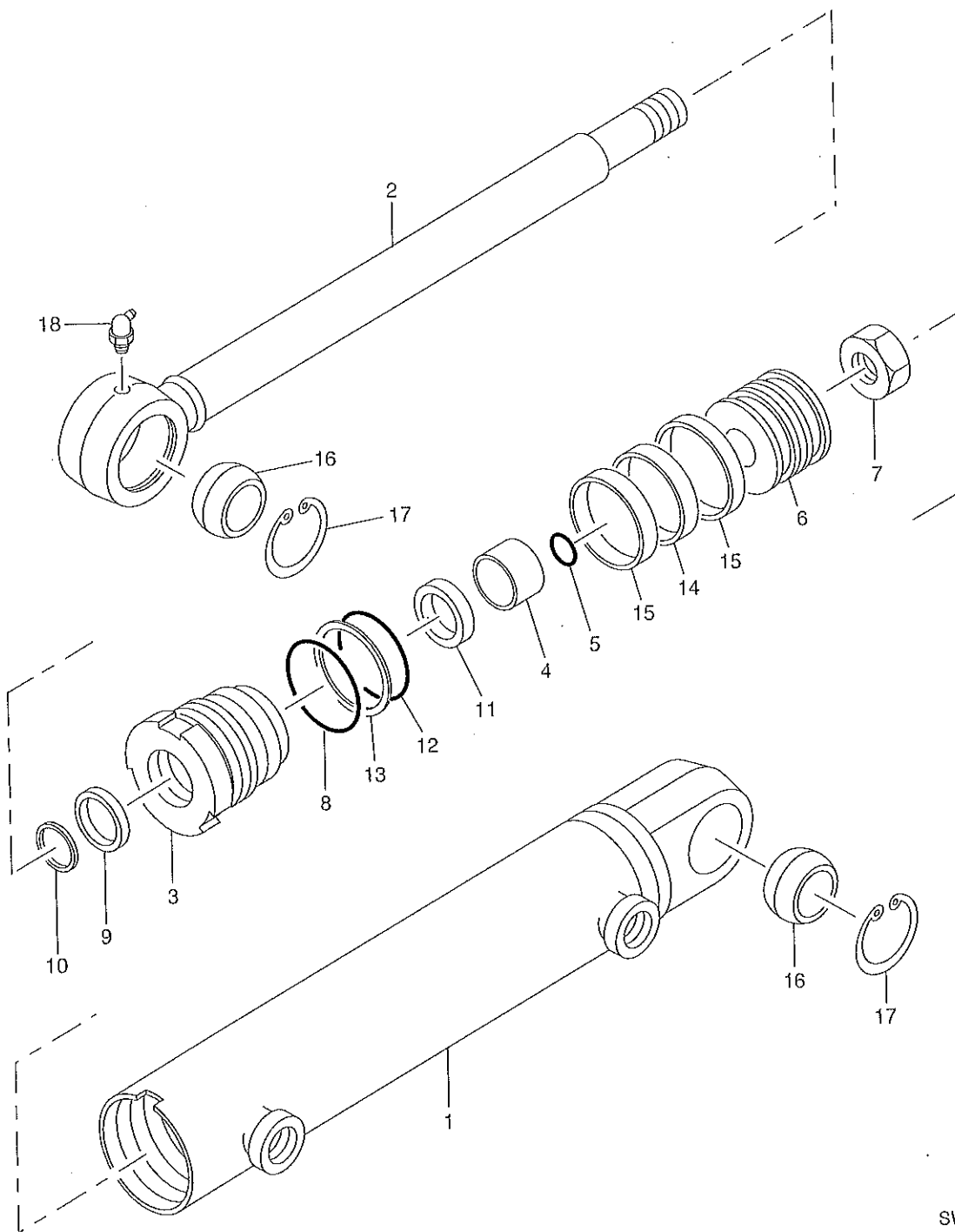
2-4-4. Frame (center pin)



SW6512042

- | | |
|--------------------|-------------------|
| 1. Yoke | 6. Roller bearing |
| 2. Bracket | 7. Grease nipple |
| 3. Bracket (upper) | 8. Grease nipple |
| 4. Bracket (lower) | 9. Grease nipple |
| 5. Cover | |

2-4-5. Steering cylinder

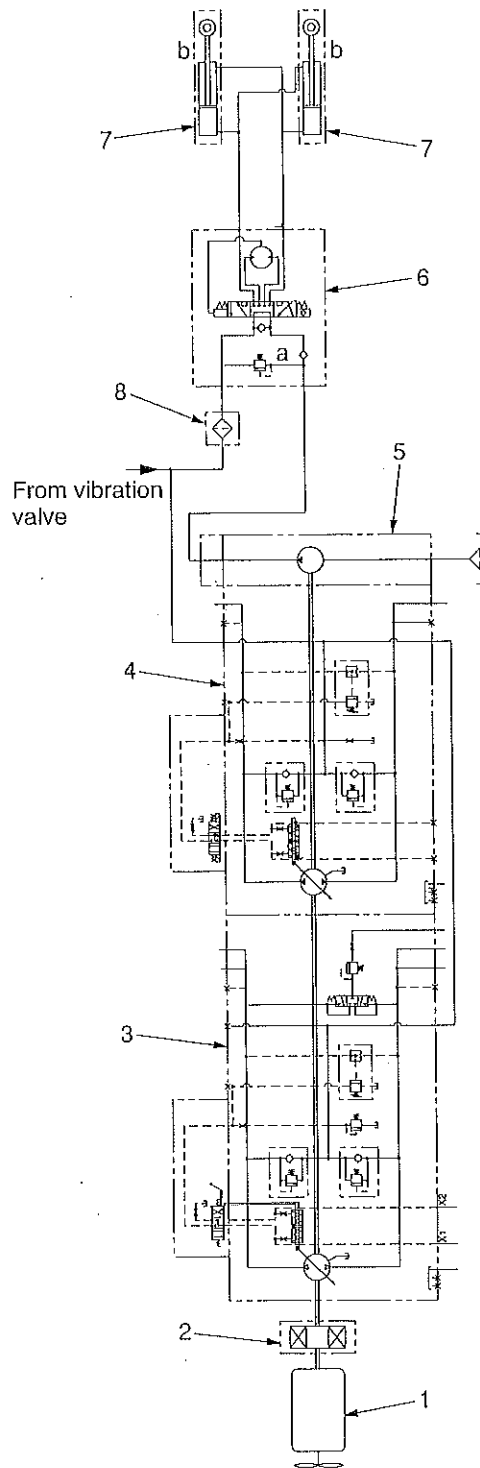


SW6512043

- | | | |
|---------------|---------------|-----------------------|
| 1. Cylinder | 7. Nut | 13. Back-up ring |
| 2. Piston rod | 8. O-ring | 14. Slipper seal |
| 3. End cap | 9. Dust wiper | 15. Wear ring |
| 4. Bush | 10. Stopper | 16. Spherical bearing |
| 5. O-ring | 11. Packing | 17. Lock ring |
| 6. Piston | 12. O-ring | 18. Grease fitting |

2-4-6. Steering circuit

- 1. Engine
- 2. Coupling
- 3. Propulsion pump
- 4. Vibrator pump
- 5. Steering pump
- a. Relief valve
- 6. Orbitrol
- 7. Steering cylinder
- b. Piston rod
- 8. Line filter (charge circuit)



SW6512044

2-4-7. Description and operation of steering circuit

Description

- The steering system is made up of the steering pump (5), the orbitrol (6), the steering cylinder (7), and the line filter (8).
The relief valve (a) is built in the orbitrol (6).

Operation

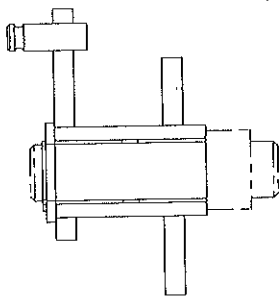
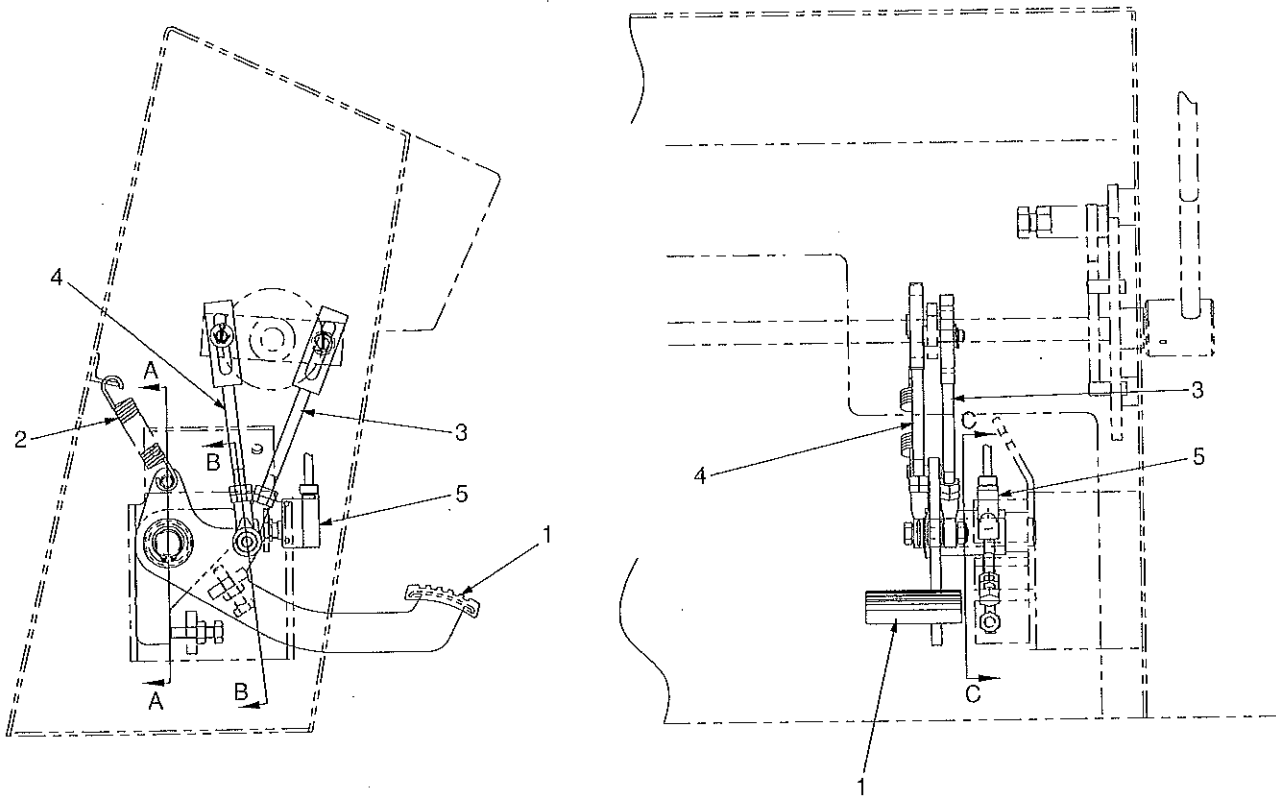
- Oil from pump (5) enters orbitrol (6). The valve feeds an amount of oil to steering cylinders (7). The amount of oil handled varies with the direction in which the steering wheel is rotated and with the speed at which the steering wheel is turned.
- The fluid fed into both steering cylinders (7) moves the piston rods (b) to achieve steering. The oil displaced from the opposite side of the pistons flows, through orbitrol (6) and line filter (8), to the charge circuit for propulsion and vibration.

★ Refer to "Charge circuit" under "Description and operation of propulsion system".

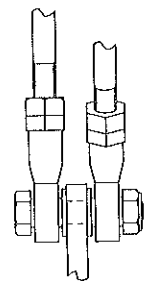
- Relief valve (a) built in orbitrol (6) opens to relieve the pressure if the system pressure exceeds the setting of the relief valve, thus protecting the circuit.

3. Brake System

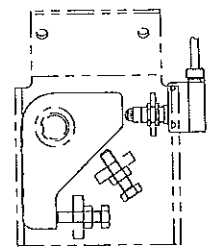
3-1. Brake system (brake pedal)



SECTION A-A



SECTION B-B



SECTION C-C

SW6512045

- 1. Brake pedal
- 2. Return spring
- 3. Rod (for neutral position of F-R lever)
- 4. Rod (for neutral position of F-R lever)
- 5. Stop lamp switch

3-2. Description and operation of brake circuit

Description:

- Consists of brake pedal (1), foot brake switch (brake release switch) (5), F-R lever (6), return-to-neutral rods (3), (4), parking brake switch (9), brake release solenoid (10) and parking brakes (negative brakes) (11), (12).

Operation:

Parking brake switch set to position PARKING:

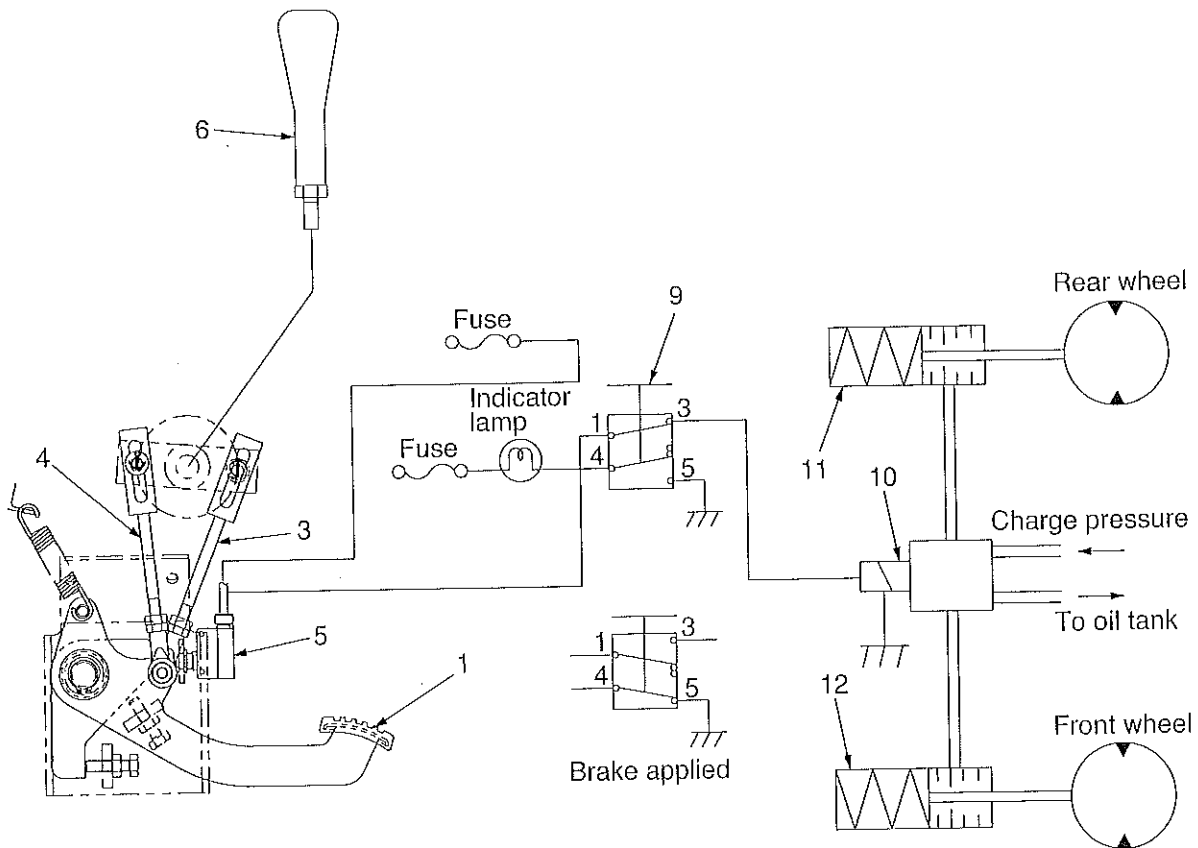
- The contacts in parking brake switch (9) open the brake release solenoid (10) circuit and close the indicator lamp (on monitor display) circuit.
- The indicator lamp comes on. The parking brakes (11) and (12) are applied.
- ★ The parking brake solenoid is deenergized.

Parking brake switch set to position RELEASE:

- The contacts in parking brake switch (9) close the circuit of brake release solenoid (10) and open the indicator lamp circuit.
- The indicator lamp comes off. The parking brakes (11) and (12) are disengaged.
- ★ The parking brake solenoid is energized.

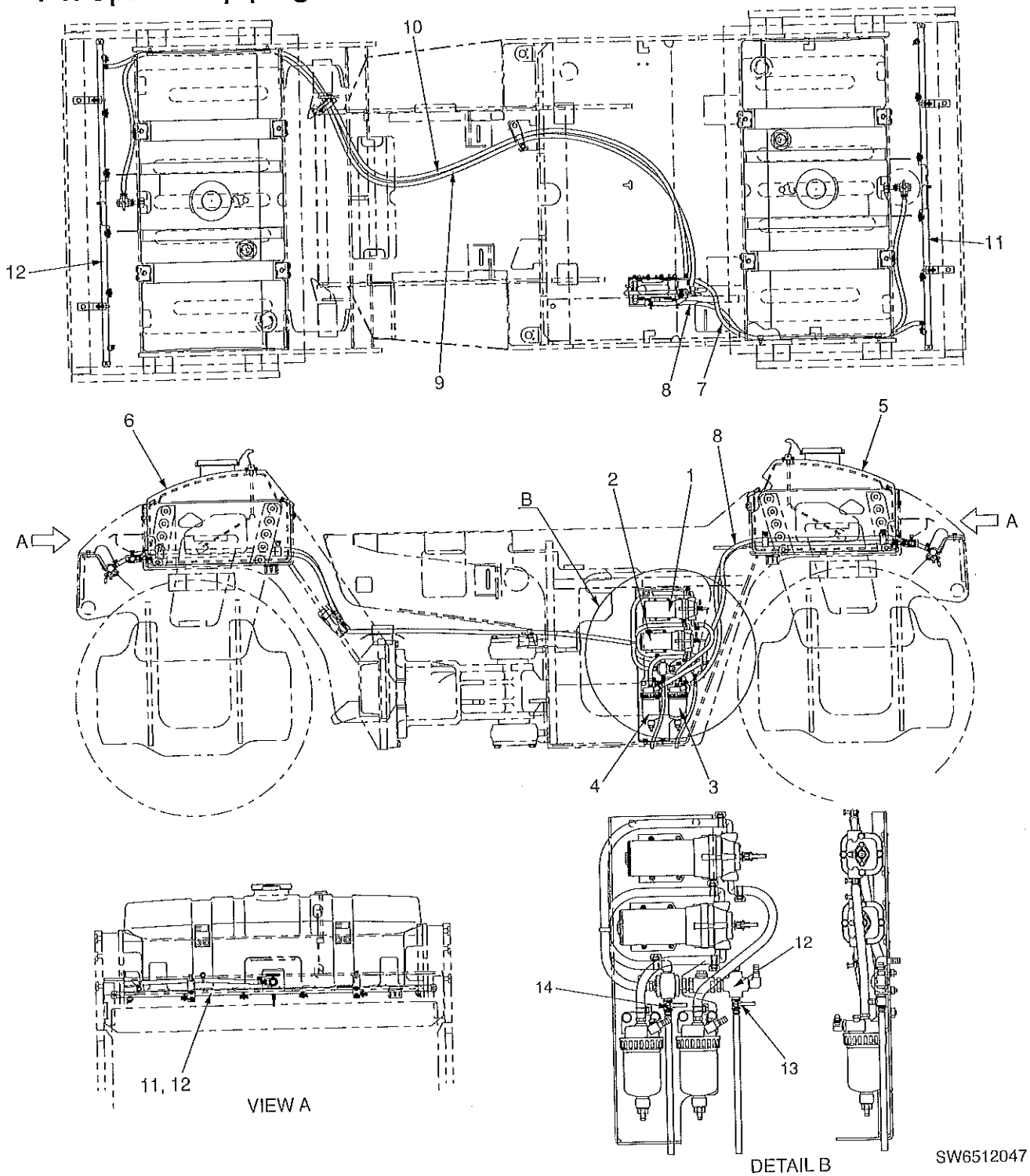
Braking in an emergency:

- Pushing down on the brake pedal as far as it will go breaks the contact in foot brake switch (brake release switch) (5), opening the parking brake solenoid circuit. At the same time, the pedal movement moves either of rods (3), (4) to bring F-R lever (6) to the neutral position.
- The parking brake solenoid is deenergized to apply the brake by means of the compression springs, and simultaneously, hydrostatic braking takes place.



4. Sprinkler

4-1. Sprinkler piping



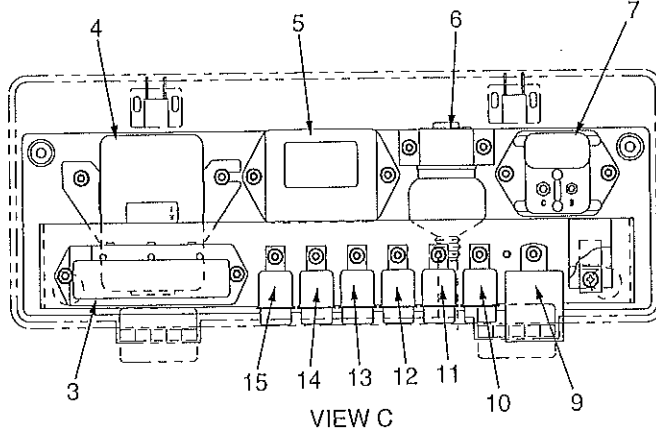
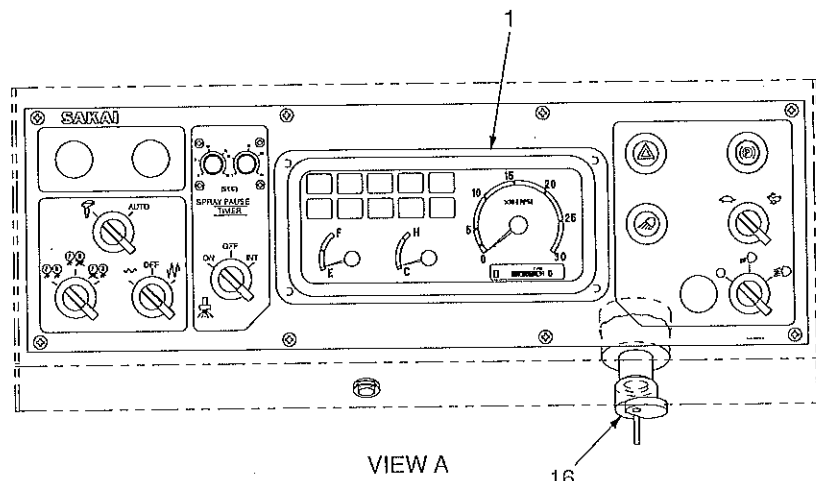
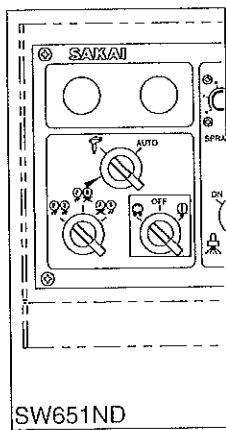
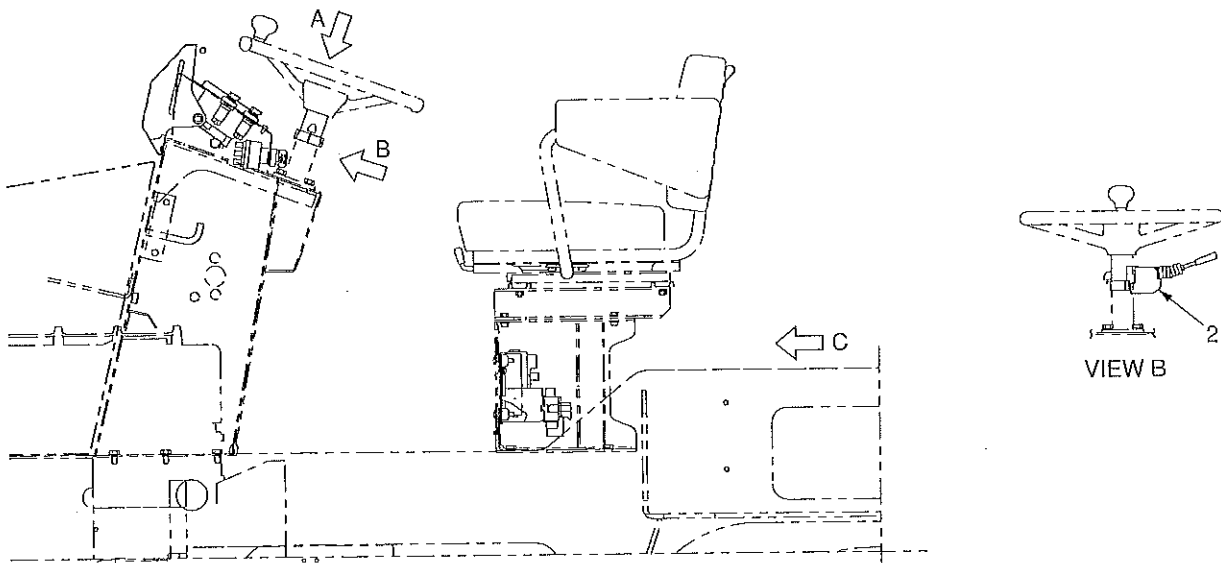
- 1. Sprinkler pump
- 2. Sprinkler pump
- 3. Filter
- 4. Filter
- 5. Sprinkler tank ass'y (rear)

- 6. Sprinkler tank ass'y (front)
- 7. Hose (rear tank to filter)
- 8. Hose (rear sprinkler)
- 9. Hose (filter to pump)
- 10. Hose (front tank to filter)

- 11. Hose (rear sprinkler)
- 12. Valve
- 13. Drain cock
- 14. Drain cock

5. Electric System

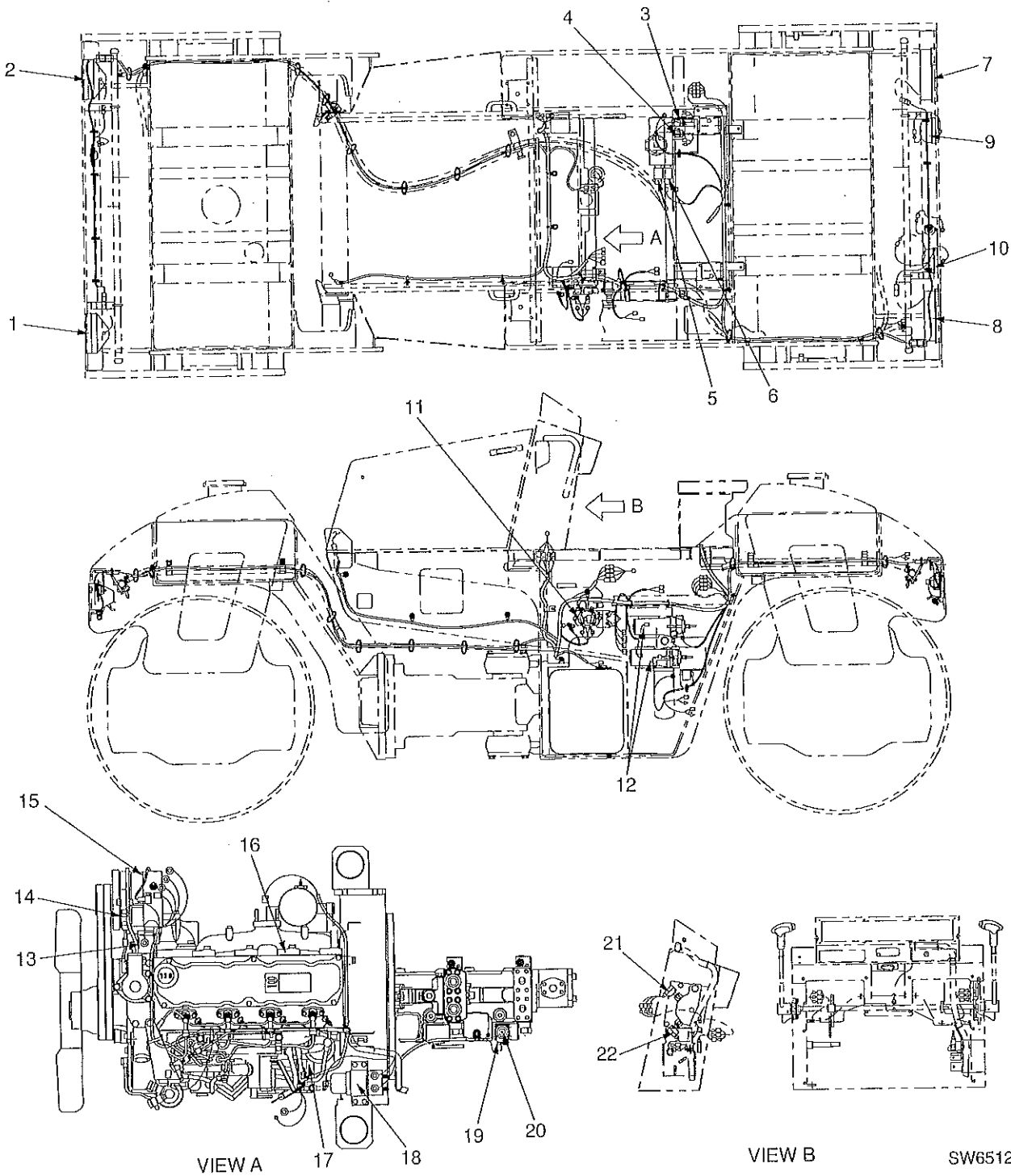
5-1. Layout of panel and relays



SW6512048

- | | | |
|----------------------------|----------------------------|-----------------------------|
| 1. Combination meter | 6. Intake air heater relay | 11. Sprinkler relay (front) |
| 2. Turn signal switch | 7. Safety relay | 12. Horn relay |
| 3. Fuse box | 8. Diode unit | 13. Lamp check relay |
| 4. Intake air heater timer | 9. Flasher unit | 14. Interlock relay |
| 5. Engine stop relay | 10. Sprinkler relay (rear) | 15. Glow rela |

5-2. Location of electric components

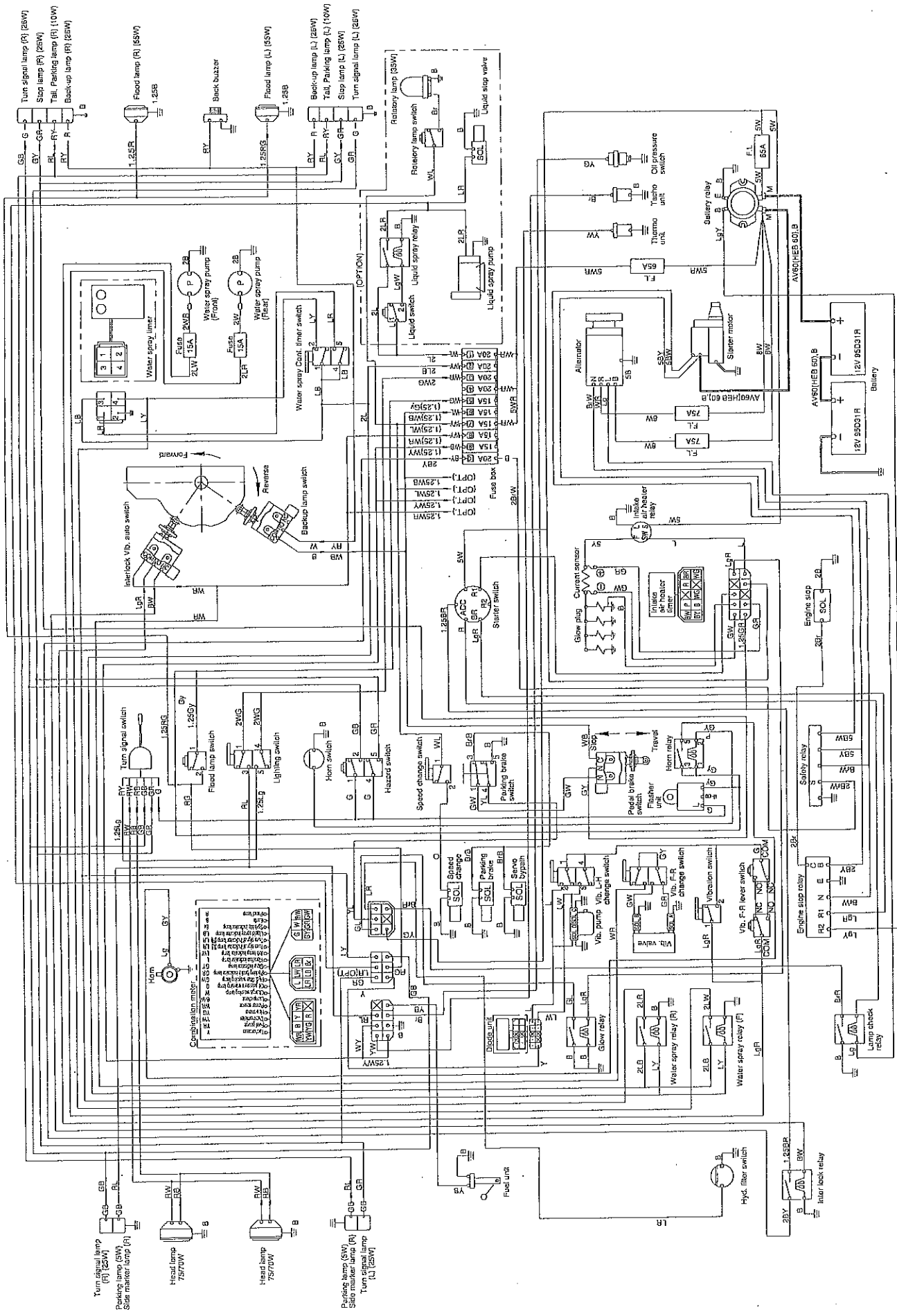


- 1. Headlamp (left)
- 2. Headlamp (right)
- 3. Brake release solenoid valve
- 4. High/low speed switching solenoid valve
- 5. Vibration switching solenoid valve
- 6. Vibration switching solenoid valve
- 7. Combination lamp

- 8. Combination lamp
- 9. Work lamps
- 10. Work lamps
- 11. Battery relay
- 12. Sprinkler pump
- 13. Water temperature sensor
- 14. Tachometer sensor
- 15. Alternator
- 16. Engine oil pressure switch
- 17. Starter

- 18. Engine stop solenoid
- 19. Glow plug
- 20. Amplitude switching solenoid valve (b)
- 21. Amplitude switching solenoid valve (a)
- 22. Interlock switch
- 23. Back lamp switch

5-3. Electric wiring diagram



INSPECTION & ADJUSTMENT

INSPECTION & ADJUSTMENT

1. Standard Value Chart	3-002
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2. Inspection & Adjustment

2-1. Measurement and adjustment of pressure in propulsion main circuit	3-101
2-2. Measurement and adjustment of propulsion and vibration pump charge circuit pressure	3-102
2-3. Measurement of switching pressure in high/low speed propulsion	3-103
2-4. Measurement of brake release pressure	3-104
2-5. Measurement and adjustment of vibrator circuit pressure	3-105
2-6. Measurement and adjustment of steering circuit pressure	3-106
2-7. Throttle linkage adjustment	3-107
2-8. Adjustment of F-R lever/speed shift lever linkage	3-108

★Precautions for Use of Standard Value Chart

- 1) Values in the chart are based upon ones when the machine leaves the factory. They should be used for estimation of wear after extended operation and for guidance when the machine is repaired.
- 2) Values in the chart are ones based on various test results etc. They should be used for a guide to fault finding practice in due consideration of the past repair frequency and operating record of the machine.
- 3) Values in the chart should not be used for the standard for claim application.

★Precautions for Checking, Adjustment and Fault Finding

- ▲ For checking, adjustment and fault finding practices, park the machine on level ground and block with the safety pins or chocks.
- ▲ When working with other workers, use hand signals positively and keep people not concerned away from the work area.
- ▲ Cool off the coolant or hydraulic fluid when removing the radiator cap or the hydraulic tank filler cap. Hot fluids can burn you.
- ▲ Do not put your hands close to parts in motion such as fan belts.

1. Standard Value Chart

1-1. Standard value chart for body

Item			Measuring conditions	Unit	Standard value for new machine	Permissible range	
Engine	Revolution	Low idle	<ul style="list-style-type: none"> Coolant temp. : Green zone on gauge Hydraulic oil temperature : $50 \pm 5^{\circ}\text{C}$ ($122 \pm 41^{\circ}\text{F}$) 	min ⁻¹ (rpm)	800±25		
		High idle			2200±30		
		Rated revolution			2050		
Travel speed	Forward & reverse	Lo	<ul style="list-style-type: none"> Engine at full throttle Coolant temp. : Green zone on gauge Hydraulic oil temperature : $50 \pm 5^{\circ}\text{C}$ ($122 \pm 41^{\circ}\text{F}$) 	km/h (mph)	0~2+1 (0~1.2+0.6)	←	
					2nd	0~4+1 (0~2.5+0.6)	←
					3rd	0~6+1 (0~3.7+0.6)	←
		Hi			1st	0~4+1 (0~2.5+0.6)	←
					2nd	0~7+1 (0~4.3+0.6)	←
					3rd	0~12+1 (0~7.4+0.6)	←
Oil pressure	Propulsion	Main circuit pressure	<ul style="list-style-type: none"> Engine at full throttle Hydraulic oil temperature : $50 \pm 5^{\circ}\text{C}$ ($122 \pm 41^{\circ}\text{F}$) 	MPa (psi) {kgf/cm ² }	33.0±1.0 (4786±145) {337±10}	30.4 (4409) {310}	
		Charge circuit pressure			2.4±0.2 (348±29) {24±2.0}	1.71 (248) {17.1}	
		Circuit pressure for switching high/low speed			2.4±0.2 (348±29) {24±2.0}	1.71 (248) {17.1}	
	Vibrator circuit pressure	34.5±1.0 (5004±145) {352±10}			31.7 (4598) {323}		
	Steering circuit pressure	15.2±0.5 (2204±72) {155±5}			12.9 (1870) {132}		
	Parking brake release circuit pressure	2.4±0.2 (348±29) {24±2.0}			1.71 (248) {17.1}		

2. Inspection & Adjustment

2-1. Measurement and adjustment of pressure in propulsion main circuit

1. Measurement

★ Hydraulic oil temperature:
 $50 \pm 5^{\circ}\text{C}$ ($122 \pm 41^{\circ}\text{F}$)

▲ Park on level ground. Stop the engine.
 Block the wheels.

★ Make certain that the parking brake functions correctly.

1) Remove plugs from gauge points (1) and (2) (7/16-20UNF-2B) in the propulsion pump and attach adapter ①.

- Port (1): Port A side
- Port (2): Port B side

2) Fit a 49MPa (7,110 psi) {500 kgf/cm²} pressure gauge to adapter ①.

3) Disconnect the high-pressure hose of the propulsion motor and plug both fittings for the hose and for the motor to block the oil.

★ When the hose to "port B" of the front motor is disconnected, disconnect the hose to "port A" of the rear motor.

4) Start the engine and operate the F-R lever slowly until engine speed reaches the rated speed to read indication on the oil pressure gauge when the engine is running at the rated speed.

★ Take the reading quickly not to put the system under high pressure for long.

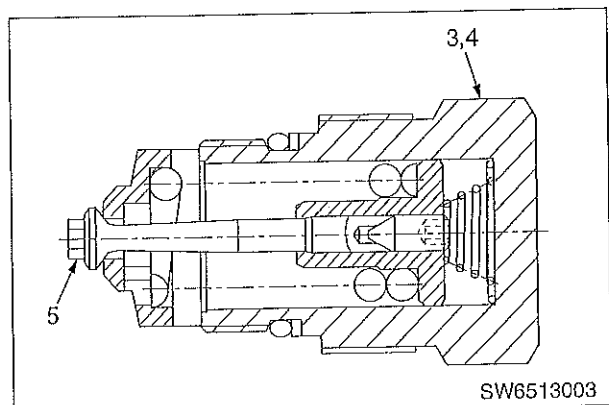
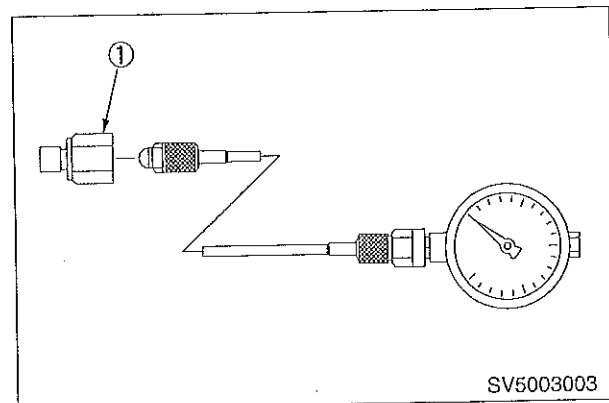
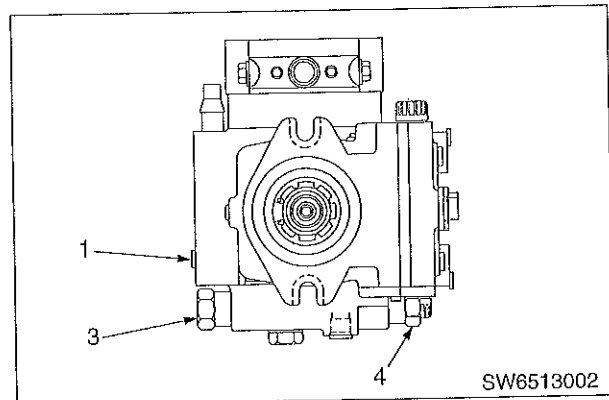
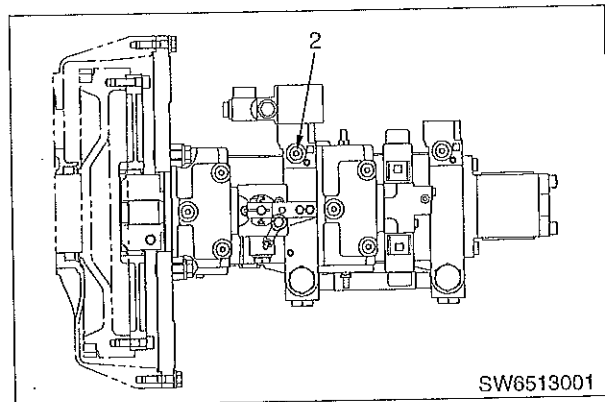
2. Adjustment

1) If the oil pressure is out of the allowable level, remove the high-pressure relief valve (3) (port A side) or the valve (4) (port B side) to adjust it by turning the screw (5).

★ Carefully perform disassembly and reassembly taking necessary measures to prevent entry of foreign matter.

★ Replace if a component has been damaged.

2) Adjust it with the screw and fit the relief valve again to measure the relief pressure.



2-2. Measurement and adjustment of propulsion and vibration pump charge circuit pressure

1. Measurement

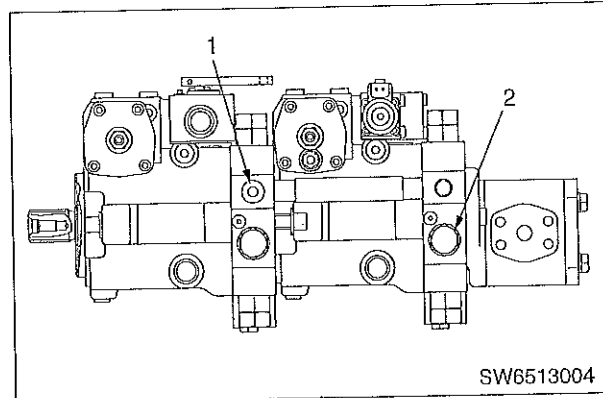
★ Hydraulic oil temperature:
 $50 \pm 5^\circ\text{C}$ ($122 \pm 41^\circ\text{F}$)

▲ Park the machine on level ground. Stop the engine and block the wheels.

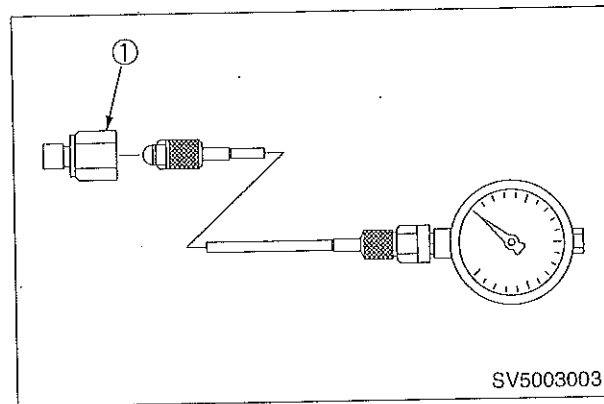
★ Because oil is supplied from steering /charge pump, make sure, before the test, that the steering system works correctly.

★ Ensure that the pump swashplate retains perfect neutral position when the F-R lever is placed in the neutral position.

- 1) Remove the gauge port (1), 3/4-16UNF-2B, to fit the adapter ① instead.
- 2) Attach a 5.9MPa (856 psi.) {60 kgf/cm²} pressure gauge to adapter ①.
- 3) Start the engine. Slowly operate the throttle lever to run the engine at maximum speed.
- 4) Ensuring that F-R lever is in the neutral position, take the reading of the pressure gauge.



SW6513004



SV5003003

2. Adjustment

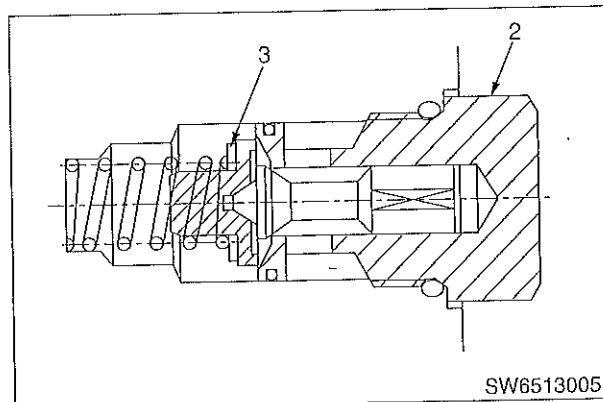
- 1) If the oil pressure is out of the allowable level, remove the charge relief valve (2) to adjust it by changing thickness of the shim (3).

★ Pressure variation per shim: 0.3MPa (43psi) {3kgf/cm²}.

★ Carefully perform disassembly and reassembly taking necessary measures to prevent entry of foreign matter.

★ Replace if a component has been damaged.

- 2) Adjust thickness of shim and fit the charge relief valve again to measure the relief pressure.



SW6513005

2-3. Measurement of switching pressure in high/low speed propulsion

1. Measurement

★ Hydraulic oil temperature:

$50 \pm 5^{\circ}\text{C}$ ($122 \pm 41^{\circ}\text{F}$)

⚠ Park the machine on level ground. Stop the engine and block the wheels.

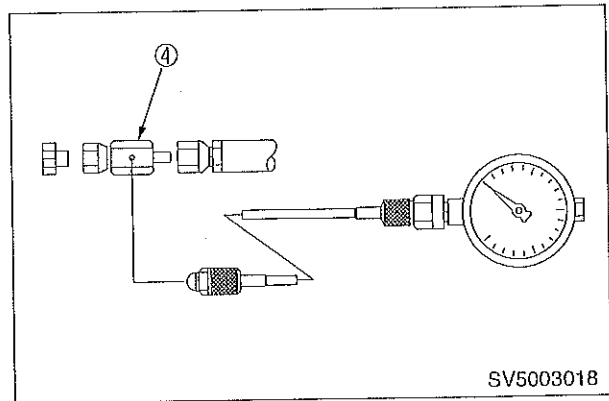
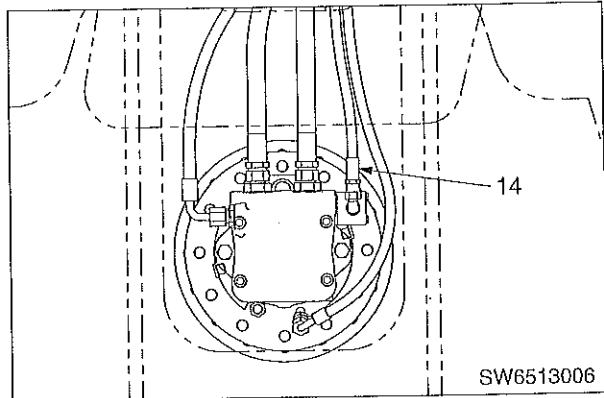
★ Because oil is supplied from steering /charge pump, make sure, before the test, that the steering system works correctly.

1) Remove the pressure hose for switching high/low speed (14) of the propulsion motor to fit the adapter ① instead.

★ Fit the plug also to the elbow in the motor in advance.

2) Attach a 5.9MPa (856 psi.) {60 kgf/cm²} pressure gauge to adapter ④.

3) Start the engine with the high/low speed selector switch thrown to "high speed" to measure the output pressure at full throttle.



2-4. Measurement of brake release pressure

1. Measurement

★ Hydraulic oil temperature:

$50\pm 5^{\circ}\text{C}$ ($122\pm 41^{\circ}\text{F}$)

▲ Park the machine on level ground. Stop the engine and block the wheels.

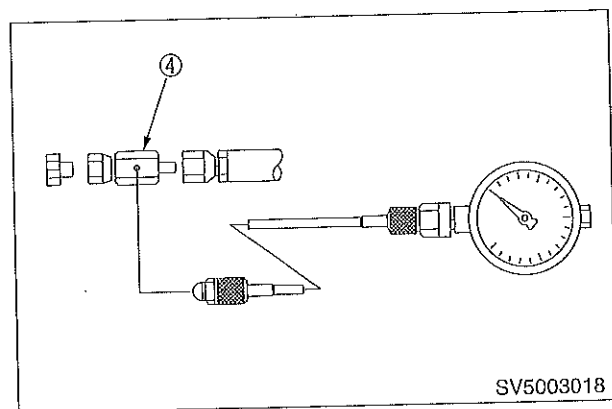
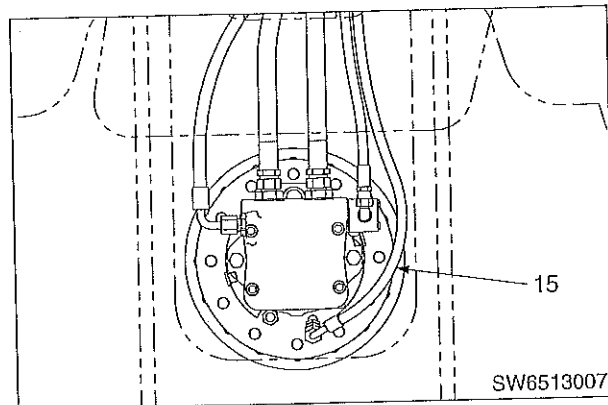
★ Because oil is supplied from the steering /charge pump, make sure, before the test, that the steering system works correctly.

1) Disconnect the parking brake release hose (15) to fit the adapter ④ instead.

★ Plug the open ports of the motor.

2) Attach a 5.9MPa (856 psi.) {60 kgf/cm²} pressure gauge to adapter ④.

3) Start the engine. Measure the pressure with the parking brake switch set to the RELEASE position and the engine at full throttle.



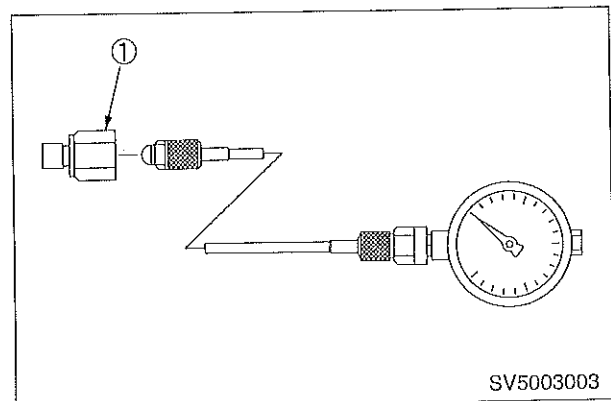
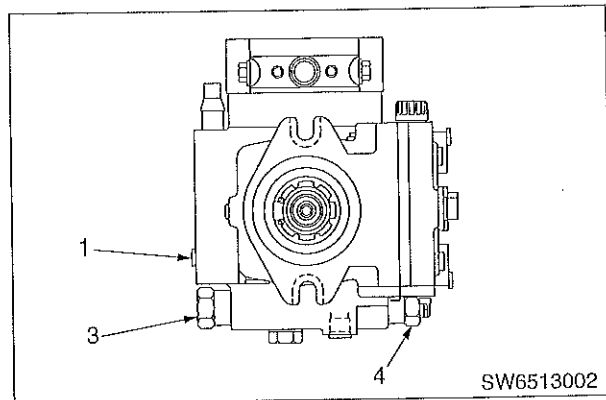
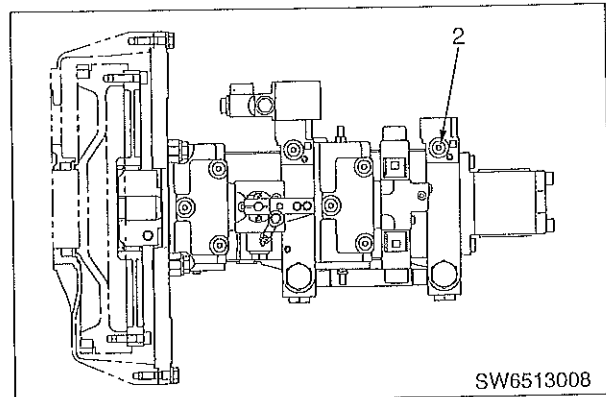
2-5. Measurement and adjustment of vibrator circuit pressure

1. Measurement

★ Hydraulic oil temperature:
 $50 \pm 5^{\circ}\text{C}$ ($122 \pm 41^{\circ}\text{F}$)

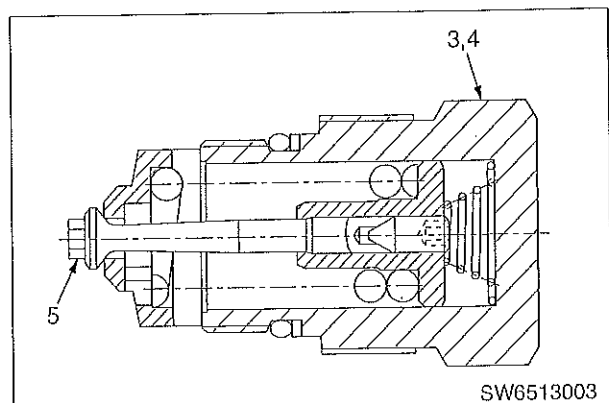
▲ Park the machine on level ground. Stop the engine and block the wheels.

- 1) Remove gauge ports (1) and (2) (7/16-20 UNF-2B) of the vibrator drive pump to fit the adapter ①.
 - Port (1): Port A side
 - Port (2): Port B side
- 2) Fit a 49MPa (7,110 psi) {500 kgf/cm²} pressure gauge to adapter ①.
- 3) Disconnect the high-pressure hose at the valve block to stop oil flow by plugging both ports for the hose and the block.
- 4) Start the engine. Slowly operate the throttle lever to run the engine at maximum speed.
- 5) Turn ON the vibrator switch in F-R lever to measure pressure.



2. Adjustment

- 1) If the oil pressure is out of the allowable level, remove the high-pressure relief valve (3) (port A side) or the valve (4) (port B side) to adjust it by turning the screw (5).
 - ★ Carefully perform disassembly and reassembly taking necessary measures to prevent entry of foreign matter.
 - ★ Replace if a component has been damaged.
- 2) Adjust it with the screw and fit the relief valve again to measure the relief pressure.



2-6. Measurement and adjustment of steering circuit pressure

1. Measurement

★ Hydraulic oil temperature:
 $50\pm 5^{\circ}\text{C}$ ($122\pm 41^{\circ}\text{F}$)

▲ Park the machine on level ground. Stop the engine and block the wheels.

1) Disconnect either one of inlet hoses (1) or (2) of the steering cylinder to fit the adapter (5) between the hose and the cylinder.

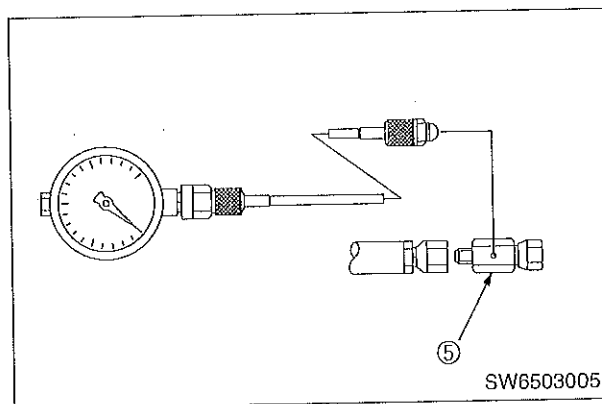
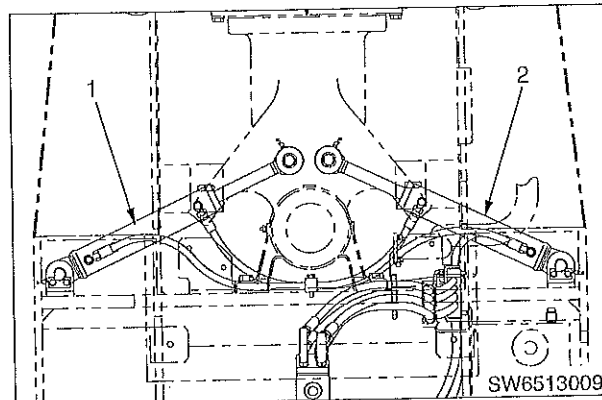
- (1): Traveling on the right side
- (2): Traveling on the left side

2) Install a 24.5MPa (3553psi) {250kgf/cm²} pressure gauge to adapter (5).

3) Start the engine. Ensuring that the F-R lever is in the neutral position, slowly move the throttle lever to FULL THROTTLE.

4) Rotate the steering wheel to the measuring side until it hits the stopper allowing relief and take the reading on the pressure gauge.

★ When rotating the steering wheel, do not allow anyone to enter the pinch area of the articulated frame.



2. Adjustment

If the measured value is not within the permissible range, disassemble and clean or renew the relief valve assembly built in Orbitrol. The valve is not adjustable.

★ Carefully perform disassembly and reassembly taking necessary means to avoid entry of foreign matter.

2-7. Throttle linkage adjustment

★ When the throttle linkage has been renewed (or reconnected) or if the high idle or low idle rpm is not to specification, adjust as follows:

1. Adjustment

★ **Coolant temperature:** Green area on gauge.

- 1) Set throttle lever (1) to the LOW IDLE position.
- 2) Connect the throttle cable (2) to the throttle lever and to governor lever (3) of the fuel injection pump.
- 3) Start the engine. Slacken lock nut (4) and adjust stop bolt (5) until correct low idle revolution is reached.

★ **Low idle:** $800 \pm 25 \text{ min}^{-1} \text{ (rpm)}$

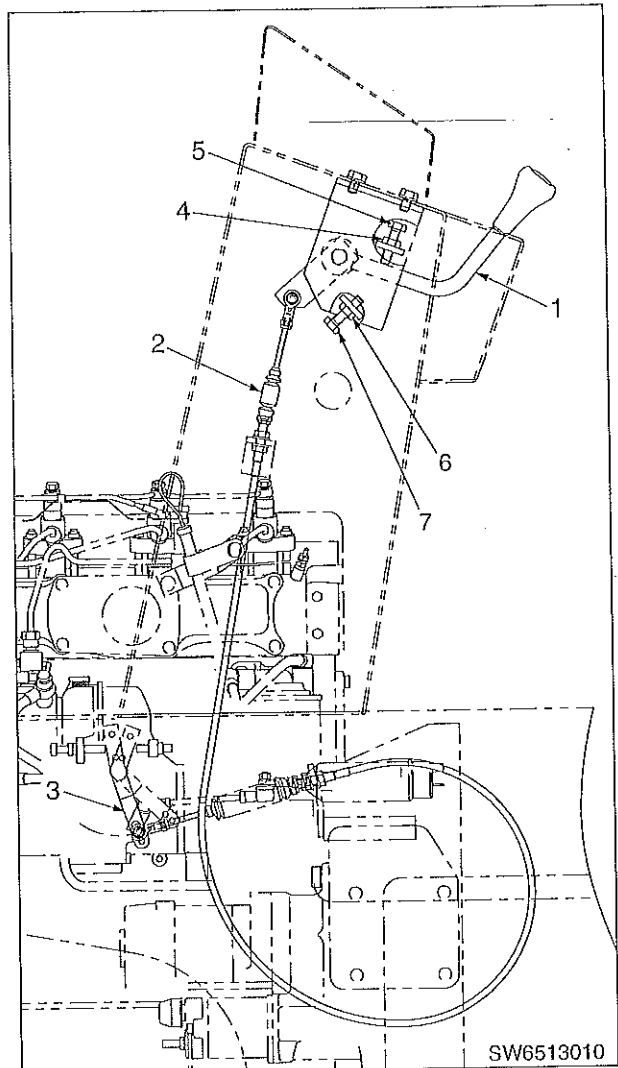
- 4) Shift the throttle lever (1) to high idling side and loosen the lock nut (6) to adjust it with the stop bolt (7) so that the high idling comes to the specified speed.

★ **High idle:**

Lower than $2200 \pm 25 \text{ min}^{-1} \text{ (rpm)}$

- ◆ If high idling speed fails to be as specified even with the governor lever in contact with the stopper on the full throttle side of the fuel injection pump, repair or replace the fuel injection pump.

★ **Because high idling speed cannot be adjusted for engines being taken measures to meet exhaust gas control.**



2-8. Adjustment of F-R lever/speed shift lever linkage

★ When the F-R lever linkage has been renewed (or reconnected) or if the F-R lever fails to move smoothly, adjust as described below:

1. Adjustment

★ Hydraulic oil temperature:

$50 \pm 5^{\circ}\text{C}$ ($122 \pm 41^{\circ}\text{F}$)

★ Since the levers controlling both forward/reverse and gear change are positioned by notch balls, inspect the mounting dimensions of the cable and the stroke of the control lever on the pump.

1) Fit the cable (3) to adjust mounting distance of the section (4) to be specified.

★ Specified distance of section (4):
190mm (74.8in.)

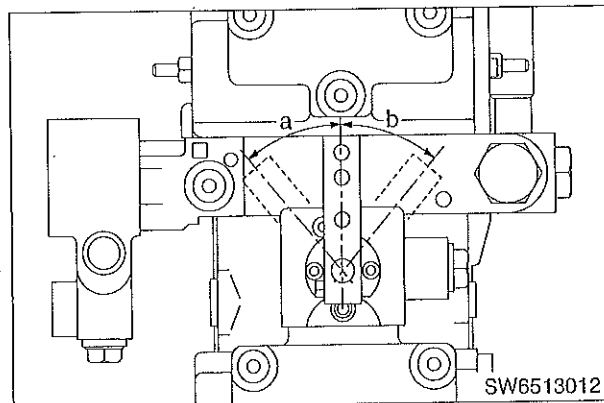
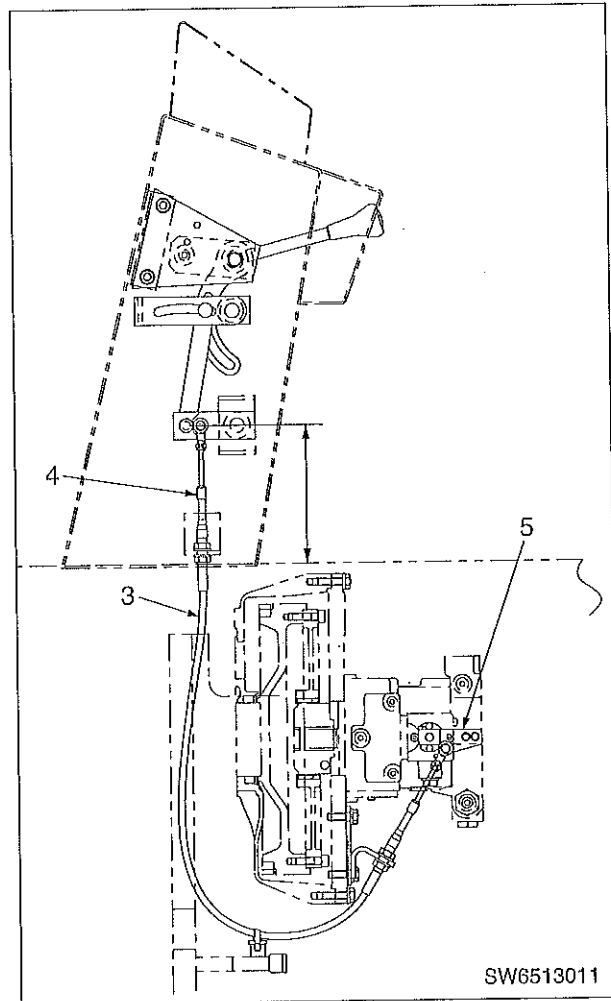
2) Put the control lever (5) at its neutral position to fit the cable (3).

3) Check that the stroke of control lever (5) on the pump is as specified.

★ Maximum stroke of lever (the same applies to forward and reverse):

a: 40°

b: 40°



TROUBLESHOOTING

TROUBLESHOOTING

1. Precautions for Troubleshooting	4-002
2. How to Diagnose the Machine	4-003
3. How to use this Chapter, "TROUBLESHOOTING" and How to Follow the Troubleshooting Flow	4-004
4. Precautions for Diagnosis of Electric Circuit	4-006
5. Troubleshooting for Electric System (Mode E)	4-201
6. Fault Finding for Hydraulic and Mechanical Systems (Mode H)	4-401

1. Precautions for Troubleshooting

- ▲ Park the machine on level ground. Make sure that the safety pins are engaged, wheels chocked and parking brake applied.
- ▲ When working with other workers, use hand signals authorized, and keep people not concerned away from the work area.
- ▲ If the radiator cap is carelessly removed from a hot engine, hot coolant will gush out to cause a burn. Remove the cap only when the engine has been cooled off.
- ▲ Exercise care not to touch hot parts or not to be caught in rotating parts.
- ▲ When disconnecting electric wires, disconnect the battery negative (-) cable.
- ▲ When taking off plugs or caps from units which are under pressure such as hydraulic, water and air pressures, fit gauges after removing residual pressure.

- Troubleshooting is to determine the root cause of troubles, repair faulty parts as quickly as practicable, and prevent recurrence of the troubles.
- Important when conducting troubleshooting practice is of course to well understand the structure and function of machines to be handled. For effective troubleshooting, however, it is of prime importance to have a clear picture of the trouble concerned by contacting the operator.

1. When a trouble has occurred, do not attempt to disassemble blindly.

Disassembling in a hurry will invite disadvantageous situations as described below:

- Parts which need not be disassembled may be disassembled.
- Tracing the cause of trouble will become more difficult.

These will cause increased service costs because of wasteful service hours, spare parts or expendables like oil or grease. To make matters worse, such a careless practice will invite operators' (customers') distrust. For these reasons, sufficient advance investigations and diagnosis in accordance with troubleshooting procedures specified are essential for efficient fault finding practices.

2. Questions to be addressed to the operator (customer) .

- 1) Are there any trouble other than the one in question?
- 2) Was there any abnormal condition with the machine before the trouble occurs?
- 3) Did the trouble occur suddenly without signs of abnormal conditions in advance?
- 4) In what occasion did the trouble occur?
- 5) Has the machine been repaired before the trouble occurs? If so, when has it been repaired?
- 6) Did similar trouble occur in the past?

3. Before-diagnosis inspection

- 1) Perform daily inspections.
- 2) Perform other inspections required for diagnosis.

4. Confirmation of trouble

Know the degree of the trouble. Determine whether it is a trouble caused by improper design etc. or the trouble was caused by incorrect handling.

★ When making the trouble recur to trace the cause of the trouble by putting the machine in motion, use care not to cause more damage to the machine.

5. Troubleshooting

From the results of items 2 to 4 above, narrow down the cause of the trouble, and pinpoint the source of the trouble by utilizing the diagnosis flow chart.

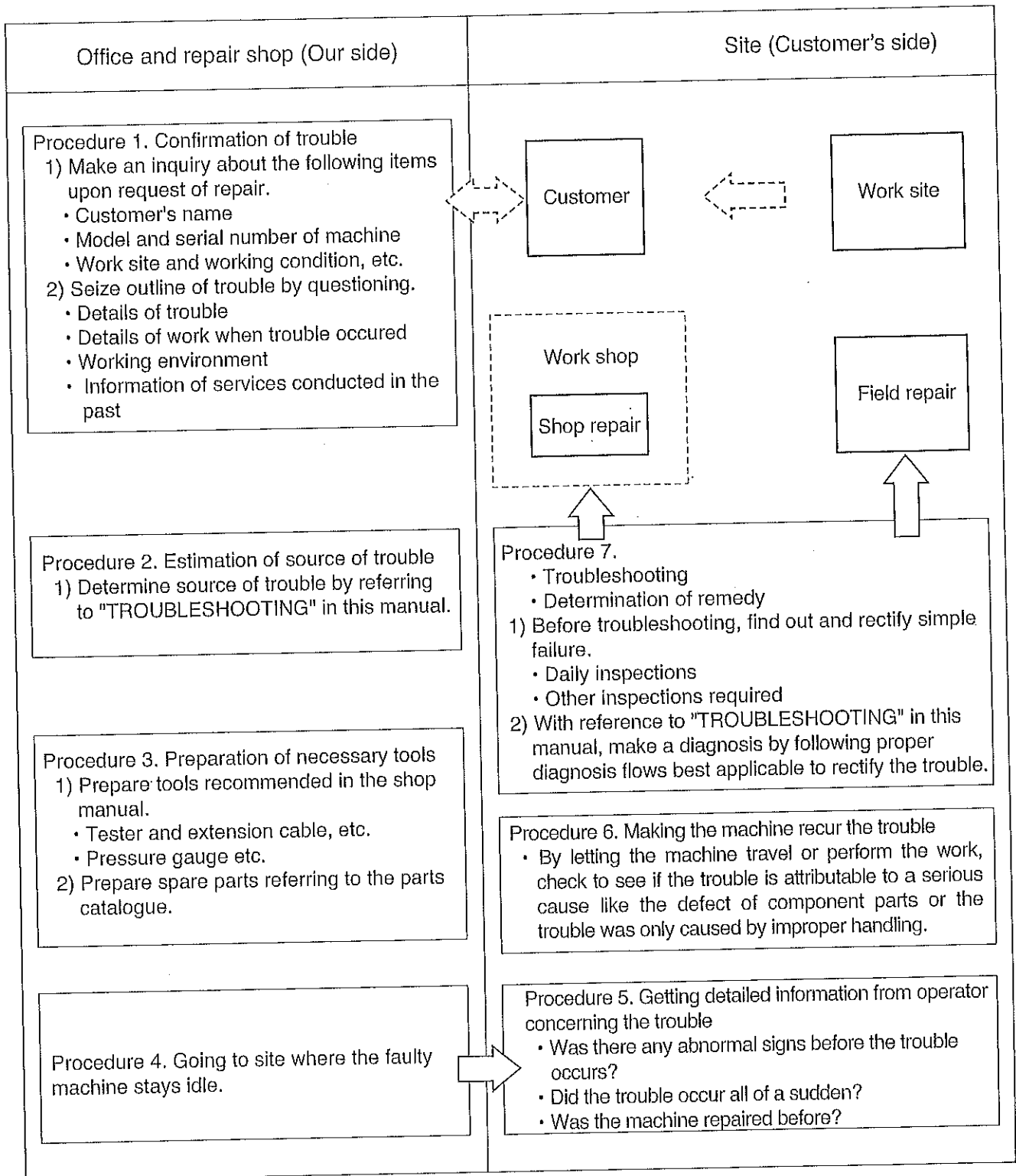
★ The basic points of the diagnosis are:

- 1) Start from the portion simple.
- 2) Start from the portion having a high probability to solve the problem.
- 3) Investigate related matters.

6. Basic remedy for the trouble

Even if a trouble has been rectified, it will develop again if its cause is not determined. It is of prime importance to trace the very cause of the trouble.

2. How to Diagnose the Machine



3. How to Use this Chapter, "TROUBLESHOOTING" and How to Follow the Troubleshooting Flow

1. Troubleshooting codes

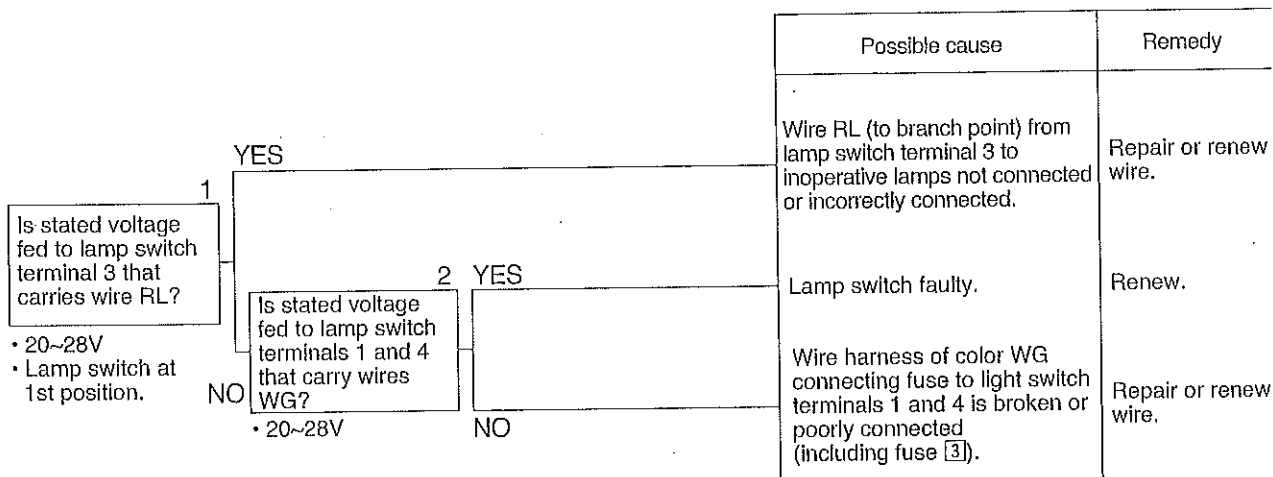
- 1) Electric system: E-01 to E-17
- 2) Hydraulic and mechanical systems: H-01 to H-08

2. How to follow the troubleshooting flow

① E-08 Head lamps do not work

- ② ★It is assumed that other electric circuits are normal.
★Take the voltage measurement with the starter switch ON.
- ③ a) Side marker lamps and tale lamps are faulty.

④



① Troubleshooting code No. and fault symptom

On top of the flow chart are code No. and fault symptom.

② General precautions

Under the code and fault symptom are precautions (marked ★) for the whole items in the flow chart. Though these precautions are not indicated inside each box (□) which contains checking instructions, pay attention to the precautions when making inspections described in the box (□).

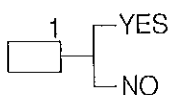
③ Sub classification

To make diagnosis easier or for simplified flow chart, fault symptom is subclassified. Ex. a) Starter does not run

④ How to forward the diagnosis

- Each box (□) contains diagnosis procedure. Depending upon the results of inspection or measurement, proceed to YES or NO line.
- Normally, if the result is YES then proceed to upper line. If NO then go to the lower line.

NOTE: The number above each box (□) is a reference number. It does not mean a diagnosis order.



How to Use this Chapter, "TROUBLESHOOTING" and How to Follow the Troubleshooting Flow

- As a result of diagnosis, if YES line or NO line directly goes to the description in CAUSE column, take necessary action as indicated in REMEDY column.
- Under each box () are normal values and conditions necessary for inspection and adjustment. If the result gives an affirmative answer to the question in the box or agrees to the normal value indicated under the box, go to YES line. Otherwise, go to NO line.
- The normal values were taken from the standard value list.
- For locations of component parts such as relay mentioned in the flow chart, see "Location of key units". Line colors mentioned in the flow charts are indicated in the electric wiring diagram shown under the flow charts. In the machine, each harness is identified by color.

4. Precautions for Diagnosis of Electric Circuit

1. When disconnecting or connecting connectors or harnesses, cut the power supply.
2. Before making a diagnosis, check the connectors or harnesses for poor connection.
★ If a connector is at fault, check it by repeating connection and disconnection several times.
3. Before proceeding to the next step, reconnect removed connectors or harnesses in place.
★ Care must be used for the controller circuit. If the power source is switched on with the connector disconnected, this can cause an incorrect measurement.
4. When making a diagnosis of circuits (measurement of voltage, resistance, current, test for continuity, etc.), check to see if tester readings vary by shaking connectors or harnesses.
★ If readings vary, a possible cause is a poor connection of the circuit.
5. For voltage measurement, turn the starter switch ON. For resistance checking, let the switch stay in the Off position.
★ If necessary to take a measurement of resistance by energizing relays or other units with the starter switch ON, necessary instructions are given in the flow charts.

5. Troubleshooting for Electric System (Mode E)

E-01 Engine does not start	4-202
E-02 Engine does not stop	4-208
E-03 Poor preheat (glow plug does not become red-hot)	4-209
E-04 No charging (charge lamp stays bright)	4-210
E-05 Reverse alarm does not sound	4-212
E-06 Horn does not sound	4-213
E-07 Turn signal lamps do not flash	4-214
E-08 Headlamps do not operate	4-216
E-09 Vibrator does not work properly	4-218
a) Vibrator itself fails to work	4-218
b) Inoperative in AUTO mode	4-219
c) Inoperative by F-R lever switch control	4-220
d) Lo/Hi vibration fails to be switched	4-221
e) Vibratory wheel fails to be switched	4-223
E-10 High/low speed fails to be switched	4-224
E-11 Parking brake not released	4-225
E-12 Sprinkler is inoperative	4-225
a) Both modes CONTINUOUS and TIMER are inoperative	4-226
b) Mode CONT is inoperative	4-227
c) Timer control operation is impossible	4-228
E-13 Fuel gauge reads wrong	4-229
E-14 Water temperature gauge reads wrong	4-230
E-15 Tachometer reads wrong	4-230
E-16 Charge lamp, engine oil pressure warning lamp, hydraulic oil filter warning lamp, and parking brake indicator lamp fail to be lit with starter switch turned ON	4-231

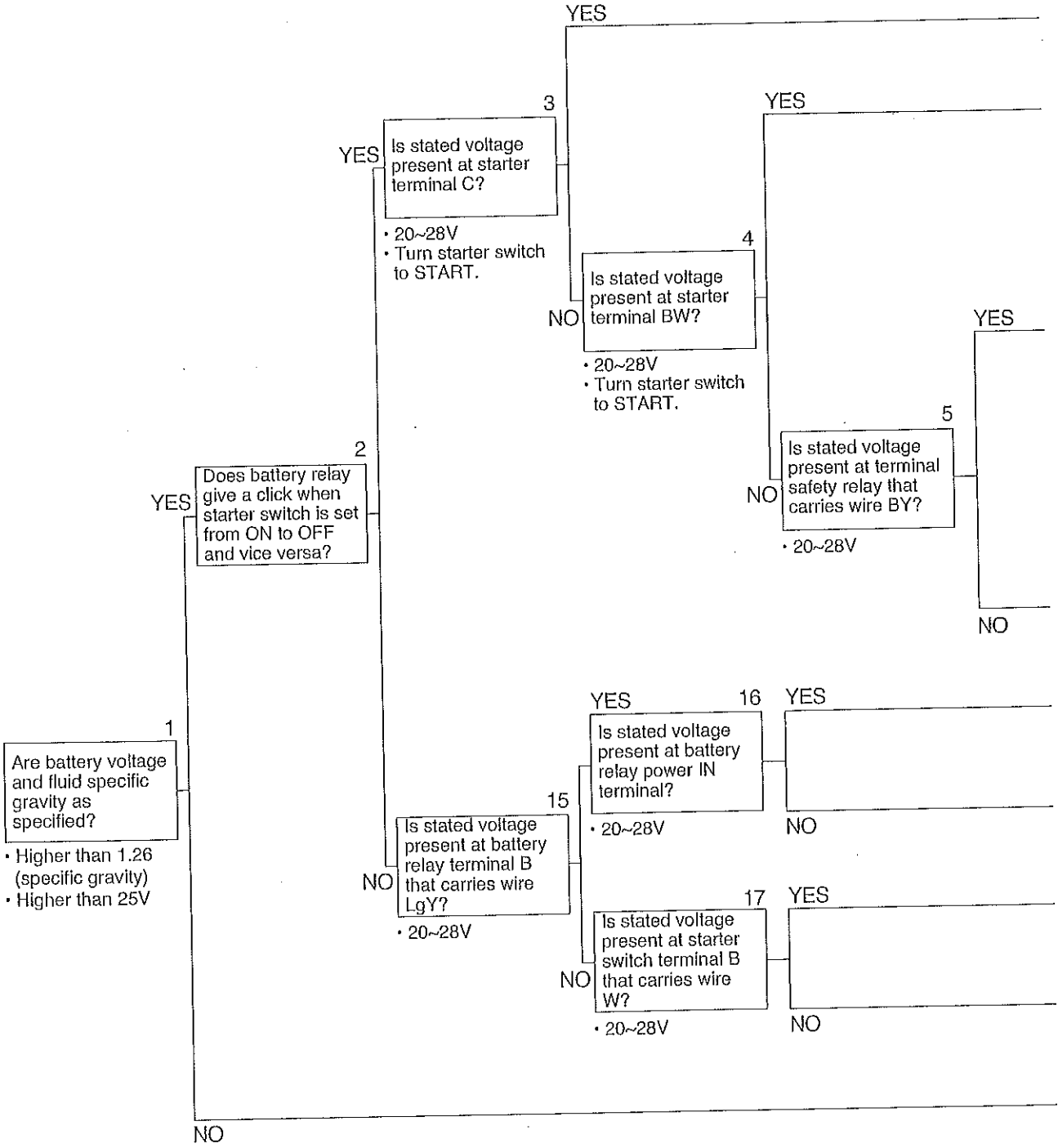
Wire color code

B	Black	BrY	Brown/ Yellow stripe	L	Blue	LgY	Light green/ Yellow stripe	W	White	YL	Yellow/ Blue stripe
BR	Black/ Red stripe	G	Green	LR	Blue/ Red stripe	R	Red	WB	White/ Black stripe	YR	Yellow/ Red stripe
BW	Black/ White stripe	GB	Green Black stripe	LW	Blue/ White stripe	RB	Red/ Black stripe	WL	White/ Blue stripe	YW	Yellow/ White stripe
BY	Black/ Yellow stripe	GL	Green Blue stripe	LY	Blue/ Yellow stripe	RG	Red/ Green stripe	WR	White/ Red stripe	Gy	Gray
Br	Brown	GR	Green Red stripe	Lg	Light green	RL	Red/ Blue stripe	WY	White/ Yellow stripe	O	Orange
BrB	Brown/ Black stripe	GW	Green White stripe	LgB	Light green/ Black stripe	RW	Red/ White stripe	Y	Yellow	Sb	Sky blue
BrR	Brown/ Red stripe	GY	Green Yellow stripe	LgR	Light green/ Red stripe	RY	Red/ Yellow stripe	YB	Yellow/ Black stripe	P	Pink
BrW	Brown/ White stripe			LgW	Light green/ White stripe			YG	Yellow/ Green stripe		

E-01 Engine does not start

- ★ Check each fuse 8 and 10 has not be blown to carry out fault finding.
- ★ Shift F-R lever to neutral position to measure voltage with starter switch turned ON.
- ★ Check also fusible link mounted between battery relay power terminal and terminal B in starter switch.

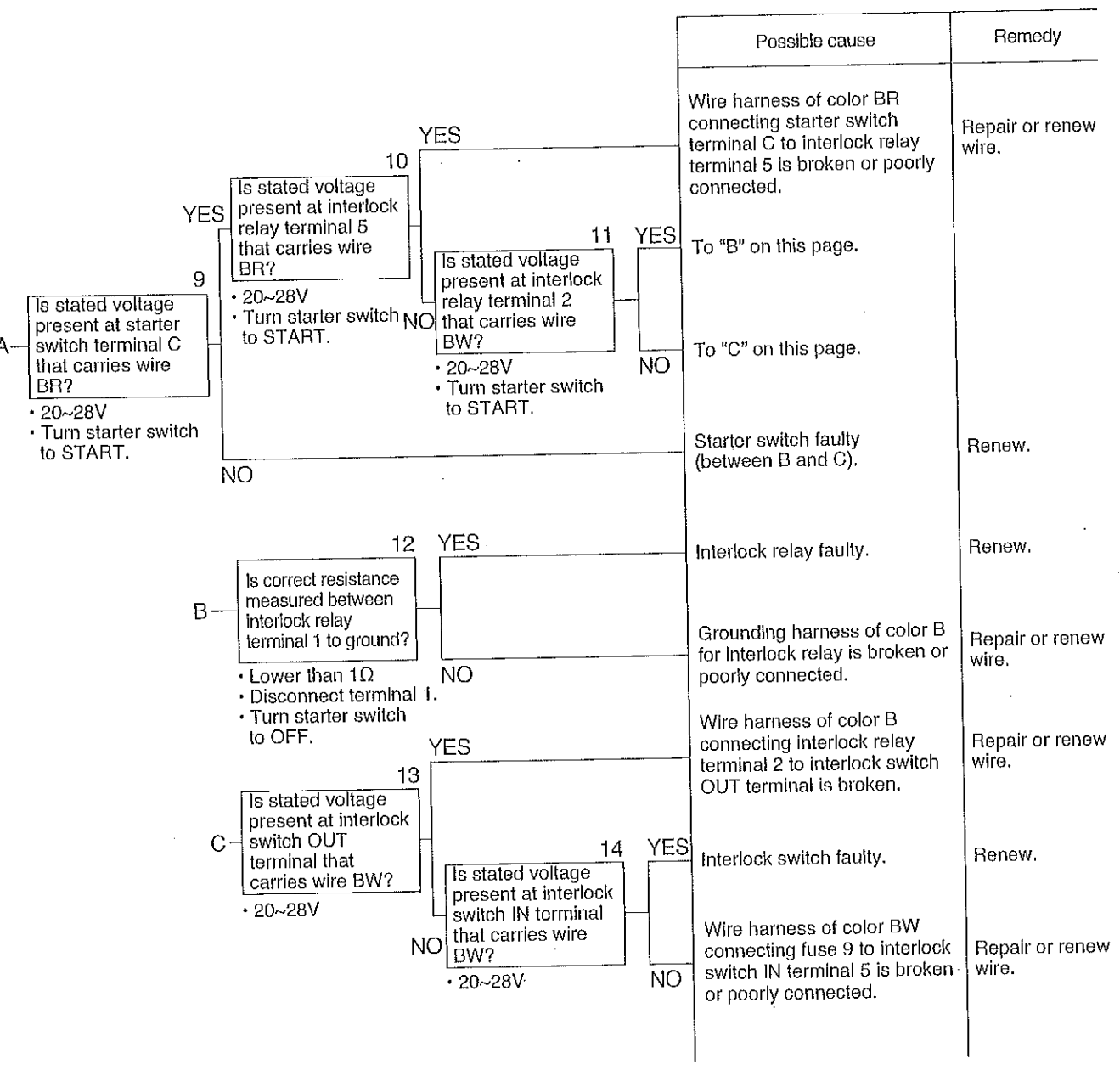
a) Starter motor does not operate. (1/2)



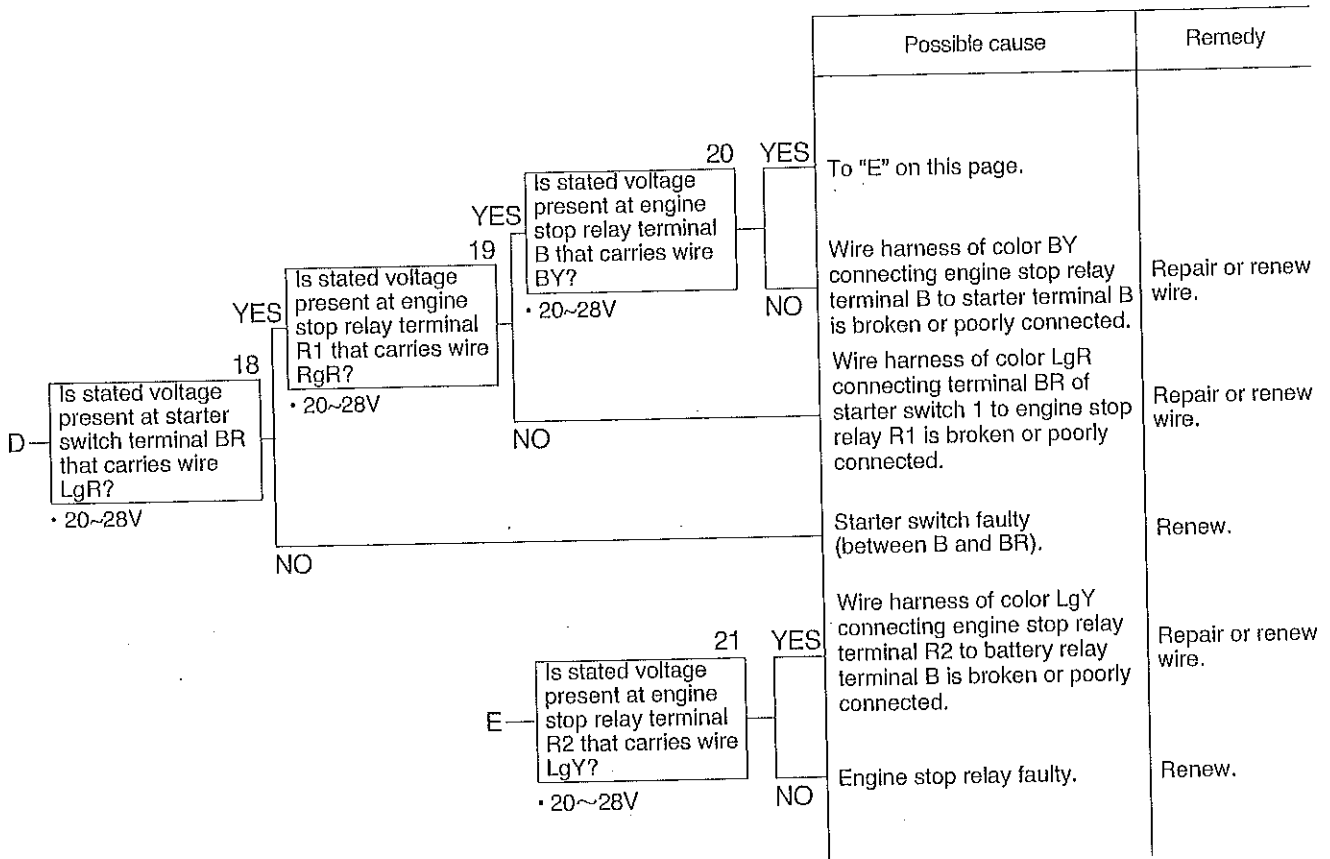
	Possible cause	Remedy
	Starter faulty.	Renew.
	Wire harness connecting safety relay terminal C to starter terminal C is broken or poorly connected.	Repair or renew wire.
	Safety relay faulty.	Renew.
<p>6 YES</p> <p>Is stated voltage present at safety relay terminal N that carries wire BrW? • 20~28V</p> <p>7 YES</p> <p>Is stated voltage present at safety relay switch terminal that carries wire BrW? • 20~28V • Turn starter switch to START.</p>	Wire harness of color BY connecting safety relay switch to interlock relay terminal 3 is broken or poorly connected.	Repair or renew wire.
<p>NO</p> <p>8 YES</p> <p>Is stated voltage present at safety relay terminal 3 that carries wire BY? • 20~28V • Turn starter switch to START.</p>	To "A" on page 4-204.	
<p>NO</p>	Alternator faulty	Repair or renew wire.
	Wire harness of color BY connecting safety relay terminal B to starter terminal B is broken or poorly connected.	Repair or renew wire.
	Battery relay faulty.	Renew.
	Wire harness connecting battery relay power IN terminal to battery (+) terminal is broken or poorly connected.	Repair or renew wire.
	To "D" on page 2-204.	
	Wire harness of color W connecting battery relay power IN terminal to starter switch terminal B is broken or poorly connected.	Repair or renew wire.
	Battery capacity lowered.	Charge or renew battery.

Troubleshooting for Electric System

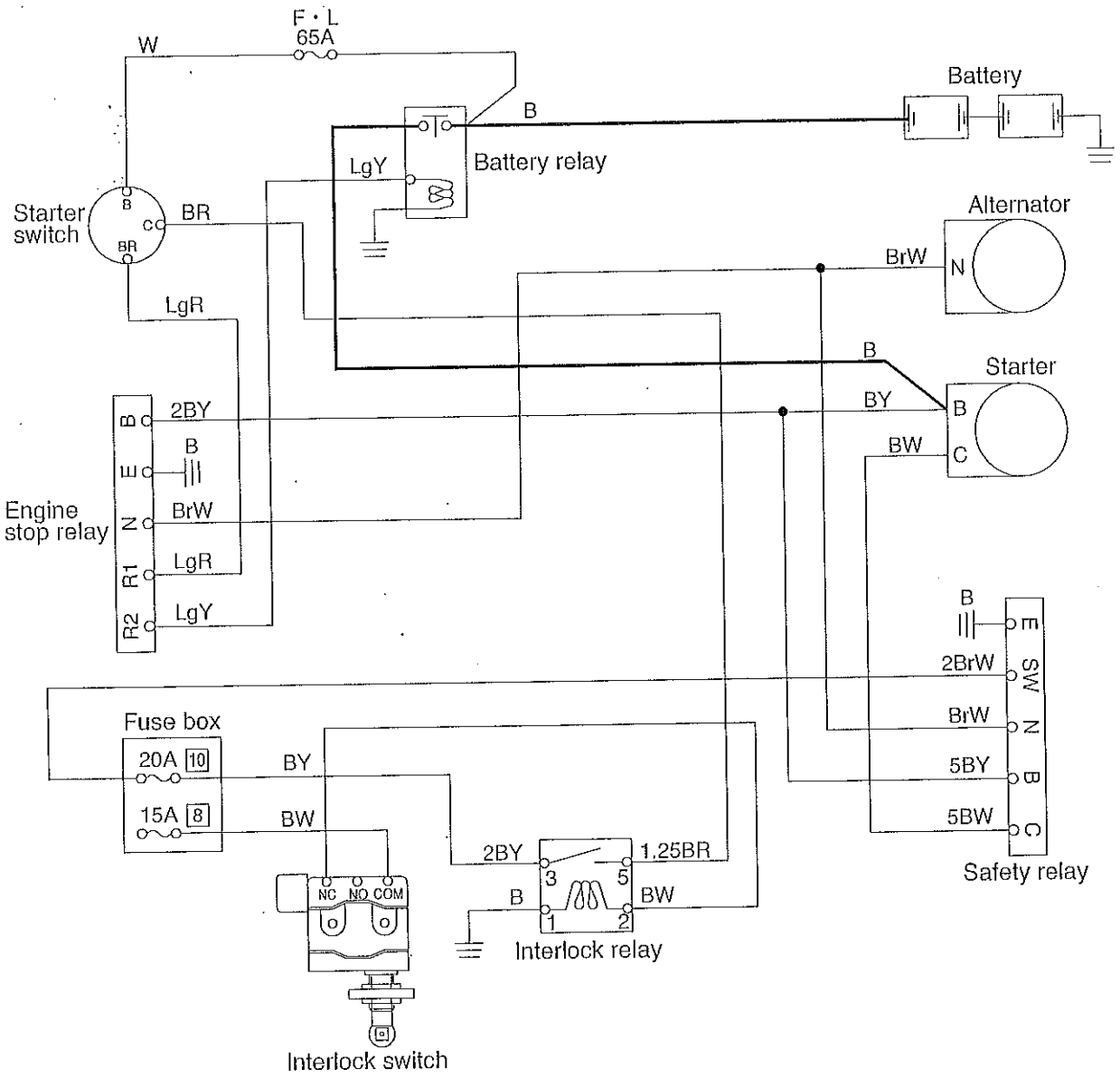
a) Starter motor does not operate. (2/2)



Possible cause	Remedy
Wire harness of color BR connecting starter switch terminal C to interlock relay terminal 5 is broken or poorly connected.	Repair or renew wire.
To "B" on this page.	
To "C" on this page.	
Starter switch faulty (between B and C).	Renew.
Interlock relay faulty.	Renew.
Grounding harness of color B for interlock relay is broken or poorly connected.	Repair or renew wire.
Wire harness of color B connecting interlock relay terminal 2 to interlock switch OUT terminal is broken.	Repair or renew wire.
Interlock switch faulty.	Renew.
Wire harness of color BW connecting fuse 9 to interlock switch IN terminal 5 is broken or poorly connected.	Repair or renew wire.

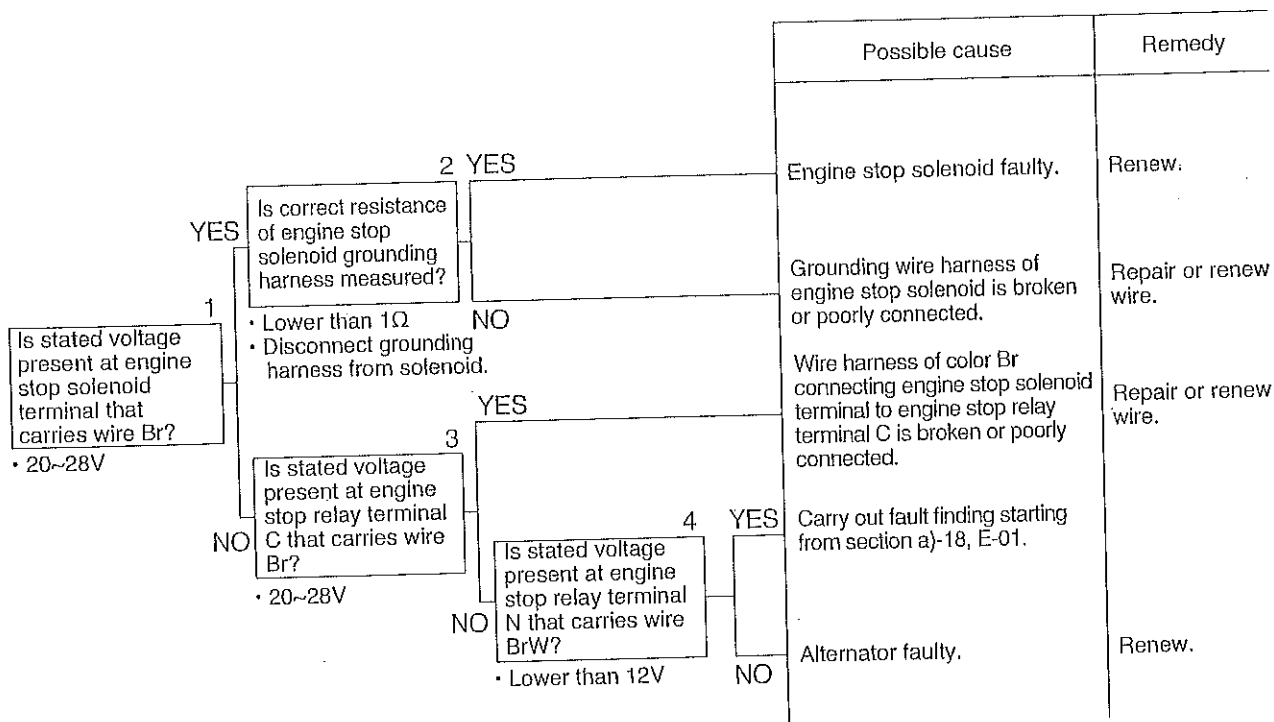


Electric wiring diagram for mode E-01-a)



SW6514001

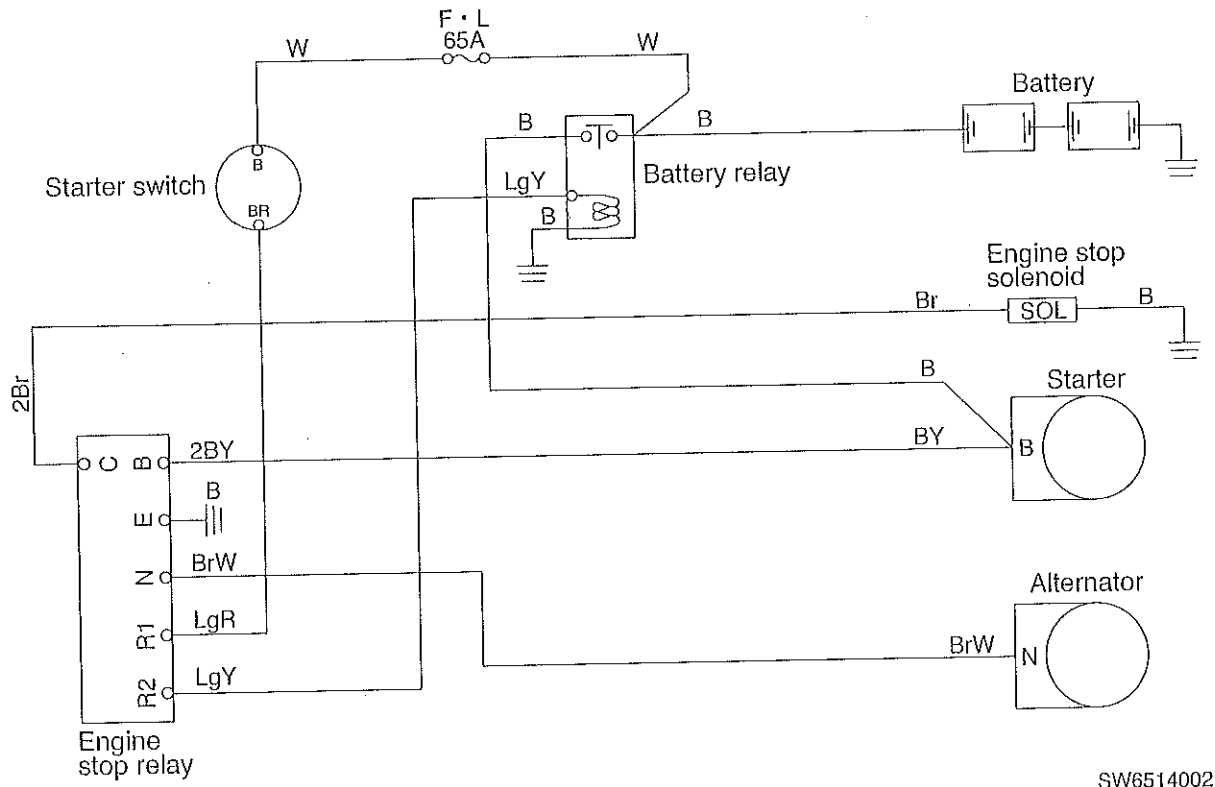
b) Engine stope solenoid does not operate.
 ★It is assumed that the starter rotation is normal.



E-02 Engine does not stop

		Possible cause	Remedy	
<p>1</p> <p>Is stated voltage present at engine stop solenoid terminal that carries wire Br?</p> <ul style="list-style-type: none"> • Lower than 1V • Turn starter switch OFF. 	YES	Engine stop solenoid is faulty.	Renew.	
	<p>2</p> <p>Is stated voltage present at engine stop relay terminal C that carries wire Br?</p> <ul style="list-style-type: none"> • Lower than 1V • Turn starter switch OFF. • Disconnect wire harness at stop relay. 	YES	Harness (+) touches wire harness of color BR connecting engine stop relay terminal C to engine stop solenoid terminal.	Repair or renew wire.
		NO	Engine stop relay faulty.	Renew.

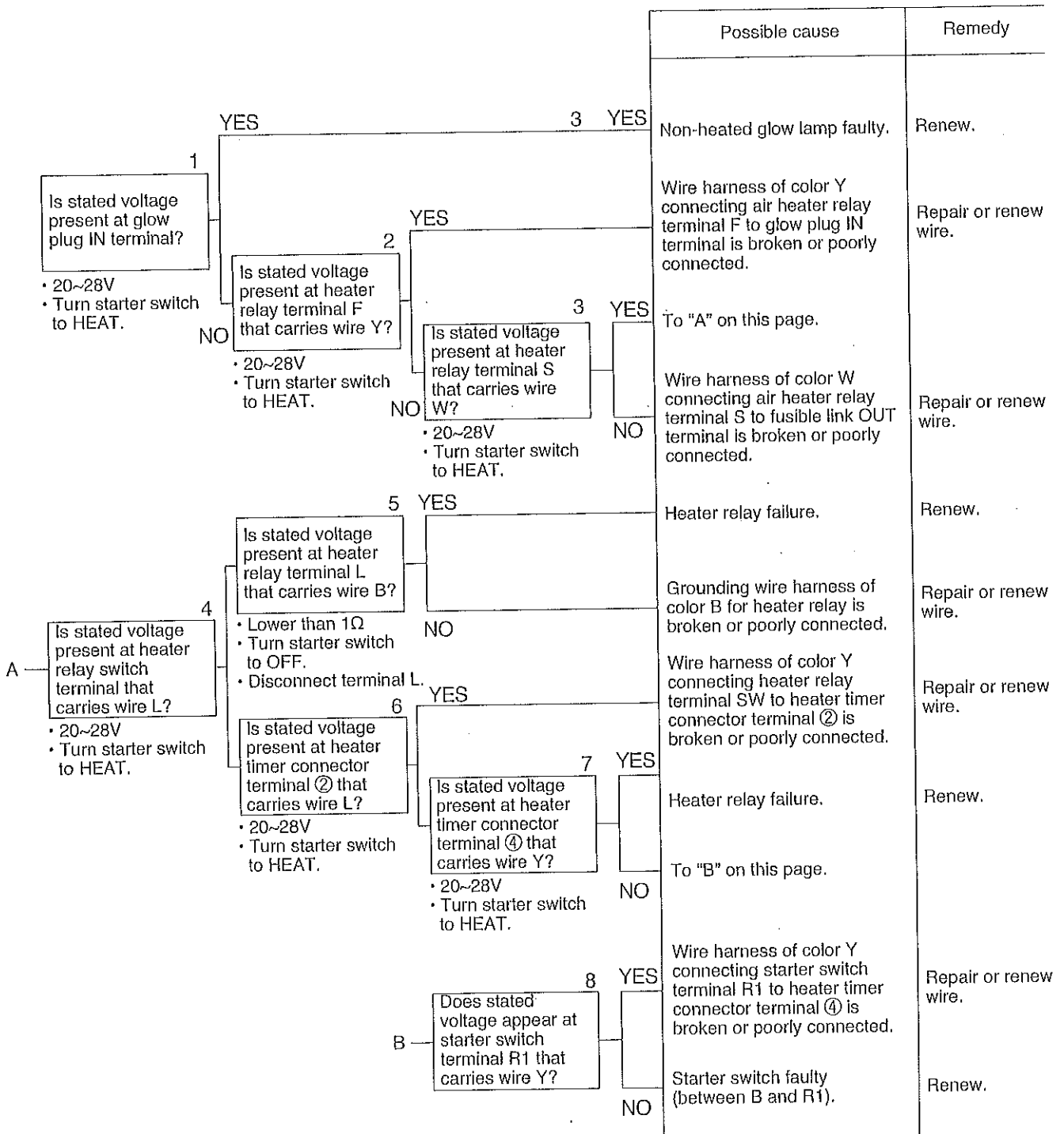
Electric wiring diagram for modes E-02



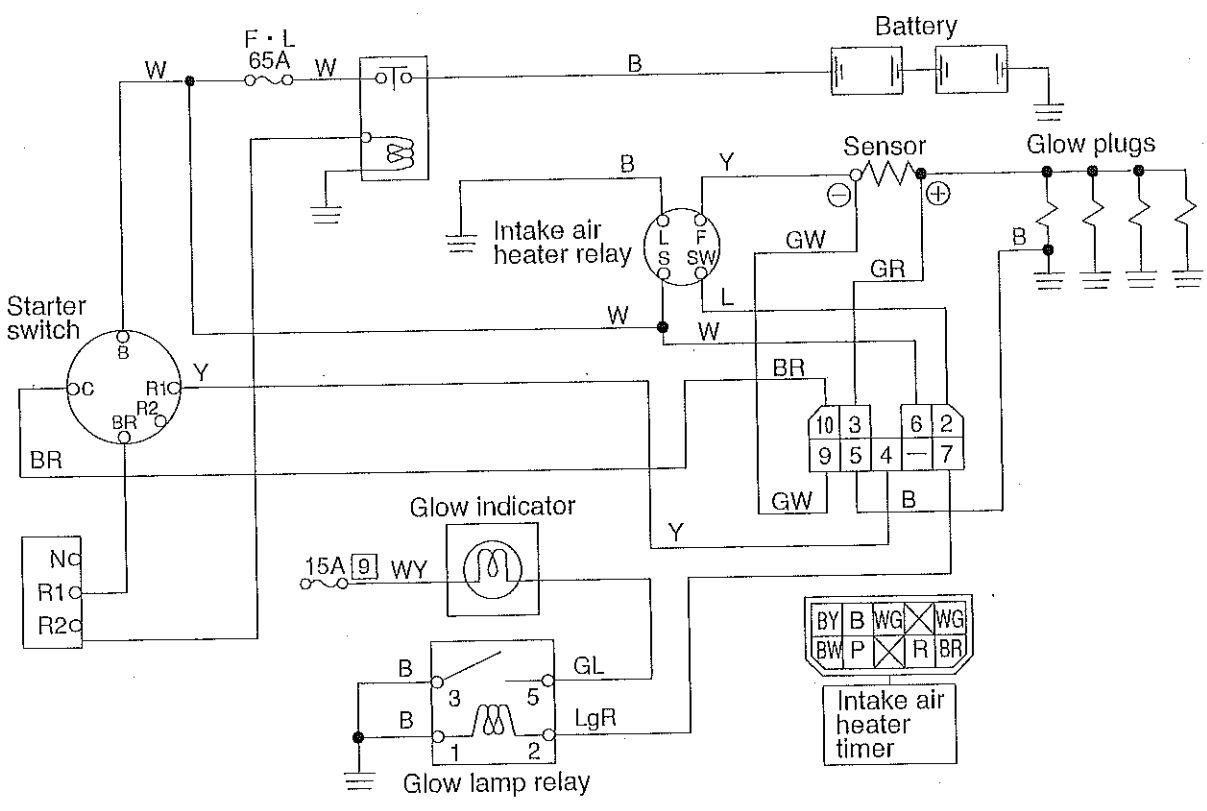
SW6514002

E-03 Poor preheat (glow plug does not become red-hot)

★When starter rotates (follow fault finding of E-01 when starter fails to rotate)



Electric wiring diagram for mode E-03

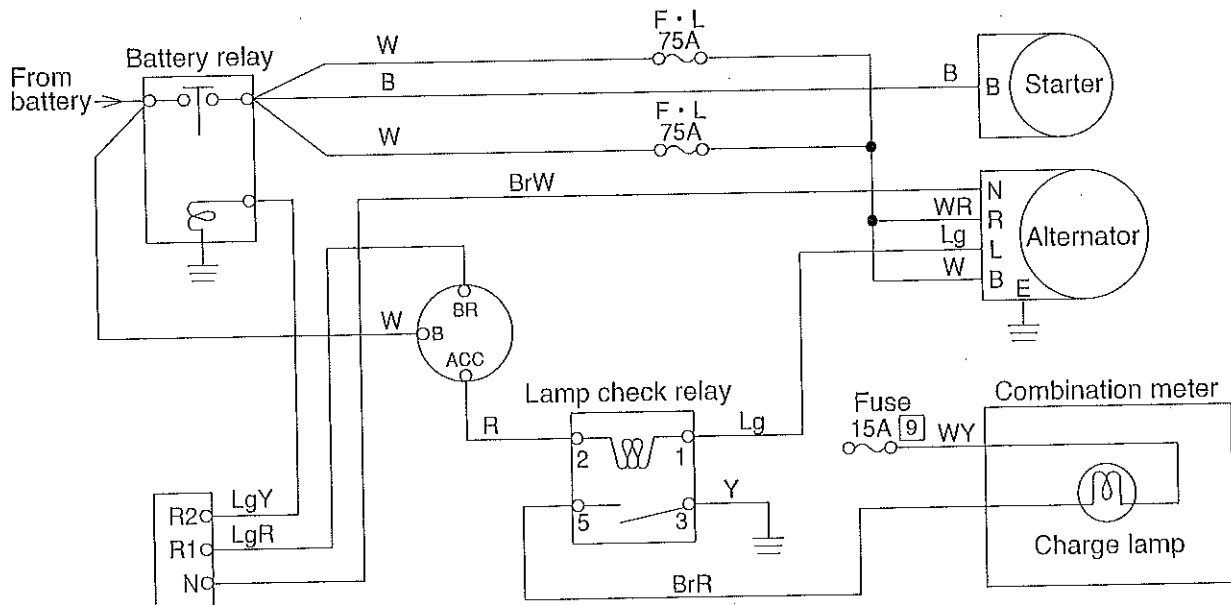


SW6514003

E-04 No charging (charge lamp stays bright.)

		Possible cause	Remedy	
<p>1</p> <p>Is stated voltage present at alternator terminal L that carries wire Lg?</p> <ul style="list-style-type: none"> • 27.5~29.5V • Run engine at higher than medium speed. 	YES	Lamp check relay faulty.	Renew.	
	NO	2	<p>3</p> <p>Is resistance of alternator ground wire as specified?</p> <ul style="list-style-type: none"> • Lower than 1Ω • Disconnect wire from alternator. 	<p>Alternator faulty.</p> <p>Renew.</p>
	NO	NO		
NO	NO	<p>Does specified voltage appear at alternator terminal B that carries wire W?</p> <ul style="list-style-type: none"> • 20~28V • Turn starter switch ON. 	<p>Wire harness of color W connecting starter terminal B to battery relay power IN terminal is broken or poorly connected.</p> <p>Repair or renew wire.</p>	

Electric wiring diagram for E-04



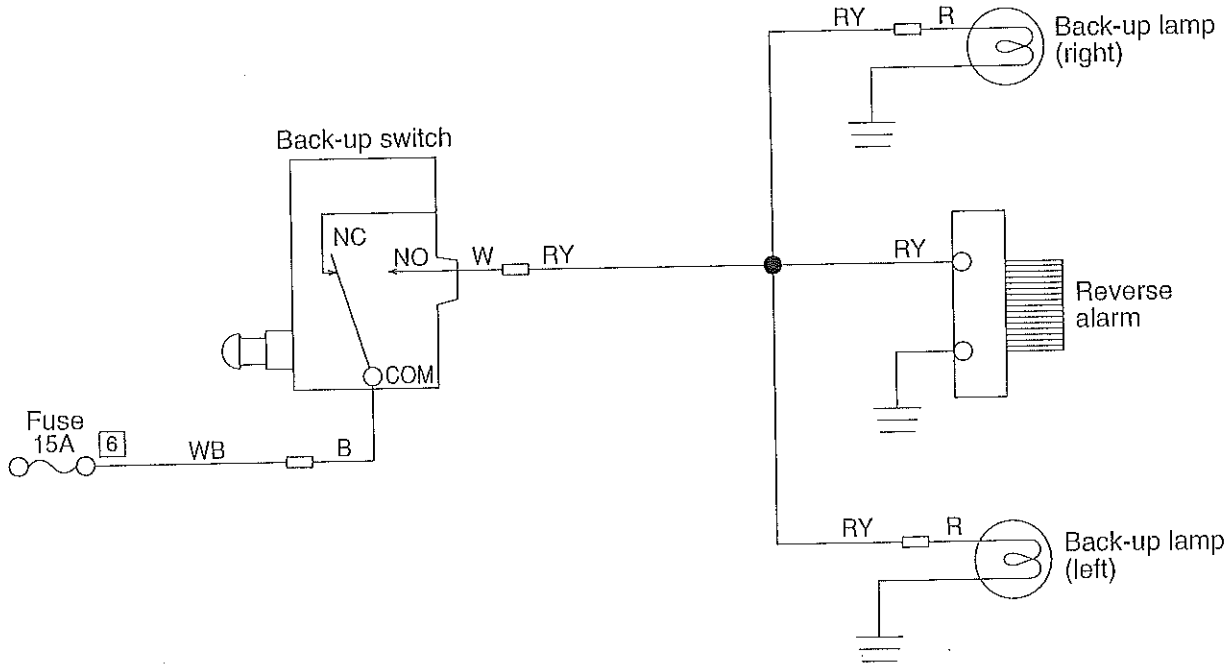
SW6514004

E-05 Reverse alarm does not sound

- ★First, check that the fuse is not blown.
- ★The voltage measurement should be taken with the starter switch ON.

		Possible cause	Remedy	
<p>1</p> <p>Does specified voltage appear at reverse alarm terminal that carries wire RY?</p> <ul style="list-style-type: none"> • 20~28V • Move F-R lever BACKWARD. 	YES	Reverse alarm faulty.	Renew.	
	NO	Reverse alarm earth wire not connected or incorrectly connected.	Repair or renew wire.	
	<p>2</p> <p>Is resistance of reverse alarm ground wire as specified?</p> <ul style="list-style-type: none"> • Less than 1Ω • Disconnect wire from reverse alarm. 	YES	Reverse alarm earth wire not connected or incorrectly connected.	Repair or renew wire.
		NO	Wire RY from back-up switch to reverse alarm not connected or incorrectly connected.	Repair or renew wire.
<p>3</p> <p>Does specified voltage appear at back-up switch that carries wire RY?</p> <ul style="list-style-type: none"> • 20~28V • Move F-R lever BACKWARD. 	YES	Back-up switch faulty.	Renew.	
	NO	Wire WB from back-up switch to fuse not connected or incorrectly connected.	Repair or renew wire.	
<p>4</p> <p>Is specified voltage present at back-up switch terminal that carries wire WB?</p> <ul style="list-style-type: none"> • 20~28V 	YES			
	NO			

Electric wiring diagram for mode E-05



SW6514005

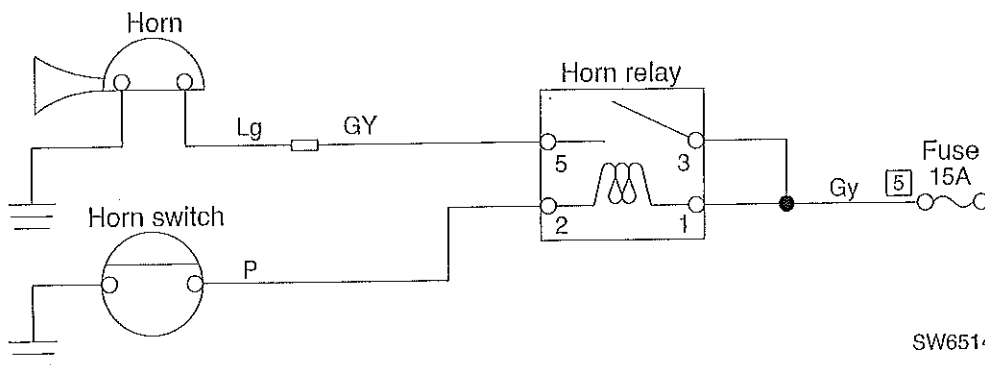
E-06 Horn does not sound

★First, check that fuse is not blown.

★The voltage measurement should be taken with the starter switch ON.

		Possible cause	Remedy
<p>1</p> <p>Is stated voltage present at horn terminal that carries wire GY?</p> <ul style="list-style-type: none"> • 20~28V • Switch on horn switch. 	<p>2 YES</p> <p>Is resistance of horn earth wire as specified?</p> <ul style="list-style-type: none"> • Lower than 1Ω • Disconnect wire from horn. 	Horn faulty.	Renew.
	<p>NO</p> <p>3</p> <p>Is stated voltage present at horn relay terminal 5 that carries wire GY?</p> <ul style="list-style-type: none"> • 20~28V • Switch on horn switch. 	Horn earth wire not connected or incorrectly connected.	Repair or renew wire.
	<p>YES</p> <p>4 YES</p> <p>Is stated voltage present at horn relay terminals 1 and 3 that carry wire Gy?</p> <ul style="list-style-type: none"> • 20~28V 	Wire GY from horn to horn relay terminal 5 not connected or incorrectly connected.	Repair or renew wire.
	<p>NO</p> <p>4 NO</p> <p>To "A" on this page.</p> <p>Wire Gy from fuse to horn relay terminals 1 and 3 not connected or incorrectly connected.</p>	Repair or renew wire.	
<p>A</p> <p>5</p> <p>Is stated voltage present at horn switch terminal that carries wire P?</p> <ul style="list-style-type: none"> • 20~28V • Switch OFF horn switch. 	<p>6 YES</p> <p>Is resistance between horn switch terminals normal?</p> <ul style="list-style-type: none"> • Lower than 1Ω when switched ON. • Disconnect wires from horn switch. 	Horn switch faulty.	Renew.
	<p>NO</p> <p>7 YES</p> <p>Is resistance of horn switch earth wire as specified?</p> <ul style="list-style-type: none"> • Lower than 1Ω • Disconnect wires from horn switch. 	Horn switch earth wire not connected or incorrectly connected.	Repair or renew wire.
	<p>YES</p> <p>8 YES</p> <p>Is stated voltage present at horn relay terminal 2 that carries wire P?</p> <ul style="list-style-type: none"> • 20~28V • Switch OFF horn switch. 	Horn switch faulty.	Renew.
	<p>NO</p> <p>8 NO</p> <p>Wire P from horn switch to horn relay terminal 2 not connected or incorrectly connected.</p> <p>Horn relay faulty.</p>	Repair or renew wire.	

Electric wiring diagram for mode E-06

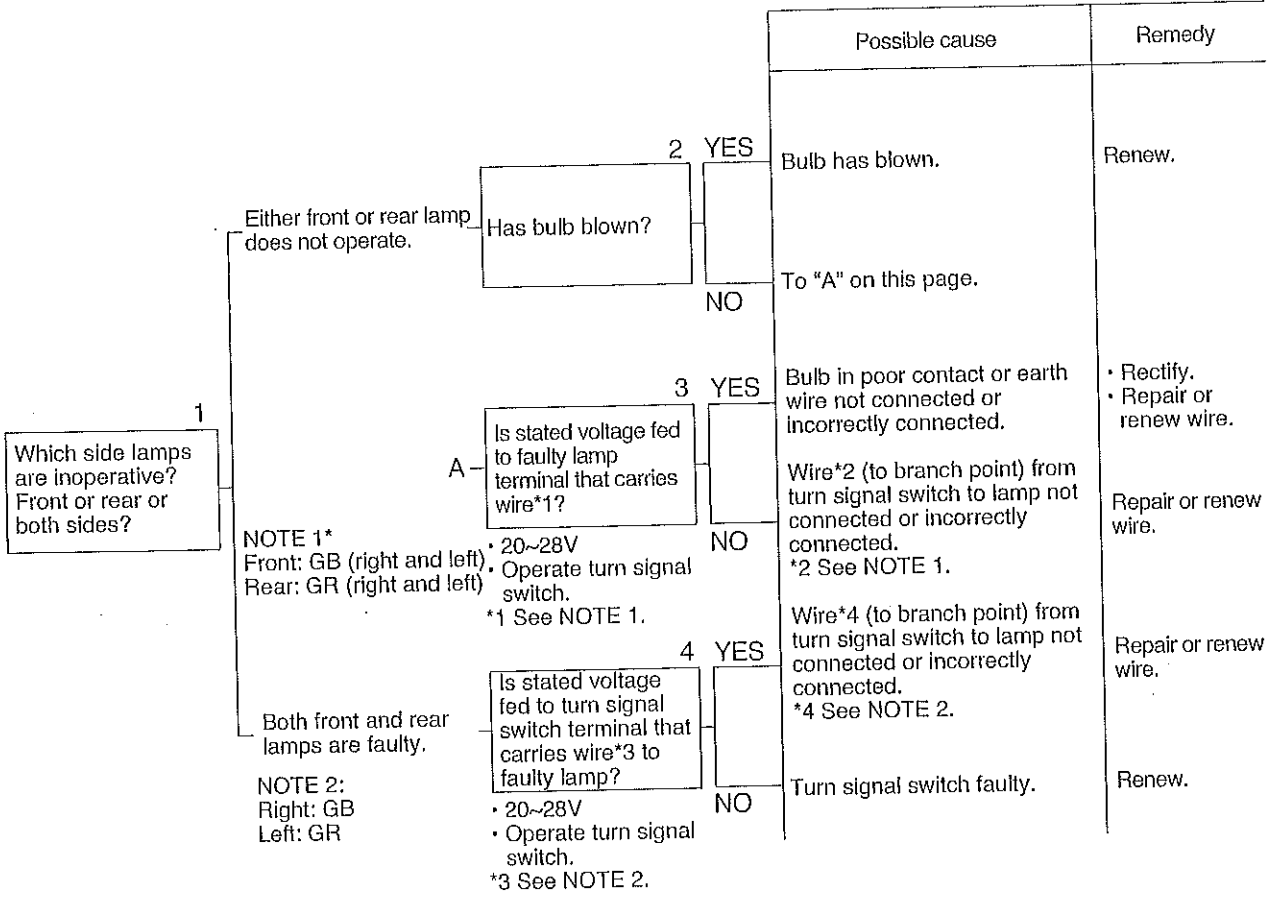


SW6514006

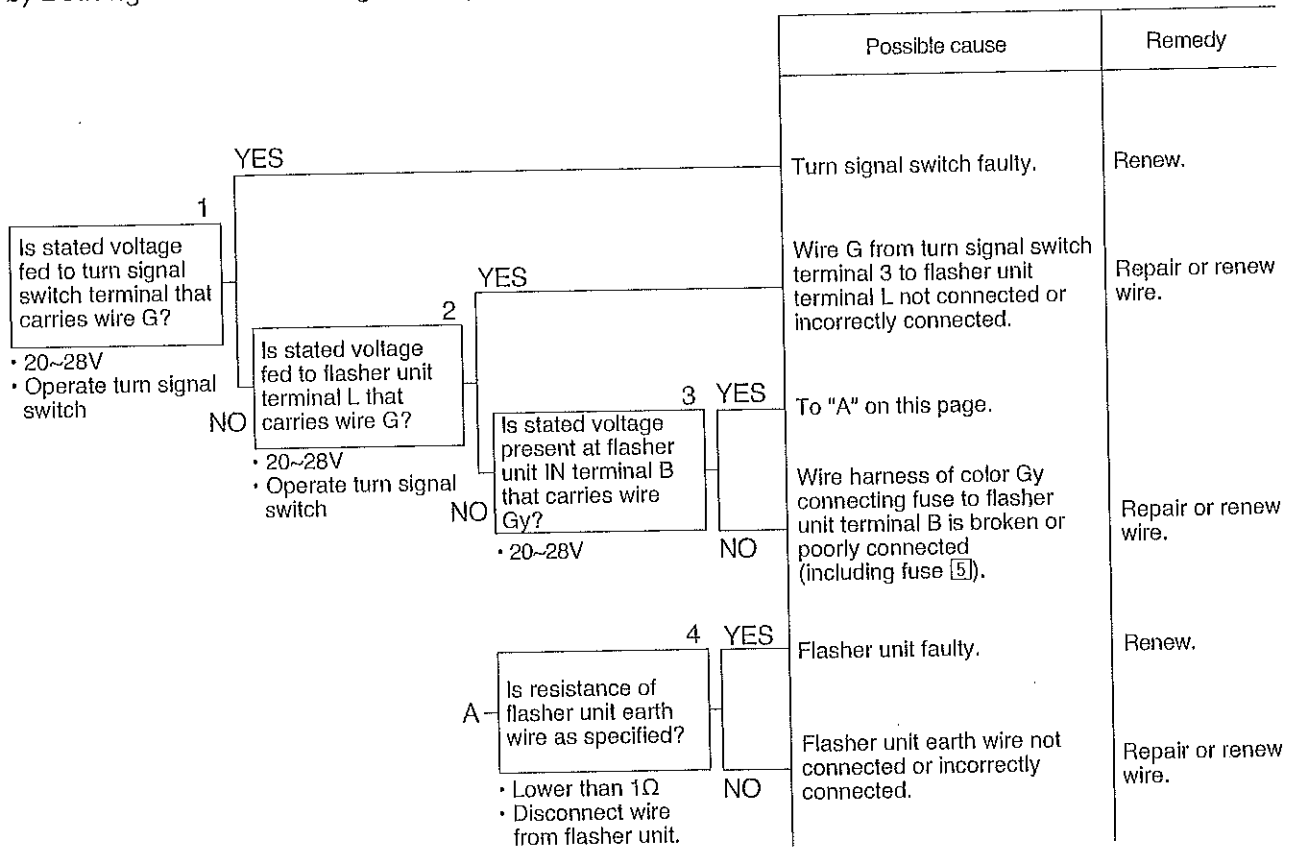
E-07 Turn signal lamps do not flash

- ★First, ensure that fuse is not blown.
- ★Measure the voltage with the starter switch ON.

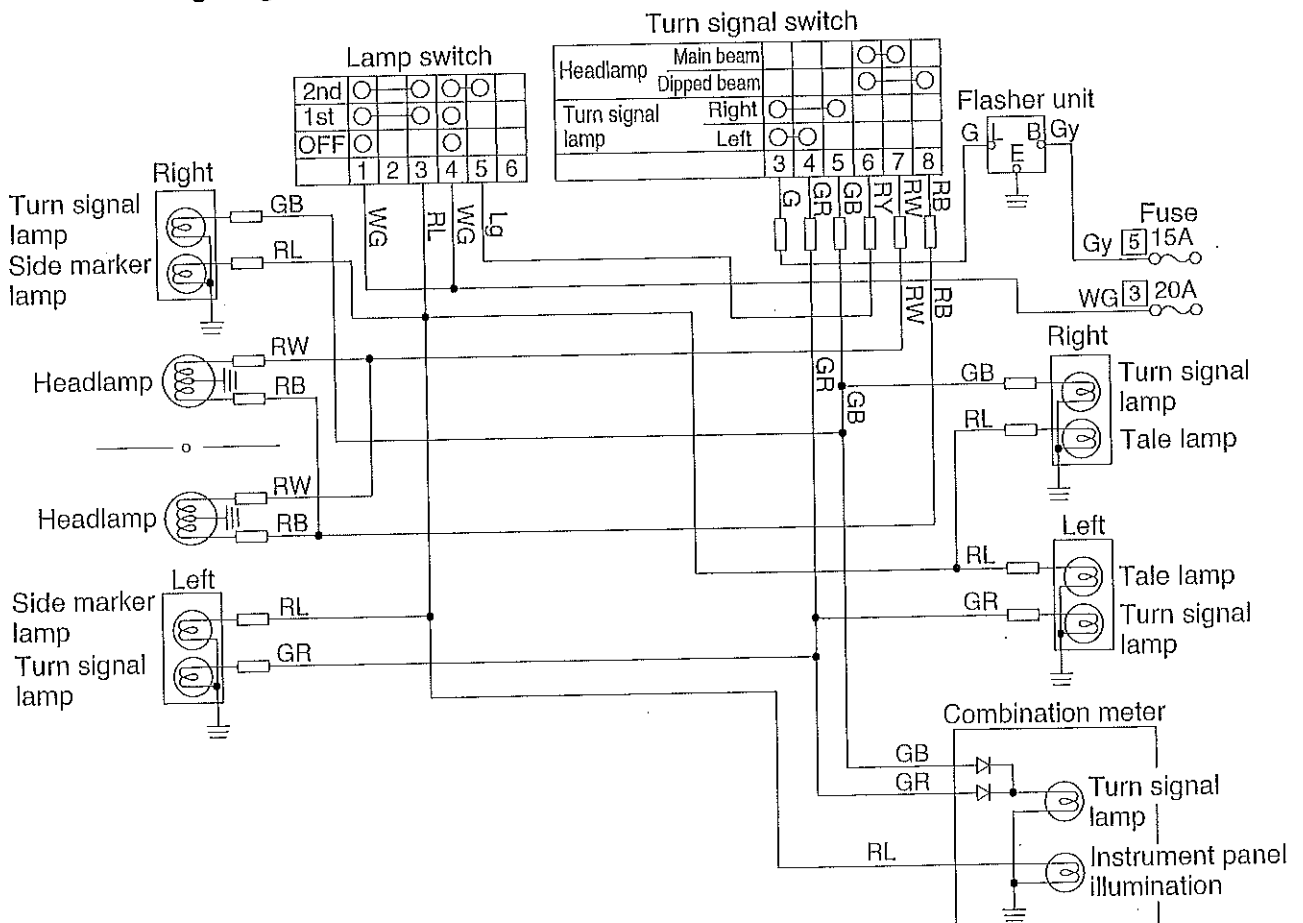
a) Either right or left lamp does not flash.



b) Both right and left turn signal lamps do not operate.



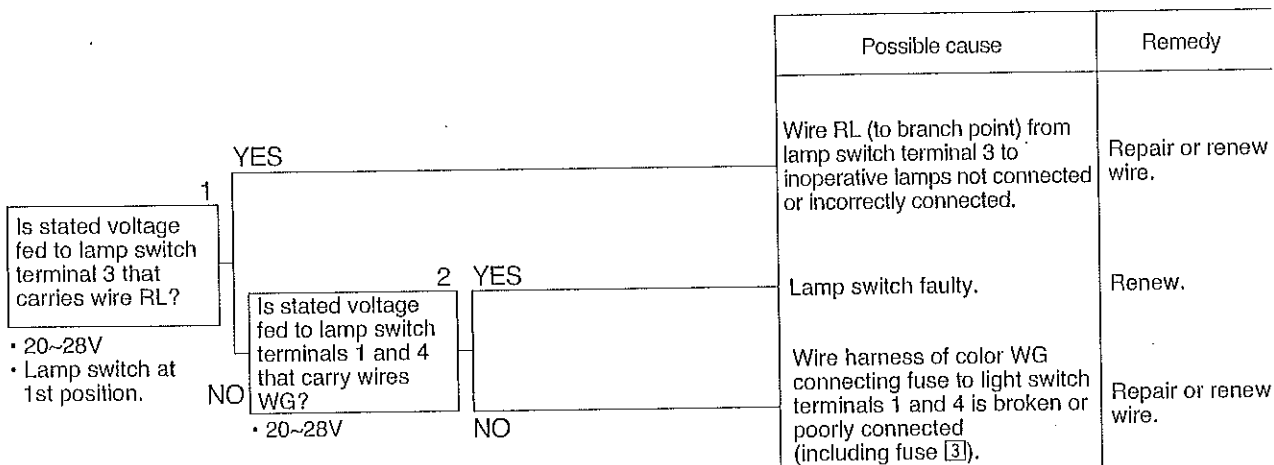
Electric wiring diagram for E-07, E-08



E-08 Headlamps do not operate

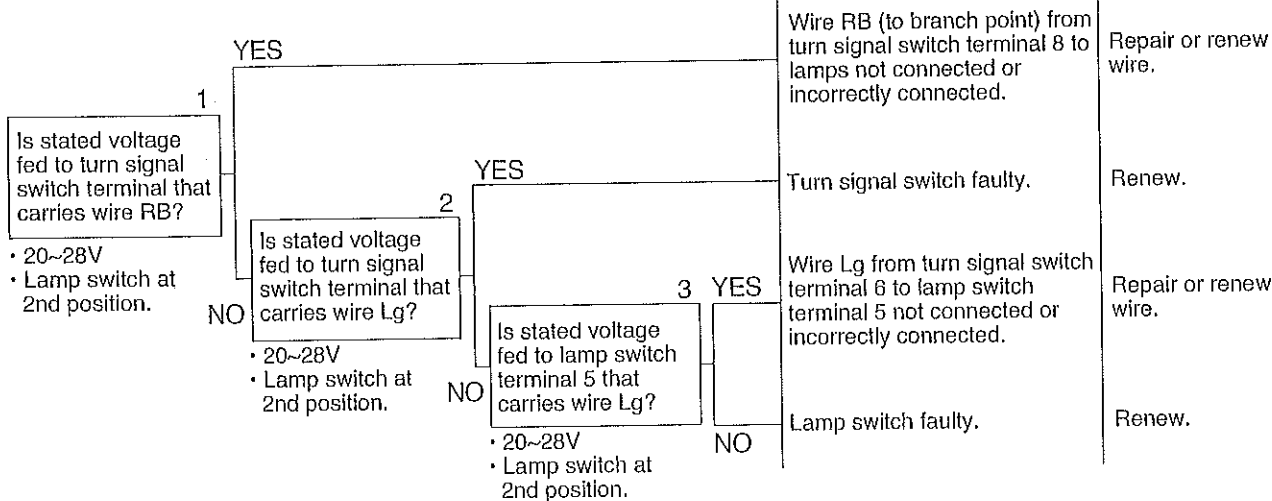
- ★First, ensure that fuse is not blown.
- ★Measure the voltage with the starter switch ON.

a) Side marker lamps and tale lamps do not come on.

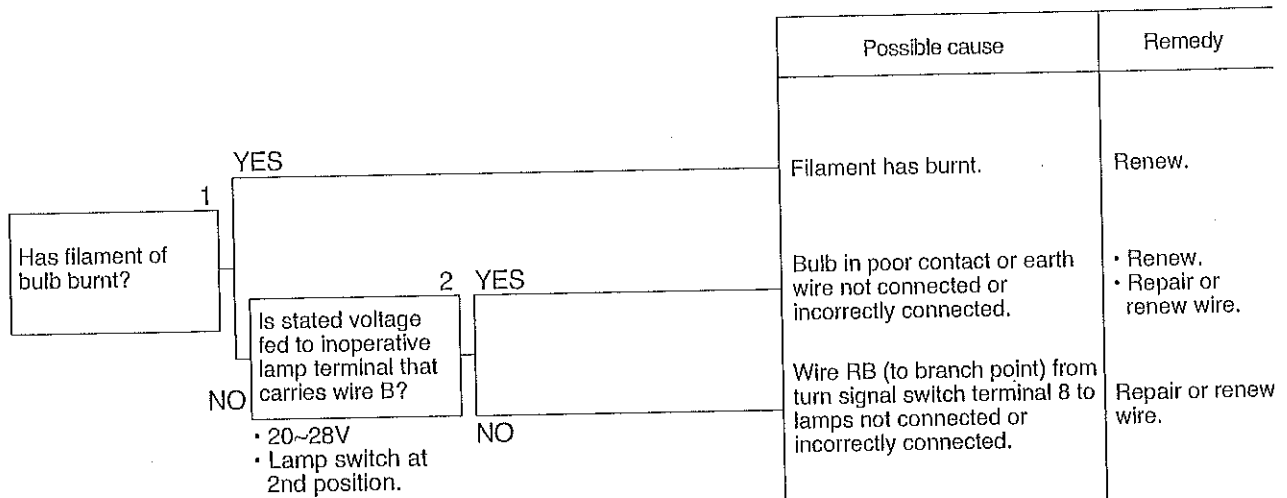


b) Right and left lamps (dipped beam) do not light.

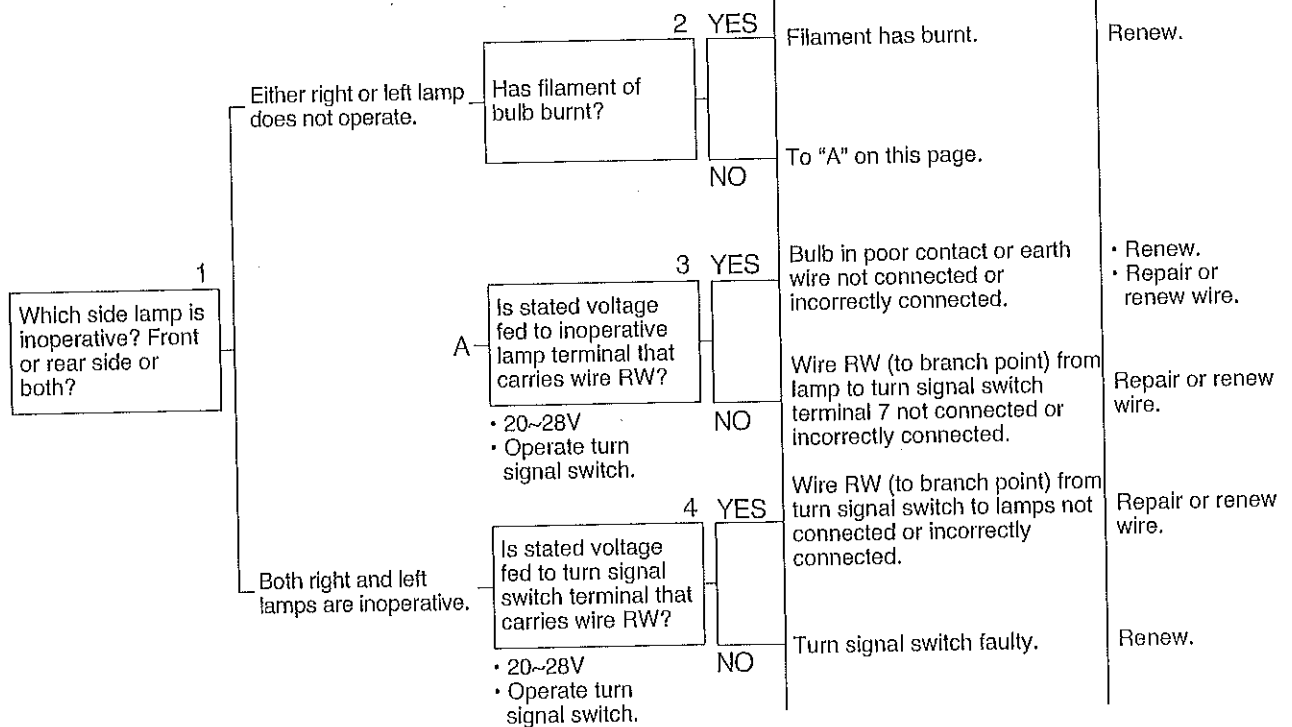
- ★Side marker lamps light up.



c) Either right or left lamp (dipped beam) does not light.



d) Main beams not selected.

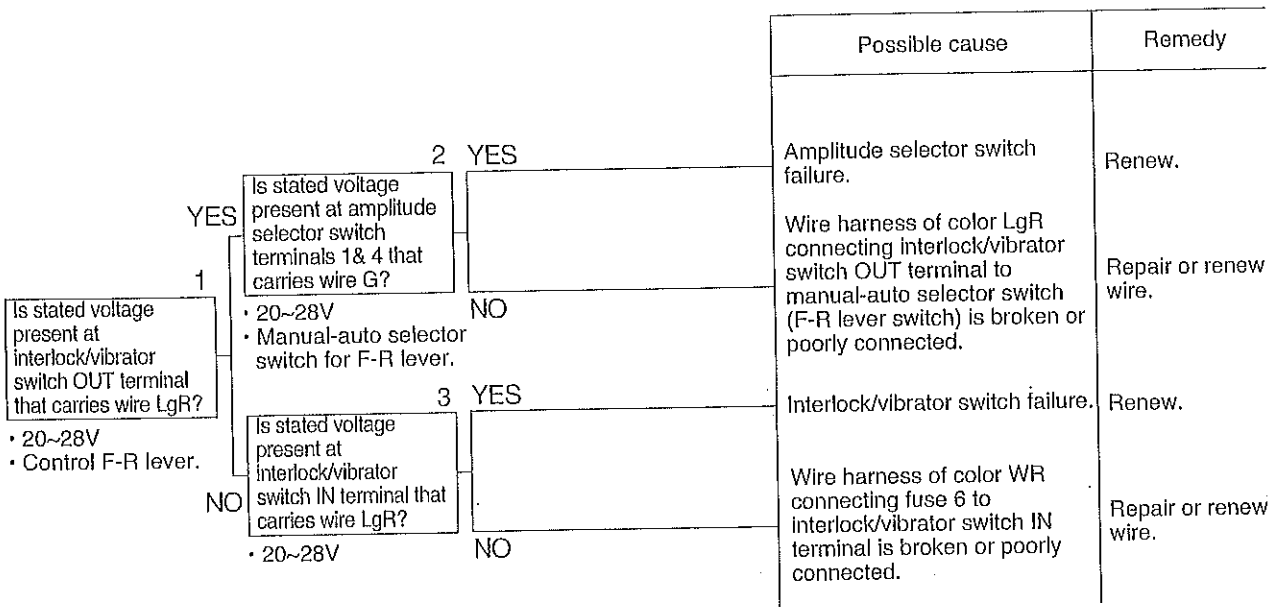


*See electric wiring diagram for modes E-07 and E-08.

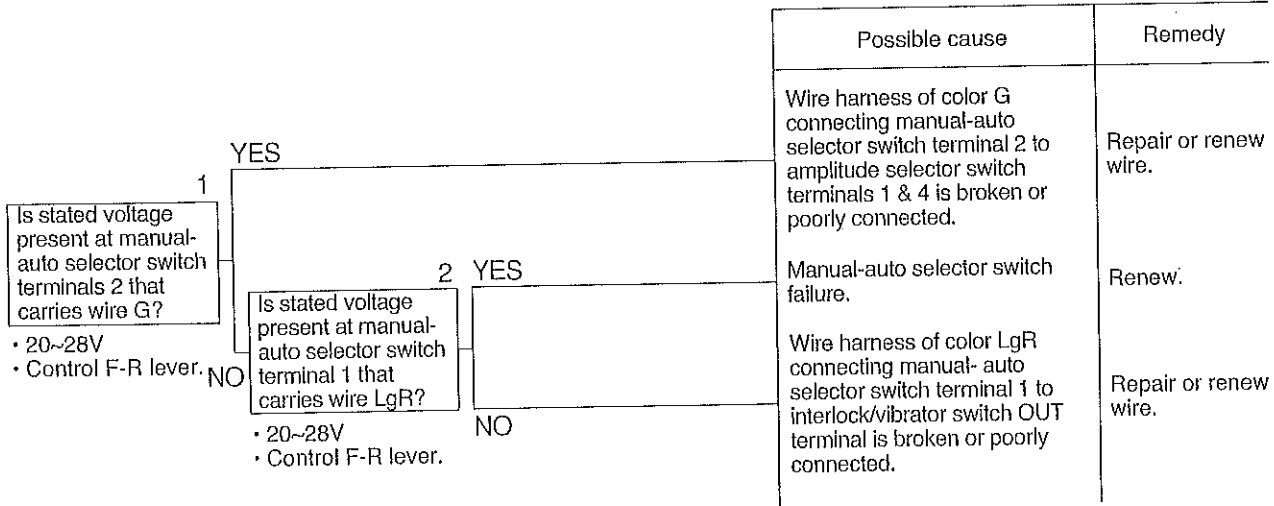
E-09 Vibrator does not work properly

- ★ Check fuse 6 has not been blown to carry out fault finding.
- ★ Measure the voltage with the starter switch ON.

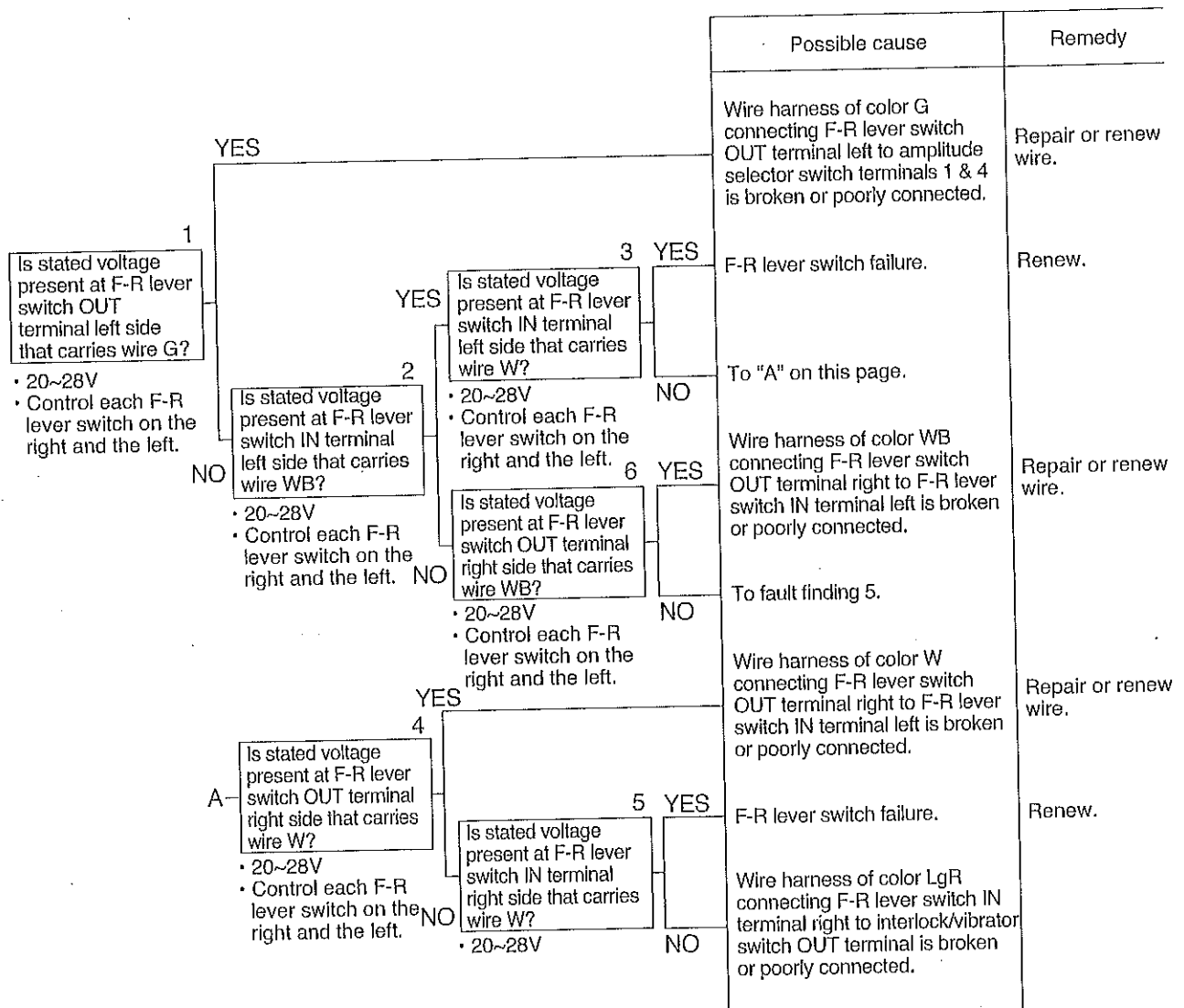
a) Vibrator itself fails to work (when it will not work even by F-R lever control switch in both manual and automatic controls)



b) Inoperative in AUTO mode (operative with F-R lever)



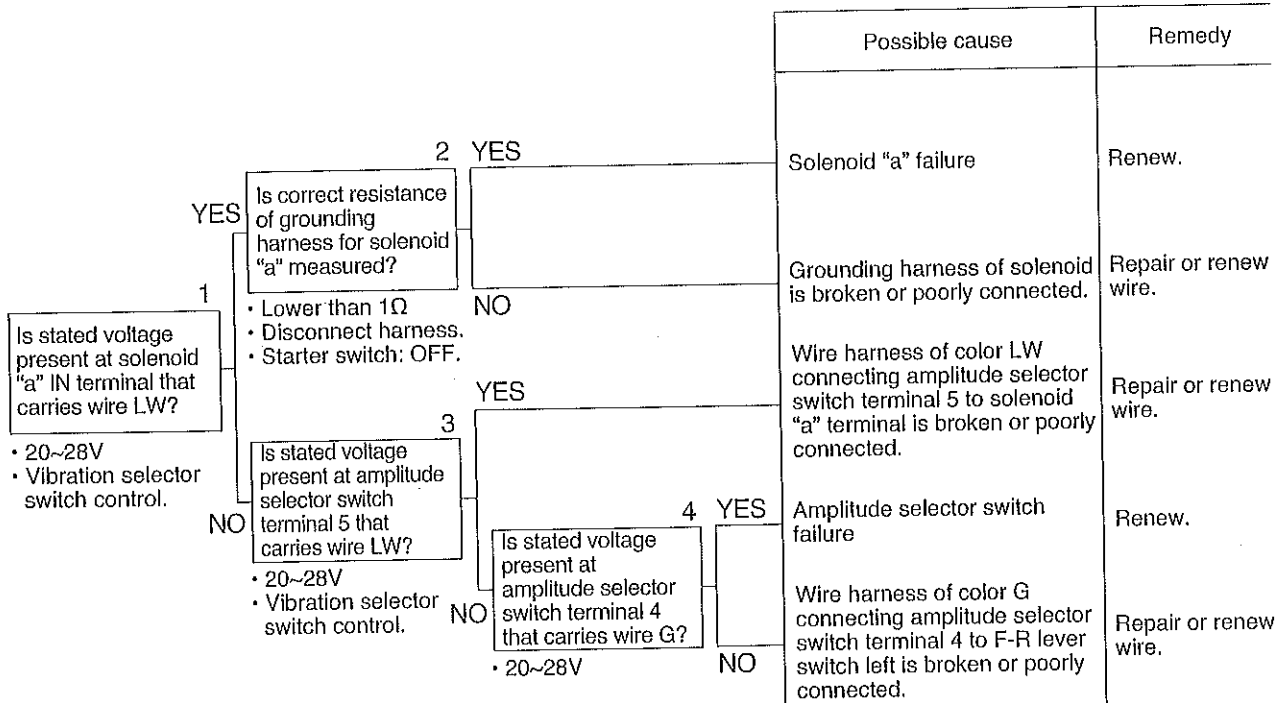
c) Inoperative by F-R lever switch control (operative with AUTO mode)



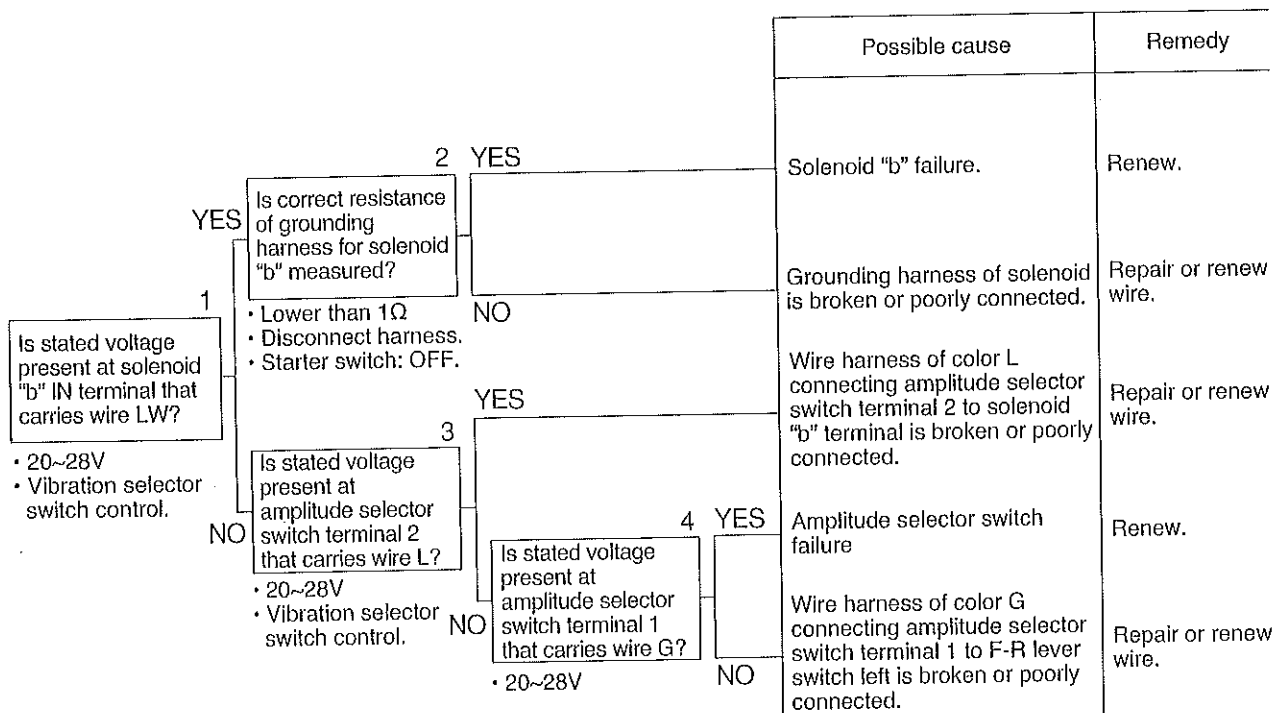
d) Lo/Hi amplitude fails to be switched
 (For SW651ND: switching horizontal and normal vibration)

★Carry out fault finding by vibratory operation.

1) When solenoid "a" is inoperative



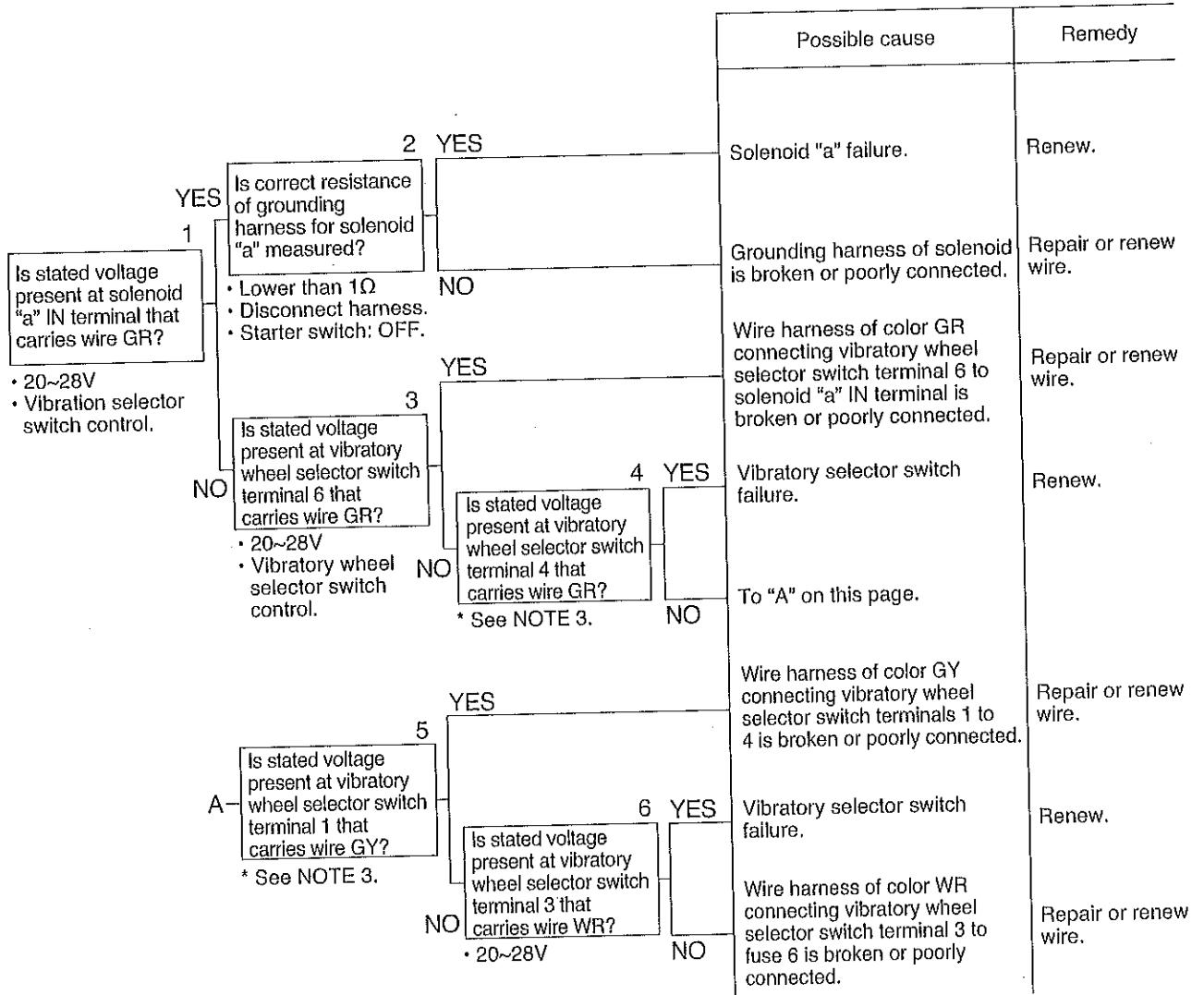
2) When solenoid "b" is inoperative



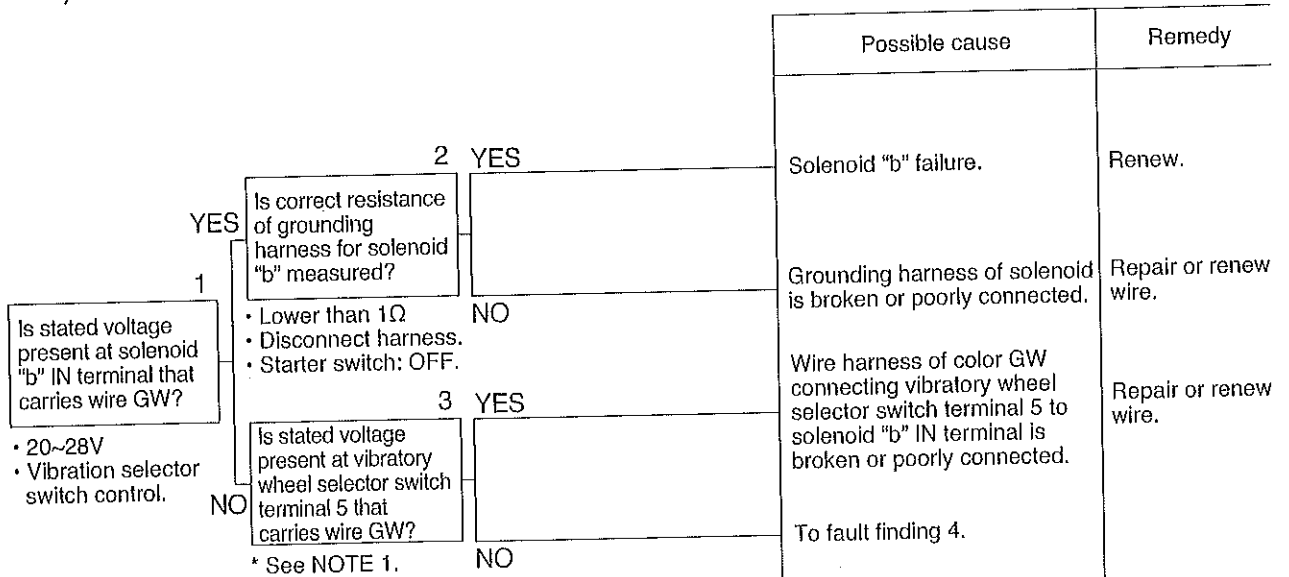
e) Vibratory wheel fails be switched

★When both solenoid "a" and "b" fail to be operated, both "front and rear wheels" vibrate.

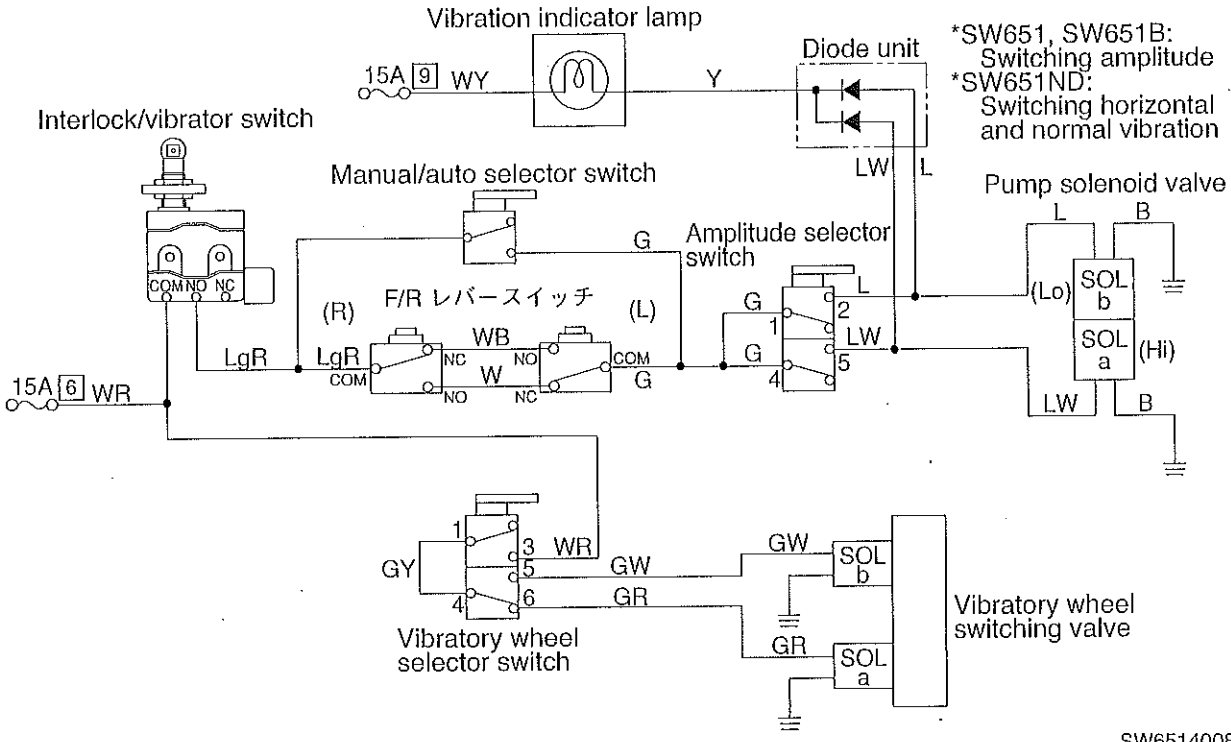
1) When solenoid "a" is inoperative



2) When solenoid "b" is inoperative



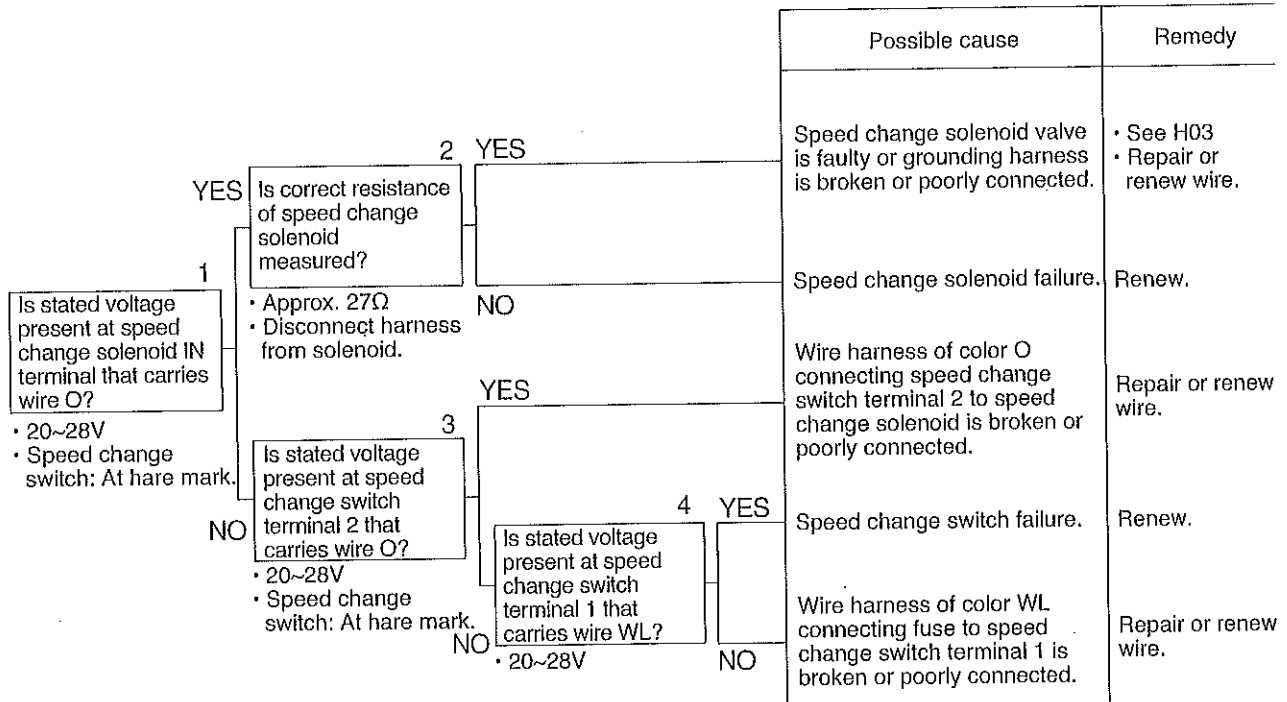
Electric wiring diagram for E-09



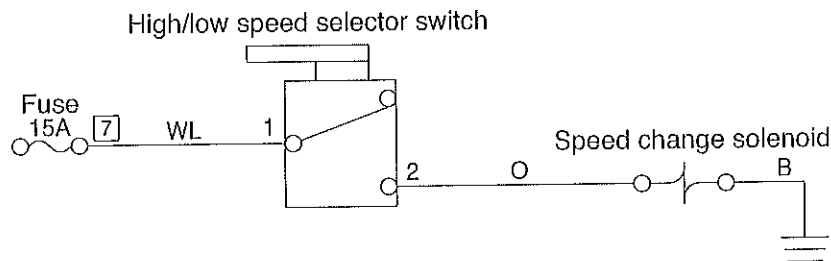
SW6514008

E-10 High/low speed fails to be switched

- ★First, ensure that the fuse is not damaged.
- ★Measure the voltage with the starter switch ON.



Electric wiring diagram for mode E-10



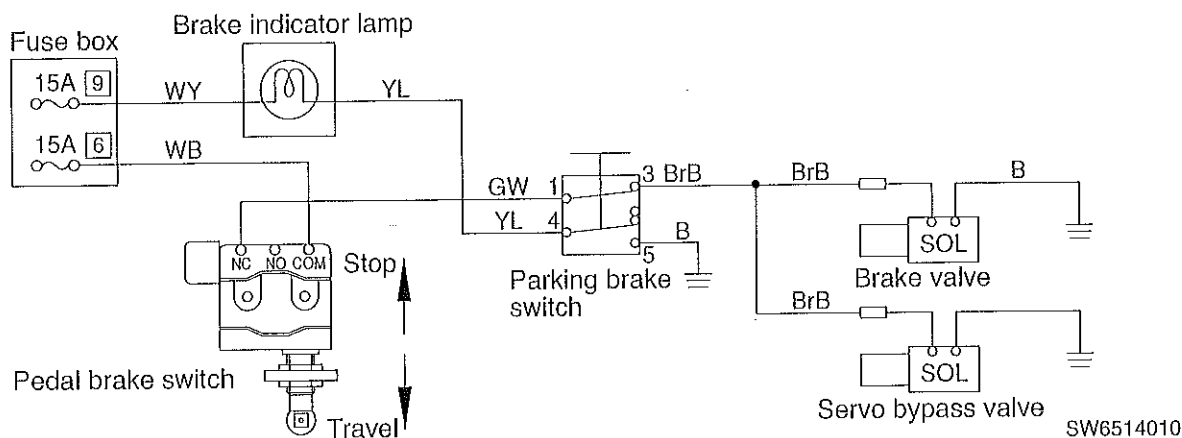
SW6514009

E-11 Parking brake not released

- ★First, ensure that the fuse is not burnt out.
- ★Measure the voltage with the starter switch ON.
- ★Set the parking brake to DISENGAGE and keep the foot brake pedal not depressed.

		Possible cause	Remedy
<p>1</p> <p>Is stated voltage present at brake release solenoid terminal that carries wire WB? • 20~28V</p> <p>2 YES</p> <p>Is solenoid resistance as specified and is solenoid insulated from body? • About 27 Ω • Disconnect wire from solenoid.</p> <p>3 YES</p> <p>Is resistance of brake release solenoid earth wires as stated? • Lower than 1 Ω • Disconnect wire from solenoid.</p> <p>4 YES</p> <p>Is stated voltage present at parking brake switch terminal 3 that carries wire BrB? • 20~28V</p> <p>5 YES</p> <p>Is stated voltage present at parking brake switch terminal 1 that carries wire GW? • 20~28V</p> <p>6 YES</p> <p>Is stated voltage present at pedal brake switch OUT terminal 3 that carries wire GW? • 20~28V</p> <p>7 YES</p> <p>Is stated voltage present at pedal brake switch IN terminal that carries wire RG? • 20~28V</p>	<p>NO</p> <p>NO</p> <p>NO</p> <p>NO</p> <p>NO</p> <p>NO</p> <p>NO</p>	<p>Brake release solenoid valve faulty (see H-08).</p> <p>Brake release solenoid faulty.</p> <p>Brake release solenoid earth wire not connected or incorrectly connected.</p> <p>Wire harness of color BrB connecting parking brake switch terminal 3 to solenoid is broken or poorly connected.</p> <p>Parking brake switch failure.</p> <p>To "A" on this page.</p> <p>Wire harness of color GW connecting pedal brake switch OUT terminal to foot brake switch IN is broken or poorly connected.</p> <p>Pedal brake switch failure.</p> <p>Wire harness of color WB connecting pedal brake switch IN terminal to fuse is broken or poorly connected (including fuse [6]).</p>	<p>Renew.</p> <p>Repair or renew wire.</p> <p>Repair or renew wire.</p> <p>Renew.</p> <p>Renew.</p> <p>Repair or renew wire.</p> <p>Renew.</p> <p>Repair or renew wire.</p>

Electric wiring diagram for E-11



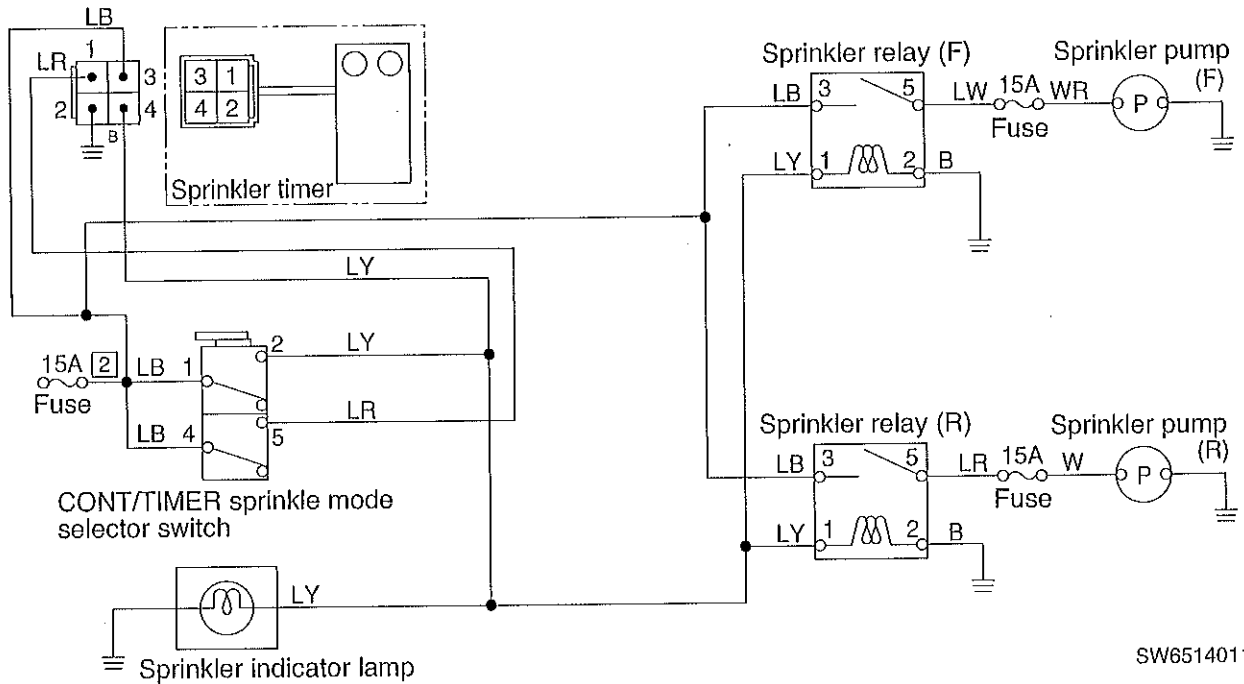
E-12 Sprinkler is inoperative

- ★First, ensure that the fuse is not damaged.
- ★Measure the voltage with the starter switch ON.

a) Both modes CONTINUOUS and TIMER are inoperative.

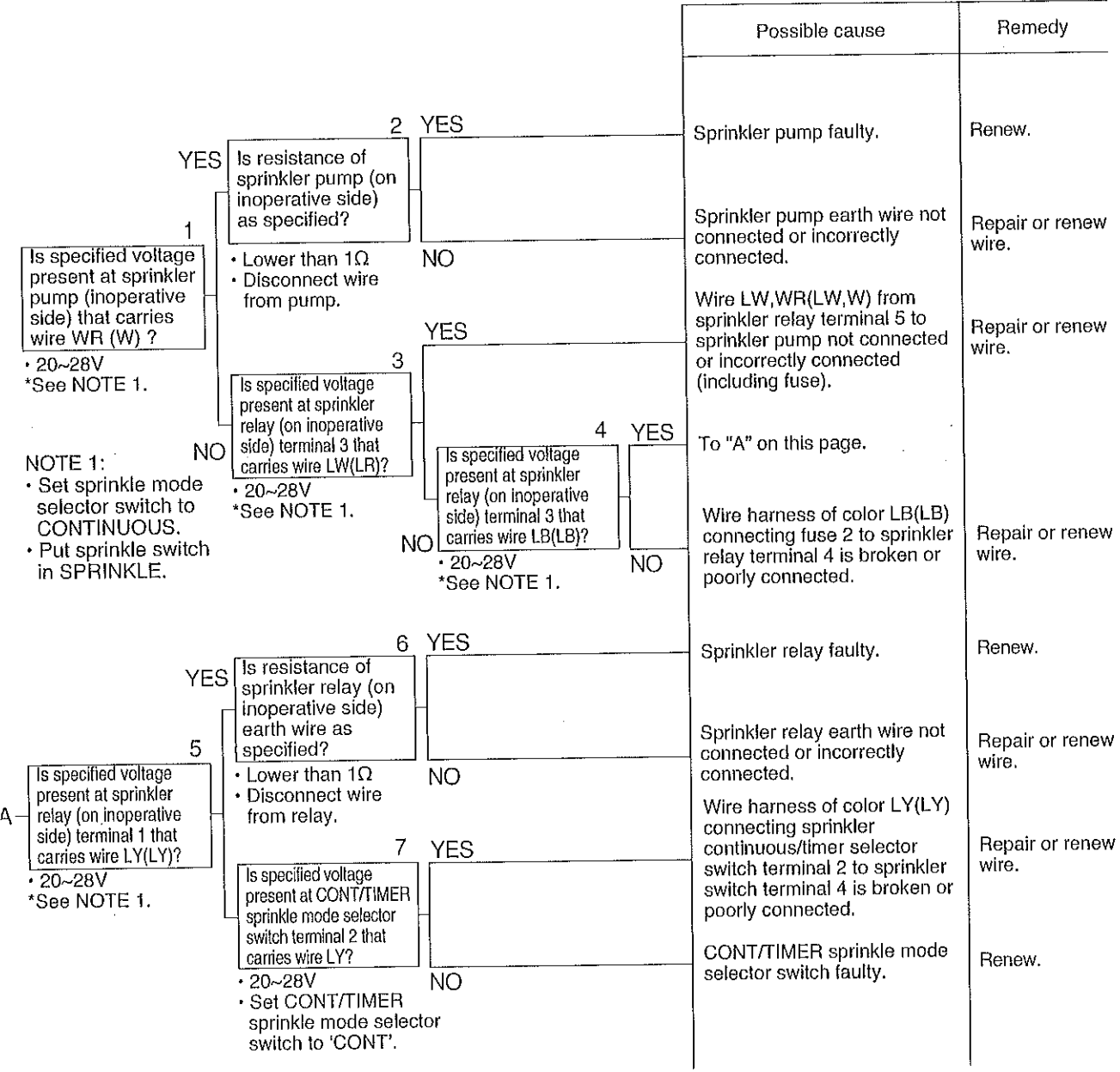
Is stated voltage fed to CONT/TIMER sprinkle mode selector switch terminal 4 that carries wire LR? • 20~28V	1 YES NO	Possible cause CONT/TIMER sprinkle mode selector switch faulty. Wire harness of color Y connecting fuse 2 to sprinkler continuous/timer selector switch terminal 4 is broken or poorly connected.	Remedy Renew. Repair or renew wire.
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Electric wiring diagram for E-12



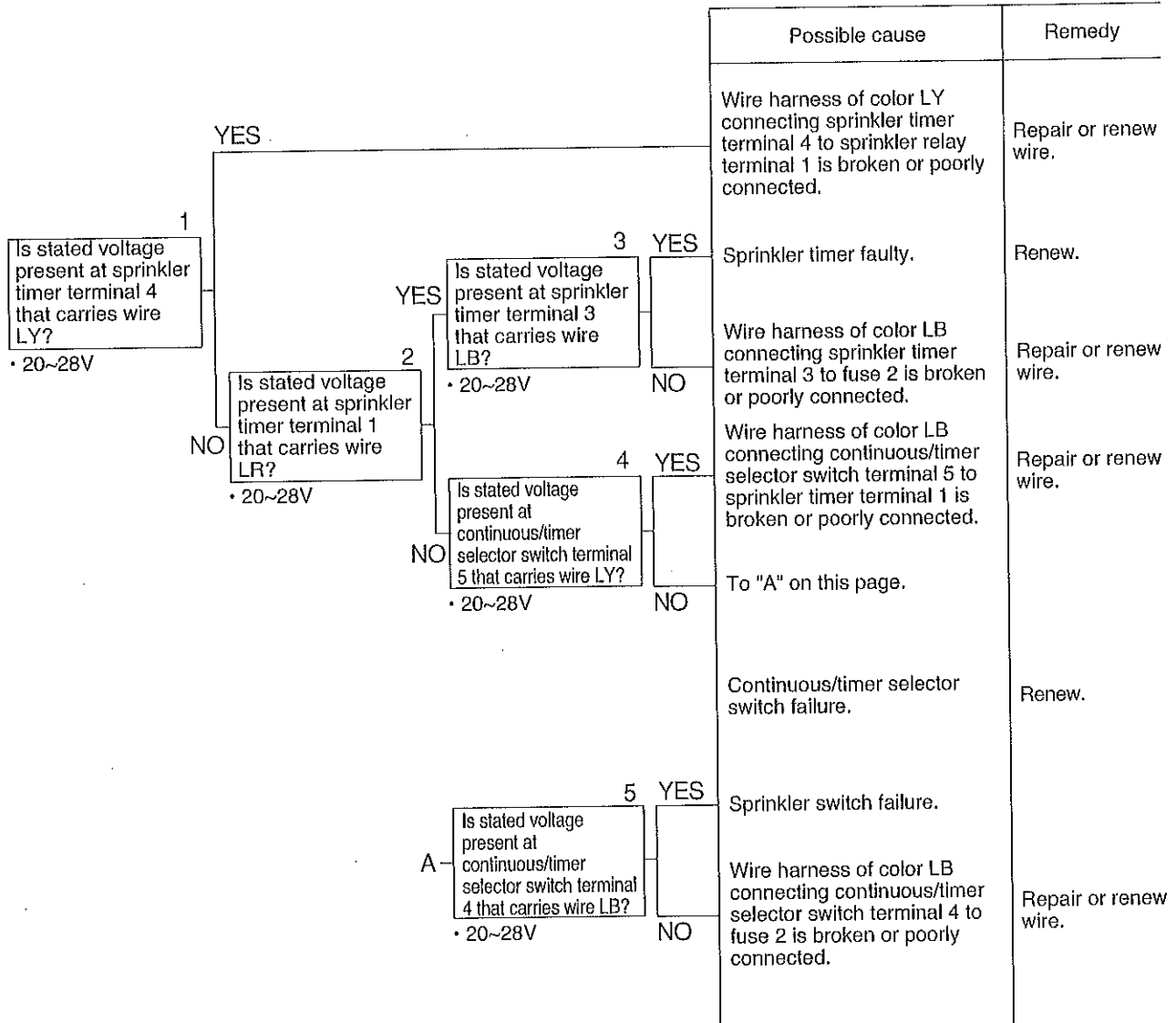
b) Mode CONT is inoperative. (Whenever mode CONTINUOUS is inoperative, mode TIMER also does not work.)

- ★If inoperative with indicator lamp illuminating, start with step 5 below:
- ★Letters enclosed in brackets indicate the wires color codes on the rear side.



c) Timer control operation is impossible (continuous operation works normally)

★Sprinkler continuous/timer selector switch is to be diagnosed on timer side.



E-13 Fuel gauge reads wrong

★Other gauges and lamps are normal.

★Measure the voltage with the starter switch ON.

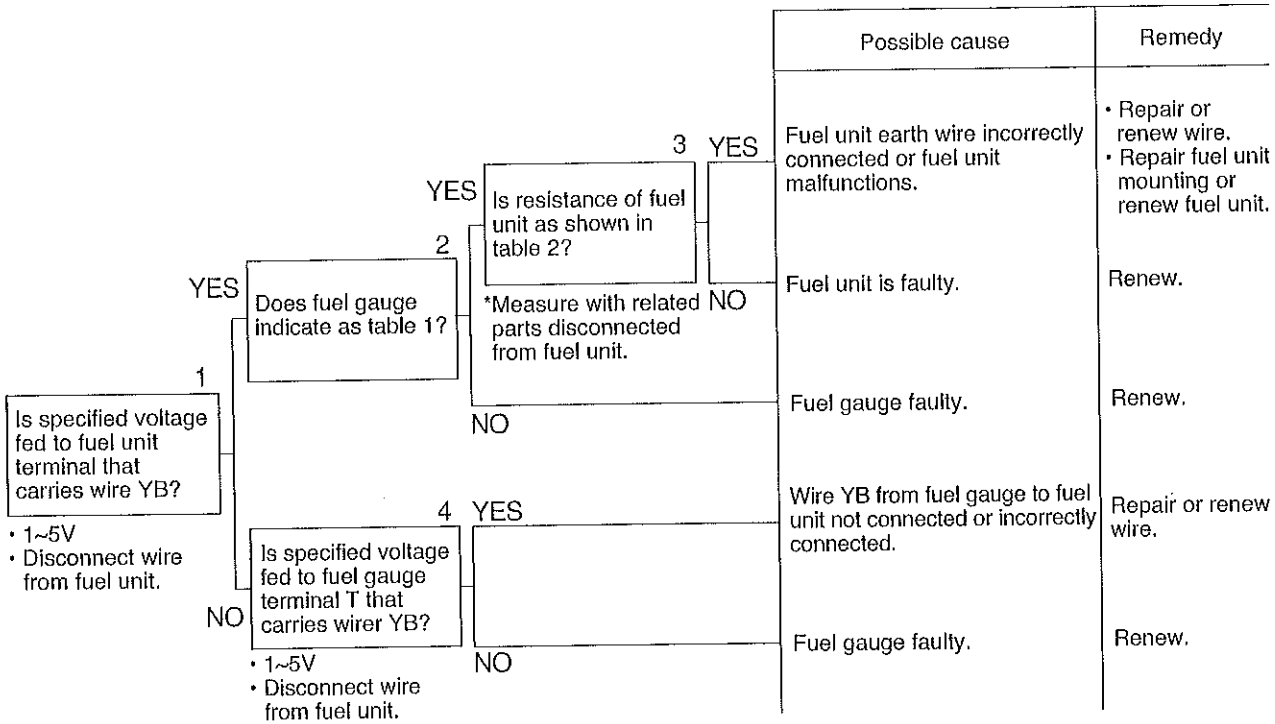


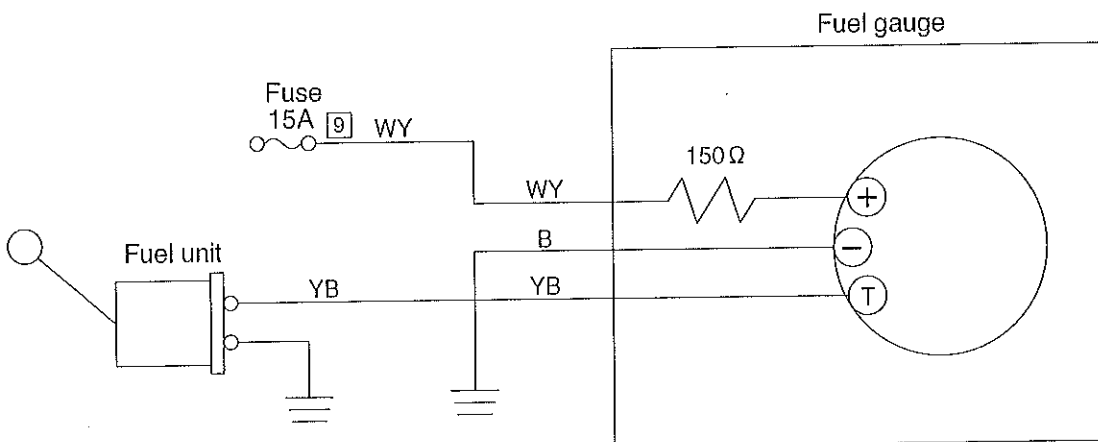
Table 1

Fuel unit wire L	Gauge reading
Disconnected	Empty
Grounded	Full

Table 2

Fuel unit float	Resistance (Ω)
Full	10~17.5
Empty	82.5~90

Electric wiring diagram for mode E-13



SW6514012

E-14 Water temperature gauge reads wrong

- ★Other gauges and lamps operate correctly.
- ★Measure the voltage with the starter switch ON.

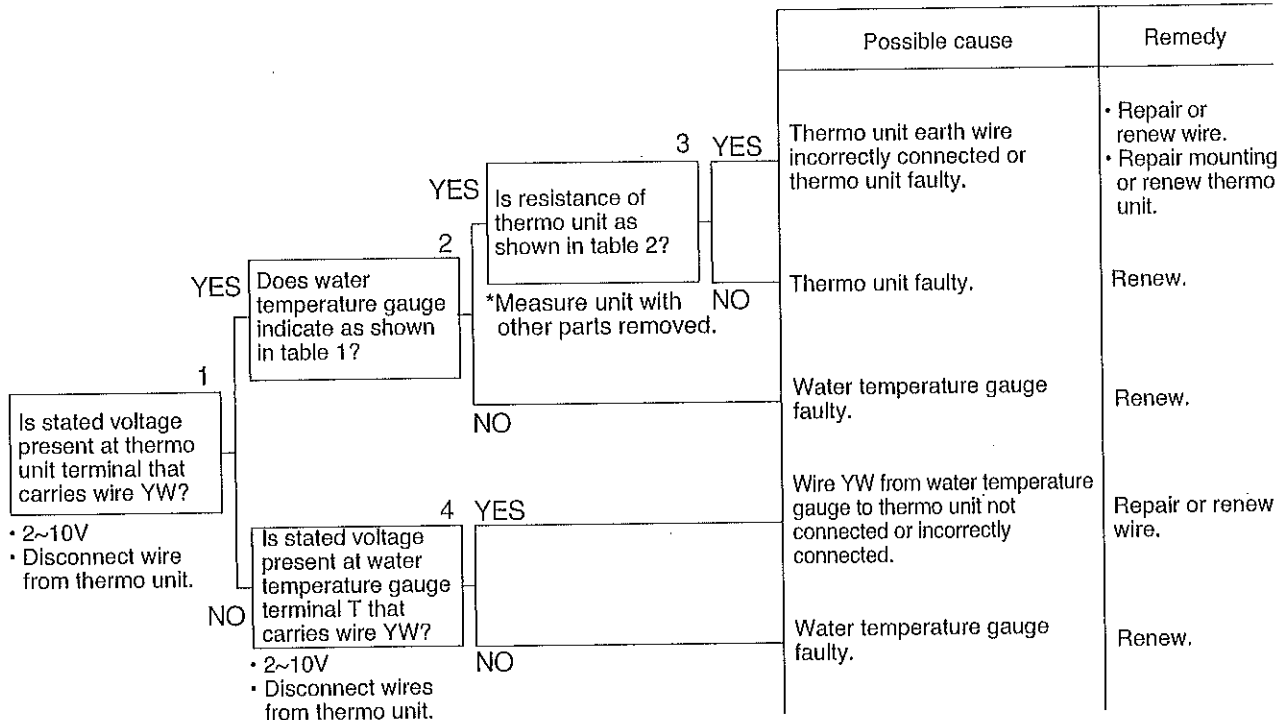


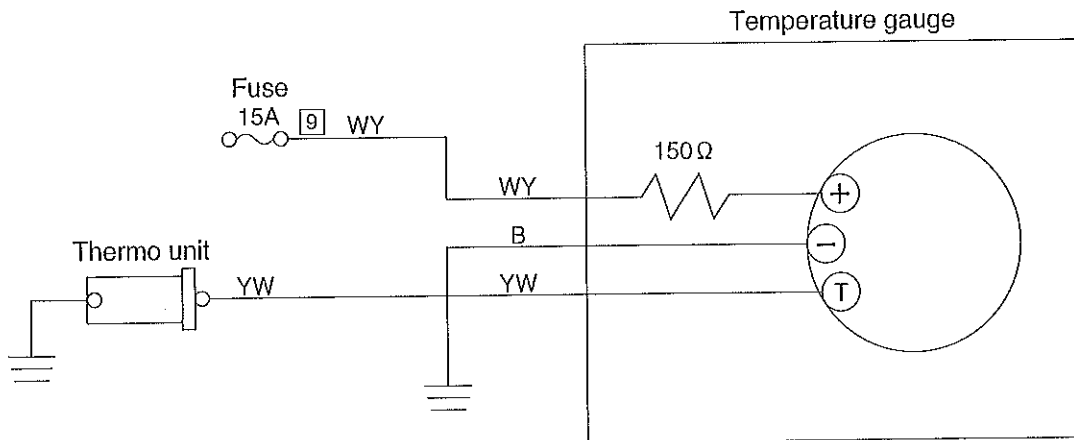
Table 1

Thermo unit terminal wire Sb	Gauge reading
Disconnected	Lowest
Grounded	Highest

Table 2

Thermo unit temperature	Resistance (Ω)
50°C	150~158
100°C	About 27.4

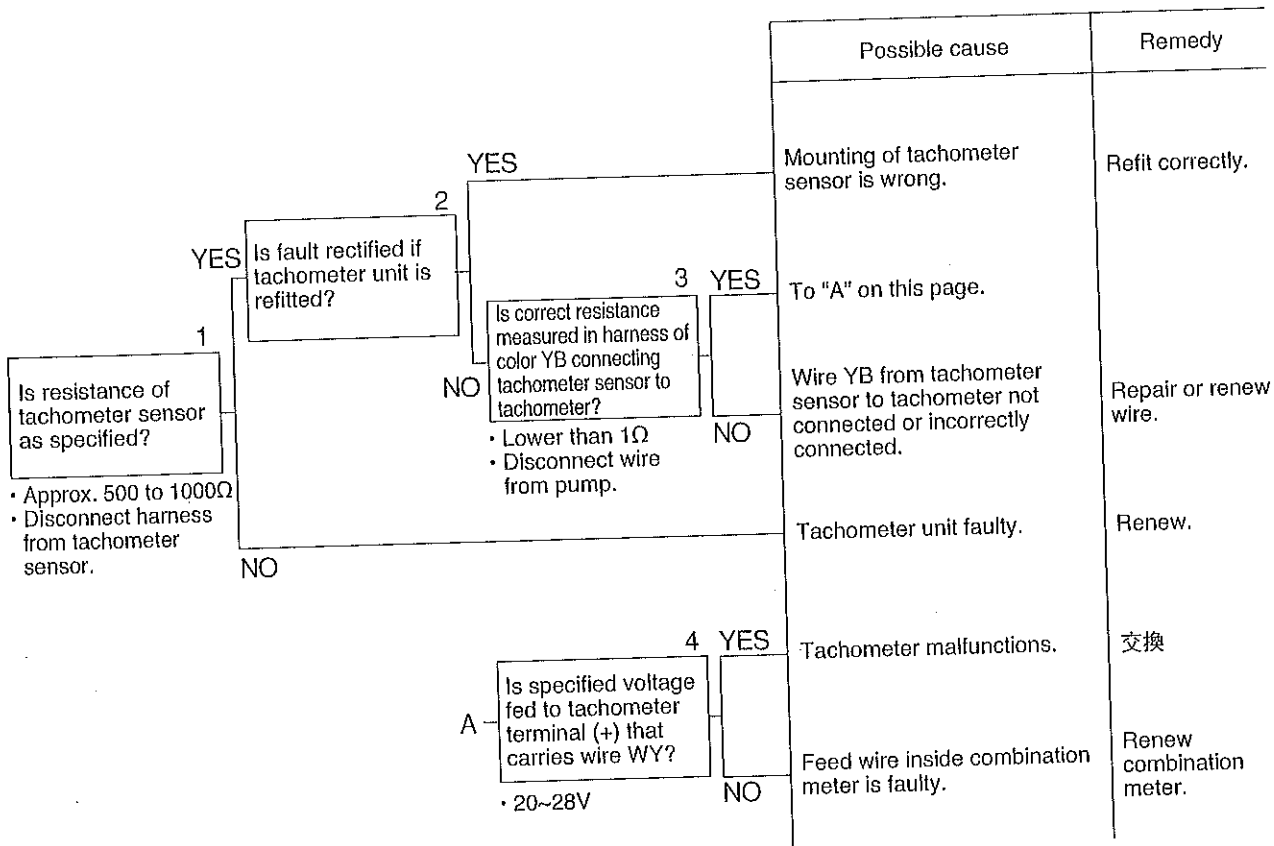
Electric wiring diagram for mode E-14



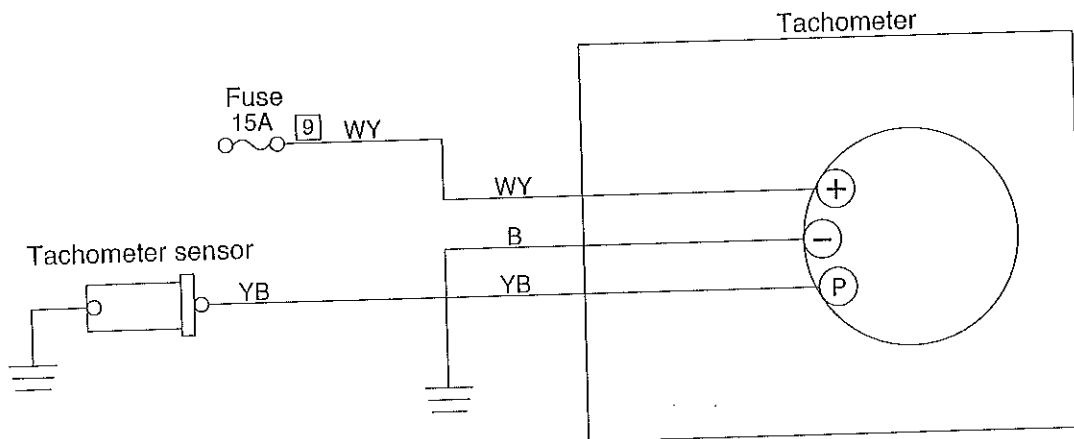
SW6514013

E-15 Tachometer reads wrong

- ★Other gauges and lamps operate correctly.
- ★Measure the voltage with the starter switch ON.



Electric wiring diagram for mode E-15

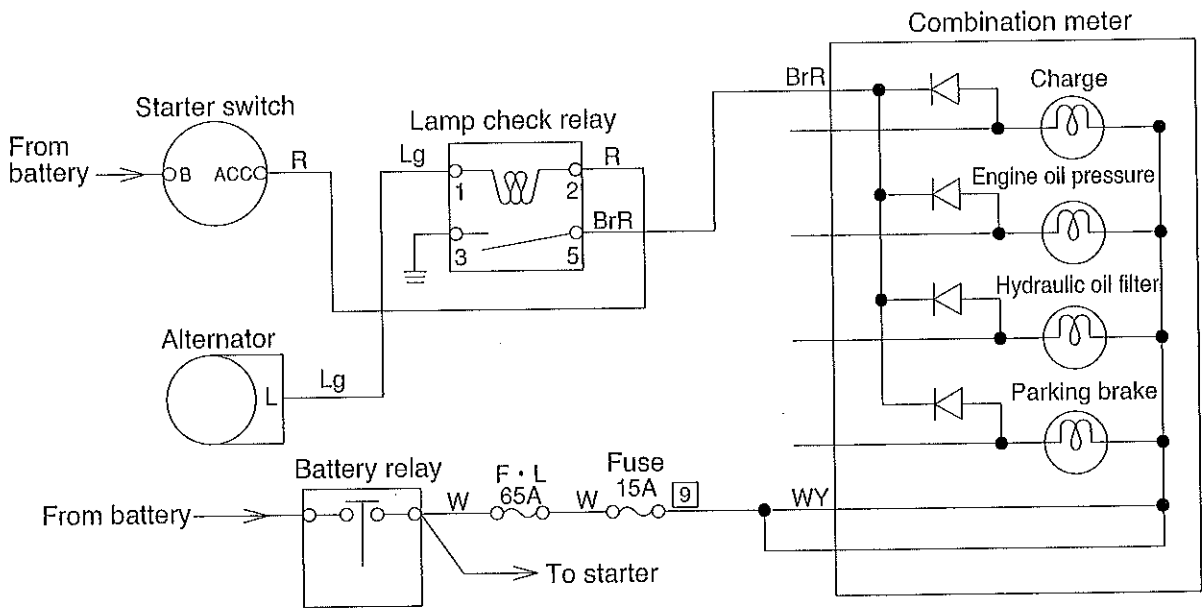


SW6514014

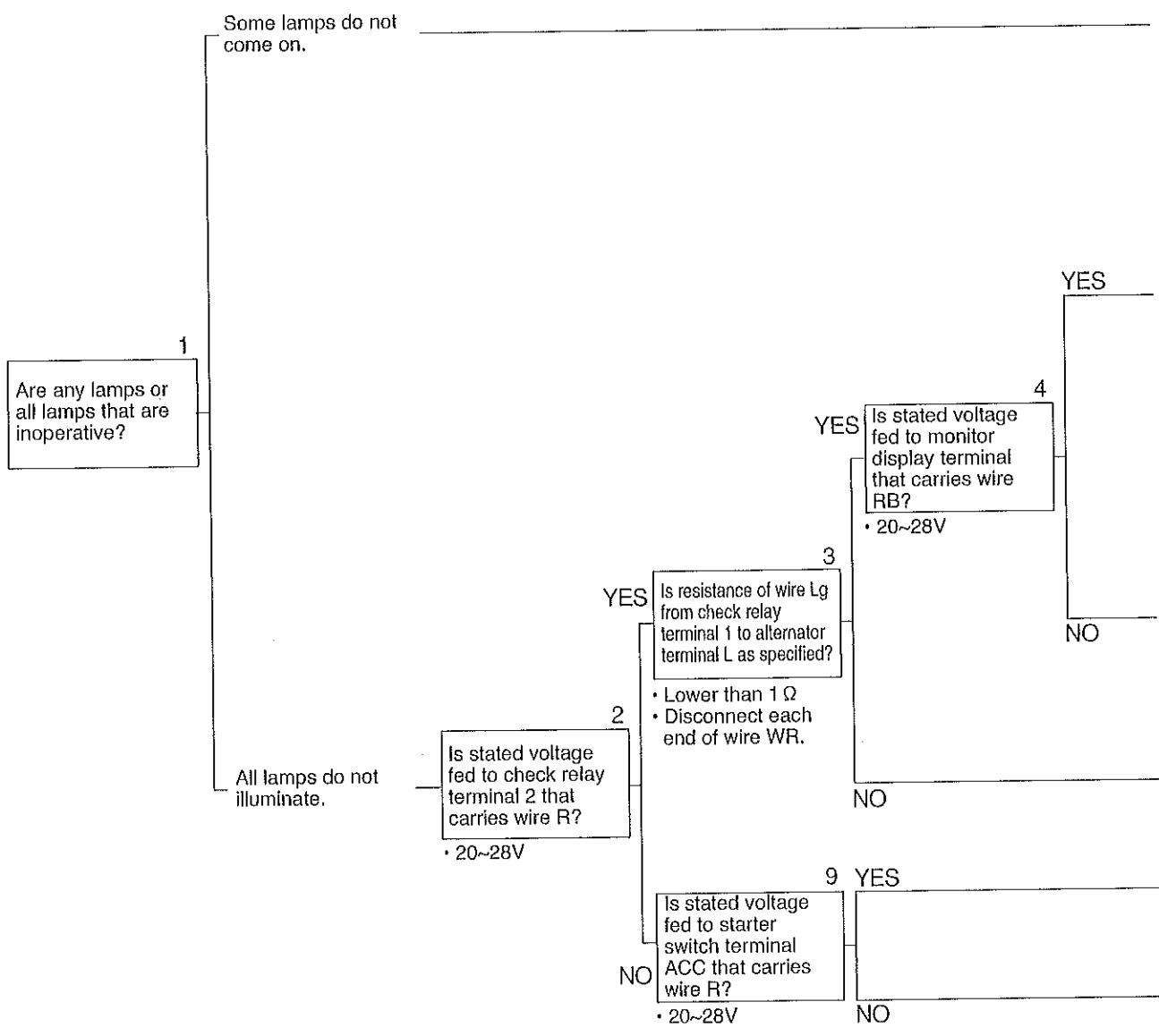
E-16 Charge lamp, engine oil pressure warning lamp, hydraulic oil filter warning lamp and parking brake indicator lamp fail to be lit with starter switch turned ON

- ★ These lamps illuminate only when the starter switch is turned to the ON position (for bulb failure check) and unusual conditions have occurred in the relevant systems.
- ★ Measure the voltage with the starter switch ON.

Electric wiring diagram for mode E-16



SW6514015



		Possible cause	Remedy
		Lamp bulb damaged.	Renew.
		Monitor display faulty.	Renew monitor display.
<p>5 YES</p> <p>Is resistance of wire BrR from monitor display to check relay terminal 5 as specified?</p> <p>• Lower than 1 Ω</p> <p>• Disconnect each end of wire.</p>		Wire BrR from check relay terminal 3 to monitor display not connected or incorrectly connected.	Repair or renew wire.
<p>6 YES</p>		Check relay faulty.	Renew.
<p>NO</p> <p>7 YES</p> <p>Is resistance of check relay earth wire as specified?</p> <p>• Lower than 1 Ω</p> <p>• Disconnect wires from relay.</p>		Check relay earth wire not connected or incorrectly connected.	Repair or renew wire.
<p>NO</p> <p>8 YES</p> <p>Does starter run?</p> <p>• Turn starter switch to START.</p>		Wire RB from fuse to monitor display not connected or incorrectly connected.	Repair or renew wire.
		Fuse is burnt out.	Renew.
		Wire Lg from check relay terminal 1 to alternator terminal L not connected or incorrectly connected.	Repair or renew wire.
		Wire R from starter switch terminal ACC to check relay terminal 2 not connected or incorrectly connected.	Repair or renew wire.
		Starter switch faulty (between terminals A and ACC).	Renew.

6. Fault Finding for Hydraulic and Mechanical Systems (Mode H)

H-01 Not propelled	4-404
H-02 Speed not gained or low traction	4-405
H-03 Vehicle speed (high/low) cannot be switched	4-406
H-04 Vibrator does not work	4-407
H-05 Weak vibration force	4-408
H-06 Steering not performed	4-408
H-07 Heavy or slow steering	4-409
H-08 Parking brake not released	4-409

Trouble modes for hydraulic and mechanic systems and sources of trouble

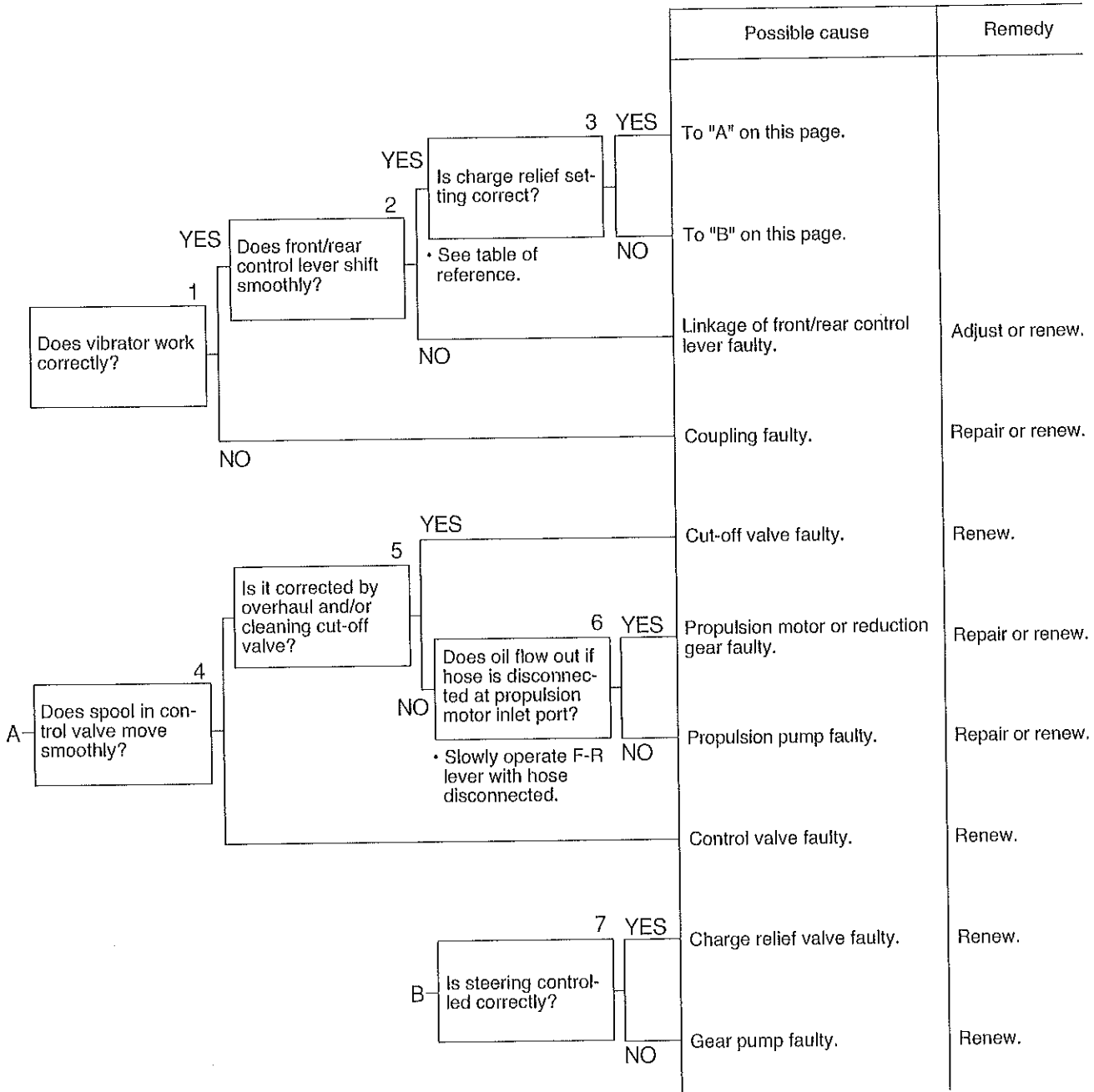
Source-of-trouble units		Trouble mode	Propulsion				Vehicle speed (high/low) cannot be switched
			Not propelled		Speed not gained or low traction		
			a) Forward and reverse	b) Either forward or reverse	a) Forward and reverse	b) Either forward or reverse	
Propulsion	Propulsion pump	Pump unit	●		●		
		Control valve	●	●	●	●	
		Servo piston	●	●	●	●	
		High-pressure relief valve				●	
		Charge relief valve	●				
	Front drive	Motor unit	○		●		
		Reduction gear	○				
		Negative brake					
		Vehicle speed switching valve or switching piston					●
	Rear drive	Motor unit	○		●		
		Reduction gear	○				
		Negative brake					
		Vehicle speed switching valve or switching piston					●
			Vehicle speed switching solenoid valve				●
		Brake release solenoid valve					
Vibrator	Pump	Pump unit					
		Vibration selector solenoid valve (*)					
		High-pressure relief valve					
			Vibratory wheel switching valve				
			Vibration selector solenoid valve				
	Front	Motor unit					
		Vibrator					
	Rear	Motor unit					
Vibrator							
Steering		Steering/charge pump	●				
		Steering valve (Orbitrol)					
		Steering cylinder					
		Steering mechanism					
Others		Coupling	●				
		F-R lever linkage	●	●	●	●	
Engine				●			
Diagnosis code			H-01a	H-01b	H-02a	H-02b	H-03

Fault Finding for Hydraulic and Mechanical Systems

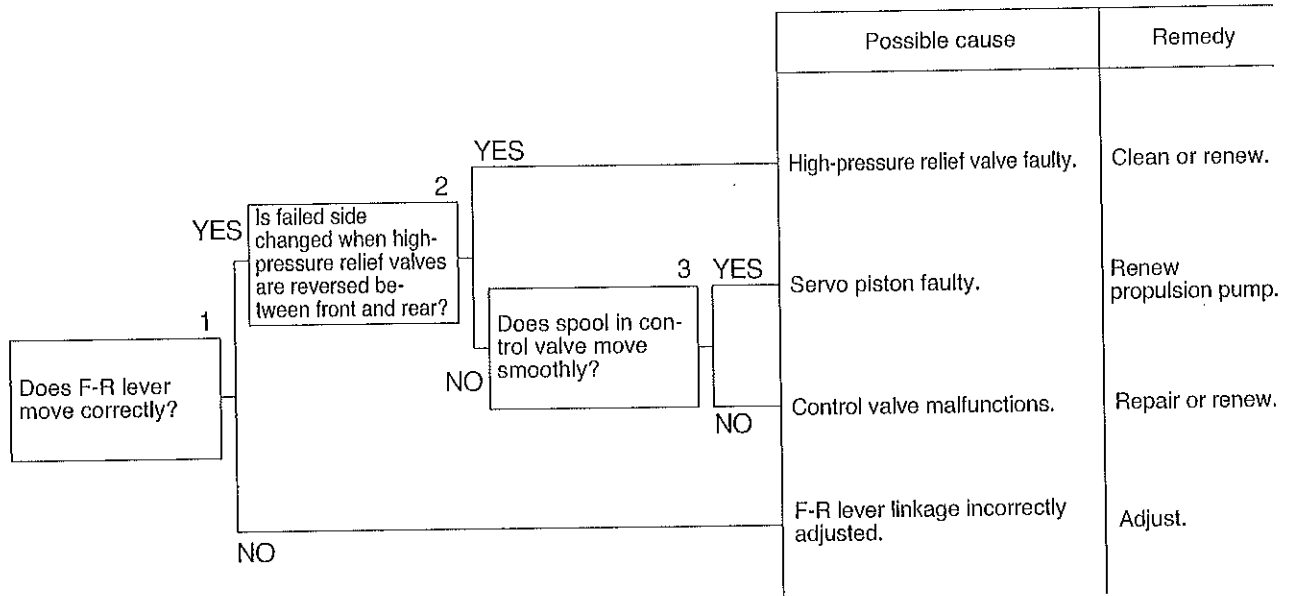
Vibrator			Steering		Brake not released
Inoperative		Low intensity	Not performed	Heavy or slow	
Amplitude of both "High" and "Low"	Either one of front or rear wheel				
					●
					●
					●
●		●			
●					
		●			
	●				
	●				
	●	●			
	●				
	●	●			
	●				
			●	●	
			●	●	
			●	●	
			●	●	
●					
H-03a	H-03b	H-04	H-05	H-06	H-07

H-01 Not propelled

a) Not propelled in both directions.

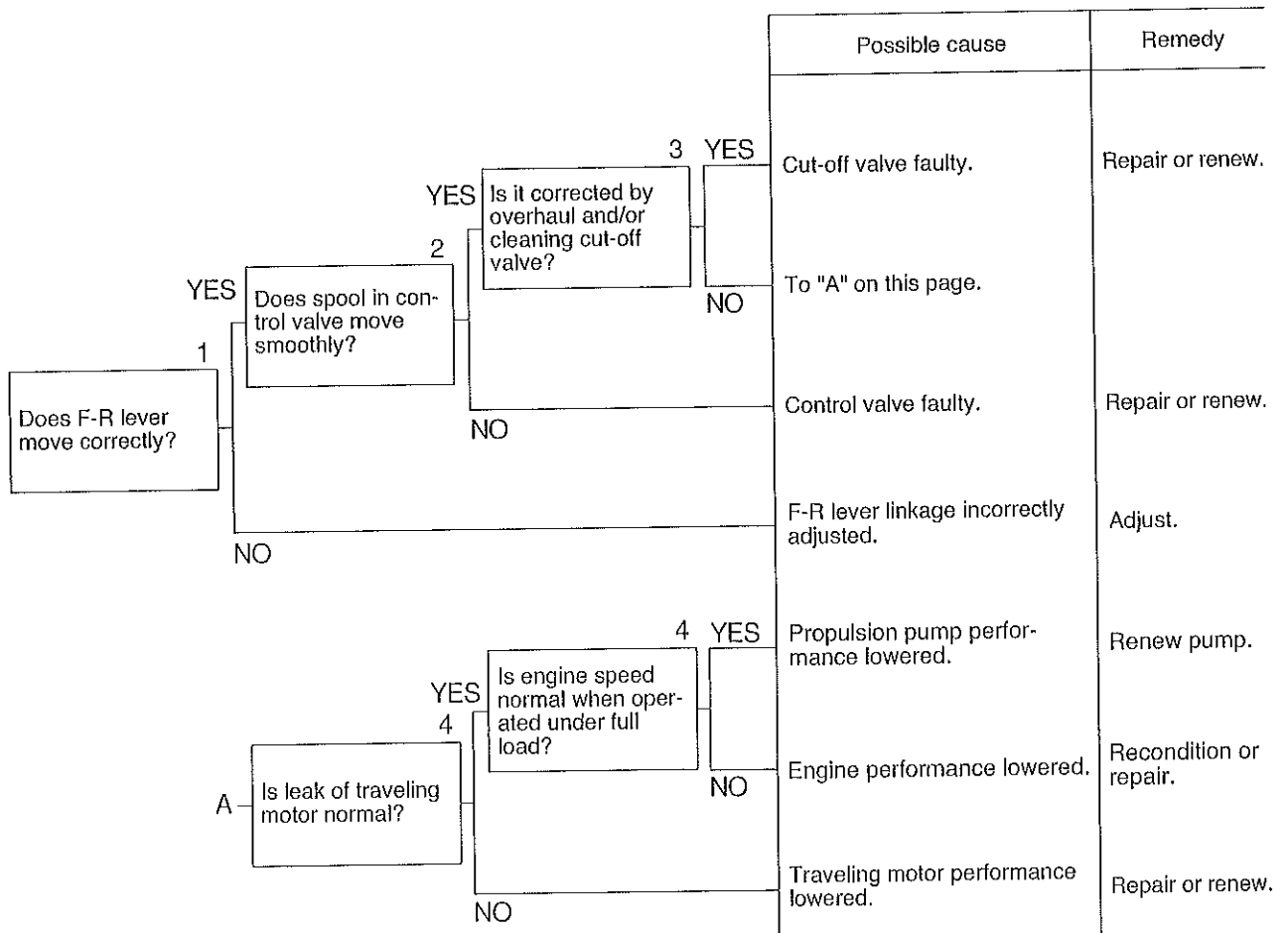


b) Machine travels in one direction only, either forward or in reverse.



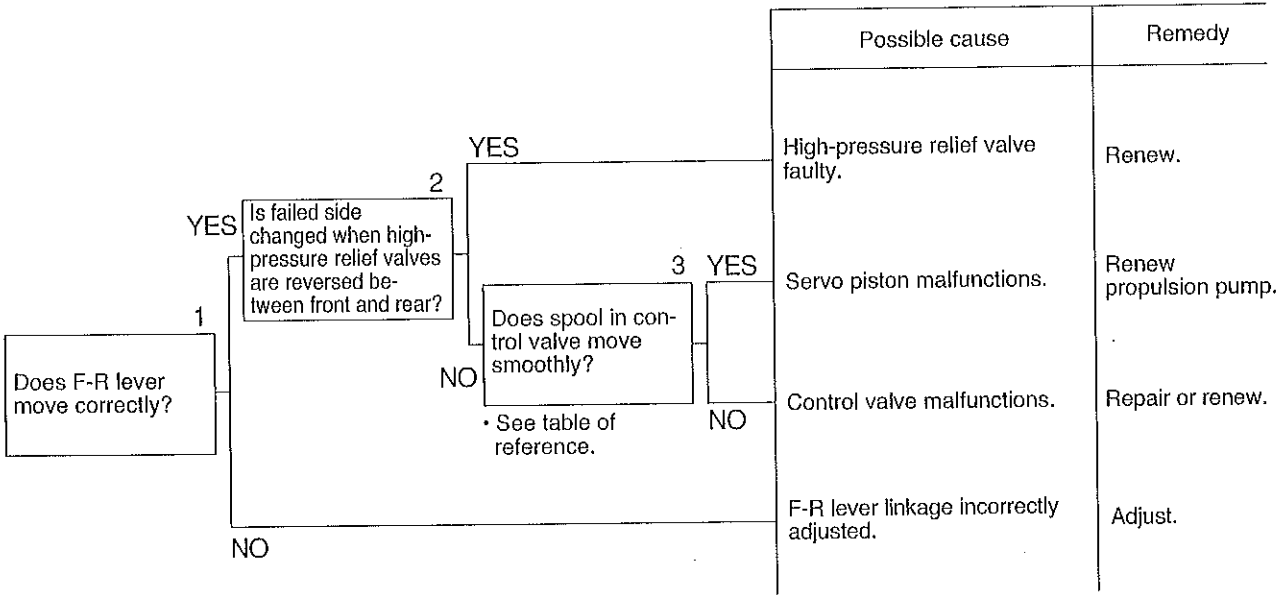
H-02 Speed not gained or low traction

a) Speed not gained in both travel directions; forward and reverse.

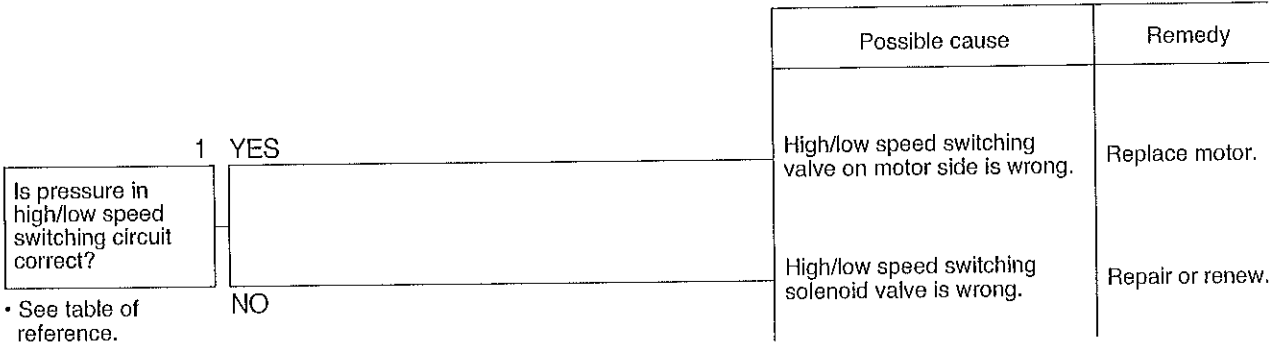


Fault Finding for Hydraulic and Mechanical Systems

b) Speed not gained in either forward or reverse direction.



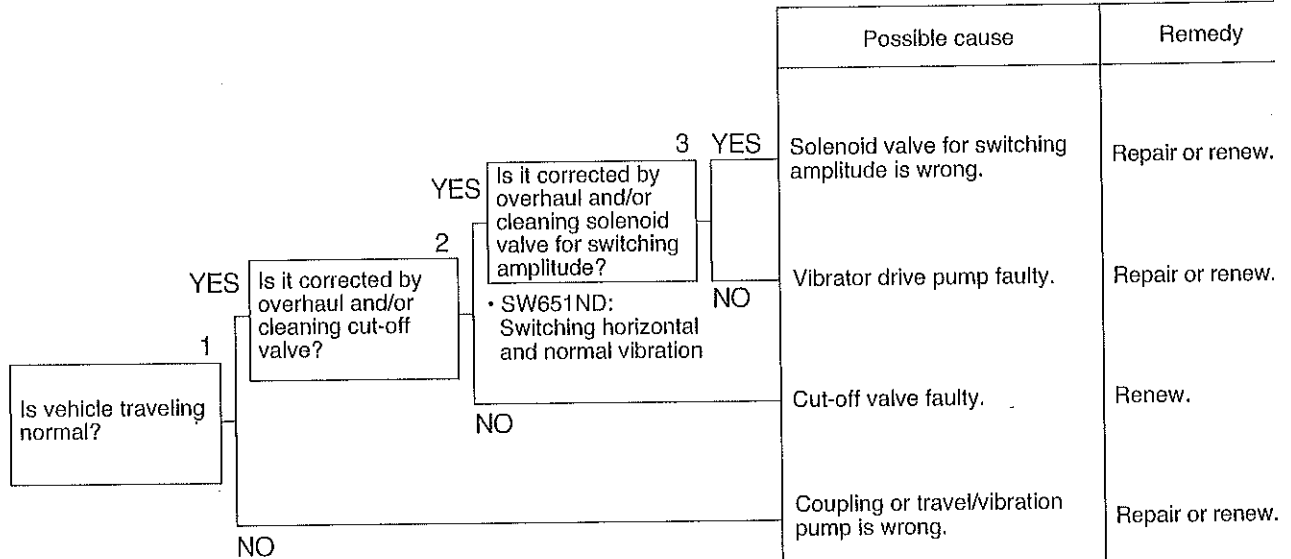
H-03 Vehicle speed (high/low) cannot be switched



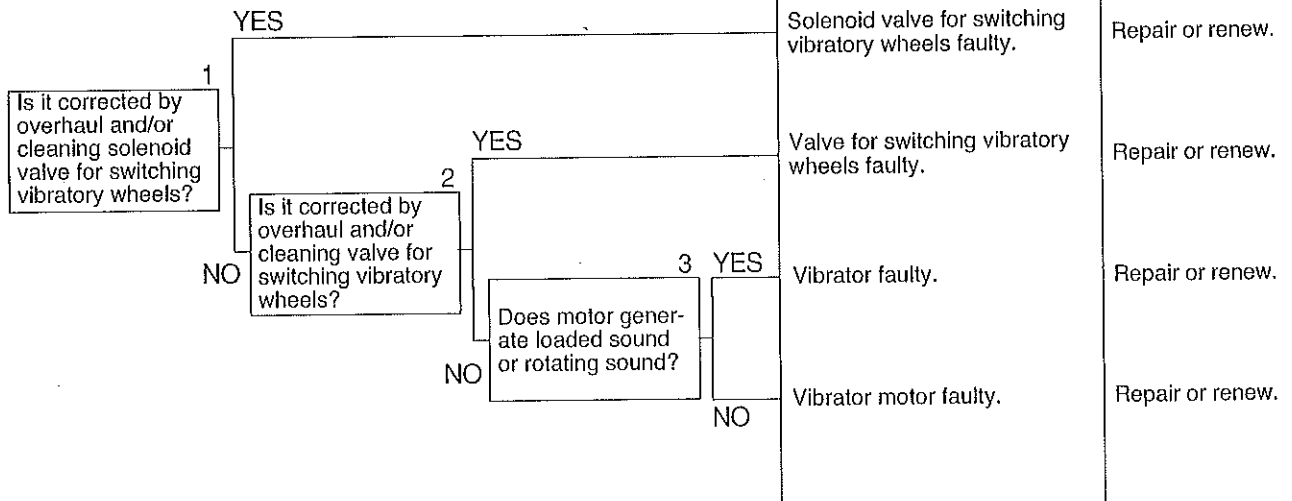
H-04 Vibrator does not work

★Diagnose electric systems first then use procedures as listed bellow.

- a) Both "Hi" and "Lo" in amplitude are inoperative
 *SW651ND: Switching horizontal and normal vibration



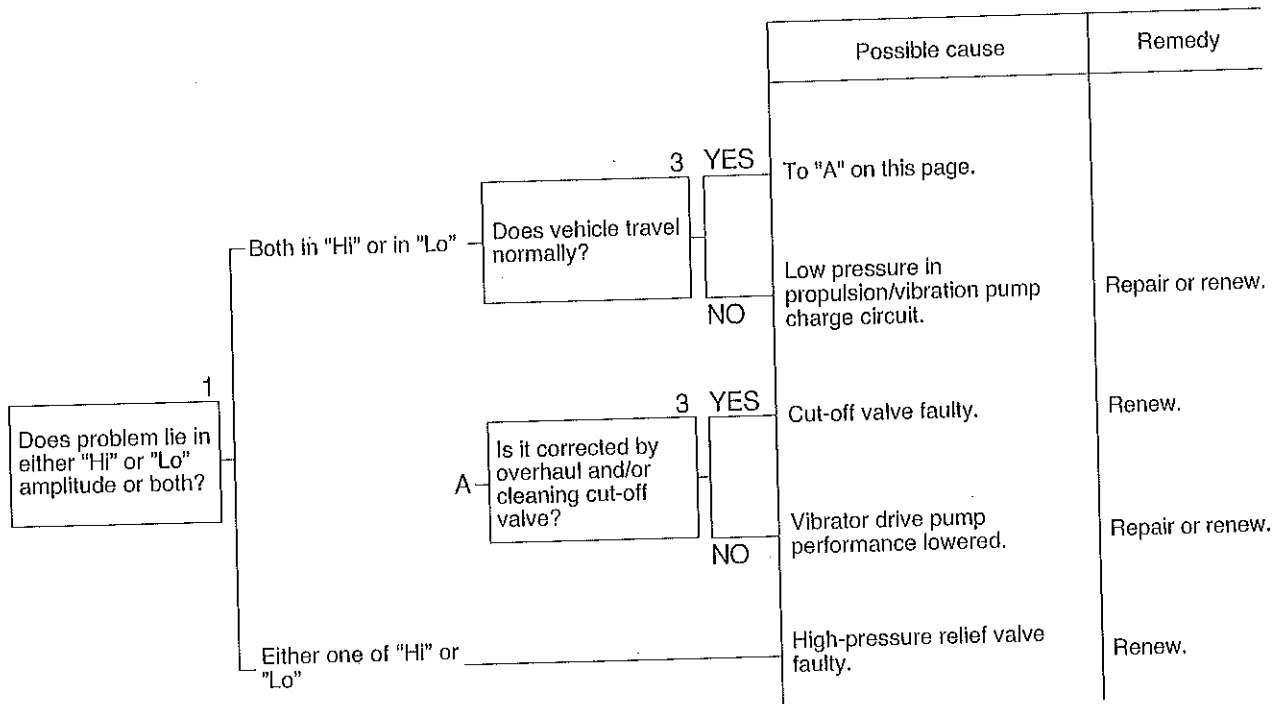
- b) Either one of front or rear wheel is inoperative



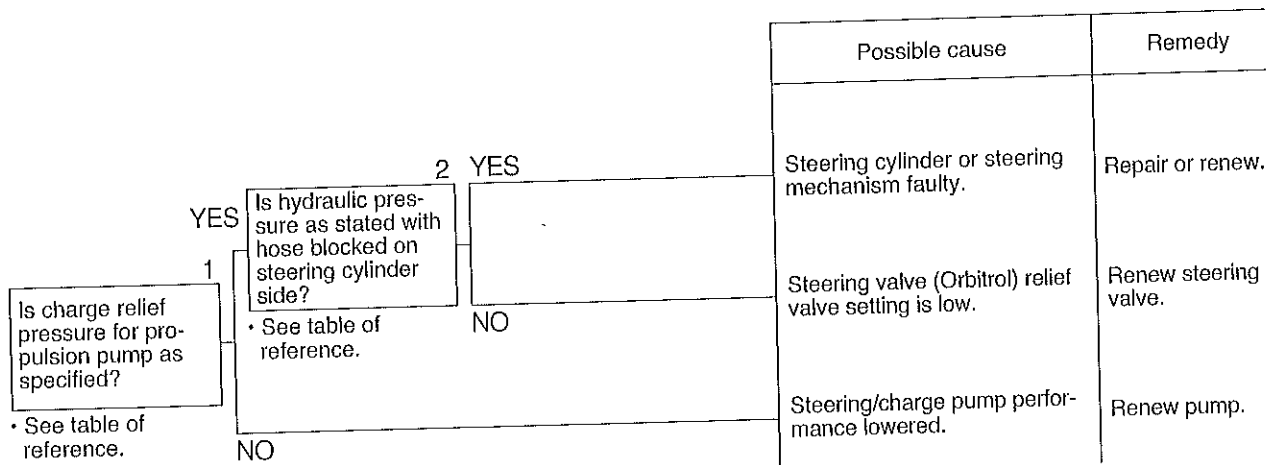
H-05 Weak vibratory force

★Vibratory force is weak in either "Hi" or "Lo" in amplitude.

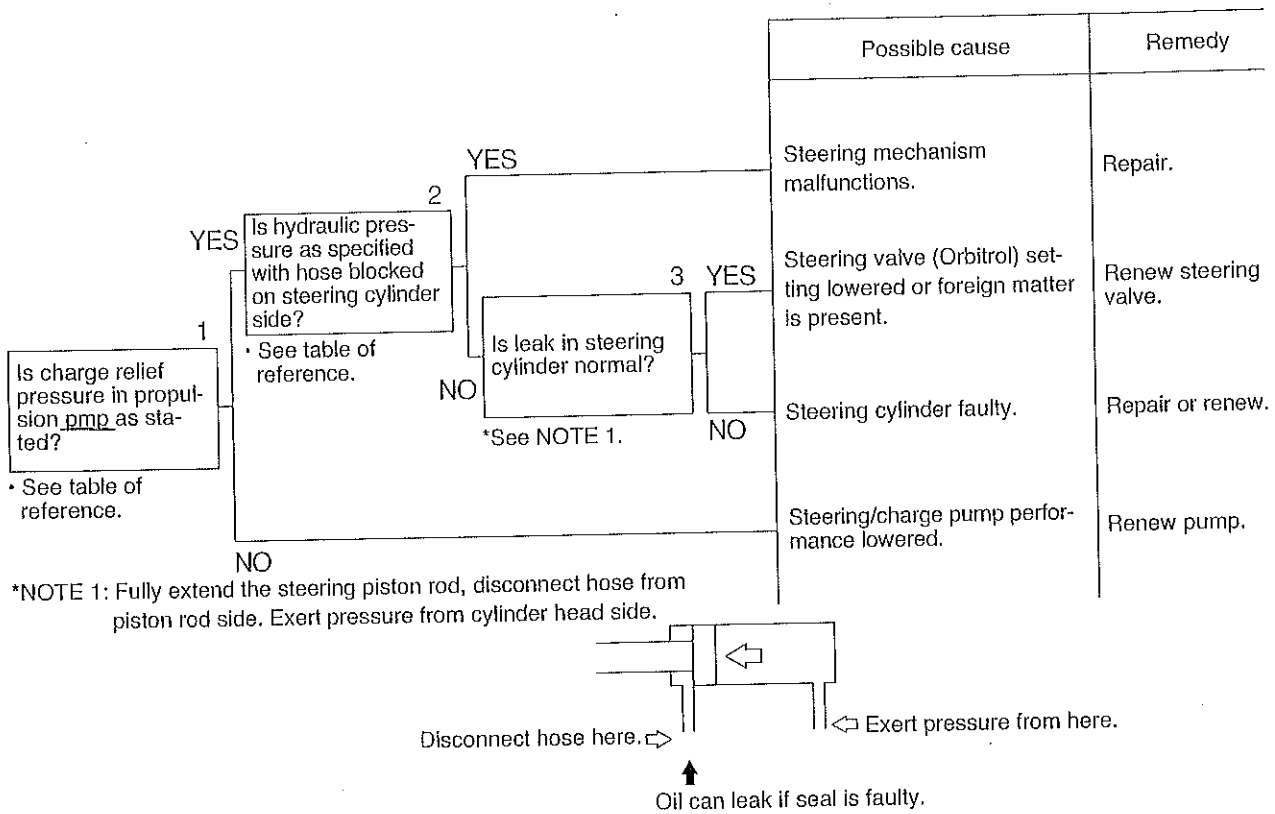
*SW651ND: Switching horizontal and normal vibration



H-06 Steering not performed

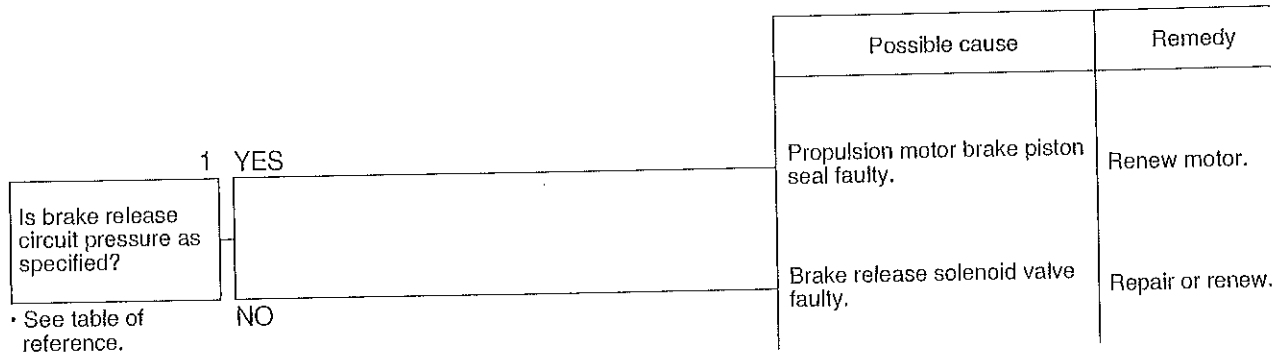


H-07 Heavy or slow steering



H-08 Parking brake not released

★Diagnose electric systems first then use procedures stated as below.



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