SV400 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 SV400 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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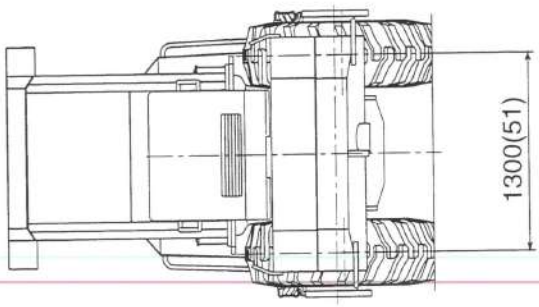
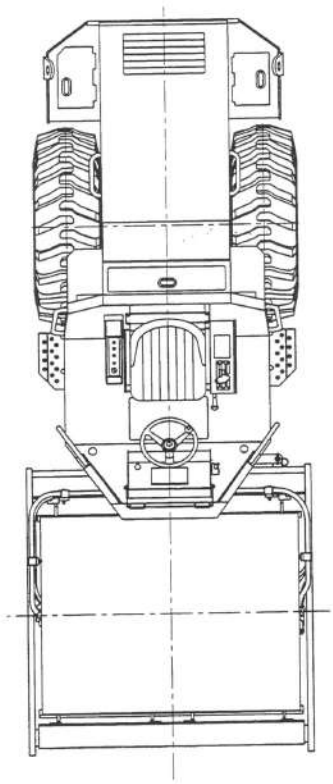
1. External Views and Specifications

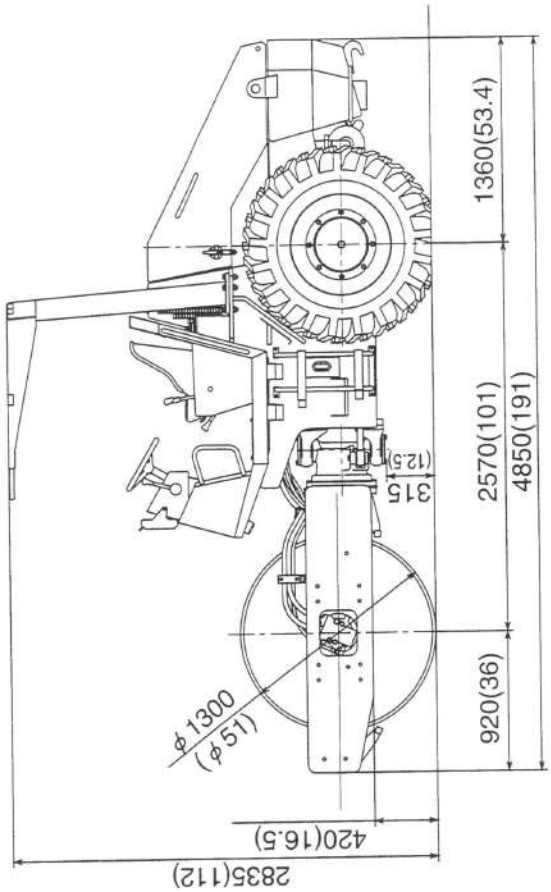
1-1. SV400D

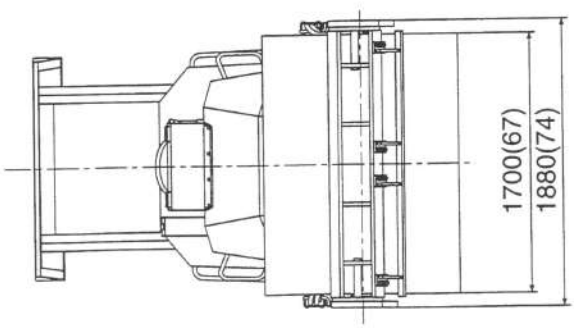
Unit in mm (in)

SV4001001









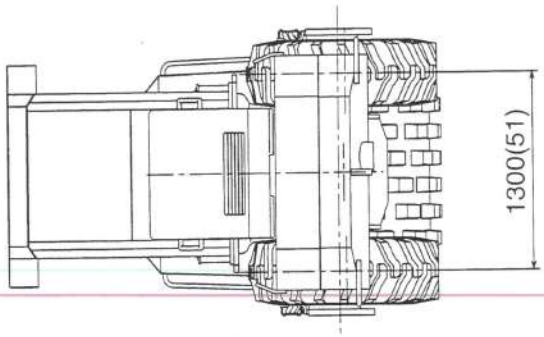
Model	SV400D
Weight:	
Gross	7,200 kg (15,880 lbs)
Load on front axle	3,500 kg (7,720 lbs)
Load on rear axle	3,700 kg (8,160 lbs)
Dimension:	
Overall length	4,850 mm (191")
Overall width	1,880 mm (74")
Overall height	2,835 mm (112")
Wheelbase	2,570 mm (101")
Rolling width	1,700 mm (67")
Ground clearance	315 mm (12.5")
Curb clearance	420 mm (16.5")
Performance:	
Speed (forward/reverse):	
Low	0 ~ 6 km/h (0 ~ 3.7 mile/h)
High	0 ~ 10 km/h (0 ~ 6.2 mile/h)
Vibrating power:	
Frequency	
Low amplitude	40 Hz (2,400 vpm)
High amplitude	30 Hz (1,800 vpm)
Centrifugal force	
Low amplitude	93 kN (20,940 lbs) {9,500 kgf}
High amplitude	118 kN (26,460 lbs) {12,000 kgf}
Min. turning radius (outer)	4.6 m (182")
Gradability	62 % (32°)
Engine:	
Model	ISUZU "A-4BG1" Diesel Engine
Type	Water-cooled, 4-cycle, 4-cylinder in-line, vertical mounted, overhead valve, direct injection type
Bore x Stroke	105 mm x 125 mm (4.134" x 4.921")
Displacement	4.329 liters (264 cu.in) {4,329 cc}
Performance:	
Rated speed	2,300 min^{-1} (2,300 rpm)
Rated output	61 kW (52 HP) {83 PS}
Max. torque	270 N•m (199 ft•lb){27.5 kgf•m} at 1600 min^{-1} {rpm}
Fuel consumption	265 g/kWh (0.436 lb/HPh) {195 g/PSh}
Governor	Mechanical all-speed type
Lubrication system	Pressure lubrication by gear pump
Oil filter	Full-flow:paper
Air cleaner	Dry type

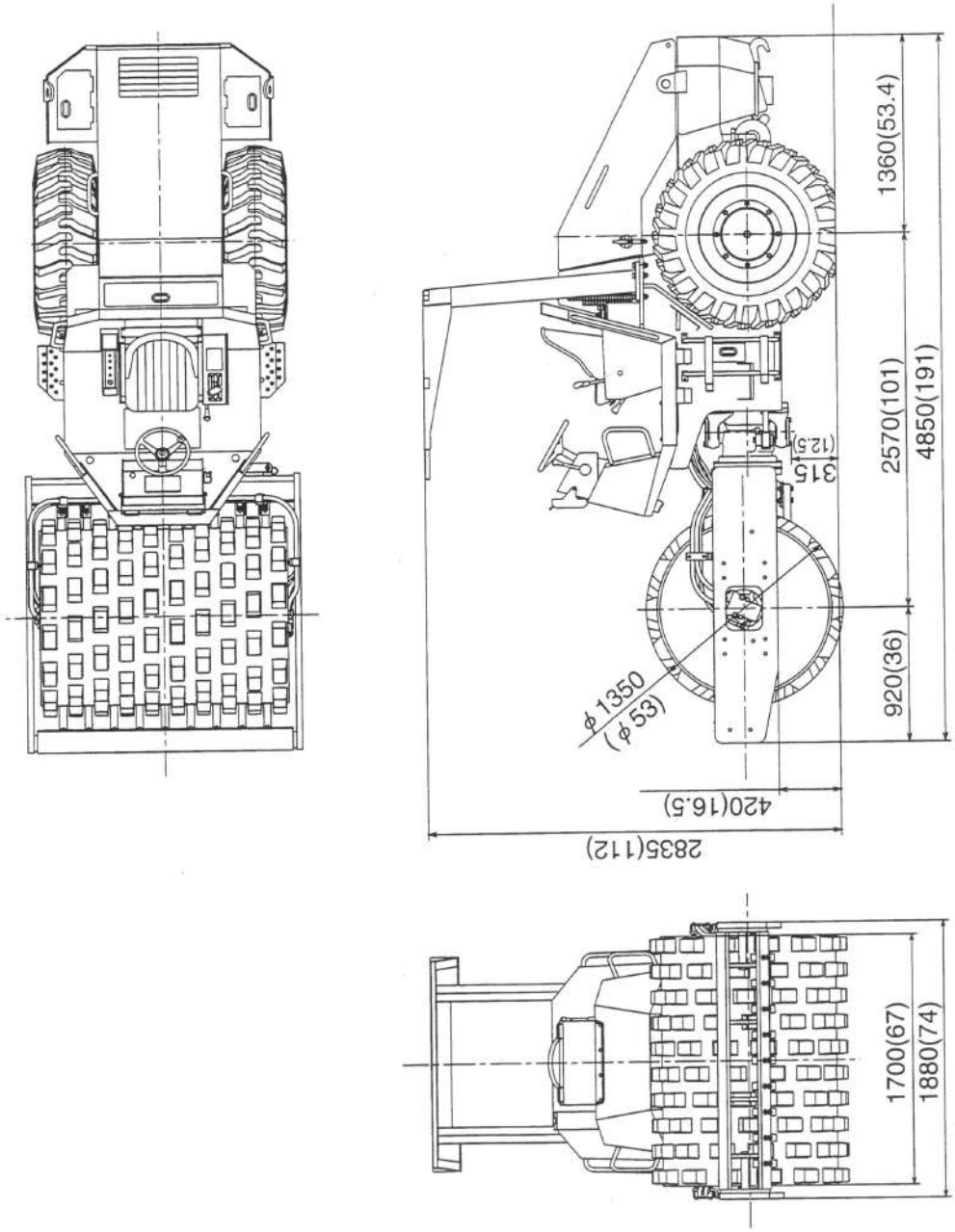
Engine:	
Cooling system	Centrifugal pump forced feeding system (pressure type)
Cooling fan	Inhaling type
Electrical system:	
Alternator	24 V 30A
Starter	24 V 4.5kW
Battery	12 V 80Ah x 2 pcs. (24 V)
Power line:	
Transmission:	
Type	Hydrostatic transmission
Speed	2 speed shifts
Reverser	Switching the direction of flow delivered from the variable pump
Differential	Auto lock type
Final drive	Planetary gear
Vibrating system:	
Transmission	Hydrostatic transmission
Vibrator	Eccentric shaft type
Brake system:	
Service brake	Hydrostatic and mechanical type
Parking brake	Mechanical, internal expanding type
Steering system:	
Type	Hydraulic type (Articulated type)
Roll & Tires:	
Use:	
Front roll	Vibrate & Drive
Rear roll	Drive
Number of tires	2
Dimension:	
Front roll (width x dia.)	1,700 mm x 1,300 mm (67" x 51")
Rear tires (size)	16.9-24-10PR (OR)
Suspension system:	
Front	Rubber damper type
Rear	Rigid
Fluid capacity:	
Cooling water	16 liters (4.2 gal)
Fuel tank	180 liters (48 gal)
Engine oil pan	13 liters (3.4 gal)
Transmission case	1.5 liters (0.4 gal)
Vibrator case	19 liters (5.0 gal)
Wheel motor gear case	3.2 liters (0.8 gal)
Differential case	8.0 liters (2.1 gal)
Final drive case	2.5 liters x 2 (0.7 gal x 2)
Hydraulic oil tank	50 liters (13 gal)

1-2. SV400T

Unit in mm (in)

SV4001002





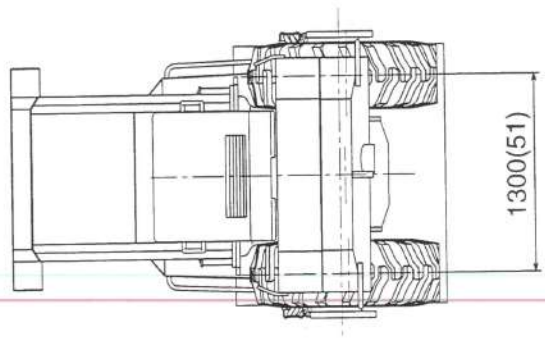
Model	SV400T
Weight:	
Gross	7,450 kg (16,430 lbs)
Load on front axle	3,750 kg (8,270 lbs)
Load on rear axle	3,700 kg (8,160 lbs)
Dimension:	
Overall length	4,850 mm (191")
Overall width	1,880 mm (74")
Overall height	2,835 mm (112")
Wheelbase	2,570 mm (101")
Rolling width	1,700 mm (67")
Ground clearance	315 mm (12.5")
Curb clearance	420 mm (16.5")
Performance:	
Speed (forward/reverse):	
Low	0 ~ 6 km/h (0 ~ 3.7 mile/h)
High	0 ~ 10 km/h (0 ~ 6.2 mile/h)
Vibrating power:	
Frequency	
Low amplitude	40 Hz (2,400 vpm)
High amplitude	30 Hz (1,800 vpm)
Centrifugal force	
Low amplitude	103 kN (23,150 lbs) {9,500 kgf}
High amplitude	127 kN (28,660 lbs) {13,000 kgf}
Min. turning radius (outer)	4.6 m (182")
Gradability	62 % (32°)
Engine:	
Model	ISUZU "A-4BG1" Diesel Engine
Type	Water-cooled, 4-cycle, 4-cylinder in-line, vertical mounted, overhead valve, direct injection type
Bore x Stroke	105 mm x 125 mm (4.134" x 4.921")
Displacement	4.329 liters (264 cu.in) {4,329 cc}
Performance:	
Rated speed	2,300 min^{-1} (2,300 rpm)
Rated output	61 kW (52 HP) {83 PS}
Max. torque	270 N•m (199 ft•lb){27.5 kgf•m} at 1600 min^{-1} {rpm}
Fuel consumption	265 g/kWh (0.436 lb/HPh) {195 g/PSh}
Governor	Mechanical all-speed type
Lubrication system	Pressure lubrication by gear pump
Oil filter	Full-flow:paper
Air cleaner	Dry type

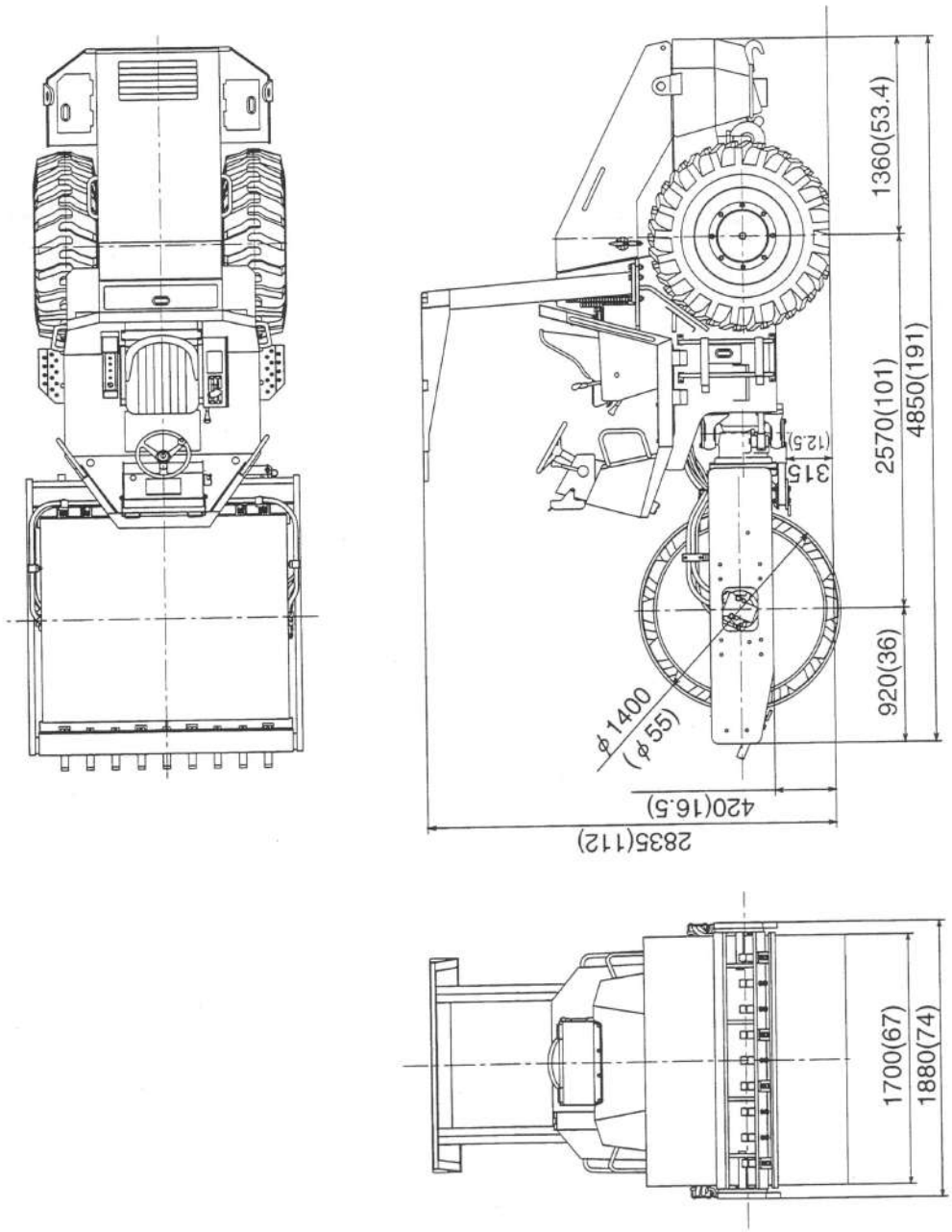
Engine:	
Cooling system	Centrifugal pump forced feeding system (pressure type)
Cooling fan	Inhaling type
Electrical system:	
Alternator	24 V 30A
Starter	24 V 4.5kW
Battery	12 V 80Ah x 2 pcs. (24 V)
Power line:	
Transmission:	
Type	Hydrostatic transmission
Speed	2 speed shifts
Reverser	Switching the direction of flow delivered from the variable pump
Differential	Auto lock type
Final drive	Planetary gear
Vibrating system:	
Transmission	Hydrostatic transmission
Vibrator	Eccentric shaft type
Brake system:	
Service brake	Hydrostatic and mechanical type
Parking brake	Mechanical, internal expanding type
Steering system:	
Type	Hydraulic type (Articulated type)
Roll & Tires:	
Use:	
Front roll	Vibrate & Drive
Rear roll	Drive
Number of tires	2
Dimension:	
Front roll (width x dia.)	1,700 mm x 1,350 mm (67" x 53")
Number of pads	140
Pad hight	175 mm (3.0")
Pad area	102 cm^2 (16 sq.in)
Rear tires (size)	16.9-24-10PR (OR)
Suspension system:	
Front	Rubber damper type
Rear	Rigid
Fluid capacity:	
Cooling water	16 liters (4.2 gal)
Fuel tank	180 liters (48 gal)
Engine oil pan	13 liters (3.4 gal)
Transmission case	1.5 liters (0.4 gal)
Vibrator case	19 liters (5.0 gal)
Wheel motor gear case	3.2 liters (0.8 gal)
Differential case	8.0 liters (2.1 gal)
Final drive case	2.5 liters x 2 (0.7 gal x 2)
Hydraulic oil tank	50 liters (13 gal)

1-3. SV400TF

Unit in mm (in)

SV4001003



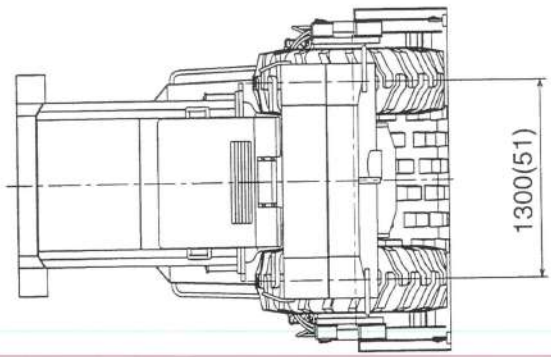


Model	SV400TF
Weight:	
Gross	8,750 kg (19,290 lbs)
Load on front axle	5,050 kg (11,130 lbs)
Load on rear axle	3,700 kg (8,160 lbs)
Dimension:	
Overall length	4,850 mm (191")
Overall width	1,880 mm (74")
Overall height	2,835 mm (112")
Wheelbase	2,570 mm (101")
Rolling width	1,700 mm (67")
Ground clearance	315 mm (12.5")
Curb clearance	420 mm (16.5")
Performance:	
Speed (forward/reverse):	
Low	0 ~ 6 km/h (0 ~ 3.7 mile/h)
High	0 ~ 10 km/h (0 ~ 6.2 mile/h)
Vibrating power:	
Frequency	
Low amplitude	40 Hz (2,400 vpm)
High amplitude	30 Hz (1,800 vpm)
Centrifugal force	
Low amplitude	103 kN (23,150 lbs) {9,500 kgf)
High amplitude	127 kN (28,660 lbs) {13,000 kgf)
Min. turning radius (outer)	4.6 m (182")
Gradability	62 % (32°)
Engine:	
Model	ISUZU "A-4BG1" Diesel Engine
Type	Water-cooled, 4-cycle, 4-cylinder in-line, vertical mounted, overhead valve, direct injection type
Bore x Stroke	105 mm x 125 mm (4.134" x 4.921")
Displacement	4.329 liters (264 cu.in) {4,329 cc}
Performance:	
Rated speed	2,300 min^{-1} (2,300 rpm)
Rated output	61 kW (52 HP) {83 PS)
Max. torque	270 N•m (199 ft•lb){27.5 kgf•m} at 1600 min^{-1} {rpm}
Fuel consumption	265 g/kWh (0.436 lb/HPh) {195 g/PSh)
Governor	Mechanical all-speed type
Lubrication system	Pressure lubrication by gear pump
Oil filter	Full-flow:paper
Air cleaner	Dry type

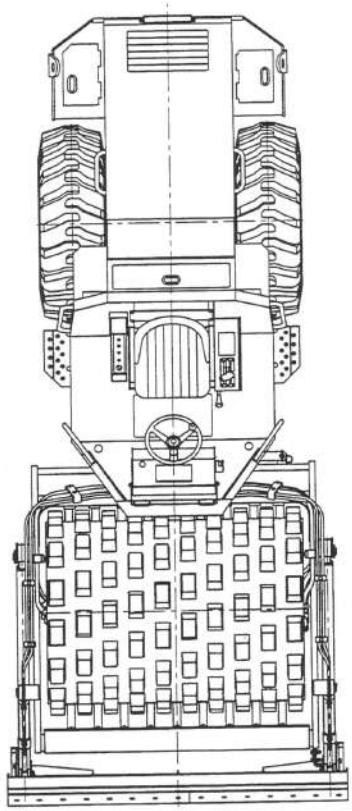
Engine:	
Cooling system	Centrifugal pump forced feeding system (pressure type)
Cooling fan	Inhaling type
Electrical system:	
Alternator	24 V 30A
Starter	24 V 4.5kW
Battery	12 V 80Ah x 2 pcs. (24 V)
Power line:	
Transmission:	
Type	Hydrostatic transmission
Speed	2 speed shifts
Reverser	Switching the direction of flow delivered from the variable pump
Differential	Auto lock type
Final drive	Planetary gear
Vibrating system:	
Transmission	Hydrostatic transmission
Vibrator	Eccentric shaft type
Brake system:	
Service brake	Hydrostatic and mechanical type
Parking brake	Mechanical, internal expanding type
Steering system:	
Type	Hydraulic type (Articulated type)
Roll & Tires:	
Use:	
Front roll	Vibrate & Drive
Rear roll	Drive
Number of tires	2
Dimension:	
Front roll (width x dia.)	1,700 mm x 1,400 mm (67" x 55")
Number of pads	140
Pad hight	175 mm (3.0")
Pad area	102 cm^2 (16 sq.in)
Rear tires (size)	16.9-24-10PR (OR)
Suspension system:	
Front	Rubber damper type
Rear	Rigid
Fluid capacity:	
Cooling water	16 liters (4.2 gal)
Fuel tank	180 liters (48 gal)
Engine oil pan	13 liters (3.4 gal)
Transmission case	1.5 liters (0.4 gal)
Vibrator case	19 liters (5.0 gal)
Wheel motor gear case	3.2 liters (0.8 gal)
Differential case	8.0 liters (2.1 gal)
Final drive case	2.5 liters x 2 (0.7 gal x 2)
Hydraulic oil tank	50 liters (13 gal)

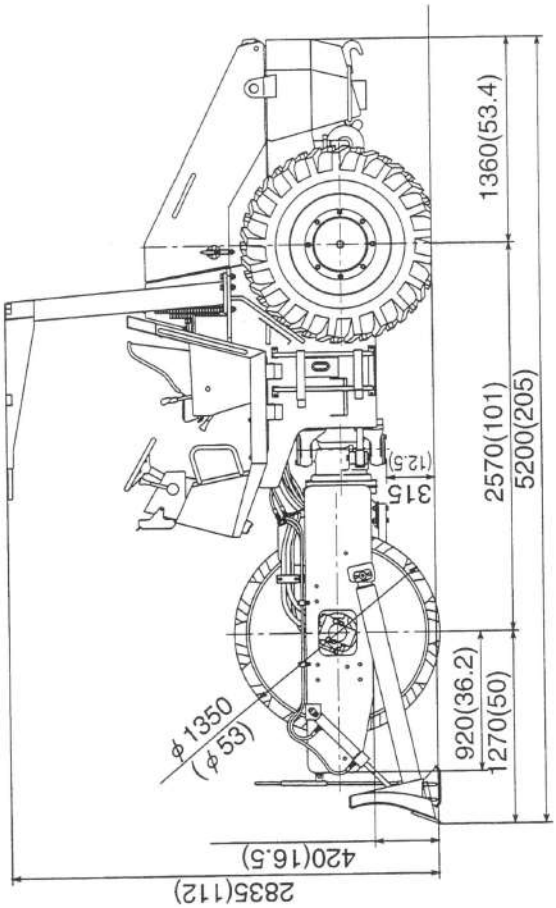
1-4. SV400TB$_E$

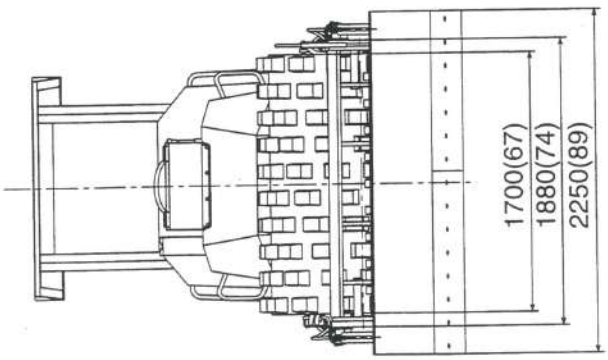
Unit in mm (in)



SV4001004







Model	SV400TB$_E$
Weight:	
Gross	7,800 kg (17,200 lbs)
Load on front axle	4,200 kg (9,260 lbs)
Load on rear axle	3,600 kg (7,940 lbs)
Dimension:	
Overall length	5,200 mm (205")
Overall width	2,250 mm (89")
Overall height	2,835 mm (112")
Wheelbase	2,570 mm (101")
Rolling width	1,700 mm (67")
Ground clearance	315 mm (12.5")
Curb clearance	420 mm (16.5")
Performance:	
Speed (forward/reverse):	
Low	0 ~ 6 km/h (0 ~ 3.7 mile/h)
High	0 ~ 10 km/h (0 ~ 6.2 mile/h)
Vibrating power:	
Frequency	
Low amplitude	40 Hz (2,400 vpm)
High amplitude	30 Hz (1,800 vpm)
Centrifugal force	
Low amplitude	103 kN (23,150 lbs) {9,500 kgf}
High amplitude	127 kN (28,660 lbs) {13,000 kgf}
Min. turning radius (outer)	4.6 m (182")
Gradability	62 % (32°)
Engine:	
Model	ISUZU "A-4BG1" Diesel Engine
Type	Water-cooled, 4-cycle, 4-cylinder in-line, vertical mounted, overhead valve, direct injection type
Bore x Stroke	105 mm x 125 mm (4.134" x 4.921")
Displacement	4.329 liters (264 cu.in) {4,329 cc}
Performance:	
Rated speed	2,300 min^{-1} (2,300 rpm)
Rated output	61 kW (52 HP) {83 PS}
Max. torque	270 N•m (199 ft•lb){27.5 kgf•m} at 1600 min^{-1} {rpm}
Fuel consumption	265 g/kWh (0.436 lb/HPh) {195 g/PSh}
Governor	Mechanical all-speed type
Lubrication system	Pressure lubrication by gear pump
Oil filter	Full-flow:paper
Air cleaner	Dry type

Engine:	
Cooling system	Centrifugal pump forced feeding system (pressure type)
Cooling fan	Inhaling type
Electrical system:	
Alternator	24 V 30A
Starter	24 V 4.5kW
Battery	12 V 80Ah x 2 pcs. (24 V)
Power line:	
Transmission:	
Type	Hydrostatic transmission
Speed	2 speed shifts
Reverser	Switching the direction of flow delivered from the variable pump
Differential	Auto lock type
Final drive	Planetary gear
Vibrating system:	
Transmission	Hydrostatic transmission
Vibrator	Eccentric shaft type
Brake system:	
Service brake	Hydrostatic and mechanical type
Parking brake	Mechanical, internal expanding type
Steering system:	
Type	Hydraulic type (Articulated type)
Roll & Tires:	
Use:	
Front roll	Vibrate & Drive
Rear roll	Drive
Number of tires	2
Dimension:	
Front roll (width x dia.)	1,700 mm x 1,350 mm (67" x 53")
Number of pads	140
Pad hight	175 mm (3.0")
Pad area	102 cm^2 (16 sq.in)
Rear tires (size)	16.9-24-10PR (OR)
Suspension system:	
Front	Rubber damper type
Rear	Rigid
Fluid capacity:	
Cooling water	16 liters (4.2 gal)
Fuel tank	180 liters (48 gal)
Engine oil pan	13 liters (3.4 gal)
Transmission case	1.5 liters (0.4 gal)
Vibrator case	19 liters (5.0 gal)
Wheel motor gear case	3.2 liters (0.8 gal)
Differential case	8.0 liters (2.1 gal)
Final drive case	2.5 liters x 2 (0.7 gal x 2)
Hydraulic oil tank	50 liters (13 gal)

STRUCTURE & OPERATION

STRUCTURE & OPERATION

1. Location of Engine-related Key Units

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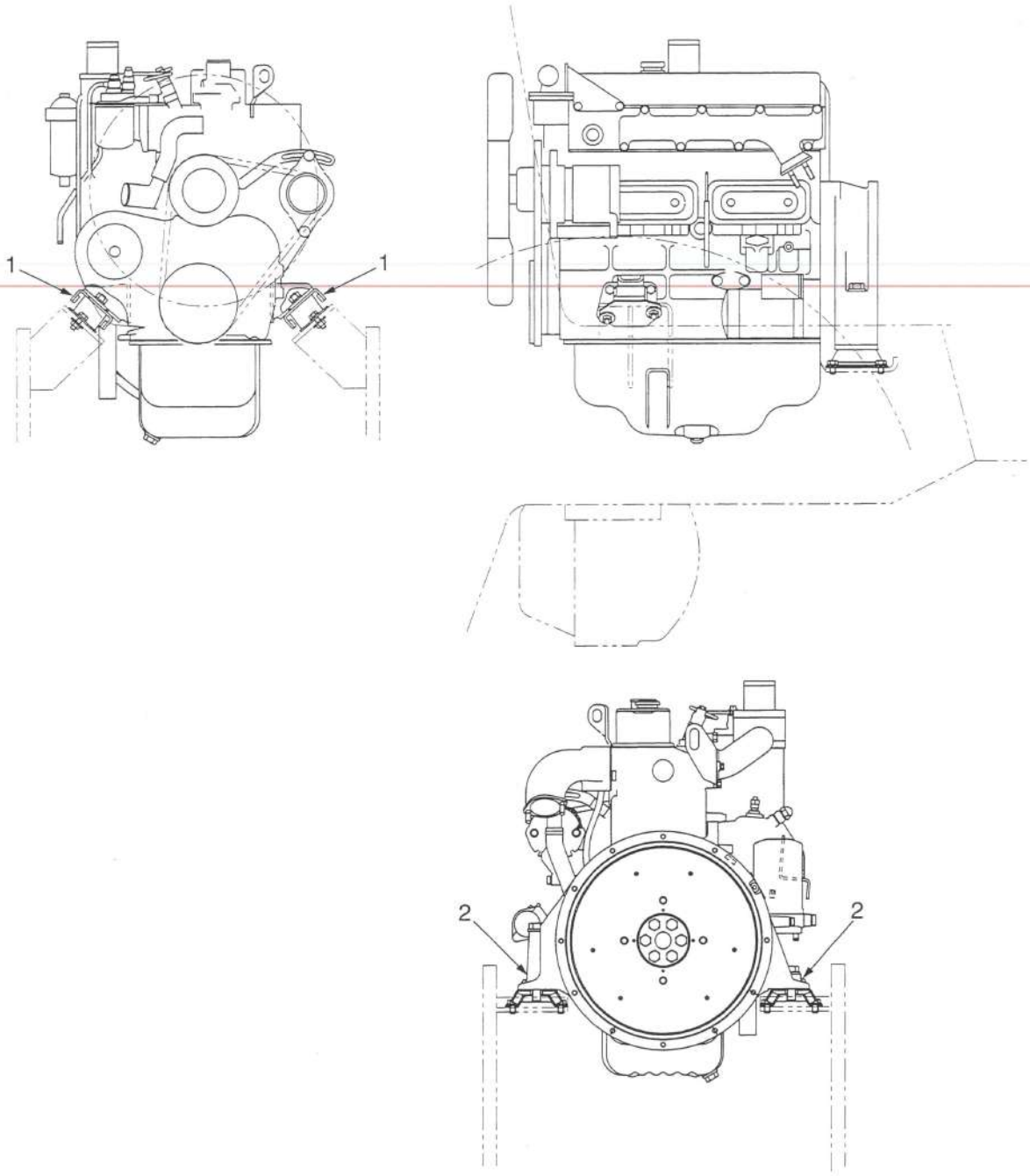
1.Location of Engine-related Key Units

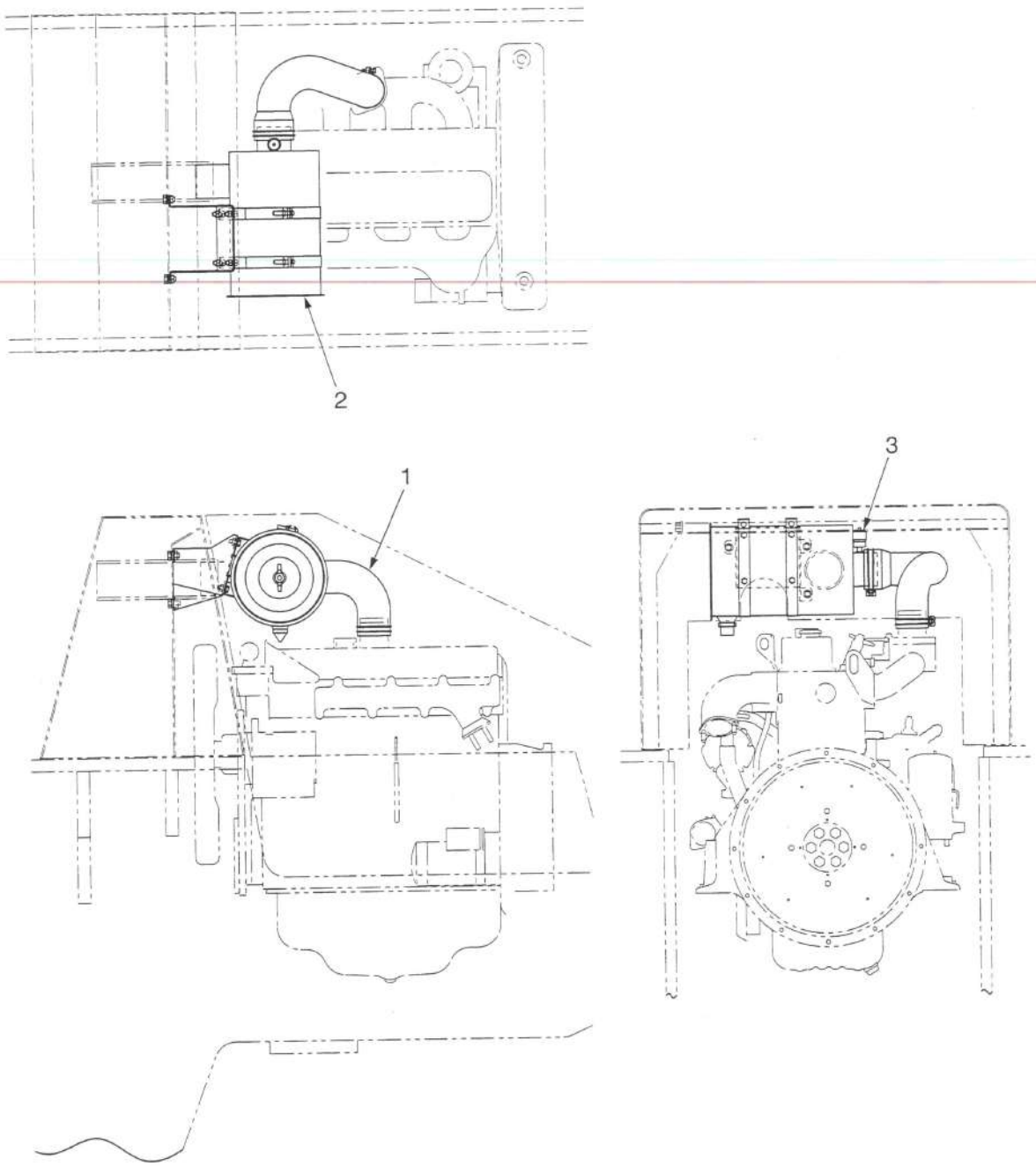
1-1. Engine mount



SV4002001

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

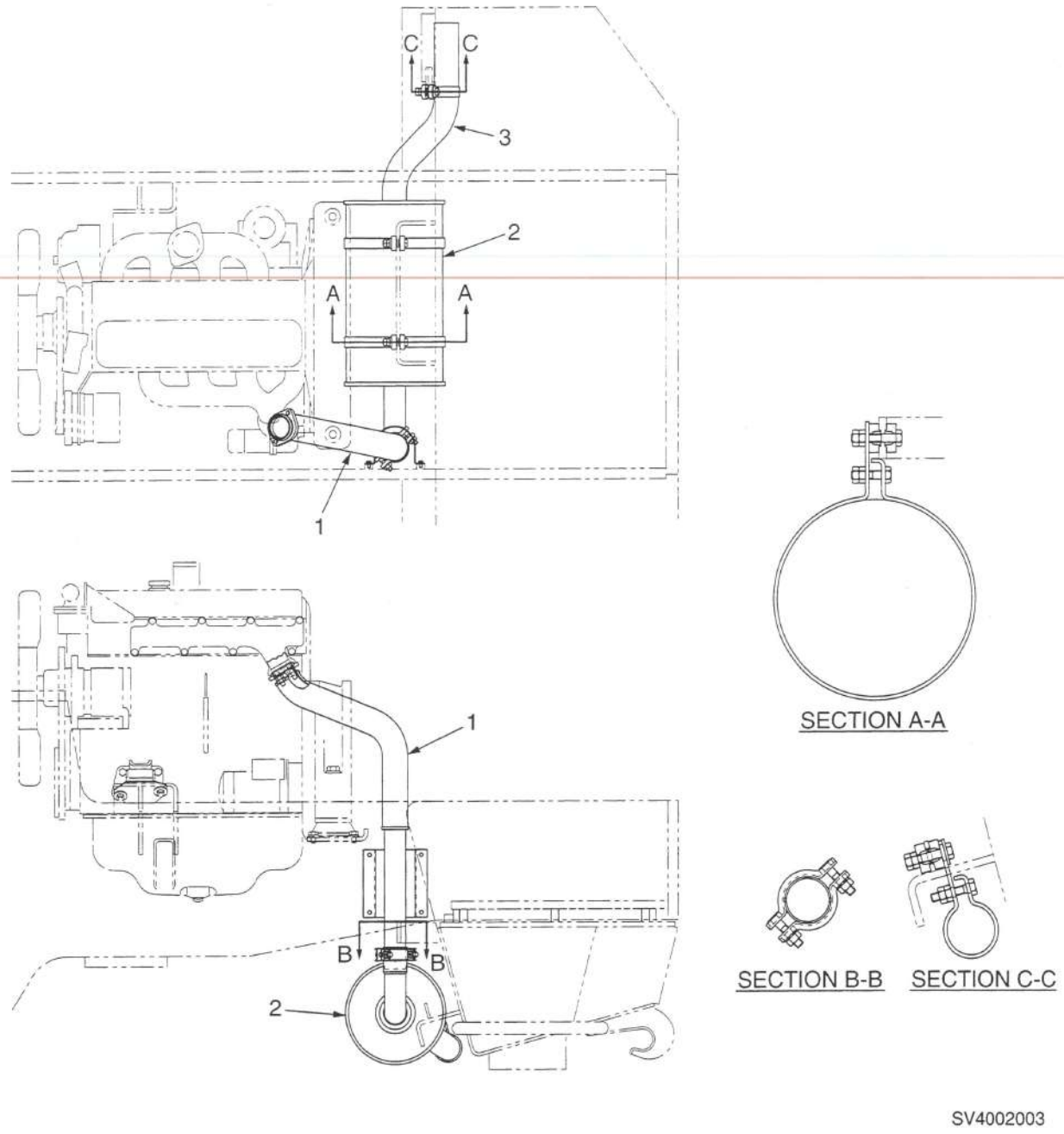
1-2. Intake system



SV4002002

1. Air cleaner
2. Intake hose
3. Restriction indicator

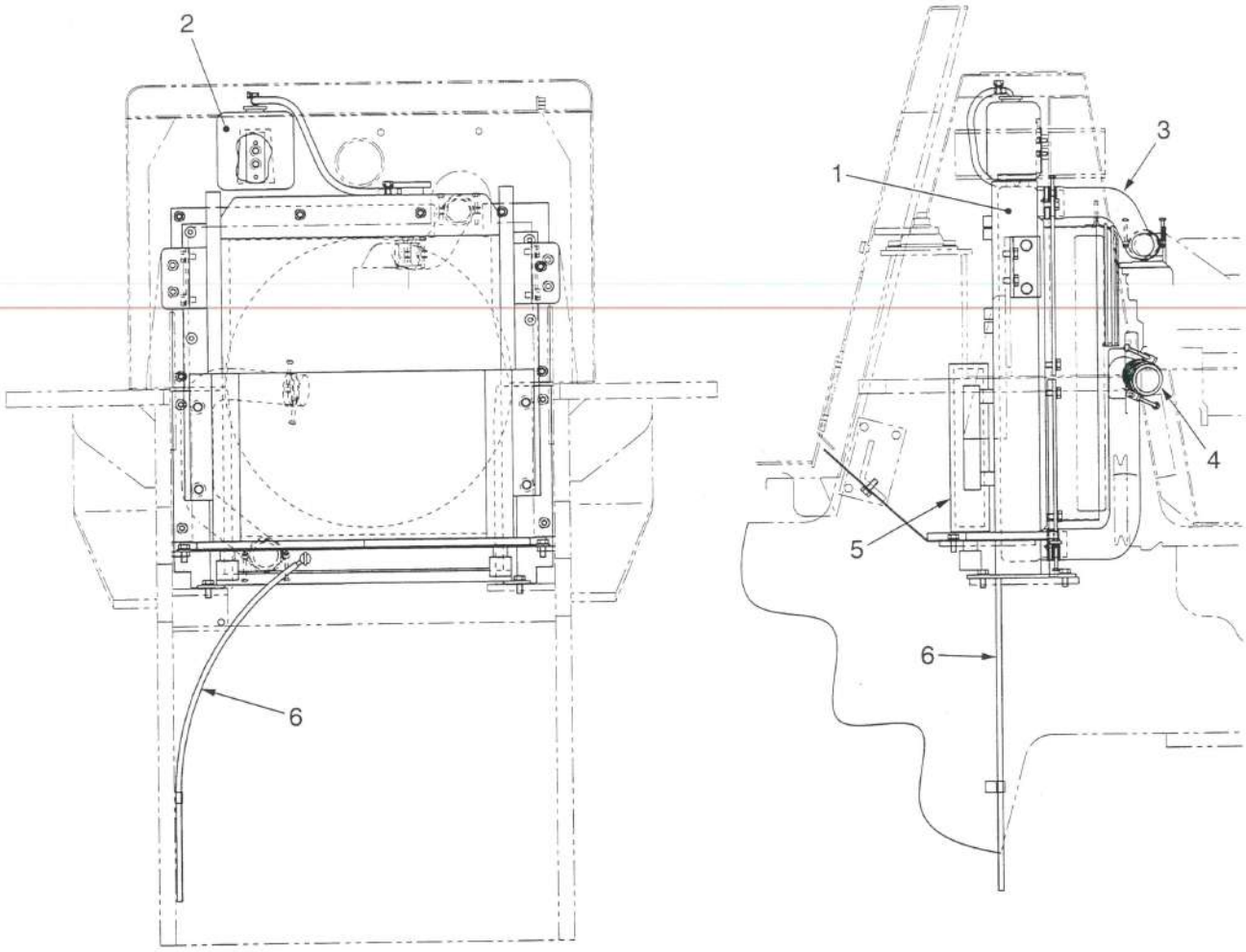
1-3. Exhaust system



SV4002003

1. Exhaust pipe
2. Muffler
3. Exhaust pipe

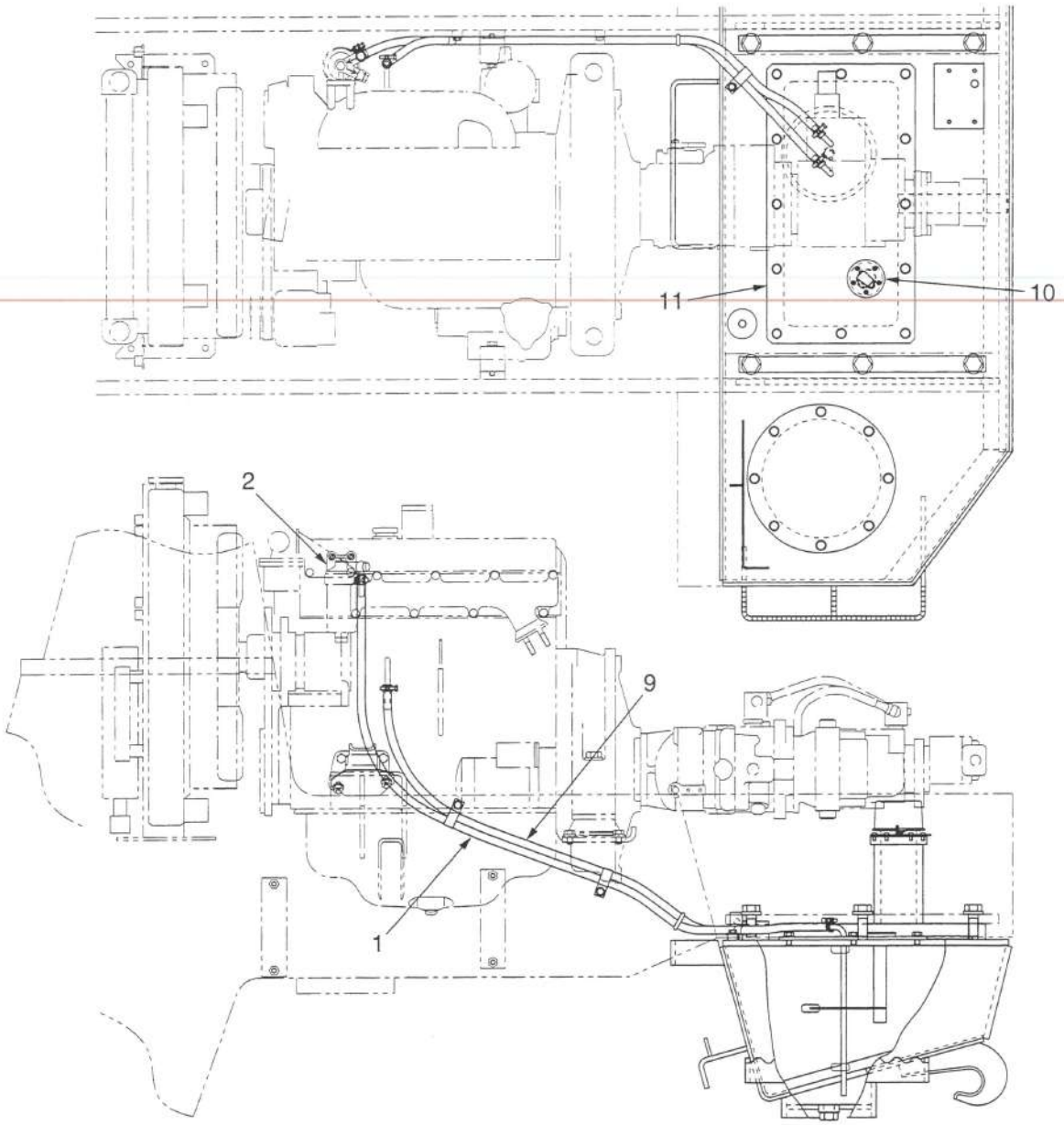
1-4. Cooling piping & radiator



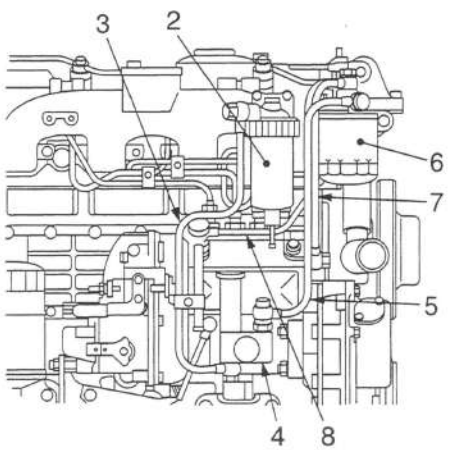
SV4002004

1. Radiator
2. Subtank
3. Radiator inlet hose
4. Radiator outlet hose
5. Oil cooler
6. Drain hose

1-5. Fuel piping & fuel tank

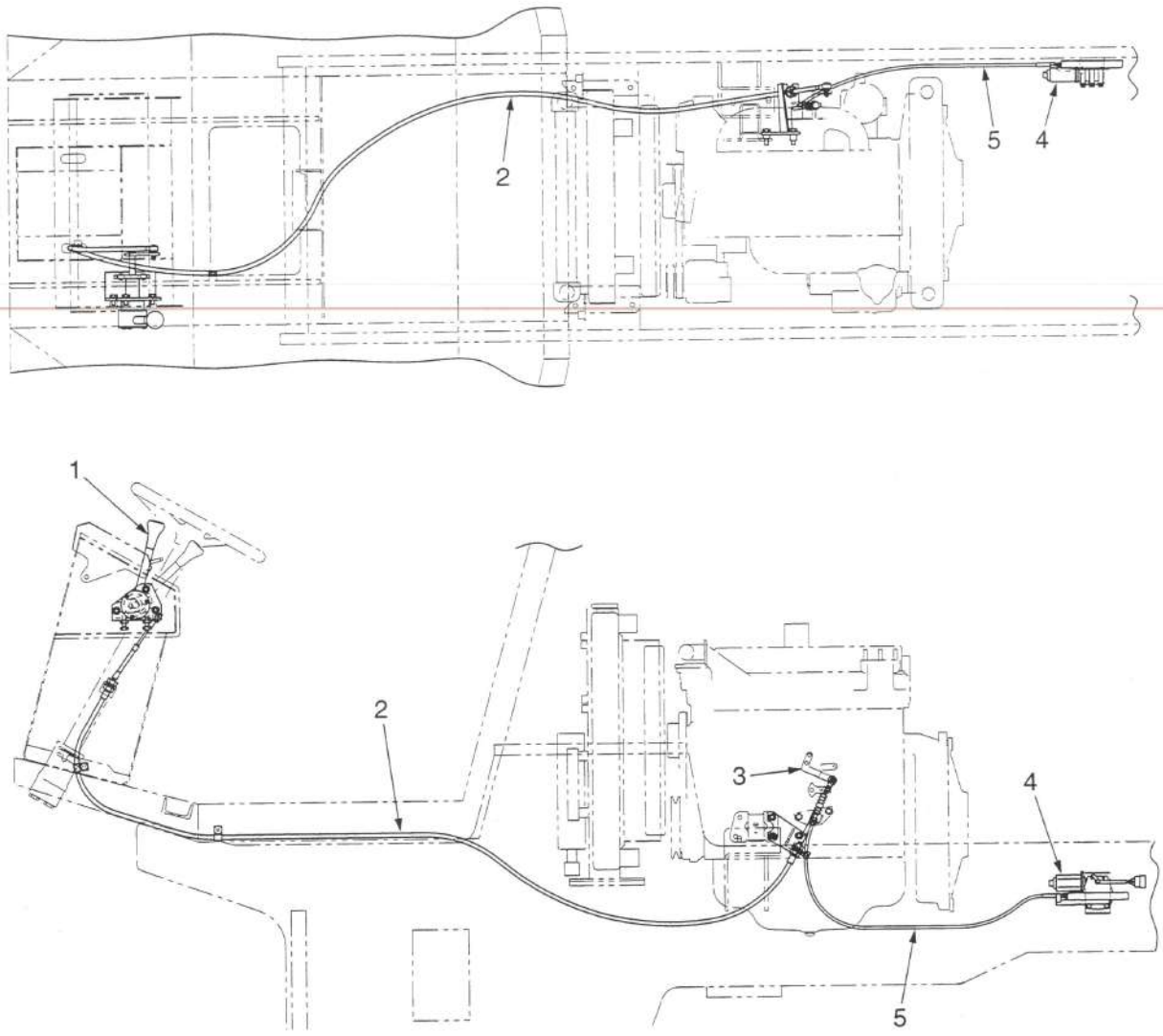


1. Suction hose (fuel tank to sedimenter)
2. Sedimenter
3. Pipe (sedimenter to feed pump)
4. Feed pump
5. Pipe (feed pump to filter)
6. Filter
7. Pipe (filter to injection pump)
8. Return pipe (filter to injection pump)
9. Return hose (injection pump to fuel tank)
10. Fuel unit
11. Fuel tank



SV4002005

1-6. Fuel controls



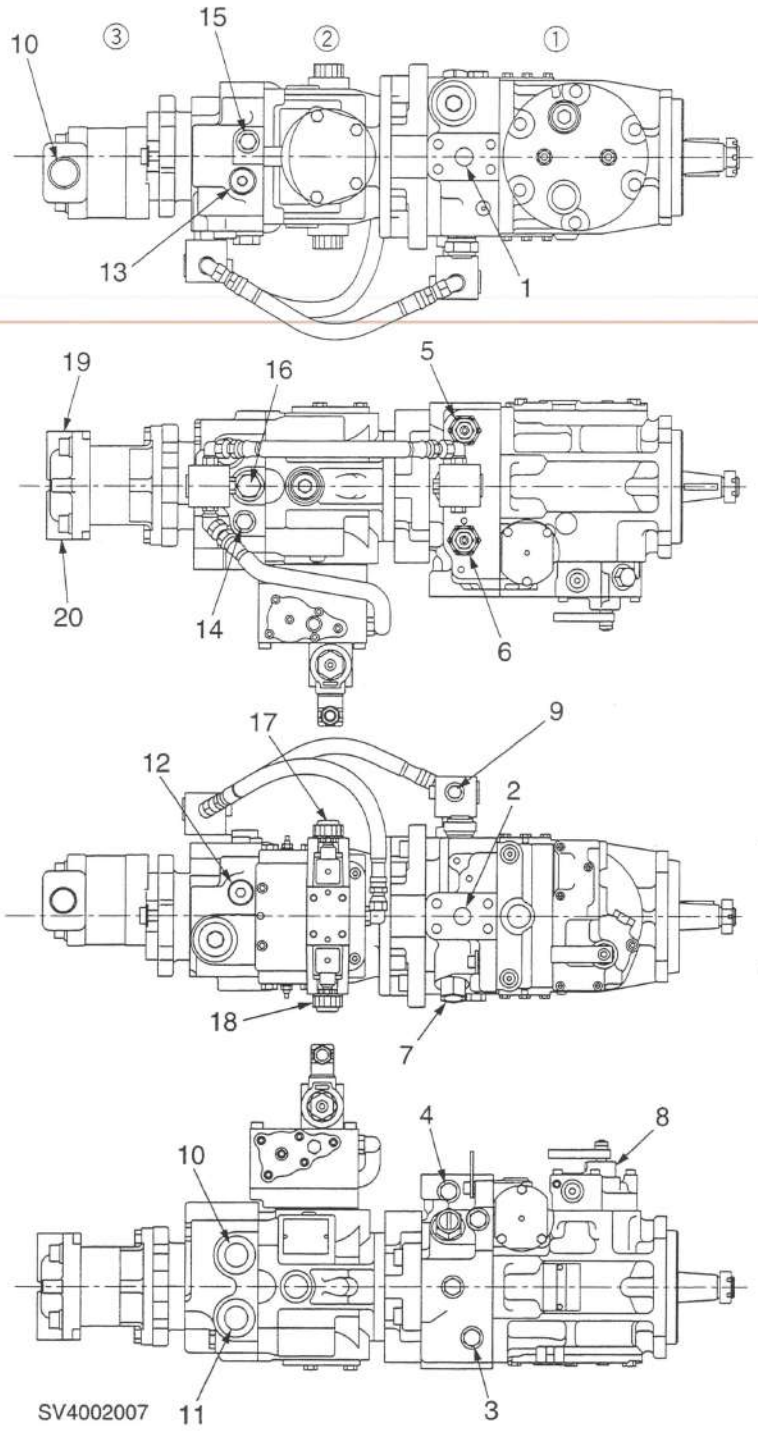
SV4002006

1. Throttle lever
2. Throttle cable
3. Fuel lever (injection pump)
4. Engine stopper
5. Engine stopper cable

2. Description and Operation of Hydraulic System

2-1. Structure of hydraulic pump and motor

2-1-1. Hydraulic pump ass'y (propulsion, vibrator, steering)

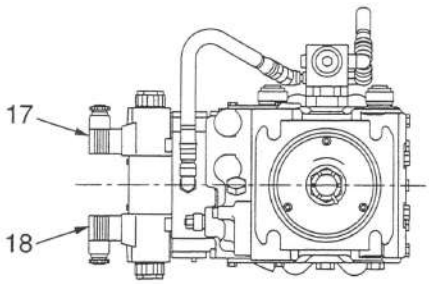


① Propulsion pump:

1. Port A1 (reverse travel)
2. Port B2 (forward travel)
3. Circuit pressure gauge port (Port A1)
4. Circuit pressure gauge port (port B2)
5. Multi-function valve (port A1)
6. Multi-function valve (port B2)
7. Charge relief valve
8. Control valve (Forward-reverse)

② Vibrator pump:

9. Charge gauge port
10. Port A2 (low amplitude)
11. Port B2 (high amplitude)
12. High pressure relief valve (port A2)
13. High pressure relief valve (port B2)
14. High pressure gauge port (port A2)



15. High pressure gauge port (port B2)
16. Charge relief valve
17. Amplitude selector solenoid valve (solenoid a)
18. Amplitude selector solenoid valve (solenoid b)

③ Steering pump:

19. Suction port
20. Delivery port

Specifications

- Model: PV05535-601

① Propulsion pump

- Displacement: 55cm³/rev(cc/rev)
- Pressure setting
  : 41.8MPa (6050psi) {426kgf/cm²}
- Charge pressure setting
  : 2.5MPa (350psi) {25kgf/cm²}

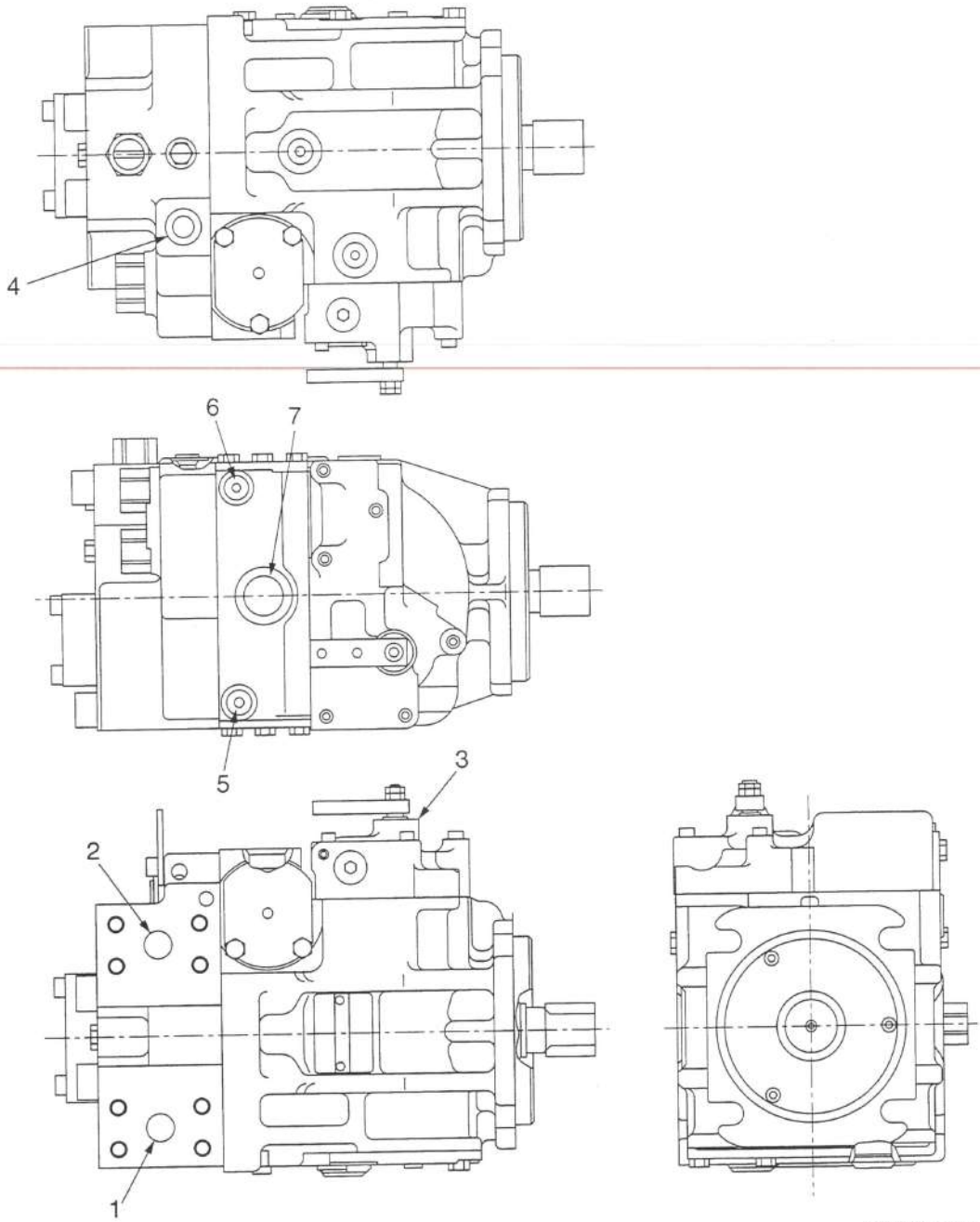
② Vibrator pump

- Displacement
  : 35cm³/rev (cc/rev) (low amplitude)
  : 27cm³/rev (cc/rev) (high amplitude)
- Charge circuit setting
  : 2.5MPa (350psi) {25kgf/cm²}

③ Steering pump

- Displacement: 24.9cm³/rev(cc/rev)
- Pressure setting
  : 10.9MPa (1560psi) {110kgf/cm²} (to be set on Orbitrol side)

2-1-2. Propulsion motor (rear drive)



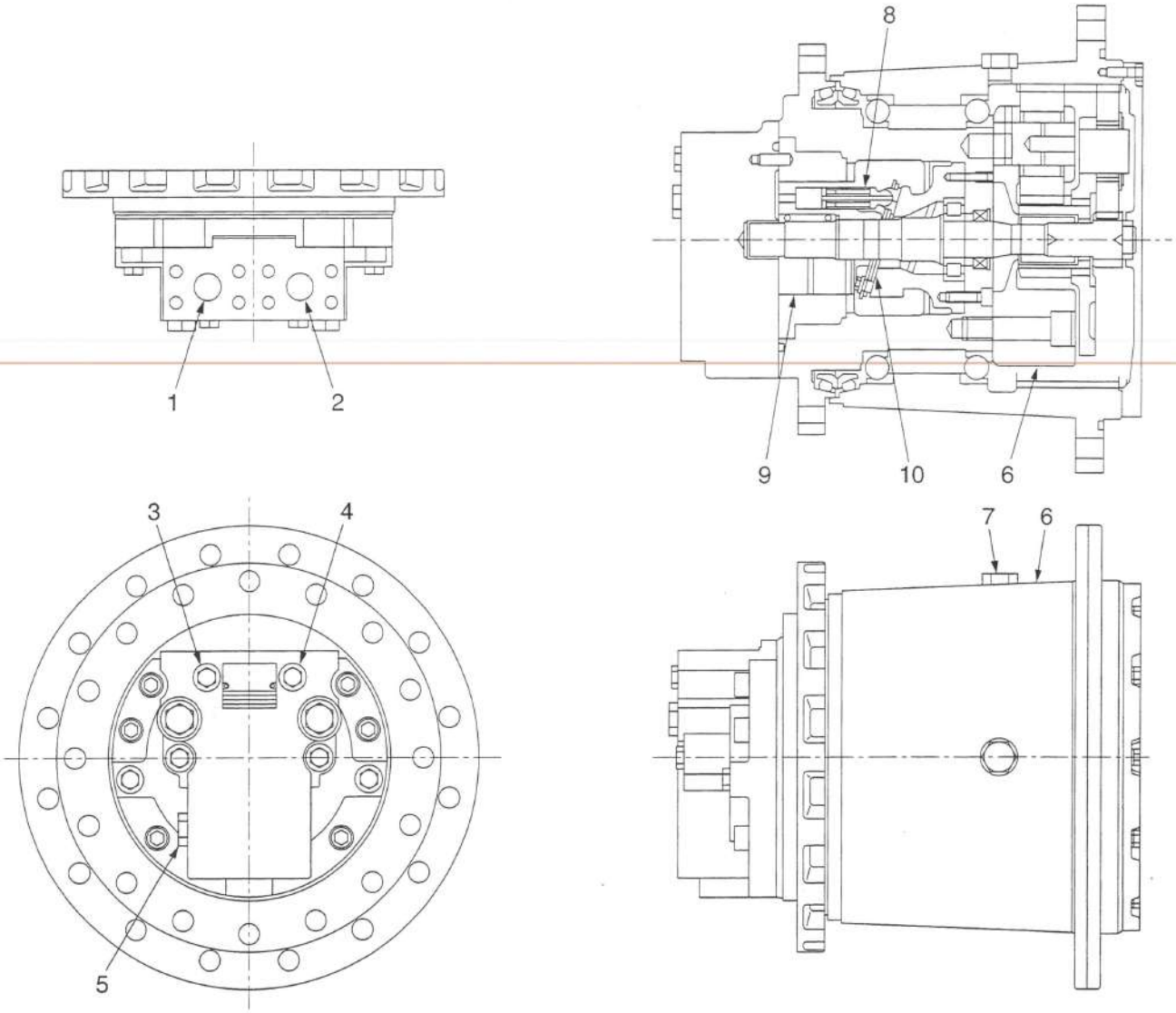
SV4002050

1. Port A (forward travel)
2. Port B (reverse travel)
3. Control valve
4. Speed shift circuit port (to operate servo piston)
5. Speed shift valve gauge port (High speed)
6. Speed shift valve gauge port (Low speed)
7. Drain port

Specifications

- Model: MV075-604
- Displacement
  (Min): 28cm³/rev(cc/rev)
  (Max): 75cm³/rev(cc/rev)
- Circuit pressure setting
  : 41.8MPa (6050psi) {426kgf/cm²}
  (to be set on pump side)
- Low pressure relief valve setting
  : 2.36MPa (330psi) {23.6kgf/cm²}

2-1-3. Propulsion motor (front drive)



SV4002008

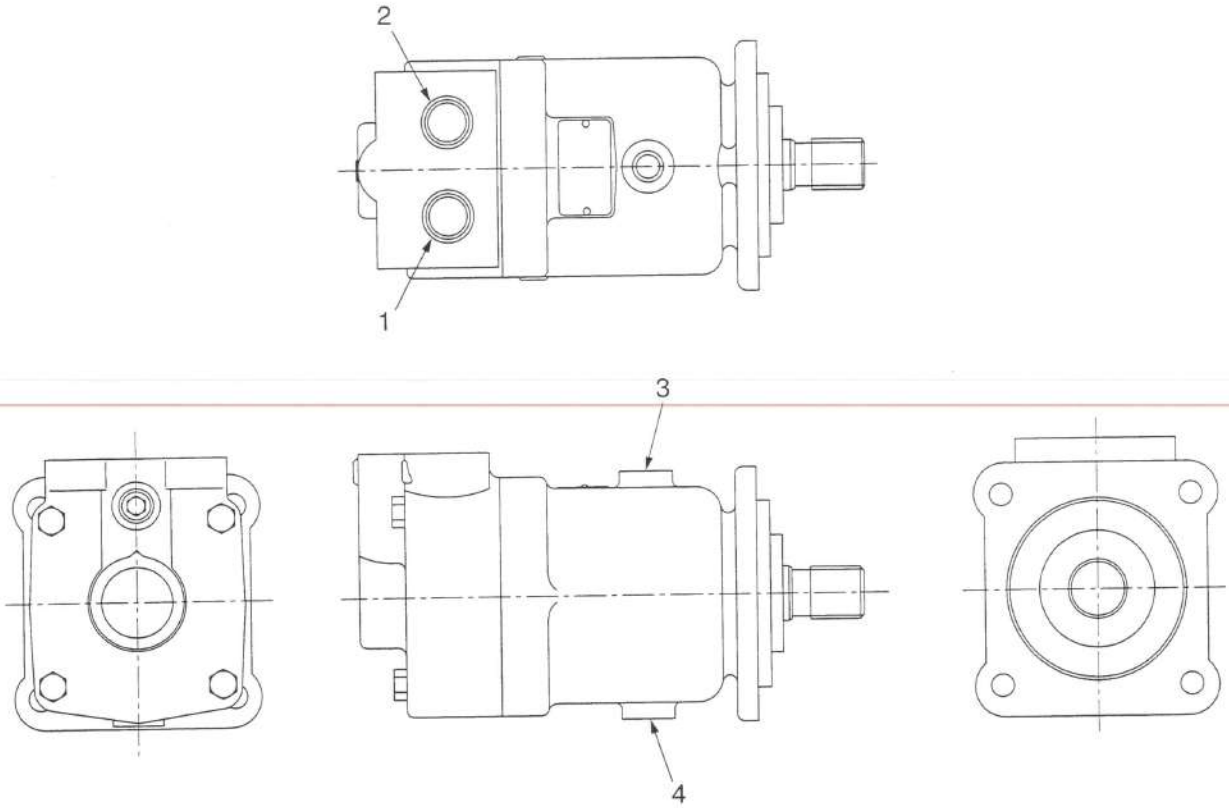
1. Port B (forward travel)
2. Port A (reverse travel)
3. High pressure gauge port (port B)
4. High pressure gauge port (port A)
5. Drain port
6. Reduction gear
7. Fill hole

Motor:

8. Piston
9. Cylinder block
10. Swashplate

Specifications
- Model: BM55K-24EH
- Displacement: 55.1cm³/rev(cc/rev)
- Circuit pressure setting
  : 41.8MPa (6050psi) {426kgf/cm²}
  (to be set on propulsion pump side)

2-1-4. Vibrator motor



SV4002040

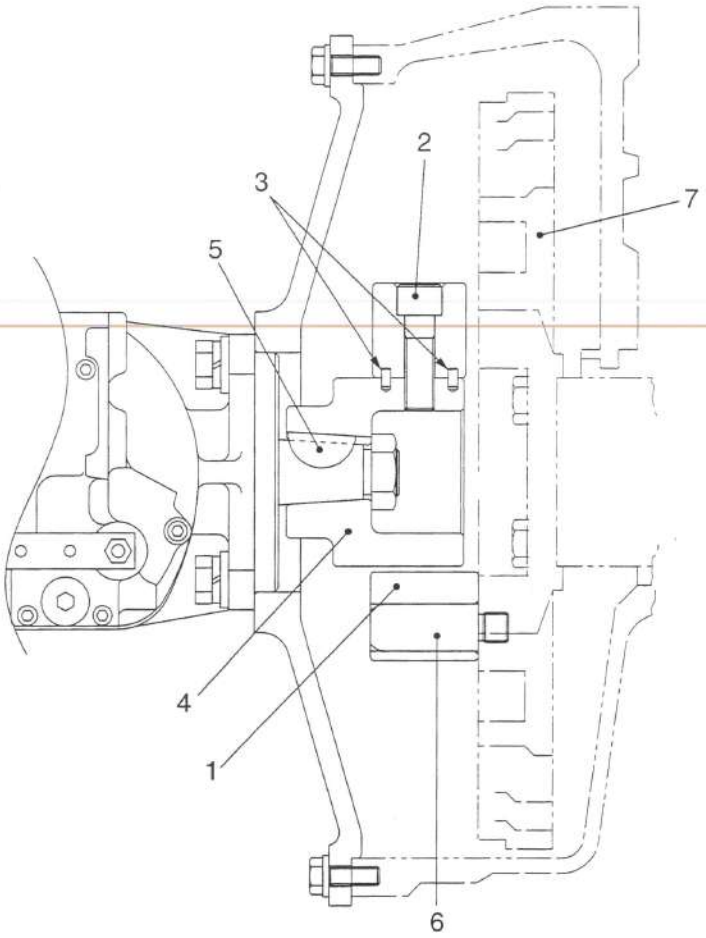
1. Port A (low amplitude)
2. Port B (high amplitude)
3. Drain port
4. Drain port

Specifications

- Model : SP35MF-546
- Displacement : 41.1cm³/rev(cc/rev)
- Circuit pressure setting : 25MPa (3260psi) {255kgf/cm²}
  (to be set on pump side)

2-2. Coupling and hydraulic circuit

2-2-1. Coupling

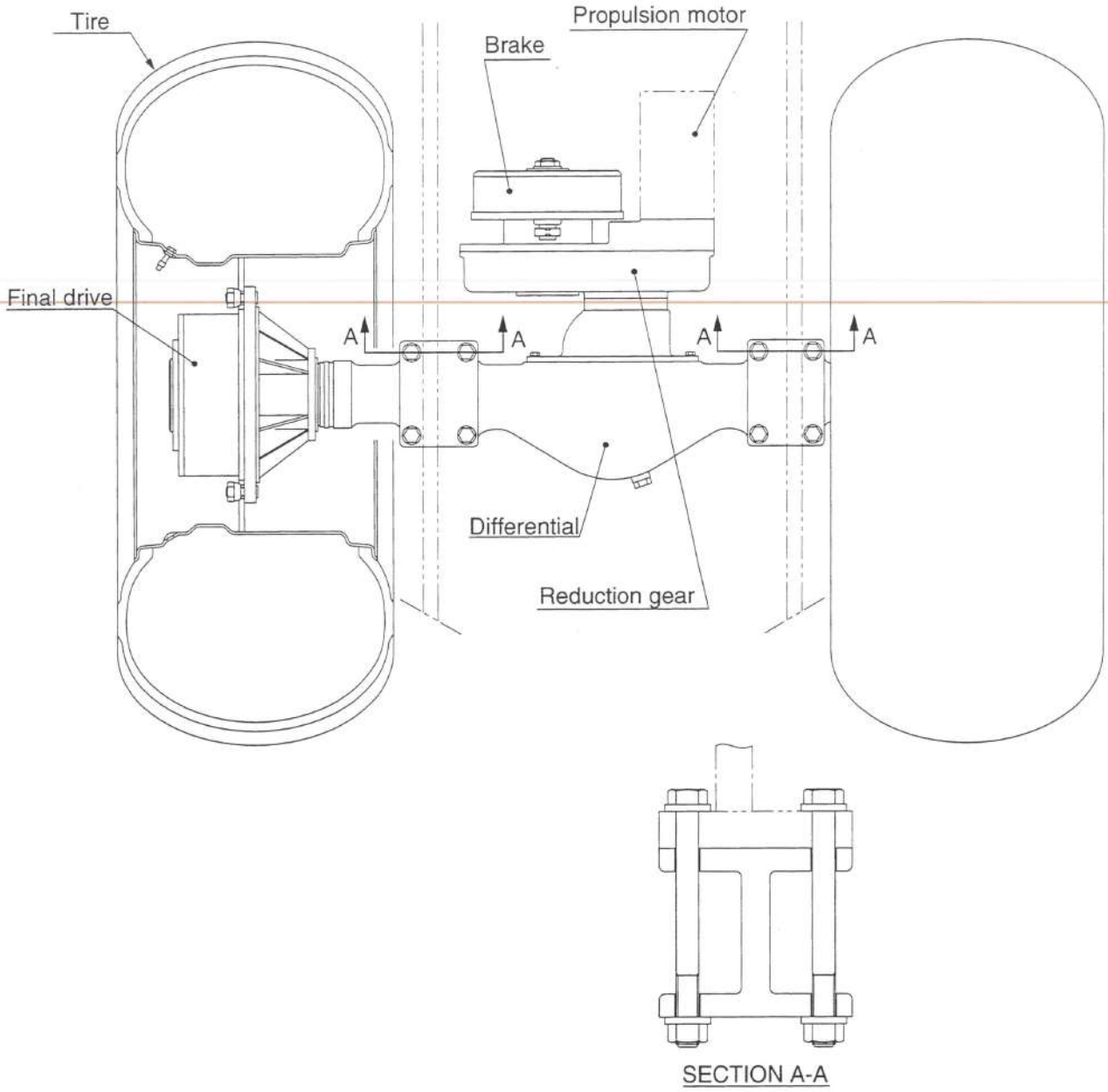


SV5102014

1. Coupling
2. Bolt
3. Spring pin
4. Boss
5. Key
6. Bolt
7. Flywheel

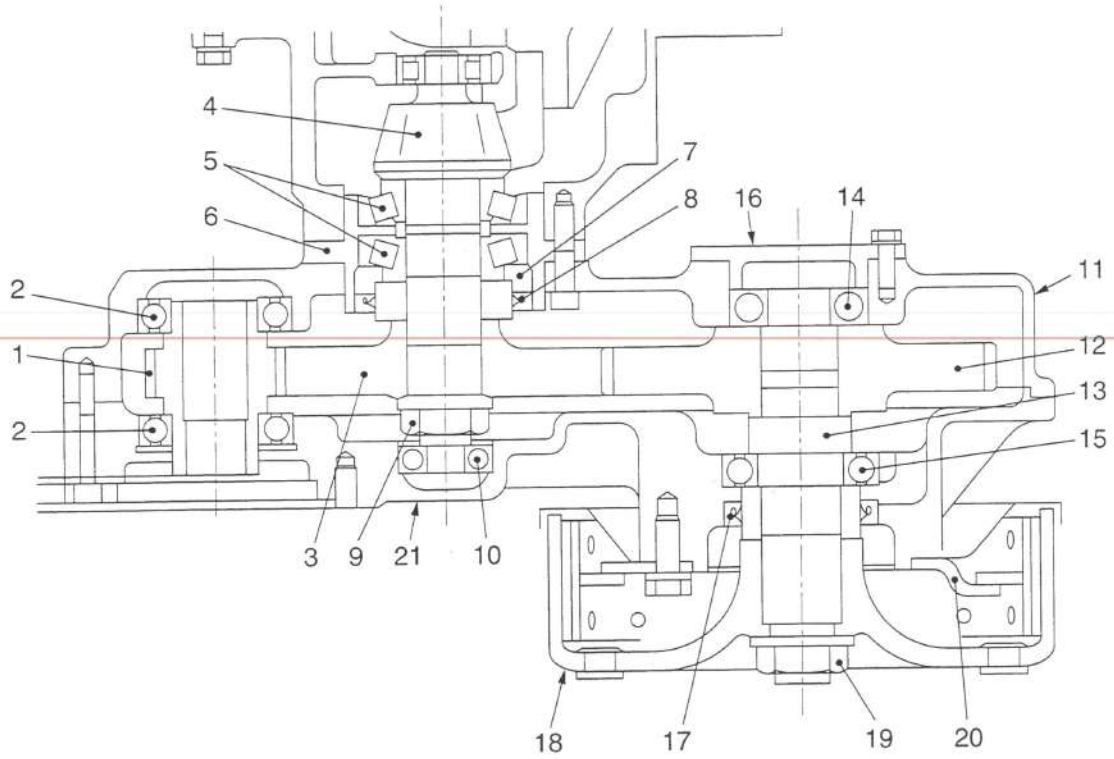
2-3. Description and operation of propulsion system

2-3-1. Rear axle ass'y



SV5102017

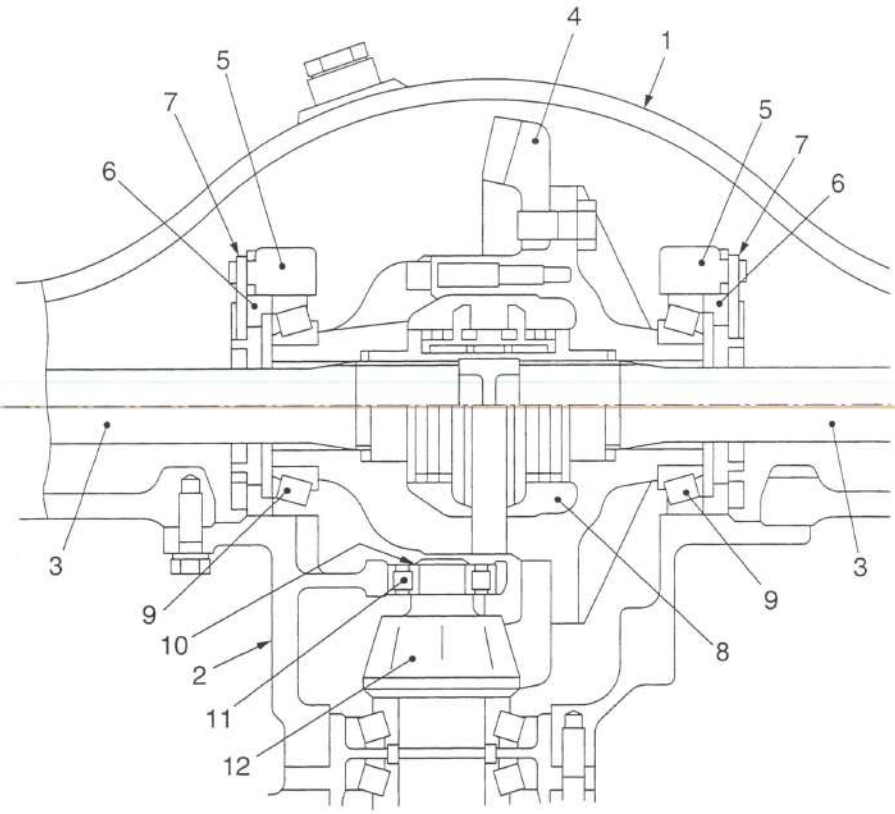
2-3-2. Reduction gear



SV5102018

1. Gear
2. Ball bearing
3. Gear
4. Shaft (bevel pinion)
5. Roller bearing
6. Bearing cage
7. Oil seal collar
8. Oil seal
9. Nut
10. Ball bearing
11. Reduction gear case
12. Gear (brake)
13. Shaft (brake)
14. Ball bearing
15. Ball bearing
16. Cover
17. Oil seal
18. Brake drum
19. Nut
20. Brake ass'y
21. Cover (case cover)

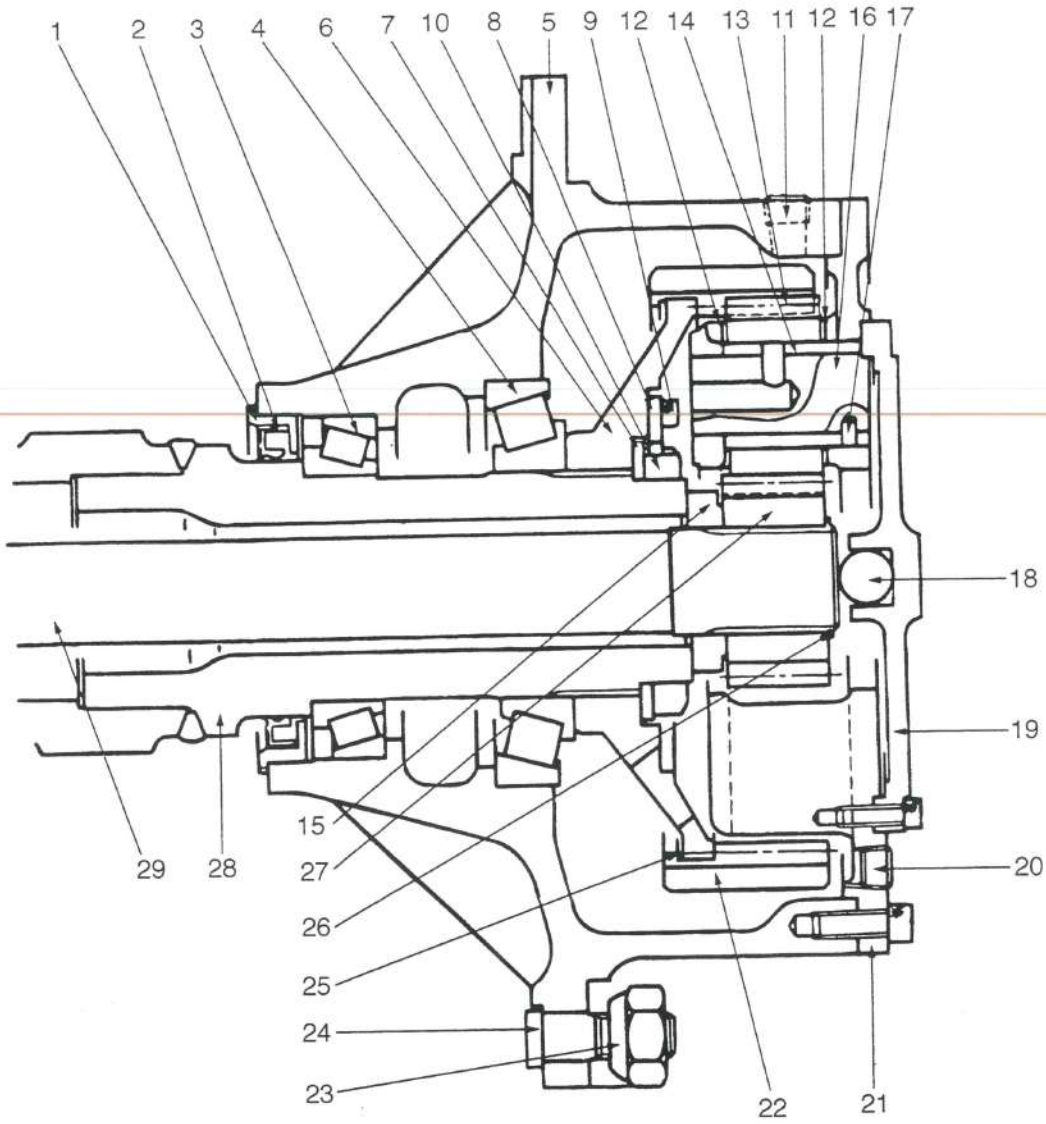
2-3-3. Differential



SV5102019

1. Housing
2. Carrier ass'y
3. Axle shaft
4. Bevel gear
5. Cap
6. Nut
7. Lock plate
8. No-spin differential
9. Roller bearing
10. Lock ring
11. Roller bearing
12. Shaft (bevel pinion)

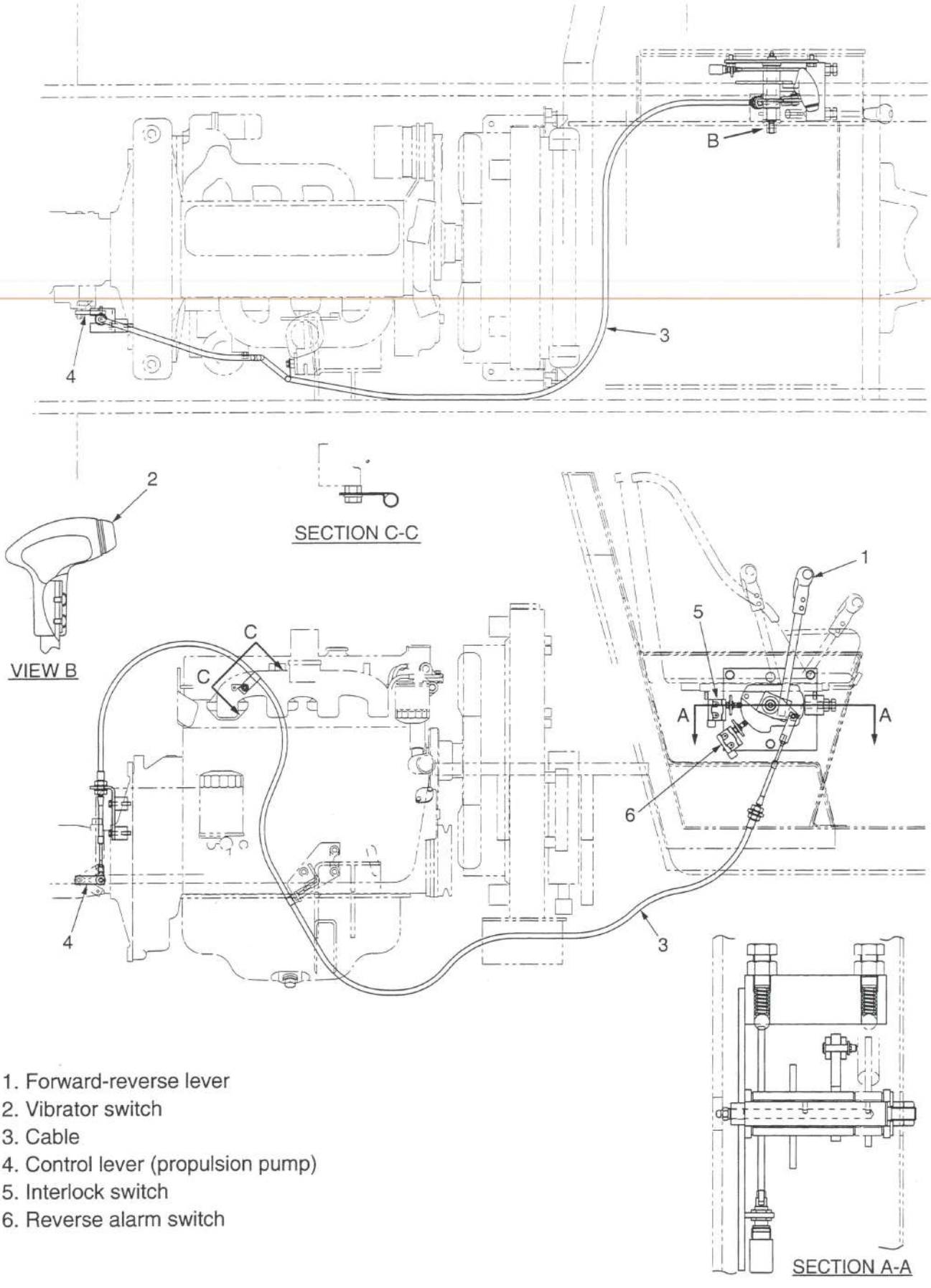
2-3-4. Final drive



SV5002039

1. Oil seal retainer
2. Oil seal
3. Roller bearing
4. Roller bearing
5. Wheel hub
6. Ring gear hub
7. Spacer
8. Lock plate
9. Bolt
10. Nut
11. Plug
12. Thrust washer
13. Planetary gear
14. Planetary gear bushing
15. Thrust washer
16. Planetary gear shaft
17. Pin
18. Steel ball
19. Cover
20. Plug
21. Planetary spider
22. Ring gear
23. Wheel nut
24. Wheel bolt
25. Stop wire
26. Lock ring
27. Sun gear
28. Axle spindle
29. Axle shaft

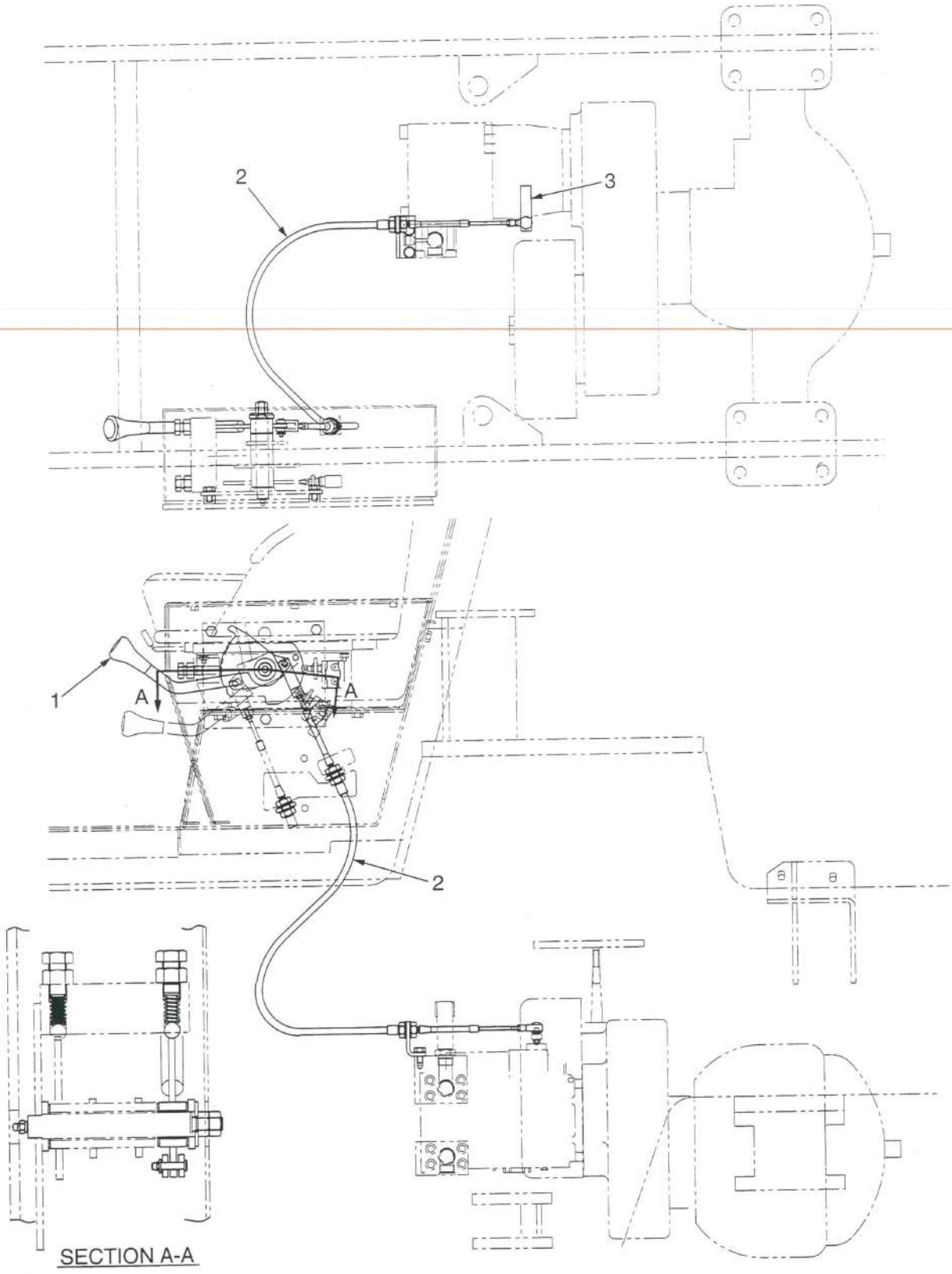
2-3-5. Travel controls (forward-reverse)



1. Forward-reverse lever
2. Vibrator switch
3. Cable
4. Control lever (propulsion pump)
5. Interlock switch
6. Reverse alarm switch

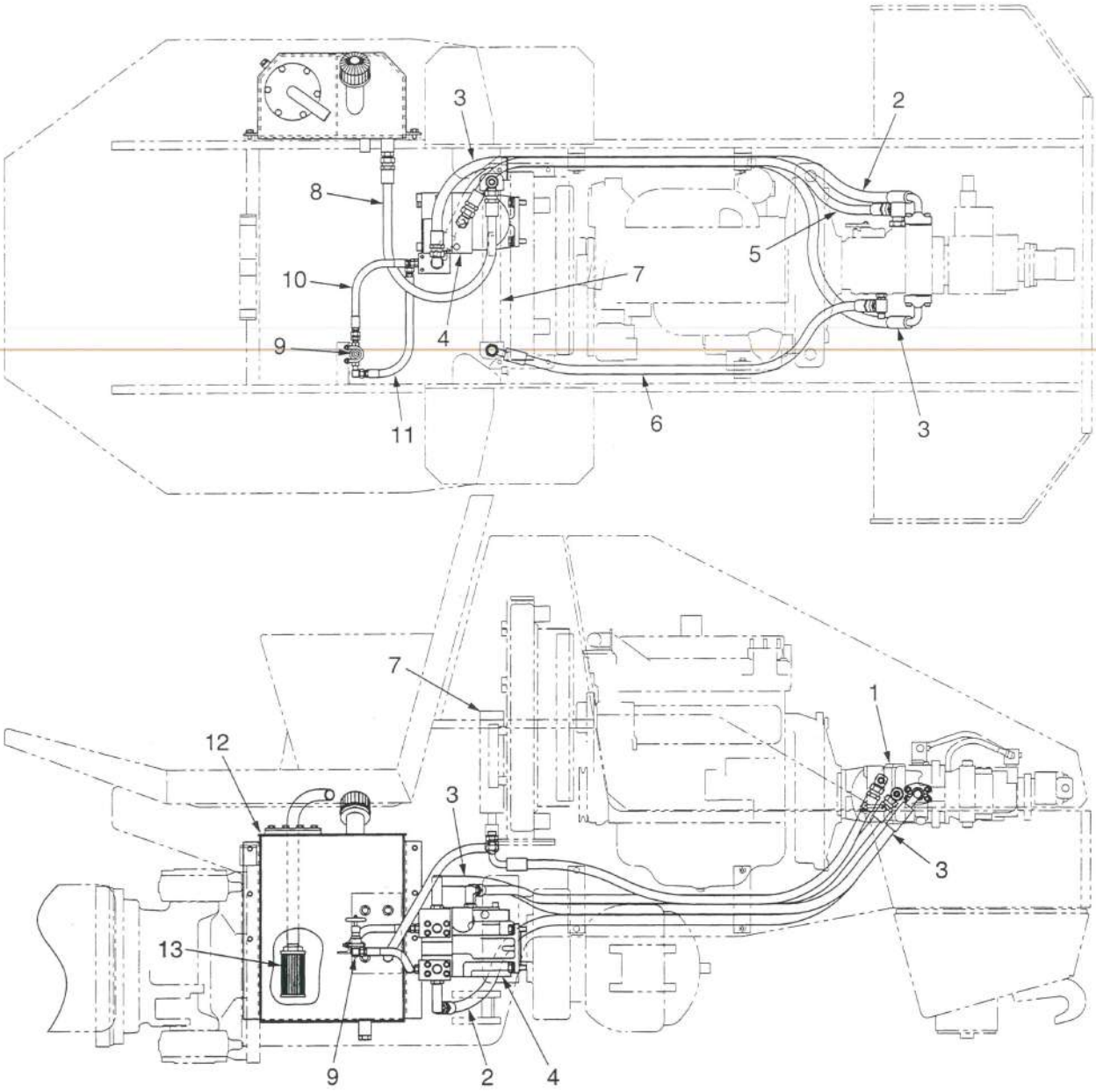
SV4002009

2-3-6. Travel controls (speed shift)



1. Speed shift lever
2. Cable
3. Control lever

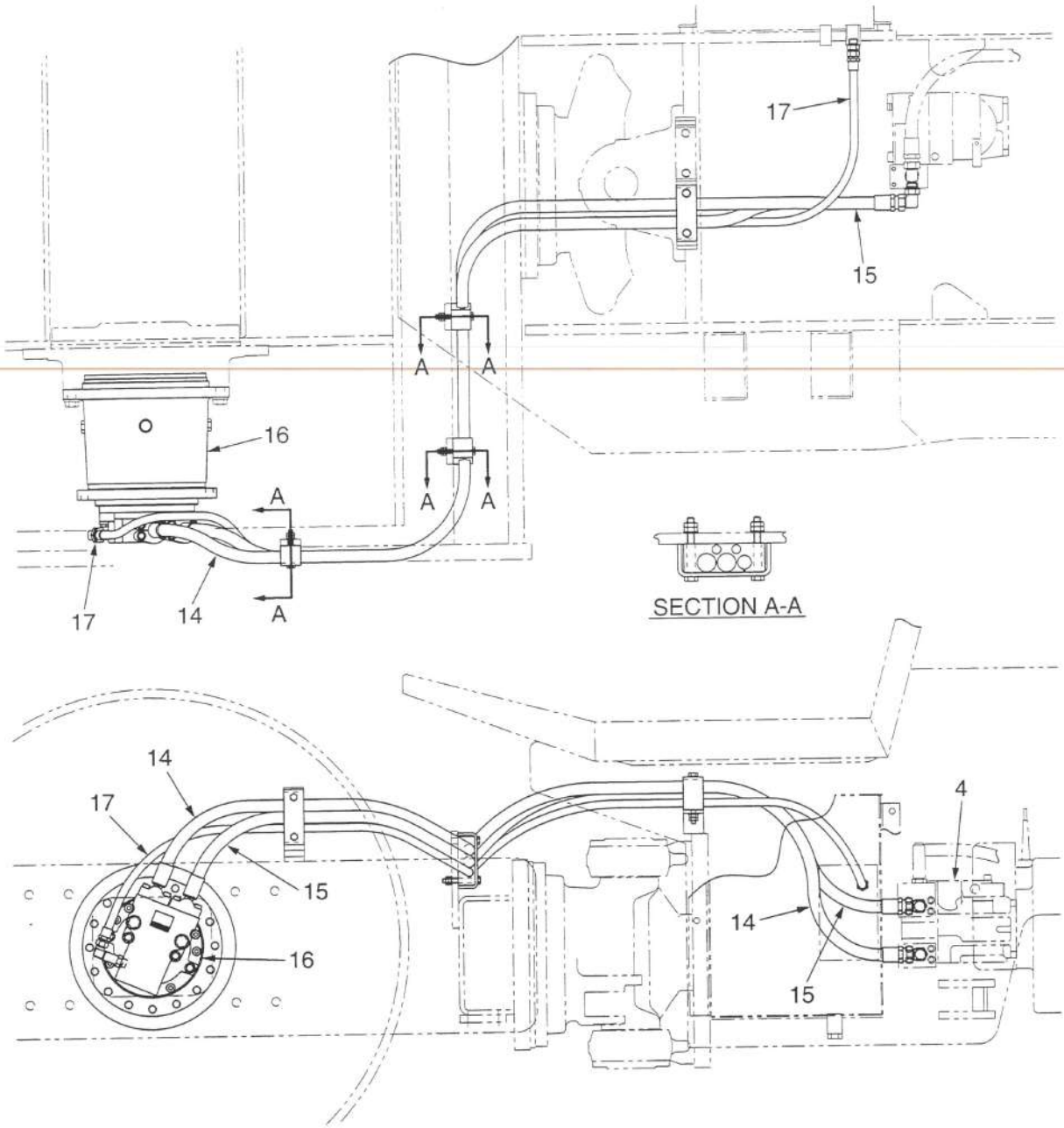
2-3-7. Hydraulic piping (rear drive)



SV4002011

1. Propulsion pump
2. High pressure hose (forward travel)
3. High pressure hose (reverse travel)
4. Propulsion motor
5. Drain hose (motor to pump)
6. Oil cooler inlet hose
7. Oil cooler
8. Drain hose (oil cooler to tank)
9. Unload valve
10. High pressure hose (unload)
11. High pressure hose (unload)
12. Hydraulic tank
13. Suction filter

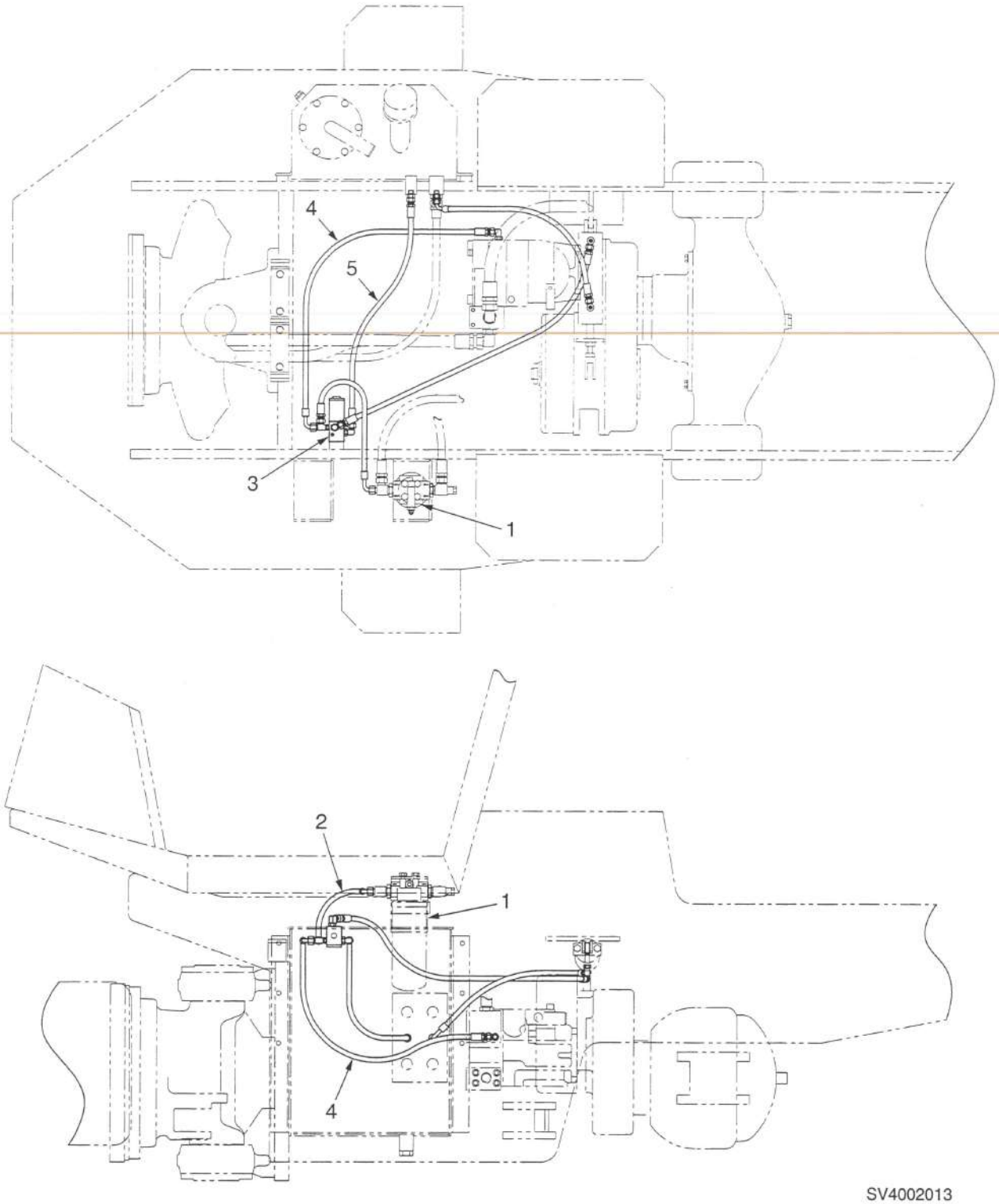
2-3-8. Hydraulic piping (front drive)



SV4002012

4. Propulsion motor (rear drive)
14. High pressure hose (forward travel)
15. High pressure hose (reverse travel)
16. Propulsion motor (front drive)
17. Drain hose

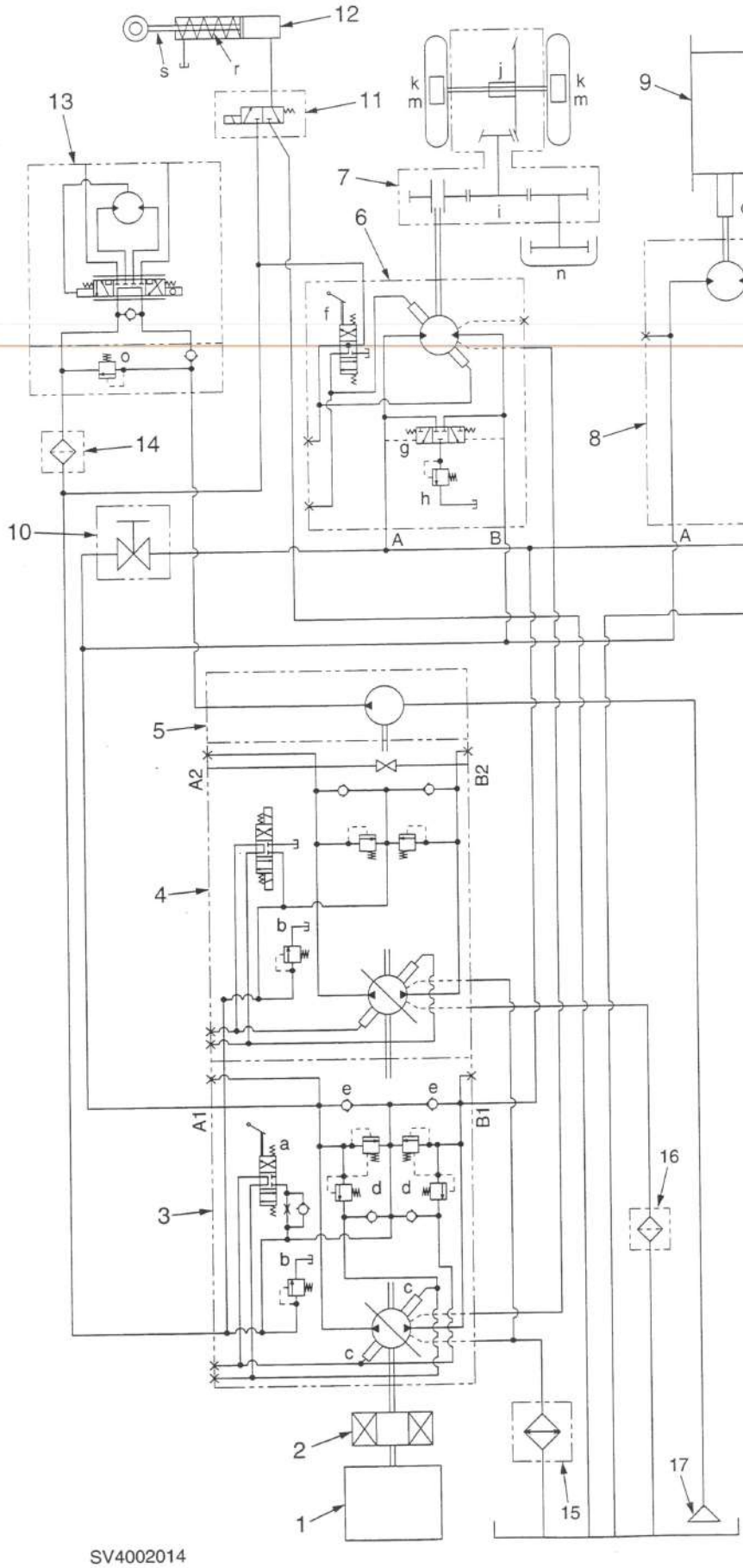
2-3-9. Hydraulic piping (Speed shift circuit)



SV4002013

1. Line filter (charge circuit)
2. Circuit pressure feed hose (filter to brake valve)
3. Brake valve
4. Speed shift circuit hose
5. Return hose

2-3-10. Propulsion circuit



1. Engine
2. Coupling
3. Propulsion pump ass'y
   a. Control valve (forward-reverse)
   b. Charge relief valve
   c. Servo cylinder
   d. Multi-function valve
   e. Check valve
4. Vibrator pump
5. Steering pump
6. Propulsion motor (rear)
   f. Speed shift valve
   g. Shuttle valve (flushing valve)
   h. Low pressure relief valve
7. Rear axle ass'y
   i. Reduction gear
   j. Differential
   k. Final drives (inside of tires)
   m. Tires
   n. Brake ass'y
8. Propulsion motor (front)
   o. Gear reducer
9. Drum
10. Unloader valve
11. Brake valve
12. Brake cylinder
    r. Spring
    s. Rod
13. Orbitrol
14. Line filter (charge circuit)
15. Oil cooler
16. Return filter
17. Suction filter

2-3-11. Description and operation of propulsion system

♦ See the hydraulic circuit on page 2-026.

Description of propulsion system

- Made up of propulsion pump (3), rear propulsion motor (6), rear axle ass'y (7), front propulsion motor (8), drum (9), brake valve (11) and brake cylinder (12).
  The rear axle ass'y includes reduction gear (i), differential (j), final drives (k), tires (m) and brake ass'y (n).

Basic function of propulsion pump and motor

- Propulsion pump
  A piston pump is used which selects forward travel, neutral and backing by varying the swashplate inclination, and thus varying the piston stroke. The travel speed is infinitely variable by the operation of the F-R (forward-reverse) lever.

- Propulsion motor
  A variable displacement piston motor is used which shifts its speeds by varying the stroke of its pistons.
  * The front propulsion motor is a fixed displacement type.

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

★ **The spring-applied hydraulically released brake is supposed to have been released.**

* Assemblies such as pump ass'y and motor ass'y are indicated by numbers such as '1' and '2', while component parts of assemblies are shown by small letters such as 'a' and 'b'.

- When the forward-reverse lever (F-R lever) is moved forward, control valve (a) is actuated to feed pressure to servo cylinder (c). Its servo piston functions to tilt the pump swashplate in the forward travel direction.
- Propulsion pump (3) discharges oil from its port B1 into the forward travel circuit, then the oil flow is diverted into two lines; the forward travel line connecting to port A of rear motor (6) and that connecting to port B of front motor (8).
- The oil fed to the forward travel ports of the motors drives the motors, flows out from the opposite side ports, joins together and returning to pump suction port P1. At the same time, part of oil is dumped into the drain line through shuttle valve (g) and low pressure relief valve (h) both of which are built in motor (6).
- The power from the motors is delivered to drums (8) and (9) through gear reducers (t).

NOTE: Because the propulsion circuit is a closed loop circuit, the relationship between the suction port and discharge port is reversed when the travel direction is reversed. (The direction of oil flow is reversed.)

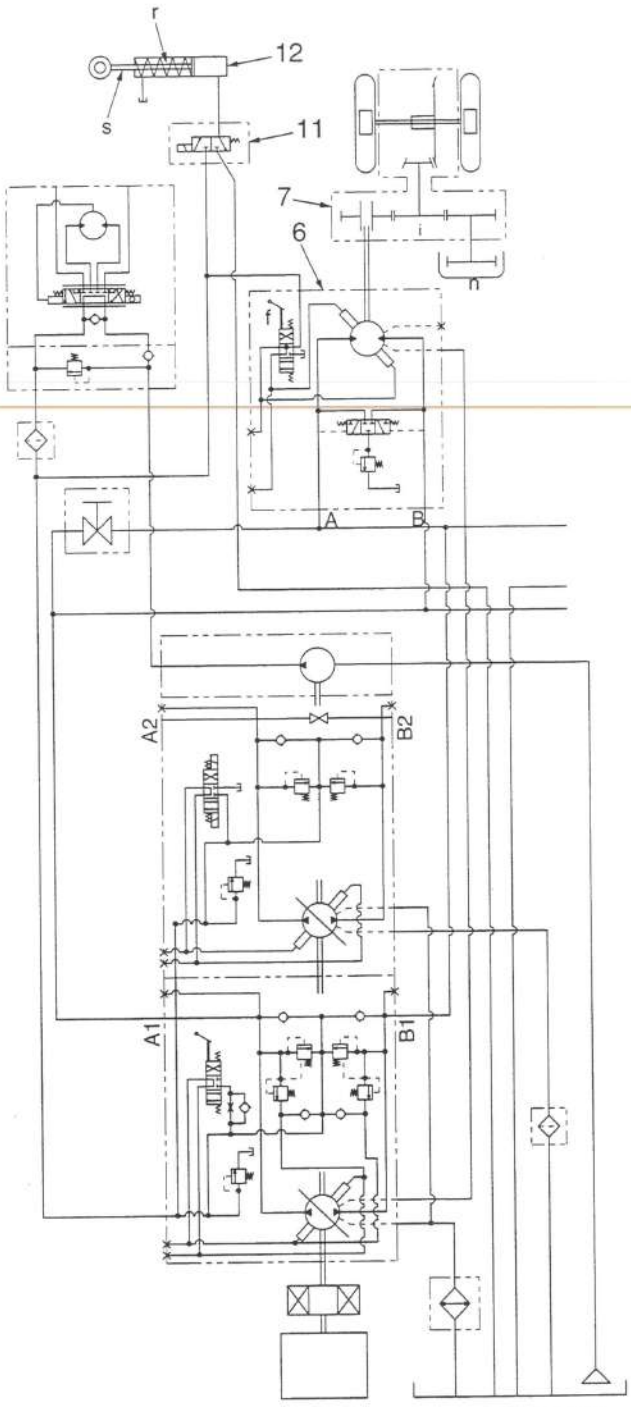
- In the rear axle, the drive is delivered through reduction gear (i) in rear axle ass'y (7), differential (j) and final reduction gear (k) to rear wheels (m).
  In the front axle, Power drives drum (9) through reduction gear (o).

Speed shift (from low to high)

- Low-high speed selector valve (f) is built in rear propulsion motor (6).
  Setting the speed shift lever to the HIGH position causes pressurized oil to flow from valve (f) to the motor servo cylinder.
- The servo cylinder piston tilts the swash-plate in the direction in which the motor piston strokes is reduced. (Displacement is reduced from 75 cm^3 to 28 cm^3). This decreases the motor displacement per shaft rotation to 1/3 of the displacement at the time when running at LOW speed. The vehicle speed increases with the pump delivery remaining constanct.

Releasing the parking brake

- Rear axle ass'y (7) includes parking brake (n).
- Operation of brake switch on the instrument panel in the driver's station enrgizes brake valve (11), which feeds brake release oil.
- The oil is fed into brake cylinder (12), extending piston rod (s) against compression spring (r) load. Brake is freed.



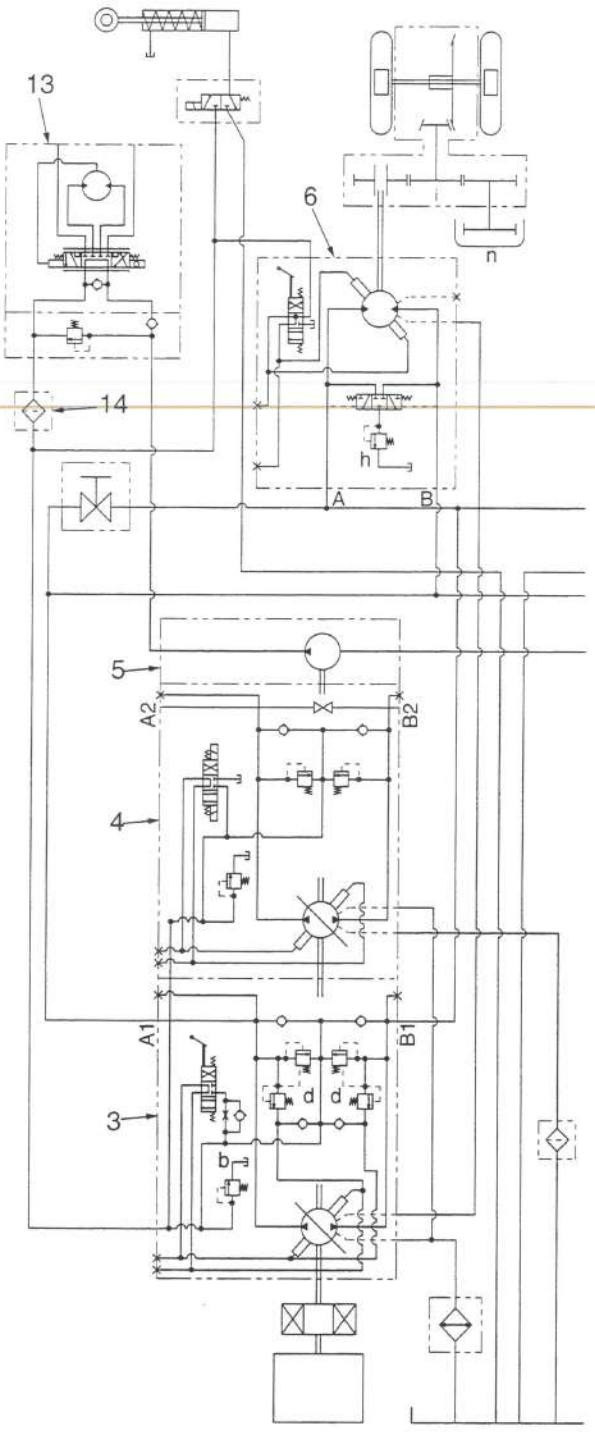
SV4002015

Circuit protection against high pressure

- Multi-function valve (d) fitted in the propulsion pump relieves pressure if the circuit pressure exceeds the setting of the valve (d), thus protecting the circuit.

Charge circuit

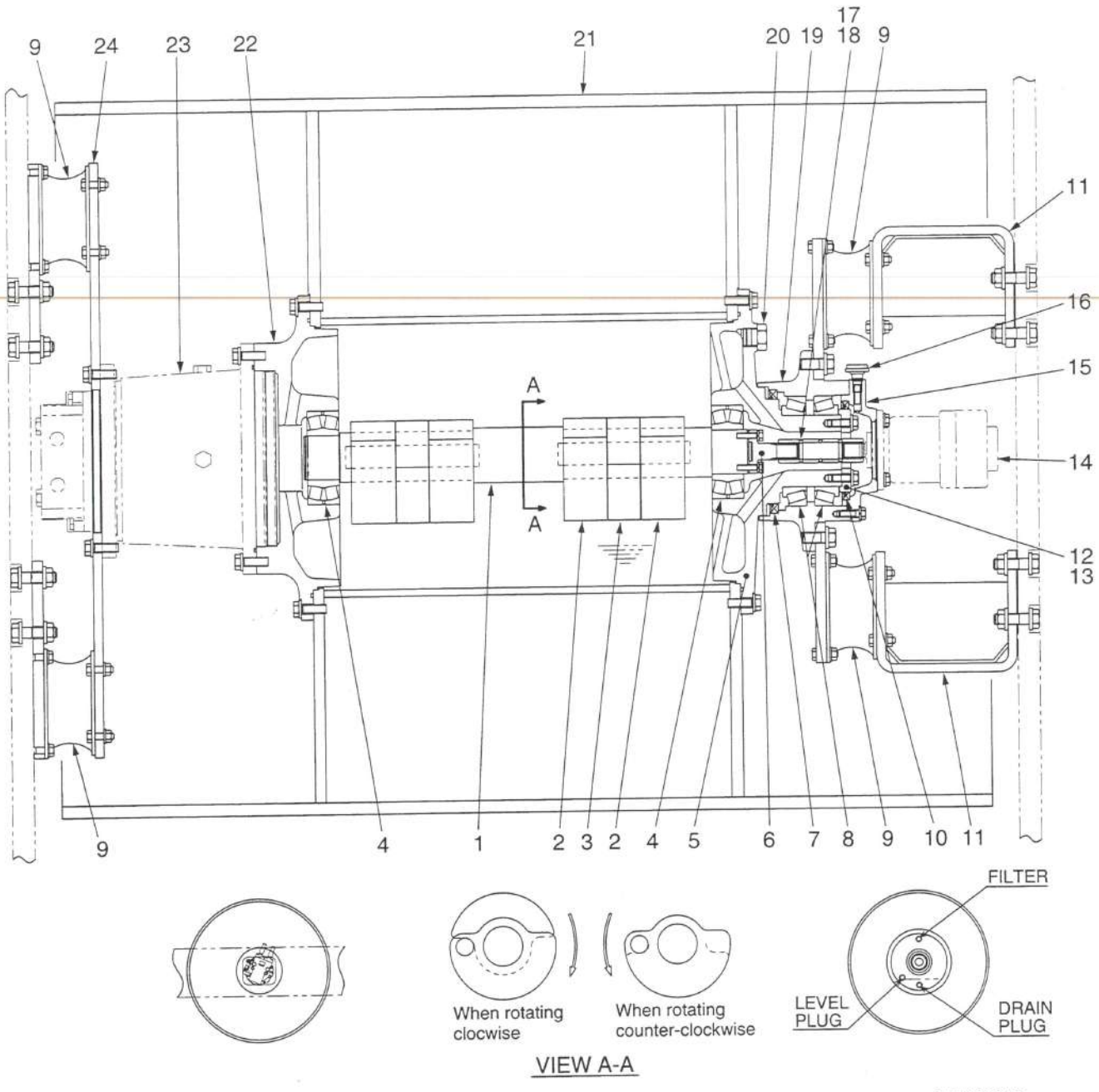
- The propulsion circuit is of a closed circuit, which needs feeding of oil into it for making up for deficiency, for cooling of oil or for other purposes.
- In the charge circuit, oil from steering pump (5) flows into steering valve (13) (Orbitrol), then the whole oil goes to propulsion pmup (3) via filter (14) irrespective of the steering wheel operation.
- The pressure adjustment is achieved by charge relief valve (b) built in the propulsion pump when the F-R lever is in the neutral position. When travelling, the pressure is adjusted by low pressure relief valve (h) built in rear propulsion motor (6).



SV4002017

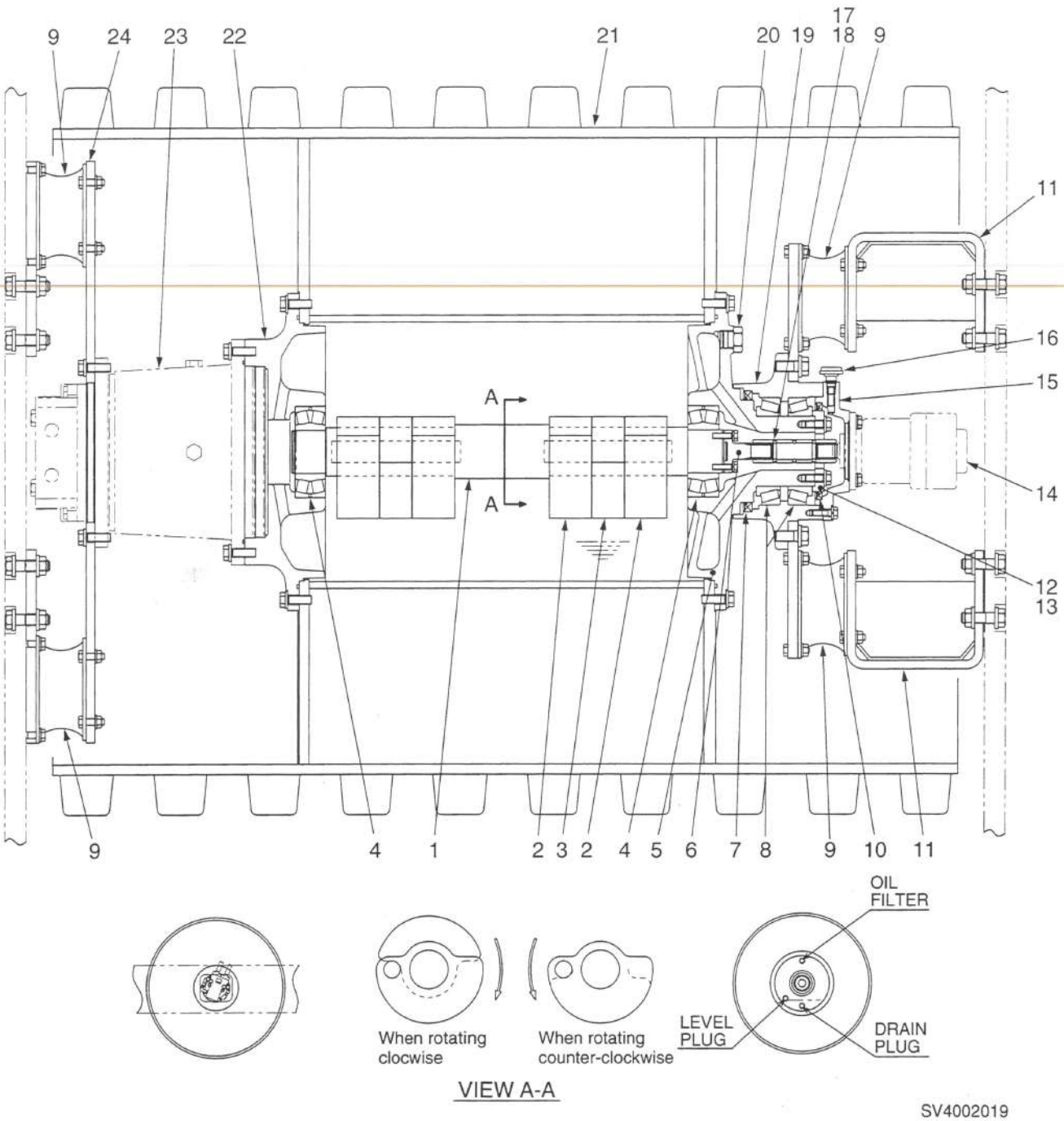
2-4. Description and Operation of Vibrator

2-4-1. Drum and vibrator (model D)



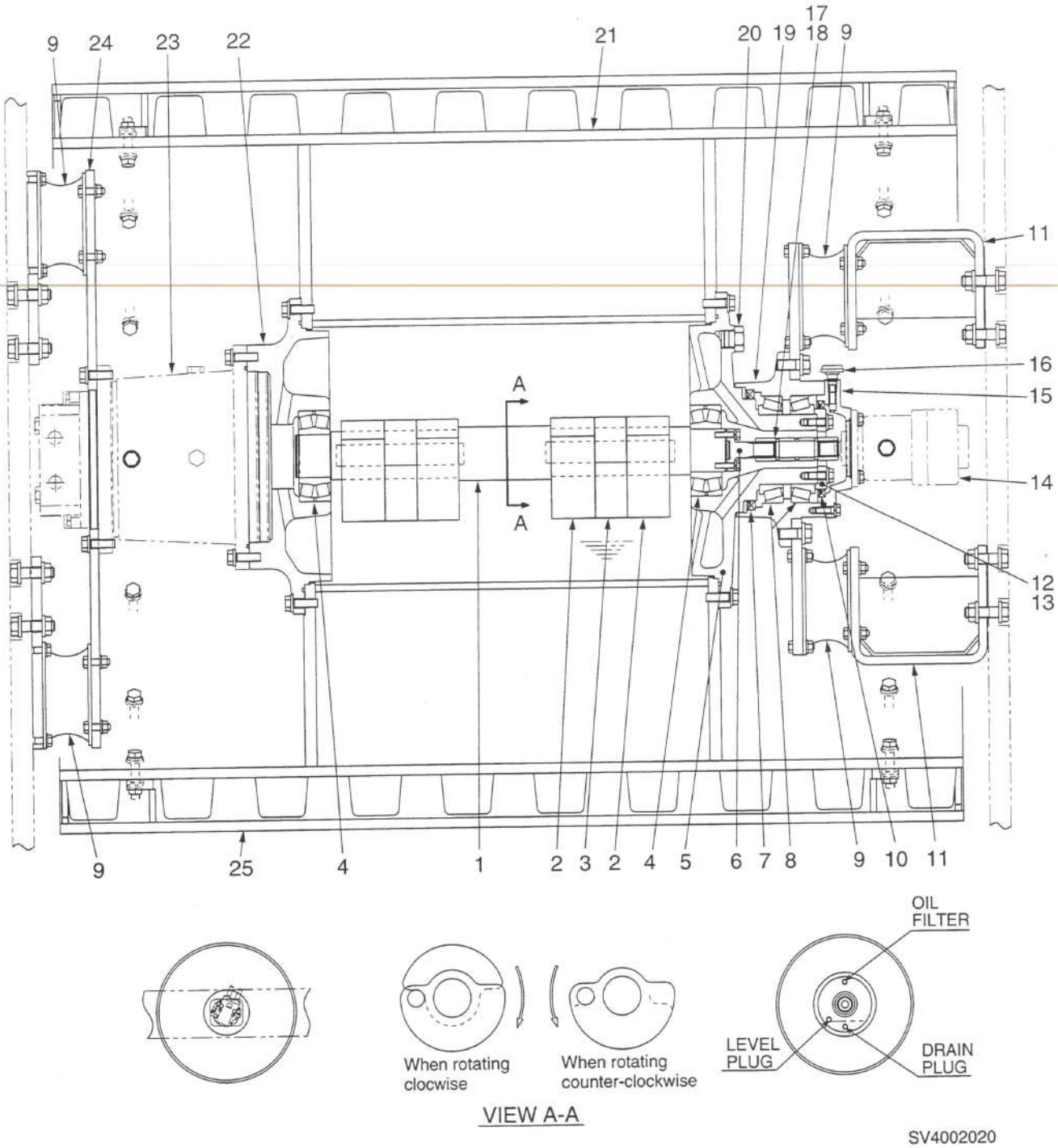
1. Vibrator shaft
2. Fixed weight
3. Movable weight
4. Roller bearing
5. Axle shaft
6. Shaft
7. Oil seal
8. Roller bearing
9. Damper
10. Oil seal
11. Holder
12. Cover
13. Shim
14. Vibrator motor
15. Cover
16. Breather
17. Sleeve
18. Spring pin
19. Housing
20. Plug
21. Flat drum
22. Axle shaft
23. Propulsion motor
24. Disc

2-4-2. Drum and vibrator (model T)



1. Vibrator shaft
2. Fixed weight
3. Movable weight
4. Roller bearing
5. Axle shaft
6. Shaft
7. Oil seal
8. Roller bearing
9. Damper
10. Oil seal
11. Holder
12. Cover
13. Shim
14. Vibrator motor
15. Cover
16. Breather
17. Sleeve
18. Spring pin
19. Housing
20. Plug
21. Tamping drum
22. Axle shaft
23. Propulsion motor
24. Disc

2-4-3. Drum and vibrator (model TF)



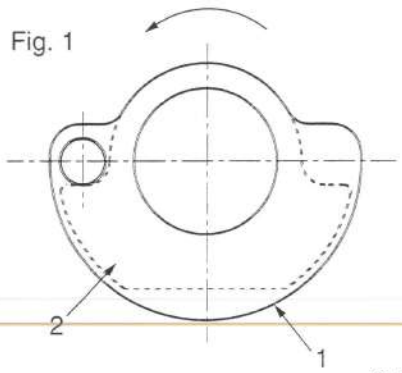
1. Vibrator shaft
2. Fixed weight
3. Movable weight
4. Roller bearing
5. Axle shaft
6. Shaft
7. Oil seal
8. Roller bearing
9. Damper
10. Oil seal
11. Holder
12. Cover
13. Shim
14. Vibrator motor
15. Cover
16. Breather
17. Sleeve
18. Spring pin
19. Housing
20. Plug
21. Tamping drum
22. Axle shaft
23. Propulsion motor
24. Disc

2-4-4. Description and operation of vibrator

Vibratory force (amplitude) varying mechanism

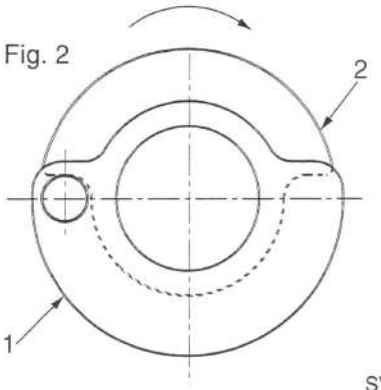
- Reversing the rotating direction of the vibrating shaft changes the vibratory force.
- The vibratory shaft has two kinds of masses; fixed masses (1) and movable ones (2).
- When the vibratory shaft rotates clockwise viewed from the vibrator motor output shaft, the relative position between the two kinds of masses is as shown in Fig.SV4002021. This gives bigger vibratory forces.
  * Setting the amplitude selector lever to the HIGH AMPLITUDE position provides this bigger vibratory force.
- If the vibrator shaft rotates in the counterclockwise direction, the two kinds of masses turn together with their relative location as illustrated in Fig.SV4002022. This creates smaller vibratory force.
  * This smaller vibratory force is available with the vibrator lever set to the LOW AMPLITUDE position.

Fig. 1

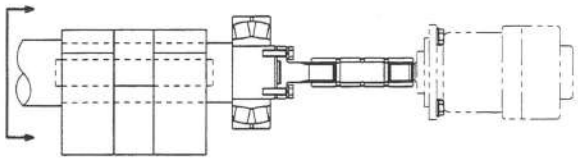


SV4002021

Fig. 2



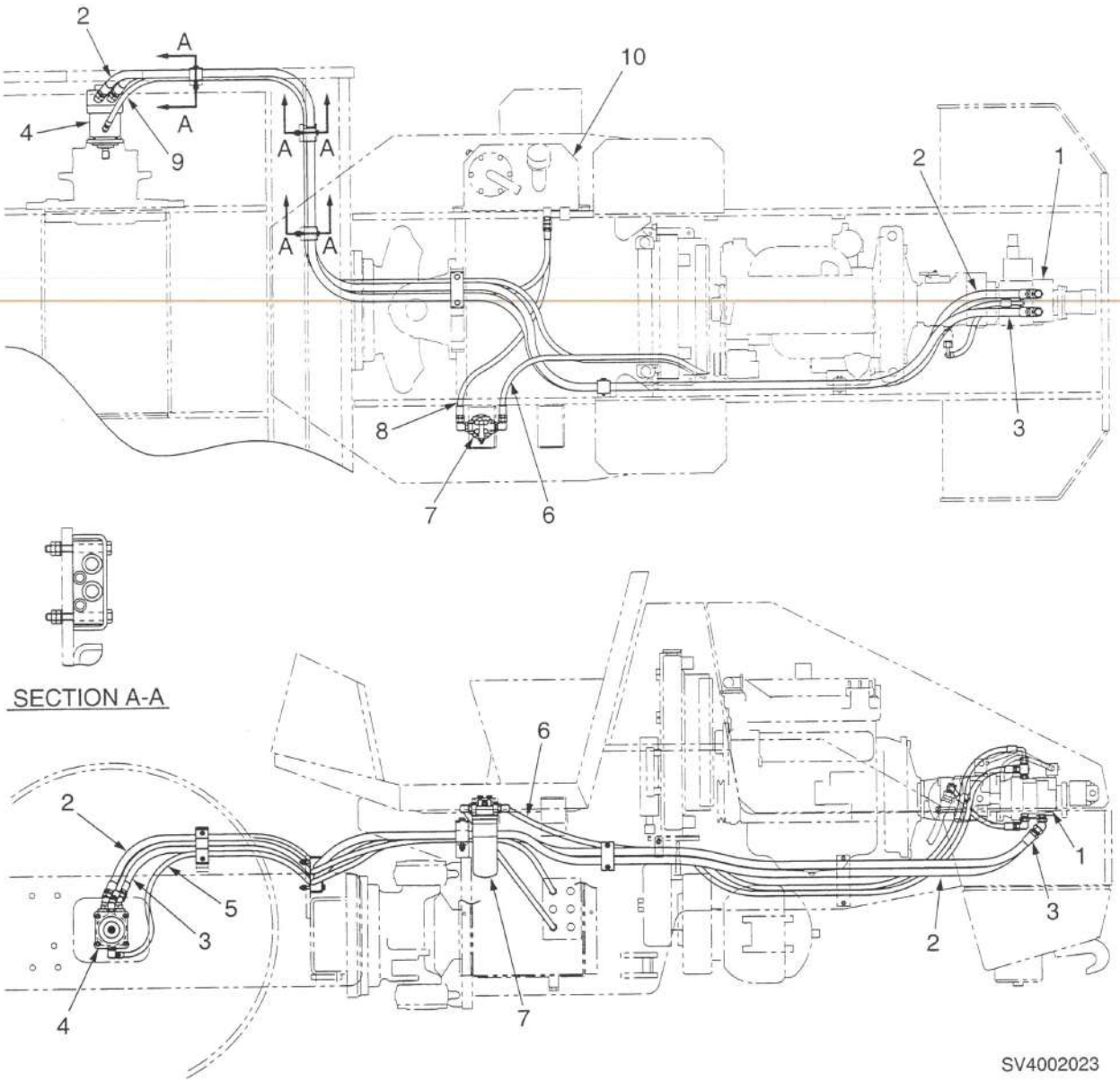
SV4002022



SV4002041

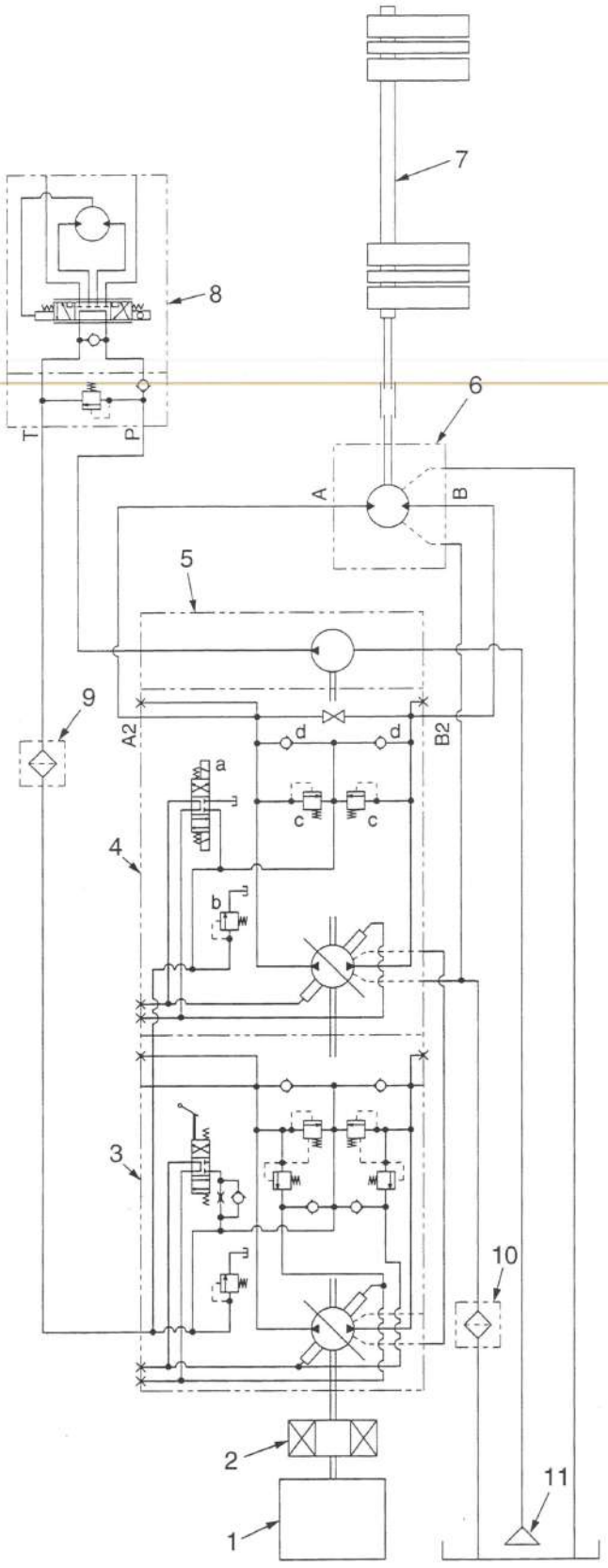
Above figures are viewed as shown by arrows.

2-4-5. Vibrator piping



1. Vibrator pump
2. High pressure hose (low amplitude)
3. High pressure hose (high amplitude)
4. Vibrator motor
5. Drain hose (motor to pump)
6. Drain hose (motor to filter)
7. Return filter
8. Return hose (filter to tank)
9. Drain hose (motor to tank)
10. Hydraulic tank

2-4-6. Vibrator circuit



SV4002024

1. Engine
2. Coupling
3. Propulsion pump ass'y
4. Vibrator pump
   a. Amplitude select valve
   b. Charge relief valve
   c. High pressure relief valve
   d. Check valve
5. Steering pump
6. Vibrator motor
7. Vibrator
8. Orbitrol
9. Line filter (charge circuit)
10. Return filter
11. Suction filter

2-4-7. Description and operation of vibrating system

Description

- Made up of vibrator pump (4), vibrator motor (6) and vibrator (7).

Basic function of vibrator pump and motor

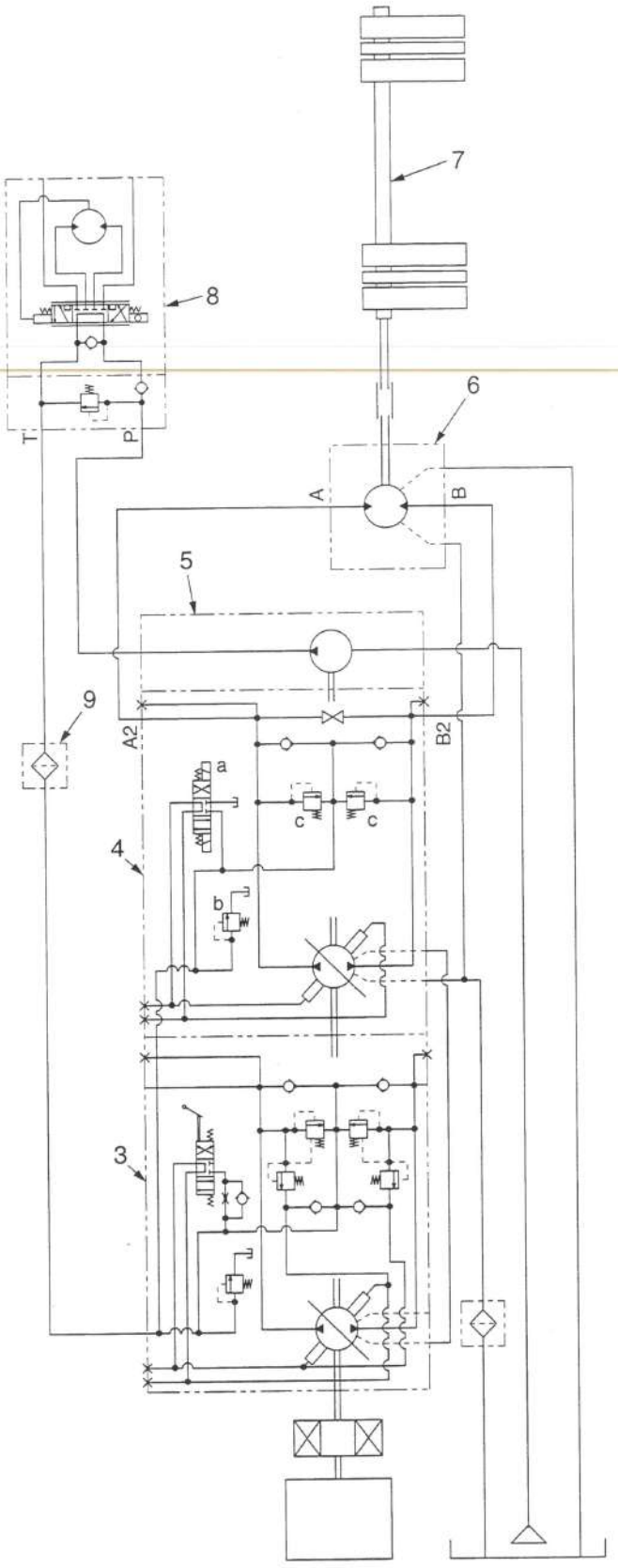
- Vibrator pump
  A piston pump is in use. Varying the piston swashplate angle varies the piston stroke to select low amplitude, neutral and high amplitude.

- Vibrator motor
  A fixed displacement piston motor is used. The displacement per rotation of the motor shaft is not variable.

Operation (It is assumed that HIGH amplitude is selected.)

- The operation of the amplitude selector switch actuates amplitude select valve (a) built in vibrator pump (4) to discharge oil from the high amplitude port (port B).
- Oil fed into the high amplitude port (port B) of the motor powers the motor and is displaced from the opposite side port (port A), getting back to the pump suction port (port A2).

NOTE: Because the vibrator system also uses a closed circuit (HST) like the propulsion circuit, every time the amplitude selection is changed from low amplitude to high or vice versa, the function of the pump inlet and outlet is reversed with each other.



SV4002025

Charge circuit

* See the circuit diagram on page 2-036.

- The vibrator circuit is also of a closed circuit, which needs feeding of oil into it for making up for deficiency and for other purposes.
- In the charge circuit, oil from steering pump (5) flows into Orbitrol (8), then the whole amount of oil goes to propulsion pump (3) via filter (9) irrespective of the steering wheel operation.
- The pressure adjustment is achieved by charge relief valve (b) when the machine is not in motion. When travelling, the pressure is adjusted by the low pressure relief valve built in the flushing valve (h).
  *Refer to 'Description and operation of propulsion system', 2-3-11.

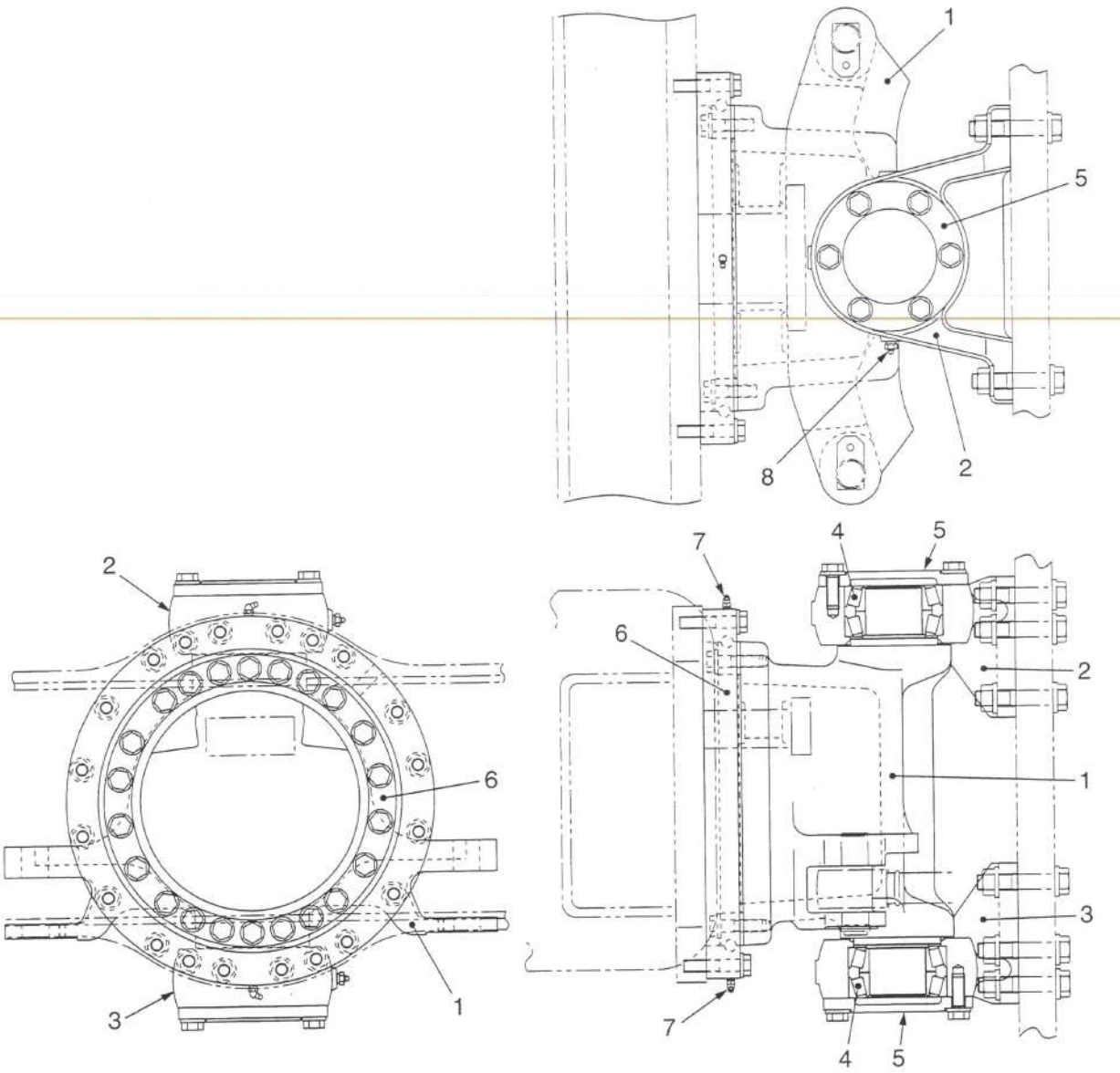
Circuit protection against high pressure

* See the circuit diagram on page 2-036.

- High pressure relief valve (c) built in the vibrator pump relieves pressure to protect the circuit when the pressure exceeds the setting of this valve.

2-5. Steering system

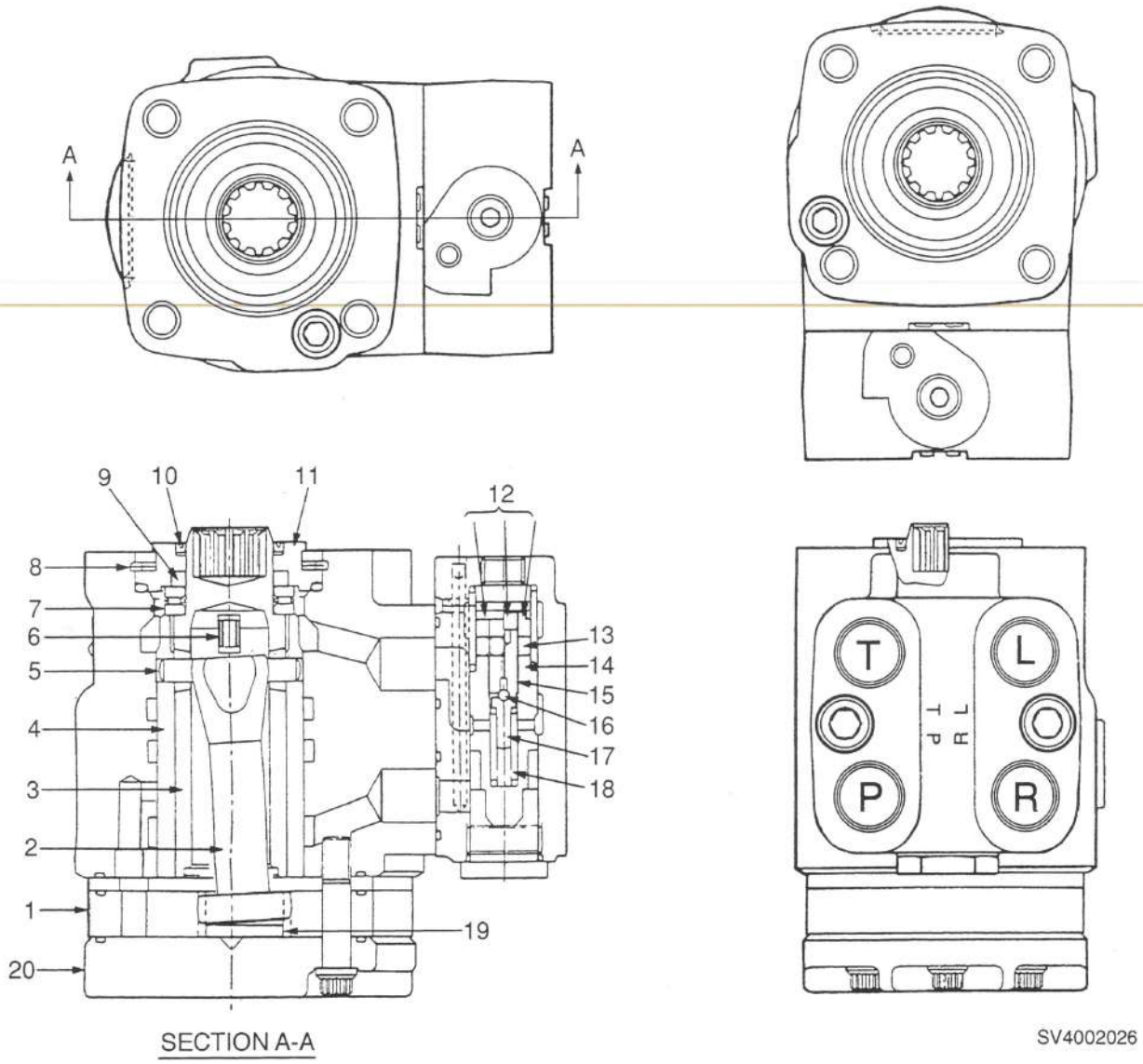
2-5-1. Center pin



SV5102035

1. Yoke
2. Bracket (upper)
3. Bracket (lower)
4. Roller bearing
5. Cover
6. Bearing
7. Grease fitting
8. Grease fitting

2-5-2. Orbitrol



SECTION A-A

SV4002026

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

Specifications

- Valve system
  : Open center non-load reaction
- Displacement
  : 369 cm^3/rev (cc/rev)
- Relief valve setting
  : 10.8 MPa (1560 psi) {110 kgf/cm^2}

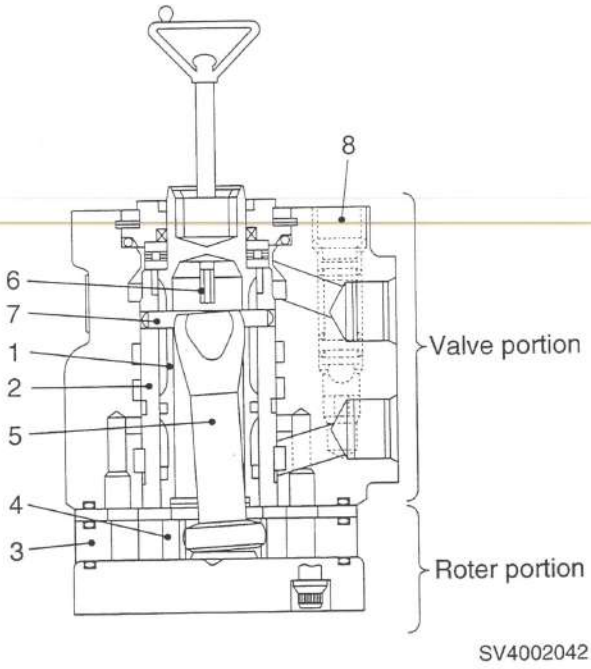
2-5-3. Description and operation of Orbitrol

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**

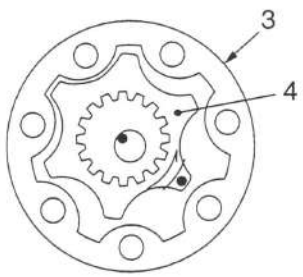
- The valve portion is a rotary direction control valve made up of spool (1) and sleeve (2). The steering wheel is spline fitted to spool (1).
- When the steering wheel is stationary (not rotated), spool (1) and sleeve (2) stay in the neutral position due to center spring (6) with the oil grooves in 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

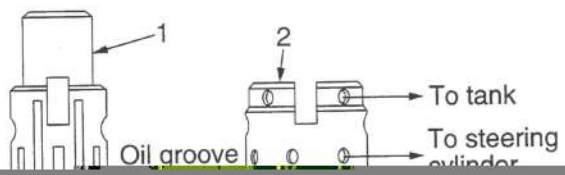
*** Rotor portion**

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



Operation

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

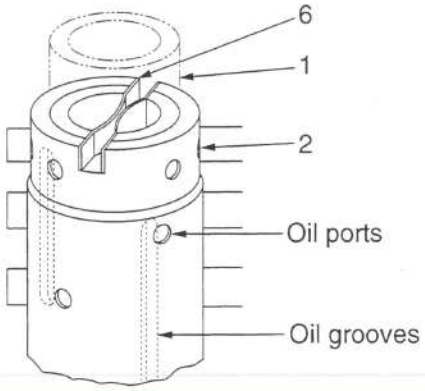
- Spool (1) and sleeve (2) have a slot into which centering spring (6) consisting of a set of plate springs is assembled.
- When the stering wheel is stationary, centering spring (6) keeps spool (1) and sleeve (2) in the neutral position.

* 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.

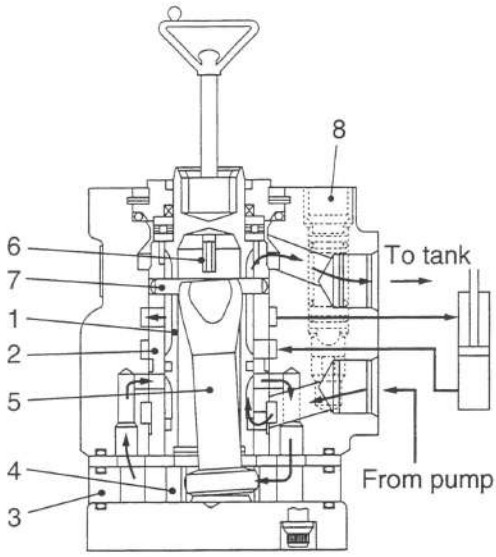
*** When making turns (Steering wheel is operated)**

* 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.

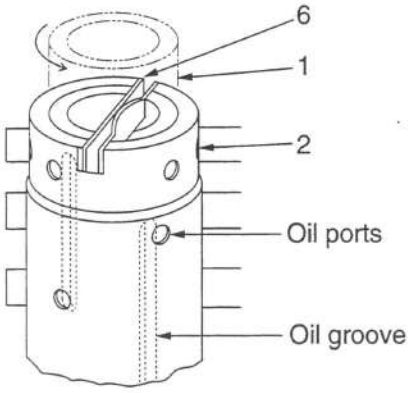


SV4002045



SV4002046

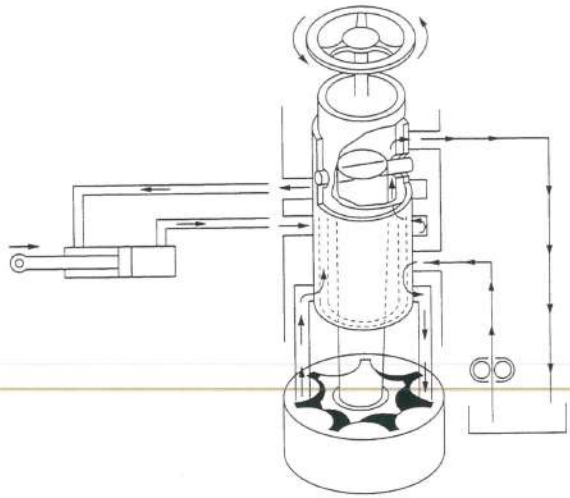
1. Spool
2. Sleeve
3. Stator
4. Rotor
5. Drive shaft
6. Centering spring
7. Cross pin
8. Check valve



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.



SV4002048

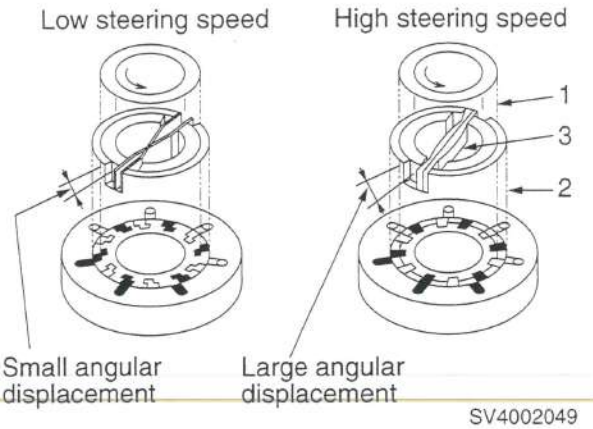
Steering wheel rotating speed and flow control

* 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.

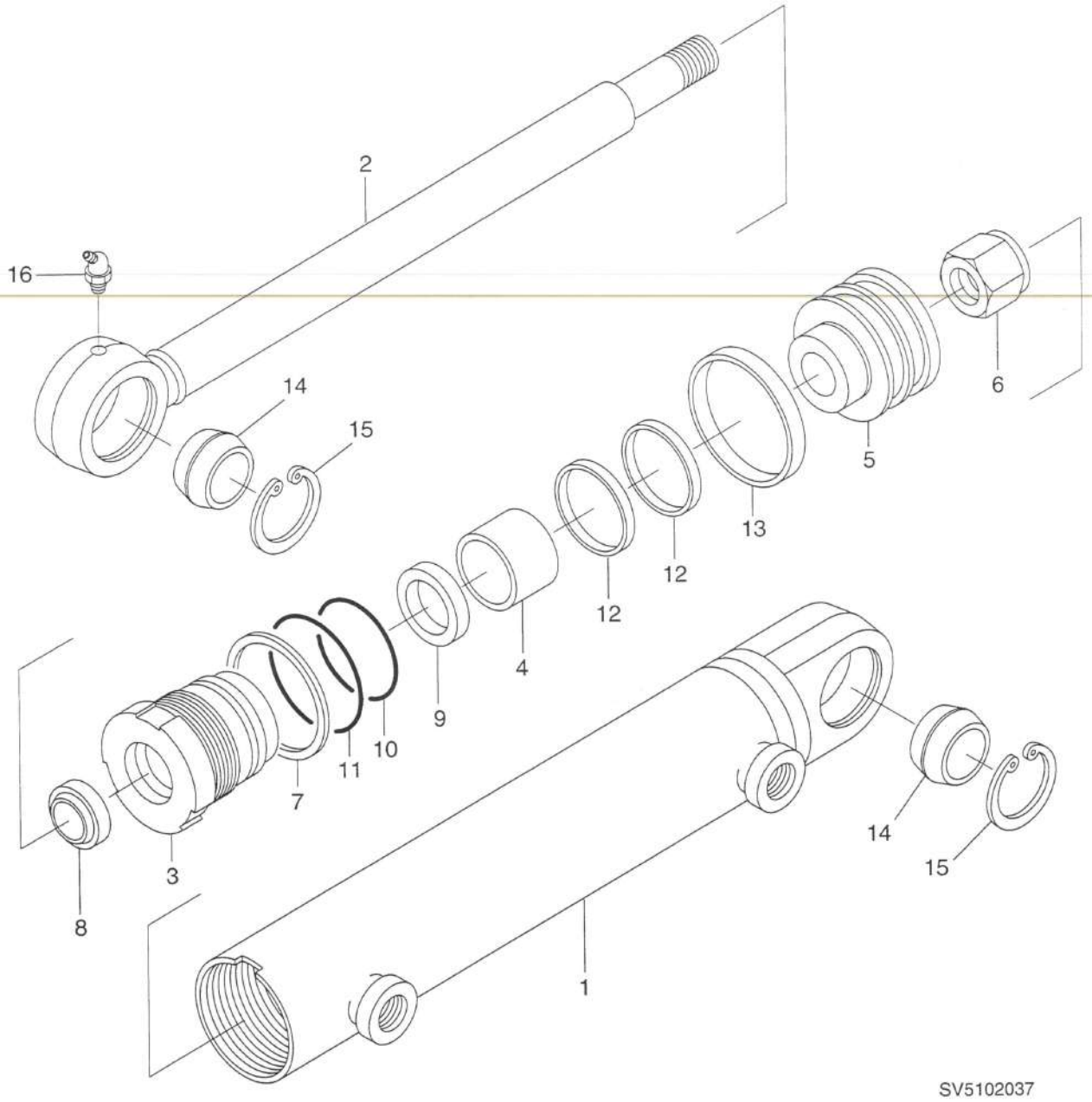
Pump flow and force to operate the steering wheel

- With sufficient pump flow, force required to operate the steering wheel is equal to sliding resistance of selleve (2) and rotor. The steering wheel is very light to rotate.
- If the pump flow is insufficeint, 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.



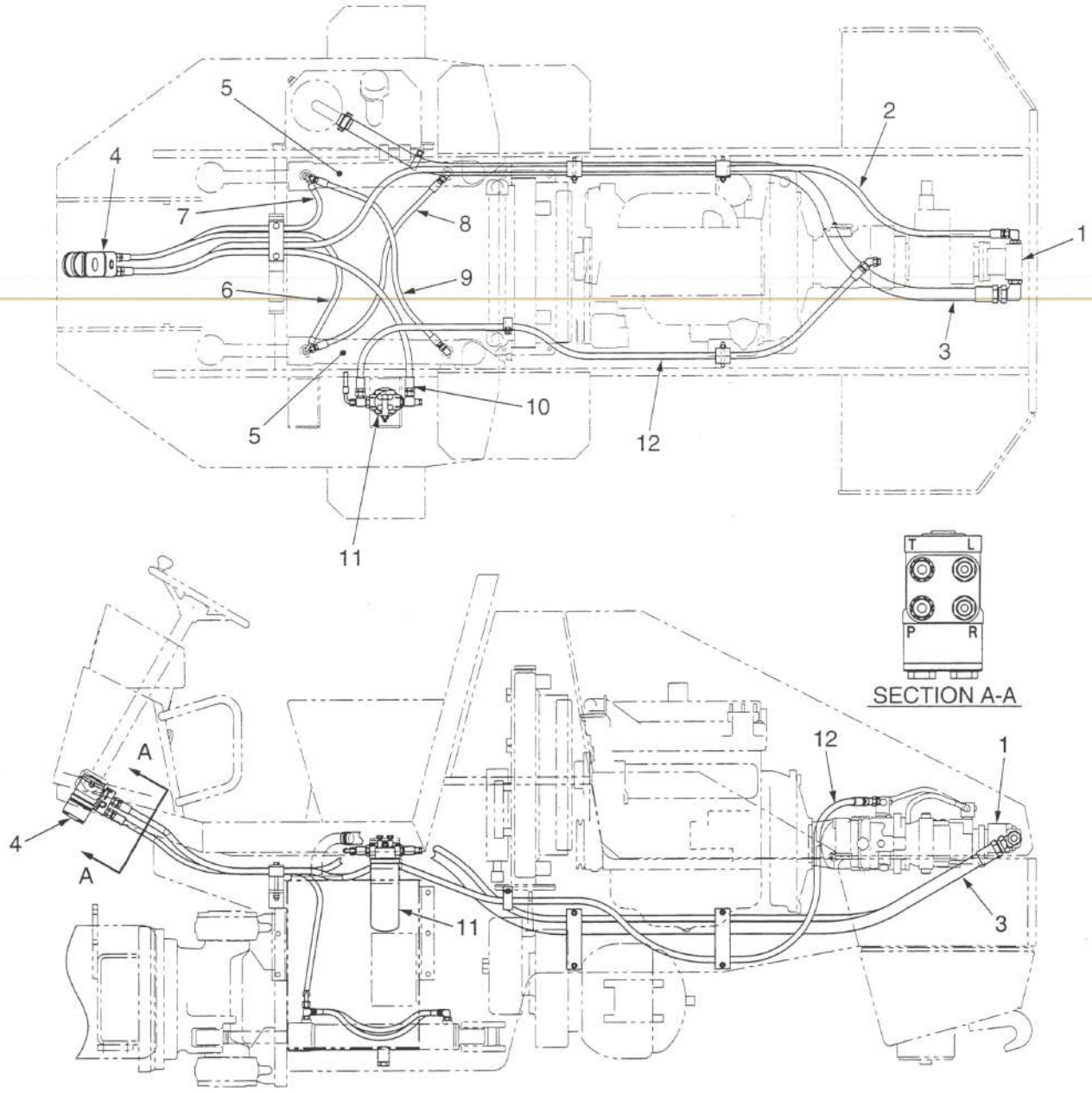
1. Spool
2. Sleeve
3. Centering spring

2-5-4. Steering cylinder



1. Cylinder
2. Piston rod
3. End cap
4. Bush
5. Piston
6. Nut
7. Washer
8. Dust seal
9. U-packing
10. O-ring
11. O-ring
12. Slipper seal
13. Wear-ring
14. Spherical bearing
15. Ring
16. Grease fitting

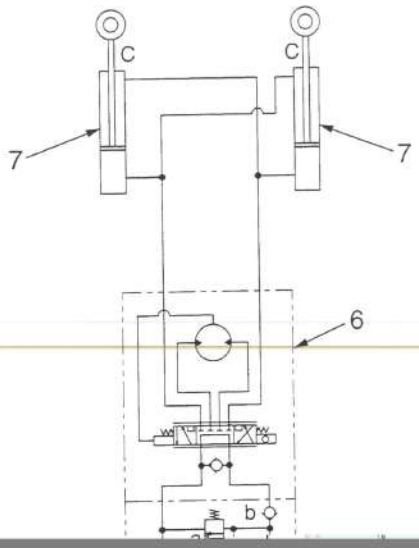
2-5-5. Steering piping



SV4002027

1. Steering pump
2. Feed hose
3. Suction hose
4. Orbitrol
5. Steering cylinders
6. High pressure hose (left turn)
7. High pressure hose (right turn)
8. High pressure hose (left turn)
9. High pressure hose (right turn)
10. Charge circuit hose (Orbitrol to filter)
11. Line filter
12. Charge circuit hose (filter to propulsion pump)

2-5-6. Steering circuit

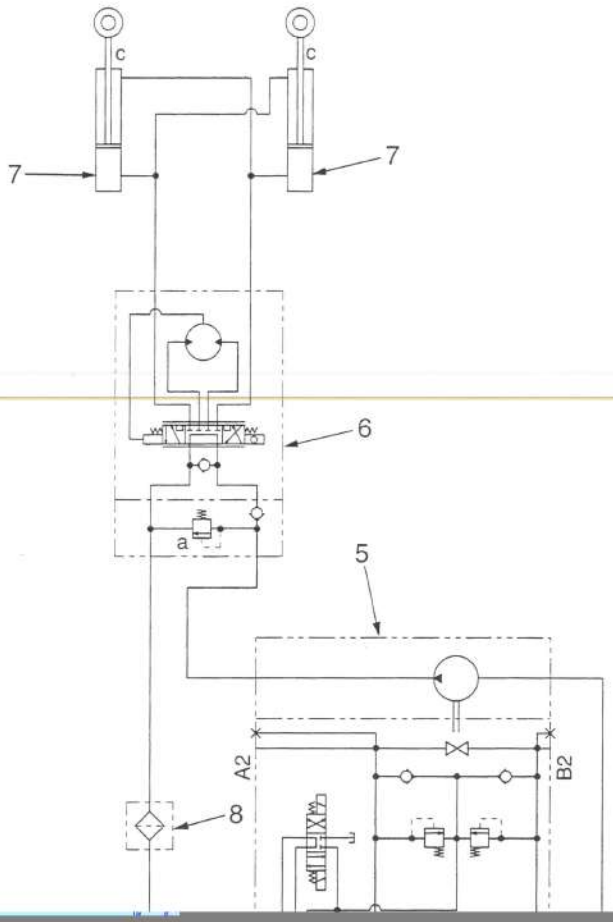


1. Engine
2. Coupling
3. Propulsion pump
4. Vibrator pump
5. Steering pump
6. Orbitrol
   a. Relief valve
   b. Check valve
7. Steering cylinder
   c. Piston rod
8. Line filter (charge circuit)
9. Suction filter

2-5-7. Description and operation of steering system

Description:

- The steering system is made up of steering/charge pump (5), Orbitrol (6), steering cylinders (7) and line filter (8).
  The steering mechanism is of an articulated type in which the machine frame is articulated at its center.

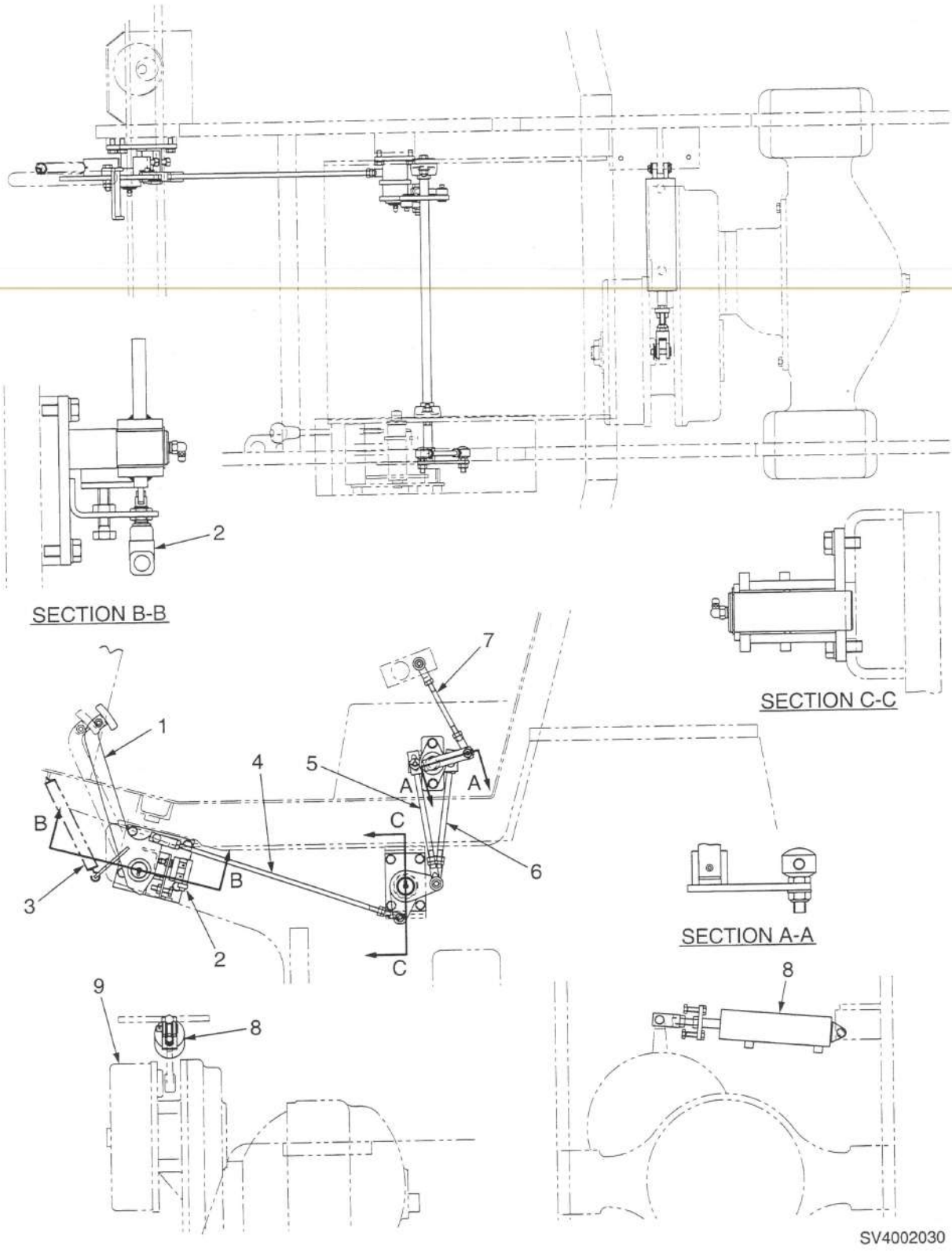


Operation

- 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 (c) to achieve steering. The oil displaced from the opposite side of the pistons flows, through Orbitrol (6) and line filter (8), to the charge line for propulsion pump (3) and vibrator pump (4).
  ★ **Refer to the "Charge circuit" for the propulsion pump.**
- Relief valve (a) built in Orbitrol (6) opens to

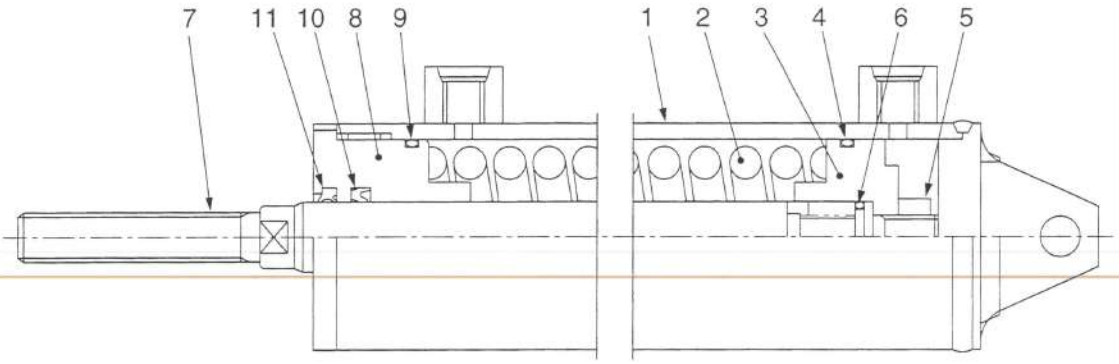
3. Brake System

3-1. Brake pedal and linkage



1. Brake pedal
2. Foot brake switch
3. Return spring
4. Rod
5. Rod (F-R lever neutral)
6. Rod (F-R lever neutral)
7. Rod (F-R lever neutral)
8. Brake cylinder
9. Parking brake ASS'Y

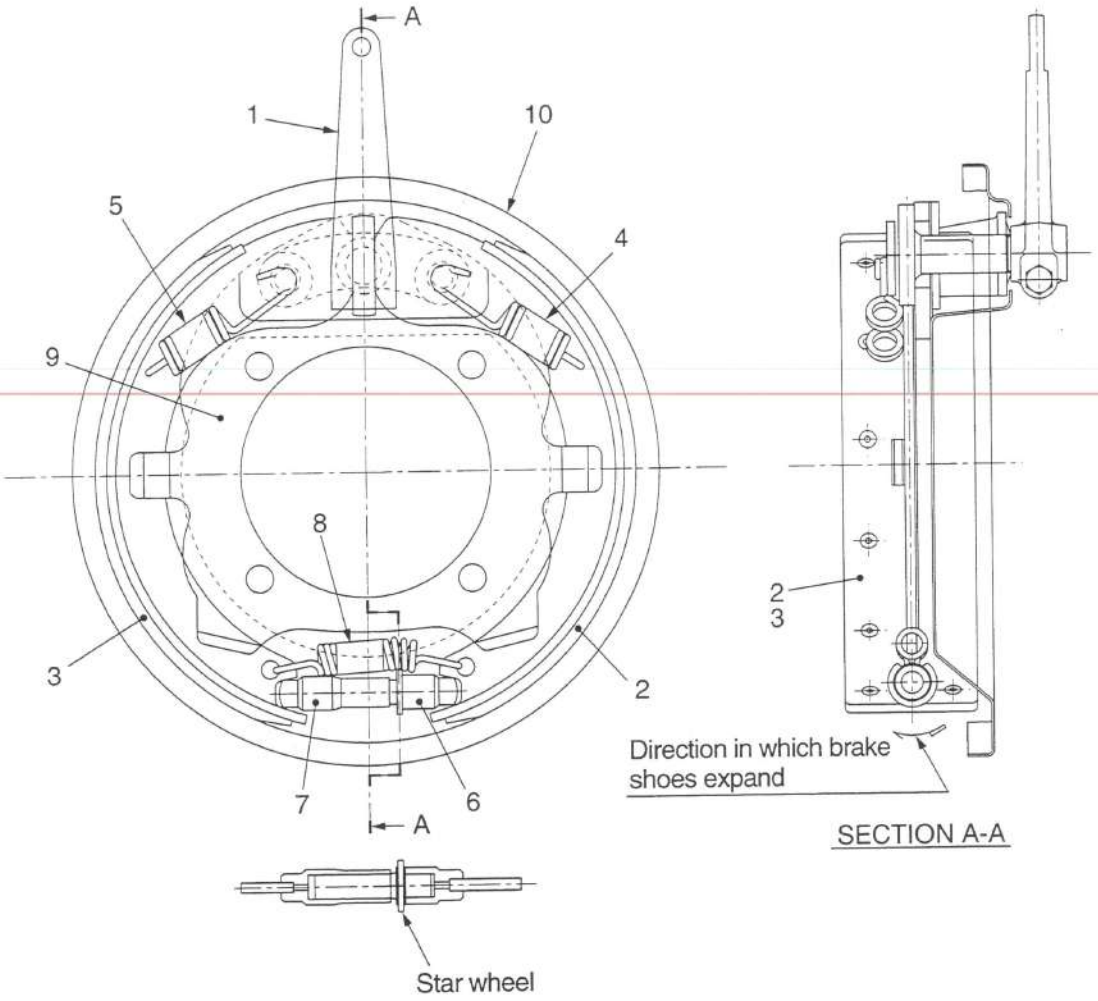
3-2. Brake cylinder



SV5102042

1. Cylinder body
2. Spring
3. Piston
4. O-ring
5. Nut
6. O-ring
7. Piston rod
8. End cap
9. O-ring
10. Packing
11. Scraper

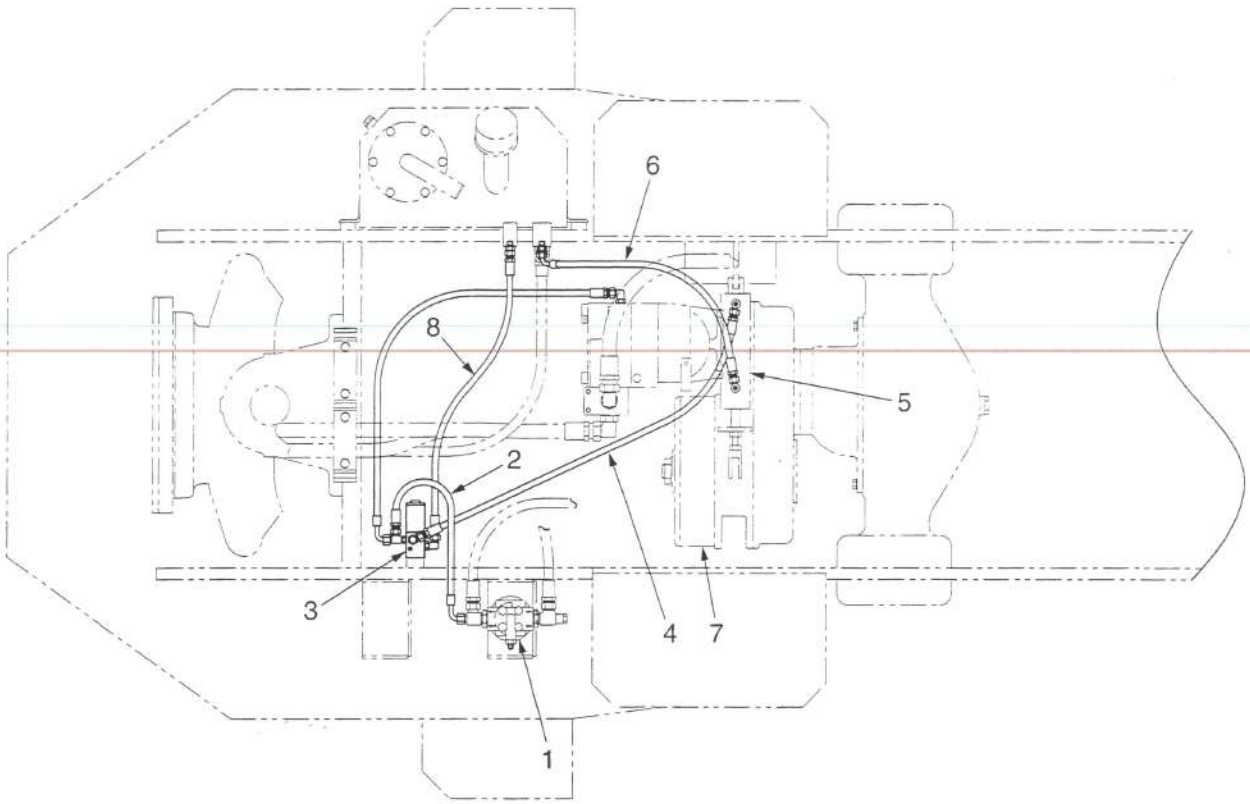
3-3. Parking brake

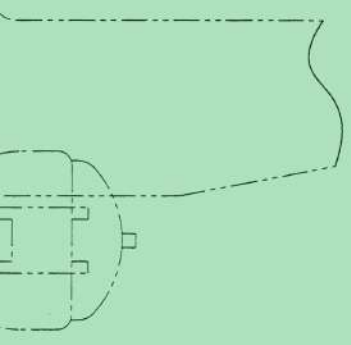


SV4002031

1. Lever
2. Shoe ass'y
3. Shoe ass'y
4. Return spring
5. Return spring
6. Adjusting gear
7. Adjusting gear
8. Spring
9. Shoe holder
10. Brake drum

3-4. Hydraulic piping (brakes)

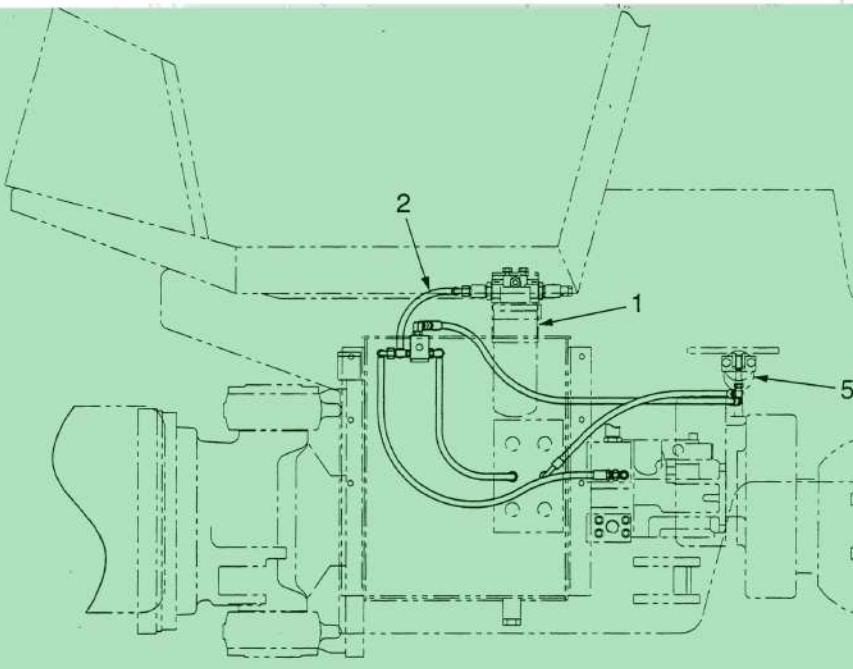




SV4002032

er

gative pressure in cylinder)
e ASS'y



1. Line filter (charge circuit)
2. Circuit pressure feed hose (filter to brake valve)
3. Brake valve
4. Hose (brake valve to brake cylinder)
5. Brake cylind
6. Hose (prevents ne
7. Parking brak
8. Return hose

3-5. Description and operation of brake circuit

Description:

- Consists of brake pedal (1), foot brake switch (2), F-R lever (3), neutral rods (4), (5), parking brake switch (6), brake valve (7), brake cylinder (8), lever (9) and brake ass'y (10).
- The foot brake switch is ON when the brake pedal is not depressed, and OFF if the pedal is pushed down on.

Operation:

Parking brake switch set to position RELEASE:

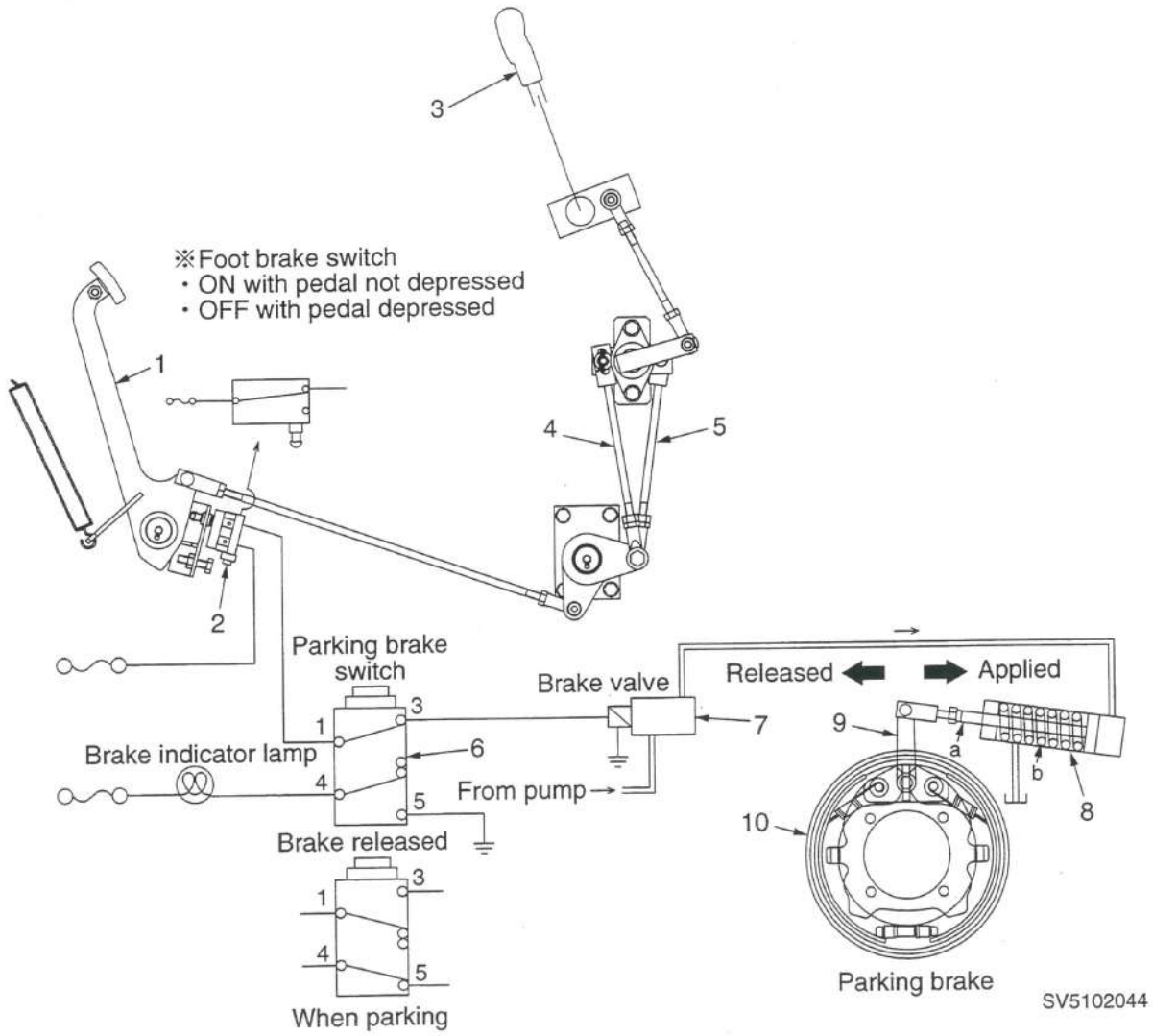
- Setting parking brake switch (6) to the RELEASE position feeds the current, through terminals 1 and 3, to brake valve (7). Feeding the brake indicator lamp is discontinued.
- Oil from brake valve (7) is fed into brake cylinder (8), and pushes brake piston rod (a) against the load of compression spring (b), releasing the brake.

Parking brake switch set to position PARKING (with brake pedal not depressed):

- Setting parking brake switch (9) to the PARKING position disconnects terminal 1 from terminal 3. Brake valve (7) is deenergized. At the same time, terminal connects with terminal 5 to light the brake indicator lamp.
- Brake valve (7) stops feeding the brake cylinder. Spring (b) moves piston rod (a) toward the cylinder head, allowing the brake facing to make a firm contact with the brake drum. The brake is applied.

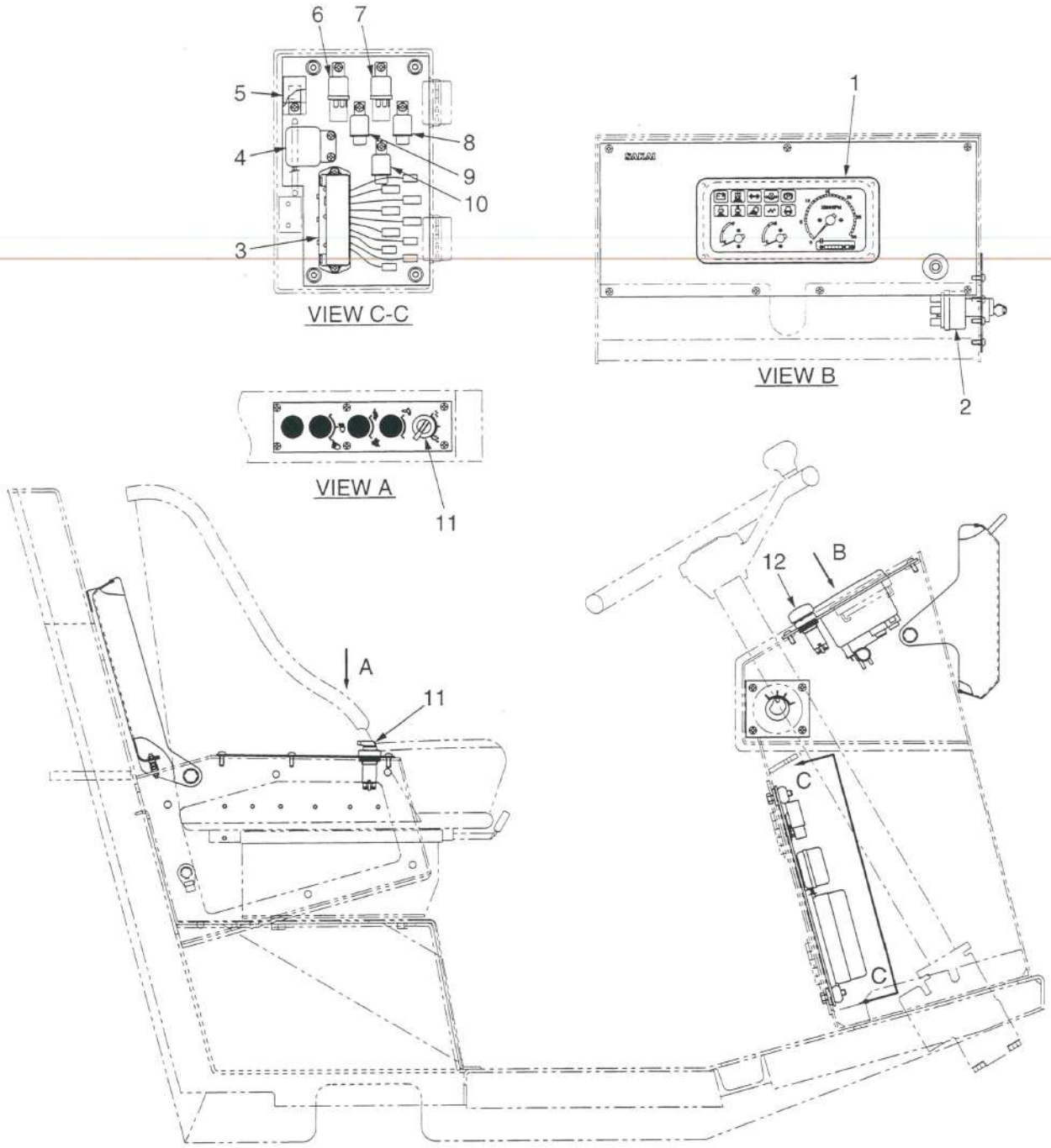
When brake pedal is pushed down on:

- Pushing down on the brake pedal opens foot brake switch (2). Feeding to parking brake switch (6) is discontinued. Even if parking brake switch is in the RELEASE position, brake valve (7) is not energized. Brake is applied.



4. Electric System

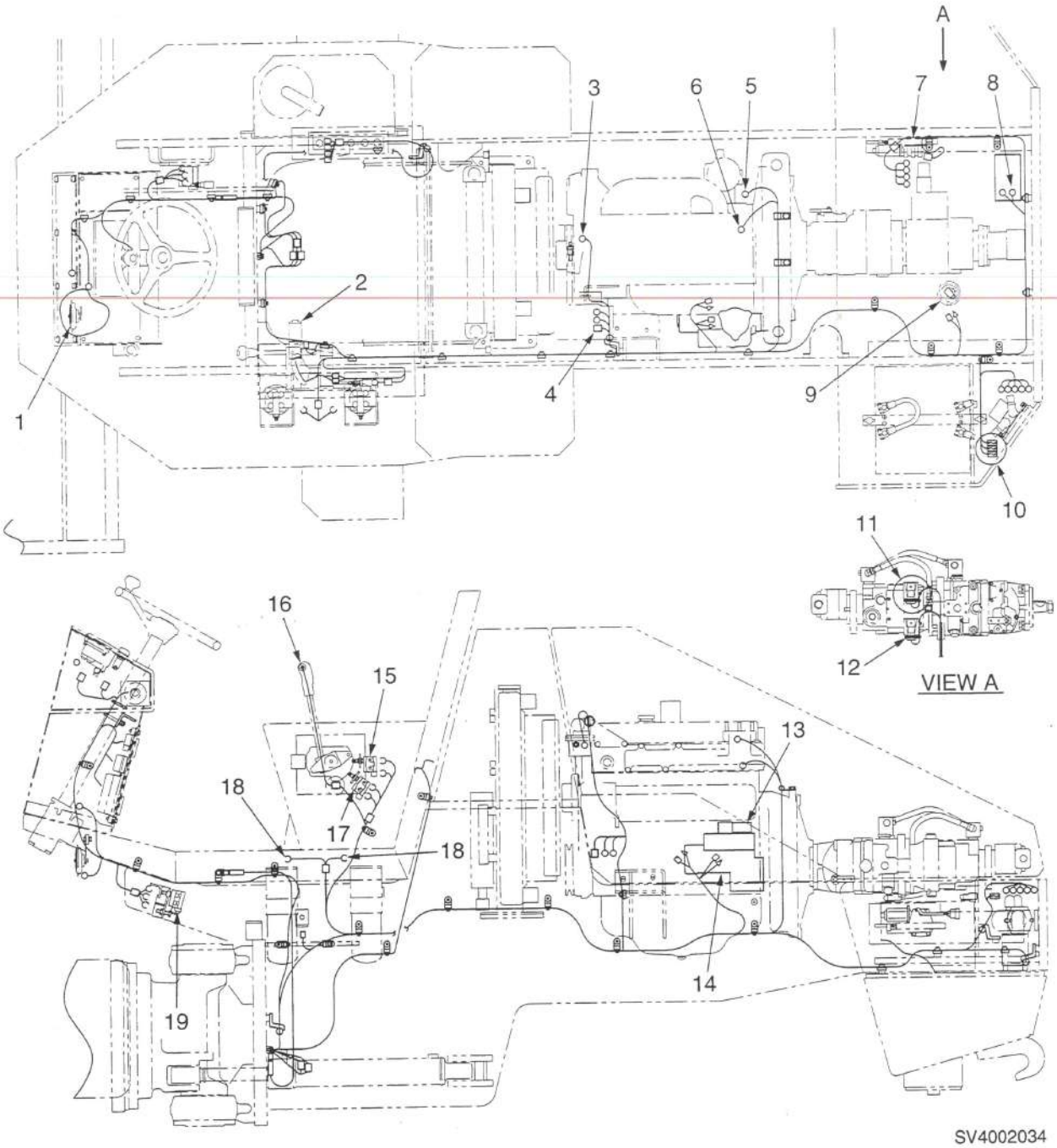
4-1. Locations of instrument panel and relays



SV4002033

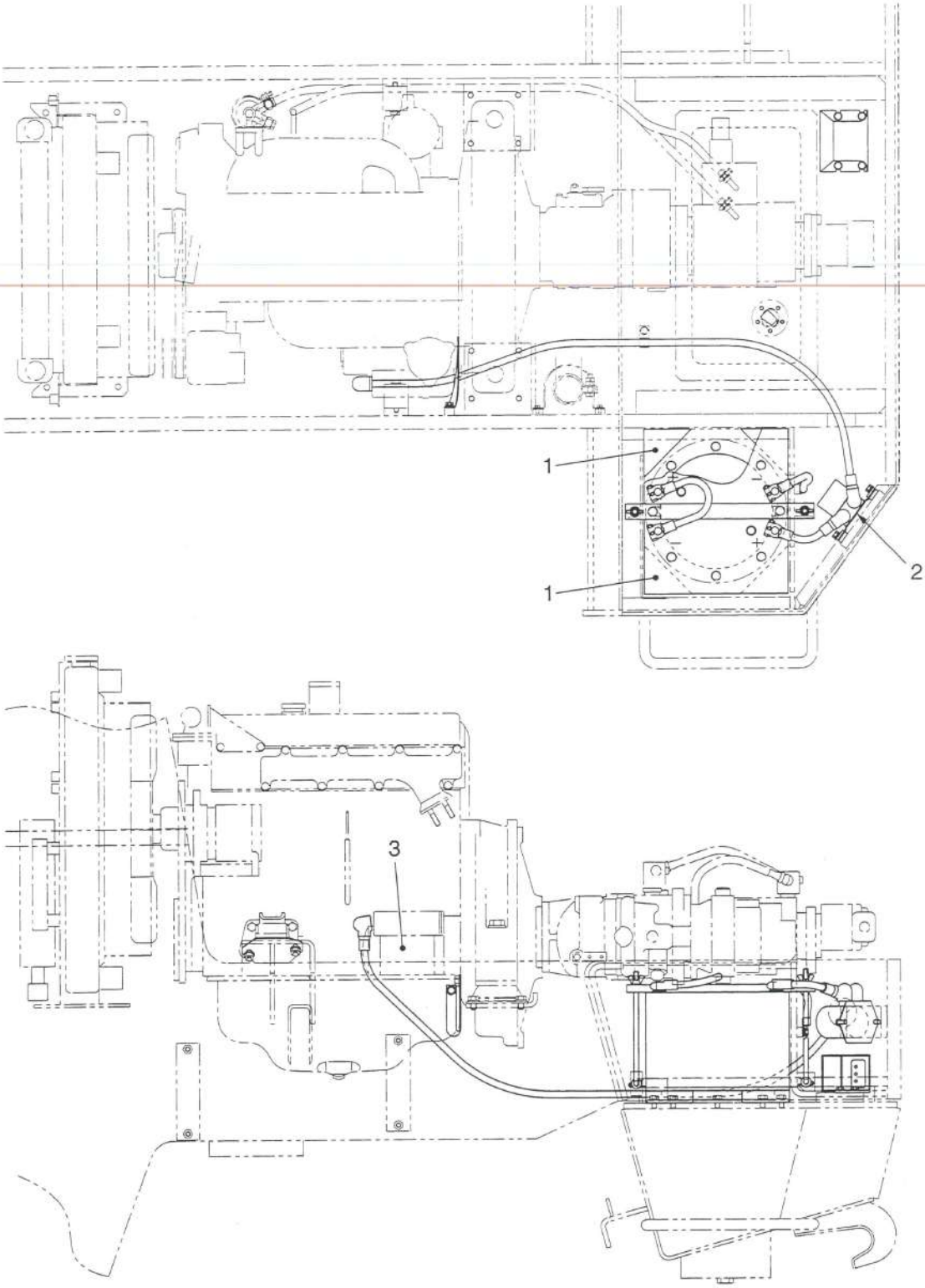
1. Panel (combination meter)
2. Starter switch
3. Fuse box
4. Timer (glow plug)
5. Diode unit
6. Engine stopper relay
7. Delay relay
8. Lamp check relay
9. Interlock relay
10. Horn relay
11. Amplitude selector switch
12. Parking brake switch

4-2. Locations of electric components [1]



1. Horn
2. Parking brake valve solenoid
3. Thermo unit
4. Alternator
5. Oil pressure switch (engine)
6. Glow plug
7. Engine stopper
8. Reverse alarm
9. Fuel unit
10. Fusible link
11. Amplitude select valve solenoid (a)
12. Amplitude select valve solenoid (b)
13. Tachometer senser
14. Starter
15. Interlock switch
16. Vibrator switch
17. Reverse alarm switch
18. Oil filter switch
19. Foot brake switch

4-3. Locations of electric components [2] (Battery)



1. Battery
2. Battery relay
3. Starter

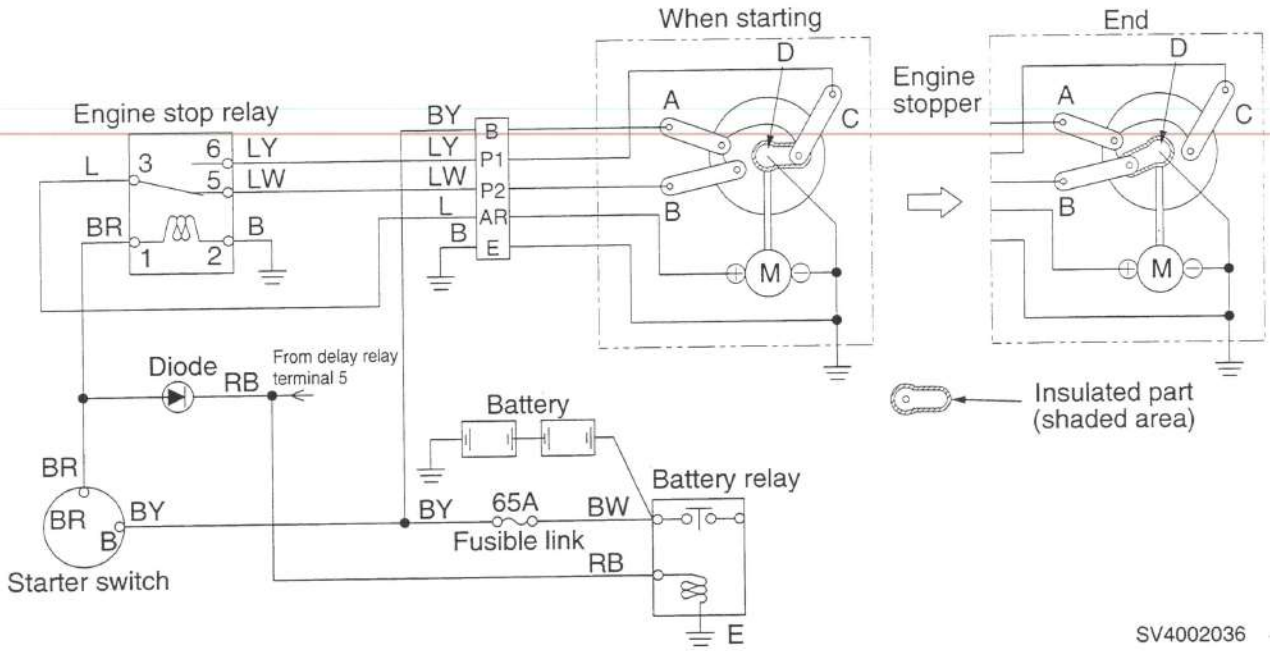
SV4002035

4-4. Description and operation of engine stopper

Description

- Operation of the starter switch alone can start and stop the engine. The major components of this device are the engine stopper and engine stop relay.

When starting the engine:

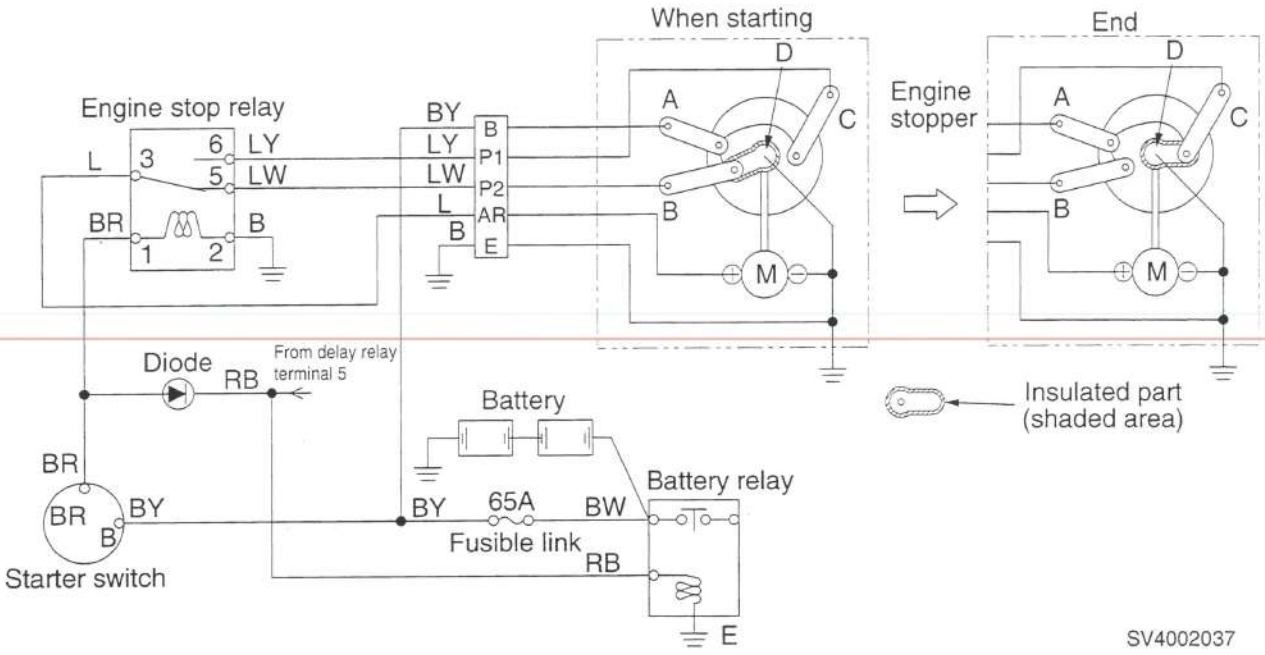


Operation

When starting:

- Turning the starter switch ON connects starter switch terminal B to terminal BR to energize the engine stop relay. In the engine stop relay, terminal 3 connects with terminal 5. The current flows as follows: Battery → Battery relay → Terminal A of engine stopper → Terminal B of engine stopper → Terminal (5) of engine stop relay → Terminal (3) of engine stop relay → Plus (+) terminal of motor in engine stopper.
  The motor is driven. (The control cable is extended.) Terminal D rotates with the motor.
  When Insulated part of terminal D reaches terminal B, the circuit between terminal A and terminal B is open to cut off the current from the battery.
  The motor continues running by inertia. When the metal part of terminal D makes contact with terminal B, both poles of the motor are earthed to stop the motor.
- In this state, the control cable is extended completely, allowing the injection pump stop lever to stay in the operating position. The engine runs.

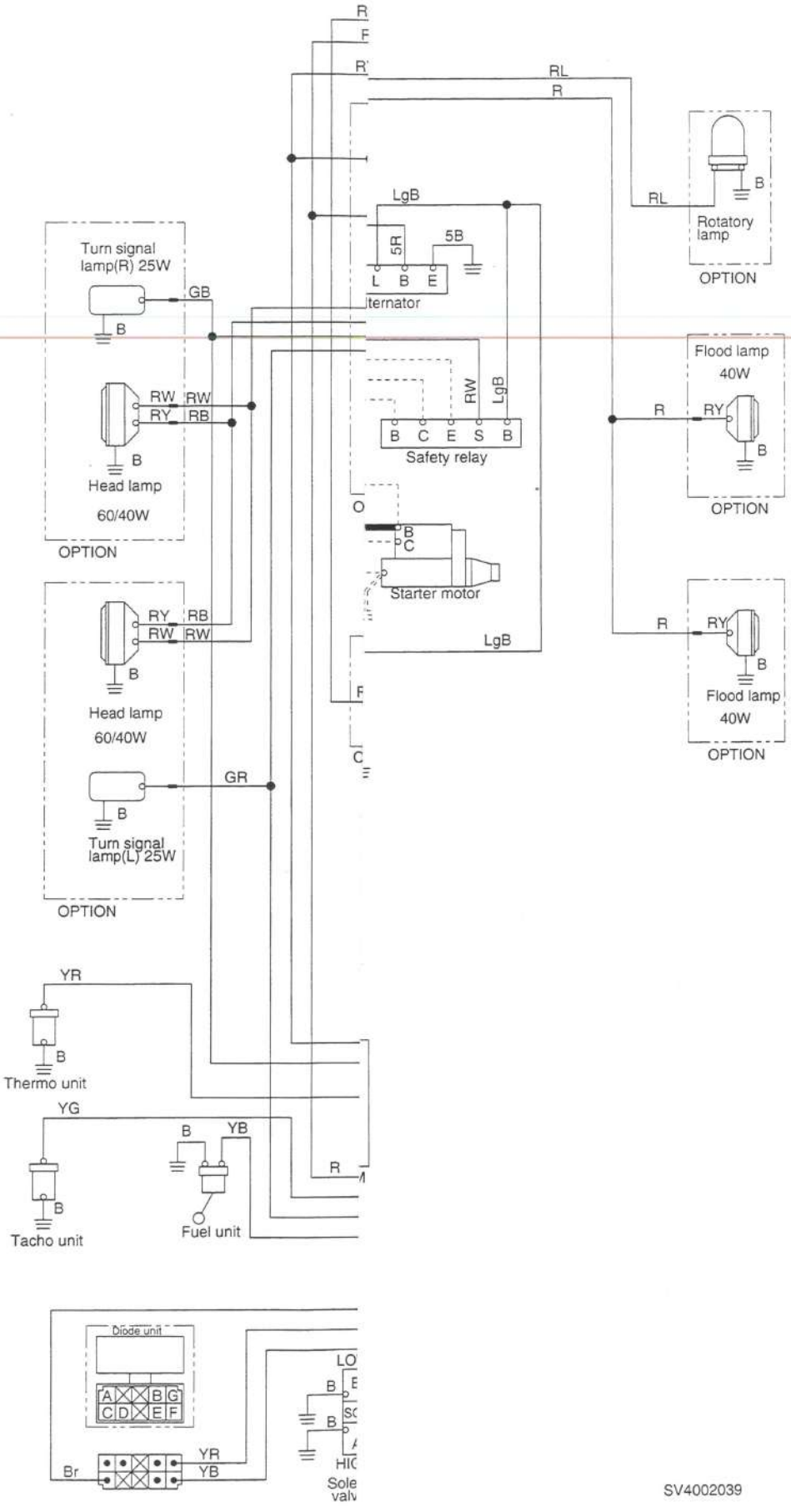
When stopping:



When stopping:

- Turning the starter switch OFF breaks the contact between terminal B and terminal BR, deenergizing the engine stop relay.
  The current is delivered in the sequence as in the following: Battery relay → Terminal A of engine stopper → Terminal C of engine stopper → Terminal (6) of engine stop relay → Terminal (3) of engine stop relay → Plus (+) terminal of motor in engine stopper. The motor runs. (The control cable is retracted.)
- Terminal D rotates with the motor.
  When the insulated portion of terminal D reaches terminal C, the circuit between terminal A and terminal C is open to cut off current from the battery.
  The motor continues running by inertia. When the metal portion of terminal D touches terminal C, both terminals of the motor lead to earth. The motor is shut down.
- In this condition, the control cable is completely retracted. The injection pump stop lever stays in the STOP position to cut off the fuel supply. The engine stops.

4-5. Electric wiring diagram



INSPECTION & ADJUSTMENT

INSPECTION & ADJUSTMENT

1.Standard Value Chart ····· 3-002

2.Inspection & Adjustment

2-1. Measurement and adjustment of pressure in propulsion main circuit ····· 3-101
2-2. Measurement of propulsion charge circuit pressure ····· 3-103
2-3. Measurement of brake release pressure ····· 3-104
2-4. Measurement of vibrator circuit pressure ····· 3-105
2-5. Measurement of steering circuit pressure ····· 3-106
2-6. Throttle linkage adjustment ····· 3-107
2-7. 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	Low idle		• Coolant temp. : Green zone on gauge • Hydraulic oil temperature : 50 ± 5°C (122±41°F)	min^{-1} (rpm)	800±25	———
	High idle				2560±50	———
	Rated revolution				2300	———
Travel speed	Forward & reverse	Low	• Engine at full throttle • Coolant temp. : Green zone on gauge • Hydraulic oil temperature : 50 ± 5°C (122±41°F)	km/h (mph)	0~6.0±1.5 (0~3.7±0.9)	———
		High			0~10.0±1.5 (0~6.2±0.9)	———
Oil pressure	Propulsion	Main circuit pressure	• Hydraulic oil temperature : 50 ± 5°C (122±41°F) • Refer to measurement procedures for relevant circuit pressures in "Inspection and Adjustment" section	MPa (psi) {kgf/cm²}	$41.8 \pm {}^{0}_{2.0}$ ($6050 \pm {}^{0}_{280}$) $\{426 \pm {}^{0}_{20}\}$	38.5 (5570) {392}
		Charge circuit pressure			$2.5 \pm {}^{0}_{0.3}$ ($350 \pm {}^{0}_{40}$) $\{25.0 \pm {}^{0}_{3.0}\}$	2.1 (298) {21}
		Delivery pressure of propulsion motor speed shift valve			$2.5 \pm {}^{0}_{0.3}$ ($350 \pm {}^{0}_{40}$) $\{25.0 \pm {}^{0}_{3.0}\}$	2.1 (298) {21}
		Parking brake release pressure			$2.5 \pm {}^{0}_{0.3}$ ($350 \pm {}^{0}_{40}$) $\{25.0 \pm {}^{0}_{3.0}\}$	2.1 (298) {21}
		Flushing valve relief pressure			$2.2 \pm {}^{0}_{0.2}$ ($320 \pm {}^{0}_{30}$) $\{22.6 \pm {}^{0}_{2.0}\}$	1.9 (270) {19}
	Vibrator	Main circuit pressure			$25.0 \pm {}^{0}_{1.0}$ ($3620 \pm {}^{0}_{140}$) $\{255 \pm {}^{0}_{10}\}$	23 (3330) {235}
		Charge circuit pressure			$2.5 \pm {}^{0}_{0.3}$ ($350 \pm {}^{0}_{40}$) $\{25.0 \pm {}^{0}_{3.0}\}$	2.1 (298) {21}
	Steering circuit pressure				$10.8 \pm {}^{0}_{0.5}$ ($1560 \pm {}^{0}_{70}$) $\{110 \pm {}^{0}_{5.0}\}$	9.9 (1440) {102}

*NOTE: 'Circuit pressure' means maximum relief pressure in a circuit with circuit losses taken into consideration. It is not a simple setting of a pressure relief valve.

2. Inspection & Adjustment

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

⚠ **Park on level ground. Apply the parking brake. Stop the engine and block the wheels.**

⚠ **Make certain that the parking brake functions correctly.**

1. Measurement

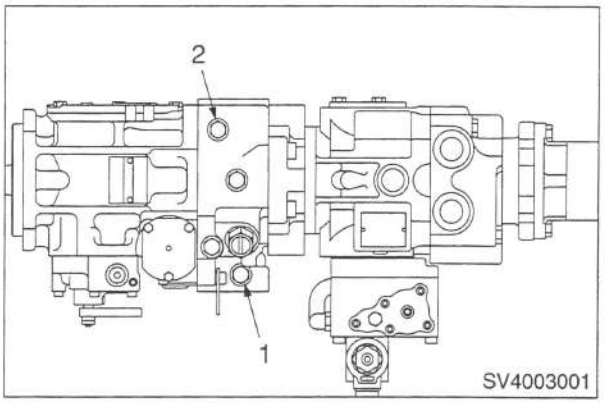
★ **Hydraulic oil temperature: 50±5°C (122±41°F)**

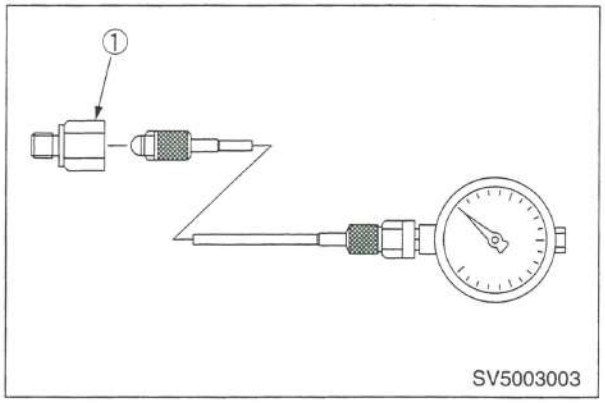
1) Remove gauge port plugs (1) and (2) from the propulsion pump and mount a pressure gauge together with adapter ①.
   - Gauge port: 9/16-18UNF
     Port (1): for forward travel
     Port (2): for reverse travel
   - Pressure gauge:
     0 ~ 60 MPa (0 ~ 9000 psi)
     {0 ~ 600 kgf/cm²}

2) Apply the parking brake by operating the parking brake switch, and operate the speed shift lever to select the HIGH speed.

3) Start the engine and set the throttle to high idle.

4) Move the F-R lever so that the pressure in the port to be measured may build up. Take the pressure reading quickly.
   ★ **Immediately when the measurement has been taken, bring the lever to the neutral position.**





2. Adjustment

If the measured value falls outside the permissible range, adjust as follows:

1) If locknut (5) of multifunction valve (7) (forward travel) or multifunction valve (8) (reversing) has no signs of looseness, dismount and disassemble the multifunction valve to clean.

   ★ Do not loosen locknut (5) to keep the setting unchanged.

   ★ Renew parts having signs of damages.

   • Tightening torque:
   Item (4): 41.2 N·m (304 lbf·ft) {420 kgf·cm}
   Item (5): 9.1 N·m (6.7 lbf·ft) {92 kgf·cm}
   Item (7) (8): 79.4 N·m (58.6 lbf·ft) {810 kgf·cm}

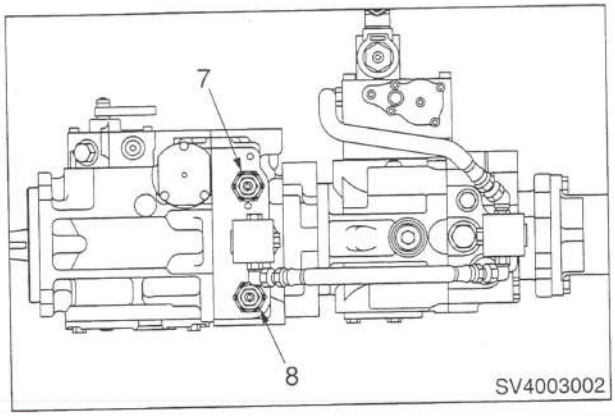
   ★ Carefully perform disassembly and reassembly taking necessary measures to prevent entry of foreign matter.

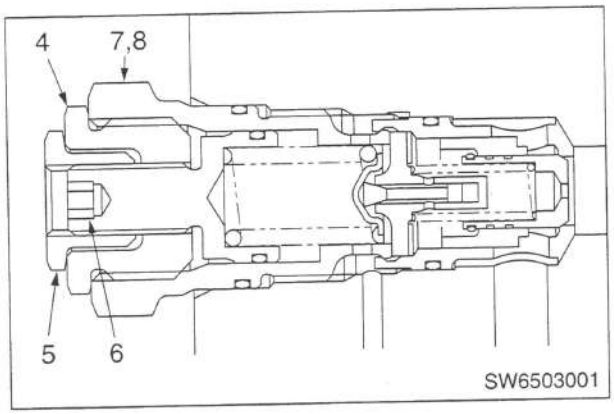
2) To adjust the setting, loosen locknut (5) and rotate adjust screw (6).
   • Adjust screw rotation:
   Clockwise ➡ Pressure increases
   Counterclockwise ➡ Pressure decreases
   • Increase or decrease in pressure per 1/4 turns of adjust screw:
   2.1 MPa (300 psi) {21 kgf/cm²}

3) For the pressure measurement during the adjustment, use procedures as stated in step 2-1-1.

4) When the adjustment is complete, tighten locknut (5) and recheck to see if correctly adjusted.

5) If the valve is beyond adjustment, take necessary measures referring to relevant items in "TROUBLE-SHOOTING".





2-2. Measurement of propulsion charge circuit pressure

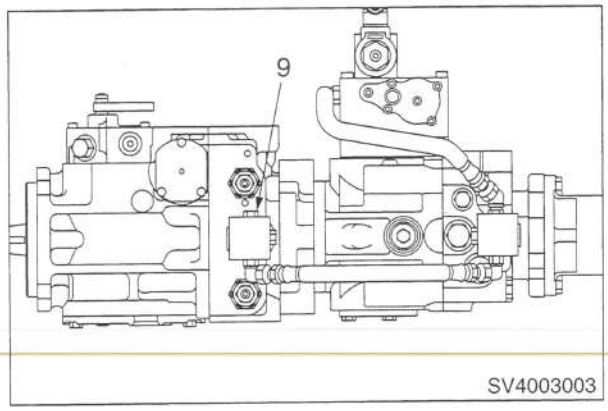
⚠ **Park the machine on level ground. Apply the parking brake. Stop the engine and block the wheels.**

★ **Because oil is supplied from the steering circuit, make sure, before the measurement, that the steering system works correctly.**

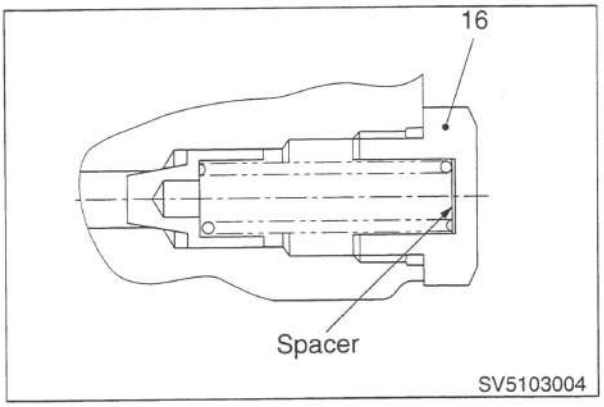
★ **Because the propulsion charge circuit connects to the vibrator charge circuit, place a spacer (12mm in diameter and 10mm in thickness) on the plug of charge relief valve (16).**

* For the location of valve (16), see Fig.SV5103004.
When the measurement and adjustment are complete, remove the spacer to restore the charge relief valve setting.

★ **When placing and removing the spacer, use caution not to lose the shims on the plug.**



SV4003003



SV5103004

1. Measurement

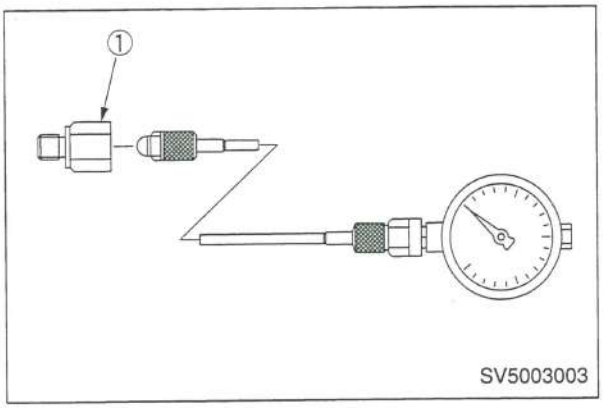
★ **Hydraulic oil temperature: 50±5°C (122±41°F)**

1) Remove the plug of gauge port (9) in the propulsion charge port elbow, mount a pressure gauge with adapter ①.
   - Gauge port: PF9/16-18UNF
   - Pressure gauge:
     0 ~ 5 MPa (0 ~ 700 psi) {0 ~ 50 kgf/cm²}

2) Start the engine and set the throttle to high idle.

3) Move the F-R lever slightly forward and backward. The charge pressure will vary. Take the maximum pressure reading.

4) After that, take the pressure readings with the F-R lever in the neutral, forward and backward positions.

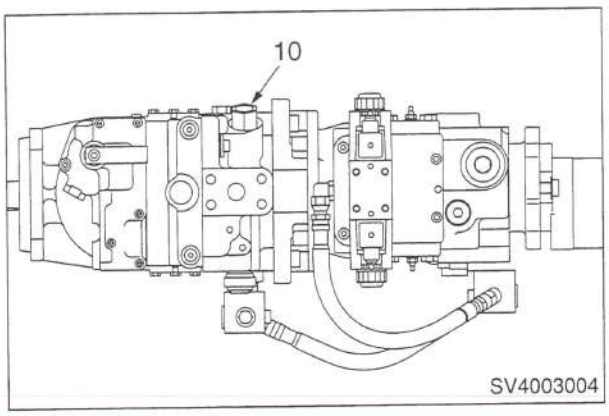


SV5003003

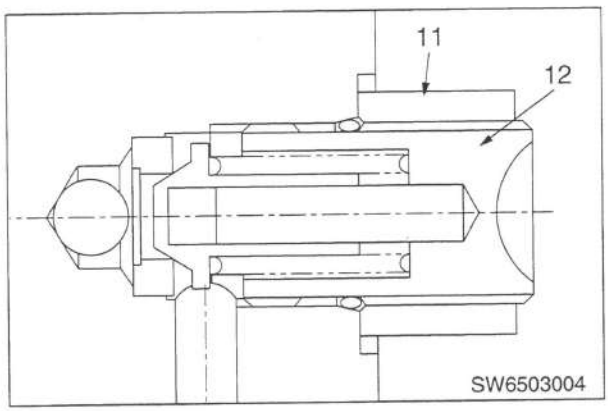
2.Adjustment

If the measurements are not within the permissible range, adjust as follows:

1) If locknut (11) of charge relief valve (10) has no signs of looseness, dismount, disassemble and clean charge relief valve (10).
   ★ Renew parts with signs of damage.
   • Tightening torque:
   Item (11)
   51.4 N•m (37.9 lbf•ft) {524 kgf•cm}
   ★ Carefully perform disassembly and reassembly taking necessary measures to prevent entry of foreign matter.



2) To adjust the setting, loosen locknut (11) and rotate adjust screw (12).
   • Adjust screw rotation:
   Clockwise ➡ Pressure increases
   Counterclockwise ➡ Pressure decreases
   • Increase or decrease in pressure per 1/4 turns of adjust screw:
   0.29 MPa (41 psi) {2.9 kgf/cm²}



3) For the pressure measurement during the adjustment, use procedures as described in step 2-2-1) above.

4) When the adjustment is complete, tighten locknut (11) and recheck to see if correctly adjusted.

5) If the valve is beyond adjustment, take necessary measures referring to relevant items in the "TROUBLE-SHOOTING".

2-3. Measurement of parking brake release pressure

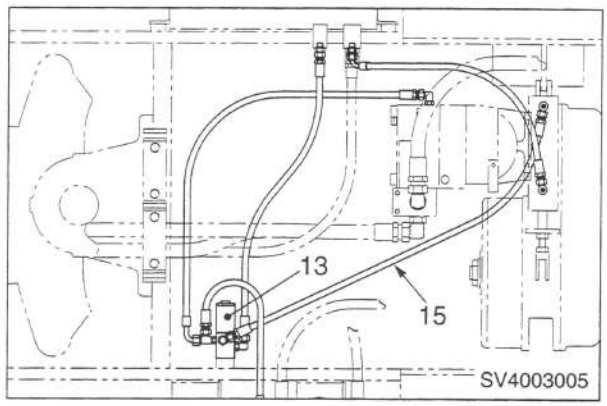
⚠ **Park on level ground. Apply the parking brake. Stop the engine and block the wheels.**

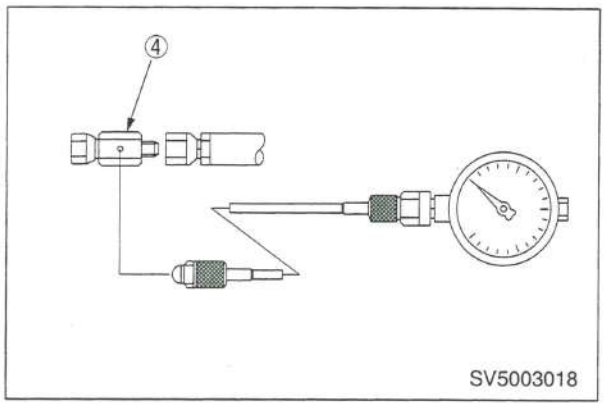
1. Measurement

★ **Hydraulic oil temperature: 50±5°C (122±41°F)**

★ **Because the charge pressure is also used for releasing the brake, make sure, before the measurement, that the charge pressure is correct.**

1) Disconnect brake release hose (15) from brake valve (13), and fit a pressure gauge with adapter ④.
   • Pressure gauge:
   0 ~ 5 MPa (0 ~ 700 psi) {0 ~ 50 kgf/cm²}
2) Start the engine and set the throttle to high idle.
3) Make sure that the F-R lever stays in the neutral position.
4) Press down the parking brake switch to free the brake and read the pressure to release the brake.





2-4. Measurement of outlet pressure in propulsion motor speed shift valve

⚠ **Park on level ground. Apply the parking brake. Stop the engine and block the wheels.**

1. Measurement

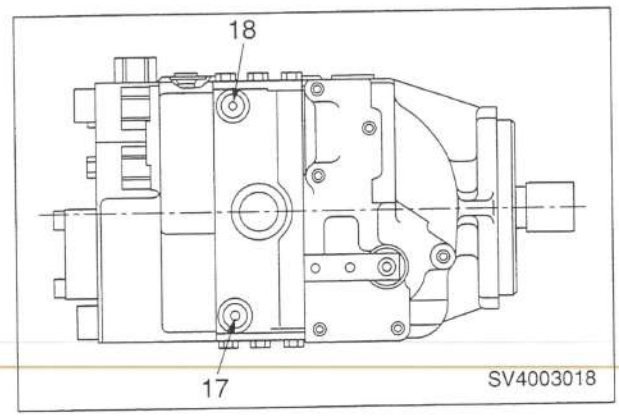
★ **Hydraulic oil temperature: 50±5°C (122±41°F)**

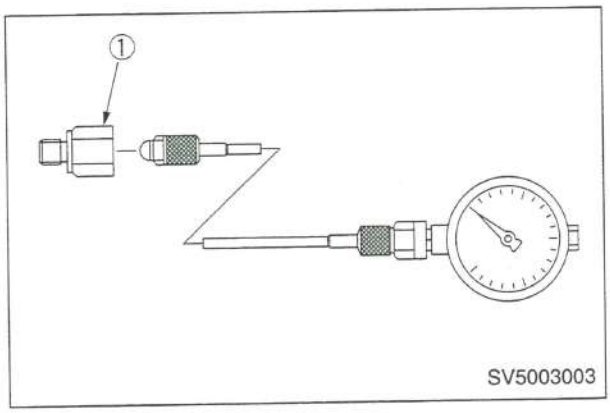
★ **Because the charge pressure is also used for releasing the brake, make sure, before the measurement, that the charge pressure is correct.**

1) Remove the plug from gauge port (17) or (18) of the propulsion motor, and mount a pressure gauge with adapter ①.
   - Gauge port: 9/16-UNF
   - Forward travel gauge port: (18)
     Rearward travel gauge port: (17)
   - Pressure gauge:
     0 ~ 5 MPa (0 ~ 700 psi) {0 ~ 50 kgf/cm²}

2) Start the engine after ensuring that the F-R lever is in the neutral position, set the throttle to high idle.

3) Take the pressure readings for the speed shift valve with the speed shift lever operated.





2-5. Measurement of vibrator circuit pressure

⚠ **Park on level ground. Apply the parking brake. Stop the engine and block the wheels.**

★ **Make sure that the F-R lever stays in the perfect neutral position when the pump is in neutral.**

1. Measurement

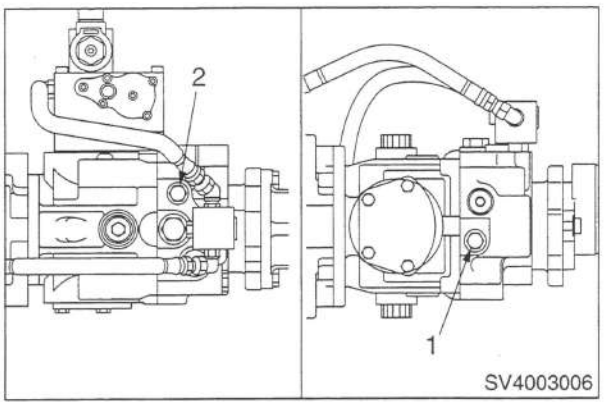
★ **Hydraulic oil temperature: 50±5°C (122±41°F)**

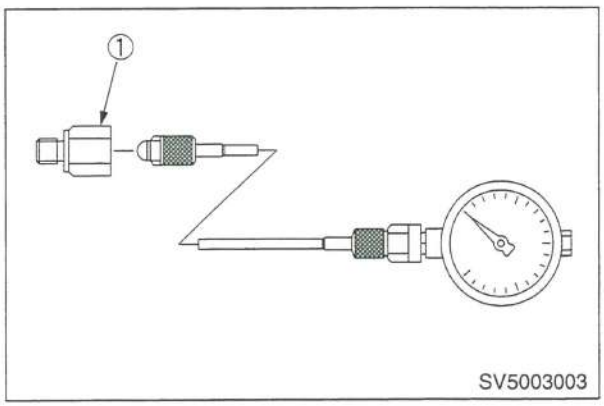
1) Remove plugs (1) and (2) from the gauge ports in the vibrator pump. Attach a pressure gauge with adapter ①.
   - Gauge ports: 7/16-20UNF
     Gauge port (1): High amplitude
     Gauge port (2): Low amplitude
   - Pressure gauge:
     0 ~ 40 MPa (0 ~ 9000 psi) {0 ~ 400 kgf/cm²}

2) Disconnect the two high pressure hoses from the vibrator motor. Blank off the hoses.
   ★ **Also plug the motor ports to prevent entry of foreign matter.**

3) Start the engine and set the throttle to high idle.

4) Switch ON the vibrator by pressing down the vibrator switch on top of the F-R lever and take the measurement of the pressure.
   ★ **When the measurement is complete, switch OFF the vibrator as quickly as practicable.**
   ★ **The procedure (Starting the vibrator ➡ Pressure measurement ➡ Shutting down the vibrator) should not exceed 3 seconds.**





2. Adjustment

If measured pressures do not fall within the specified range, adjust as follows:

1) Remove, disassemble and wash clean high pressure relief valve (3) (high amplitude) or high pressure relief valve (4) (low amplitude).

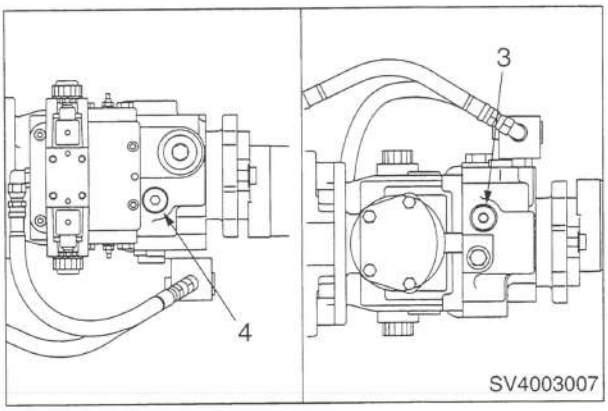
★ Renew parts with signs of damages.

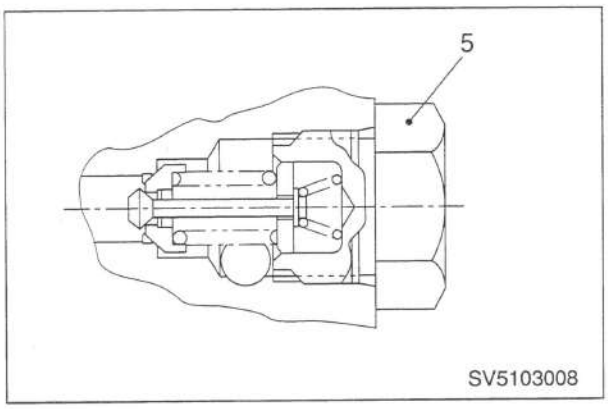
★ The relief valves are not adjustable.

• Tightening torque:
Item (5): 176 N•m (130 lbf•ft) {1800 kgf•cm}

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

2) If the pressure is not adjusted to the correct level, take necessary means referring to appropriate instructions in the chapter, TROUBLESHOOTING.





2-6. Measurement and adjustment of vibrator charge circuit pressure

⚠ **Park on level ground. Apply the parking brake. Stop the engine and block the wheels.**

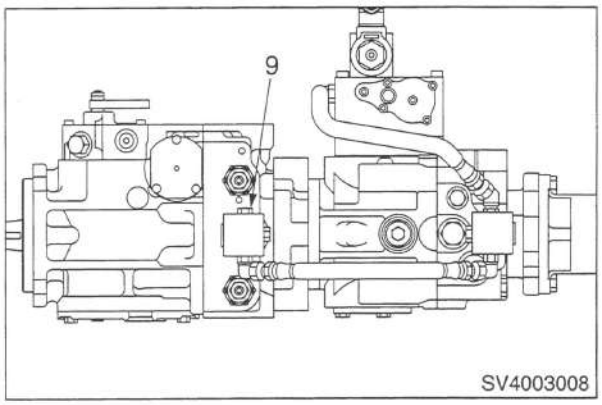
★ **Because the steering circuit feeds the vibrator charge circuit, make sure that the steering system functions correctly.**

★ **Make sure that the F-R lever stays in the perfect neutral position when the pump is in neutral.**

★ **Because the vibrator charge circuit connects to the propulsion charge circuit in parallel, block charge relief valve (10) by fully screwing in adjusting screw (12).**

* For the location of valve (10), refer to Fig.SV400-3004, page 3-104.

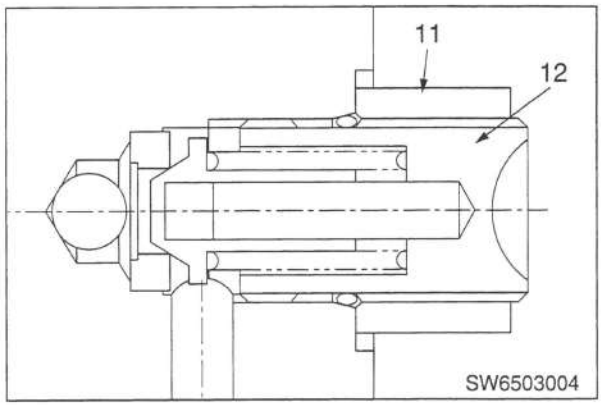
★ **When screwing in adjusting screw (12), record the number of turns at which the screw is rotated. When the measurement and adjustment are complete, restore the setting of charge relief valve (10) by screwing out adjusting screw (12) by the same amount and tightening locknut (11).**



1. Measurement

★ **Hydraulic oil temperature: 50±5°C (122±41°F)**

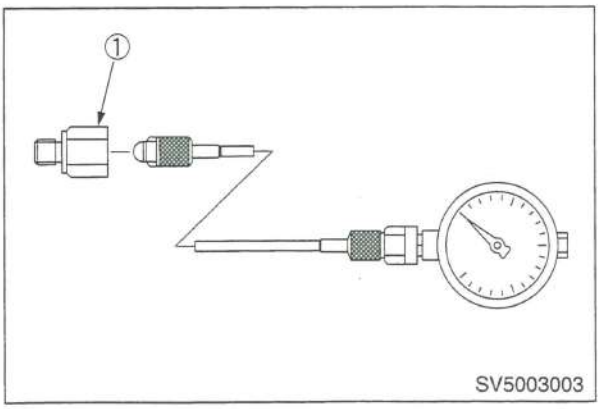
1) Remove the plug from gauge port (9) provided at the elbow connected to the propulsion pump charge port. Attach a pressure gauge with adapter ①.
   - Gauge ports: 9/16-UNF
   - Pressure gauge: 0 ~ 5 MPa (0 ~ 700 psi) {0 ~ 50 kgf/cm²}



2) Start the engine and set the throttle to high idle.

3) Move the F-R lever slightly forward and backward. The charge pressure will vary. Read the maximum charge pressure.

4) After that, take the pressure readings with the F-R lever in the neutral position.



2. Adjustment

If measured pressures do not fall within the specified range, adjust as follows:

1) Remove, disassemble and wash clean charge relief valve (16).

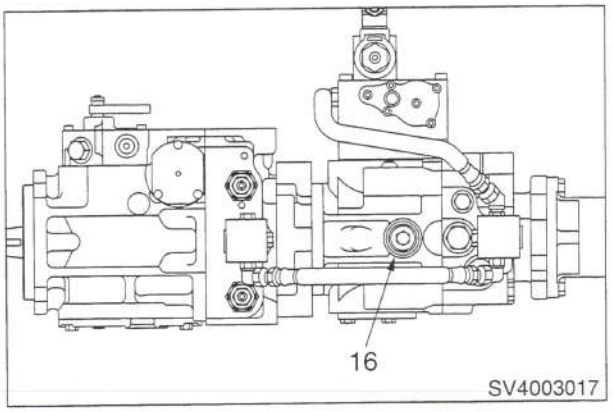
★ Renew parts with signs of damages.

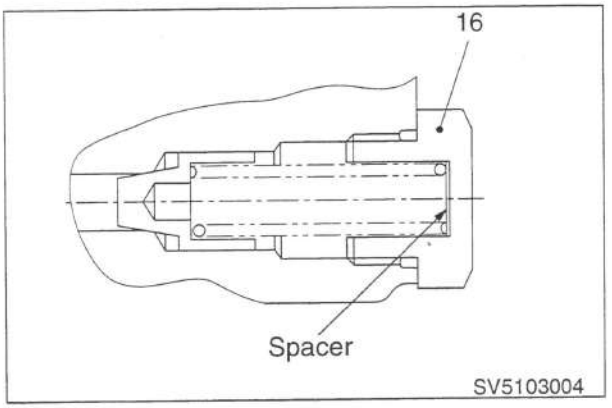
★ The relief valve is not adjustable.

• Tightening torque:
Item (8): 73.5 N•m (54.2 lbf•ft) {750 kgf•cm}

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

2) If the pressure is not adjusted to the correct level, take necessary means referring to appropriate instructions in the chapter, TROUBLESHOOTING.

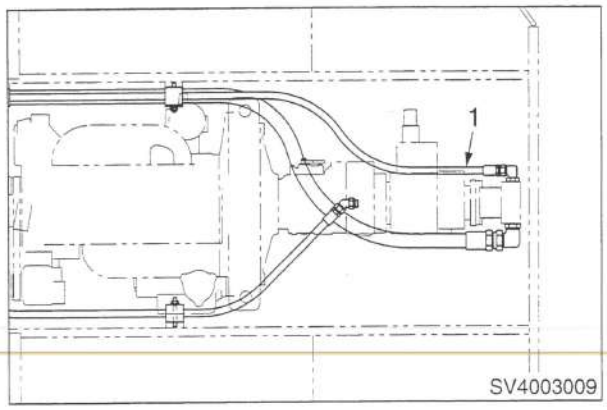




2-7. Measurement and adjustment of steering circuit pressure

⚠ **Park on level ground. Apply the parking brake. Stop the engine and block the wheels.**

★ **Because the propulsion charge circuit makes use of the pressure of return oil from the steering circuit, check to see if the pressure in the propulsion charge circuit is normal.**



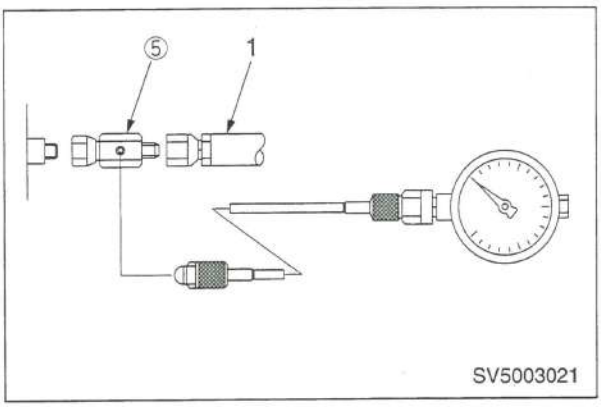
1. Measurement

★ **Hydraulic oil temperature: 50±5°C (122±41°F)**

1) Disconnect feed hose (1) from the steering pump, and connect a pressure gauge to the pump using adapter ⑤.
   • Pressure gauge:
   0 ~ 25 MPa (0 ~ 3500 psi) {0 ~ 250 kfg/cm²}

2) Start the engine. Ensuring that the F-R lever is in the neutral position, set the throttle lever to high idle.

3) Rotate the steering wheel clockwise to full lock to allow the relief valve to function and take the reading of the pressure gauge.
   ★ **Do not allow the relief valve to function (stays open) longer than 3 seconds.**



2. Adjustment

If the measured value is not within the permissible range, disassemble and clean the relief valve built in Orbitrol.

★ **The valve is not adjustable.**

★ **Renew parts if found to be damaged.**

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

2-8. Throttle linkage adjustment

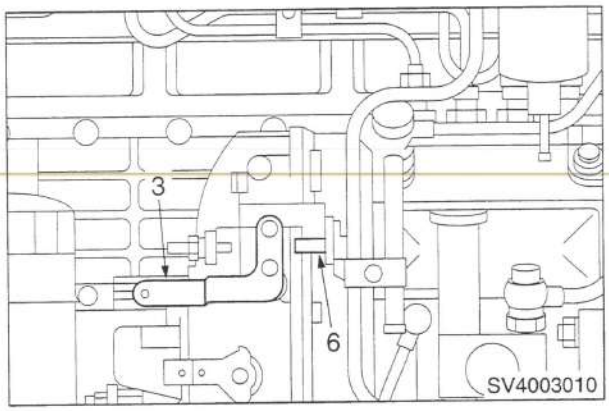
★ **When the throttle linkage has been renewed (or reconnected) or if the high idle or low idle rpm is not to specification, adjust as follows:**

1. Adjustment

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

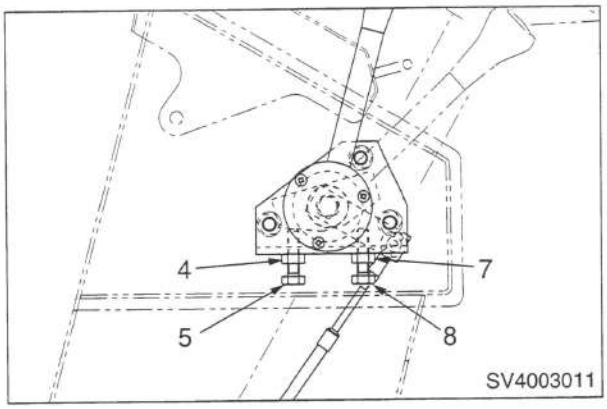
1) Set throttle lever (1) to the low idle position. Connect throttle cable (2) between fuel injection pump governor lever (3) and throttle lever (1).

2) Start the engine. Slacken lock nut (4) and adjust stop bolt (5) until correct low idle revolution is reached.
   ★ **Low idle:**
   800±20 min^{-1} (rpm)

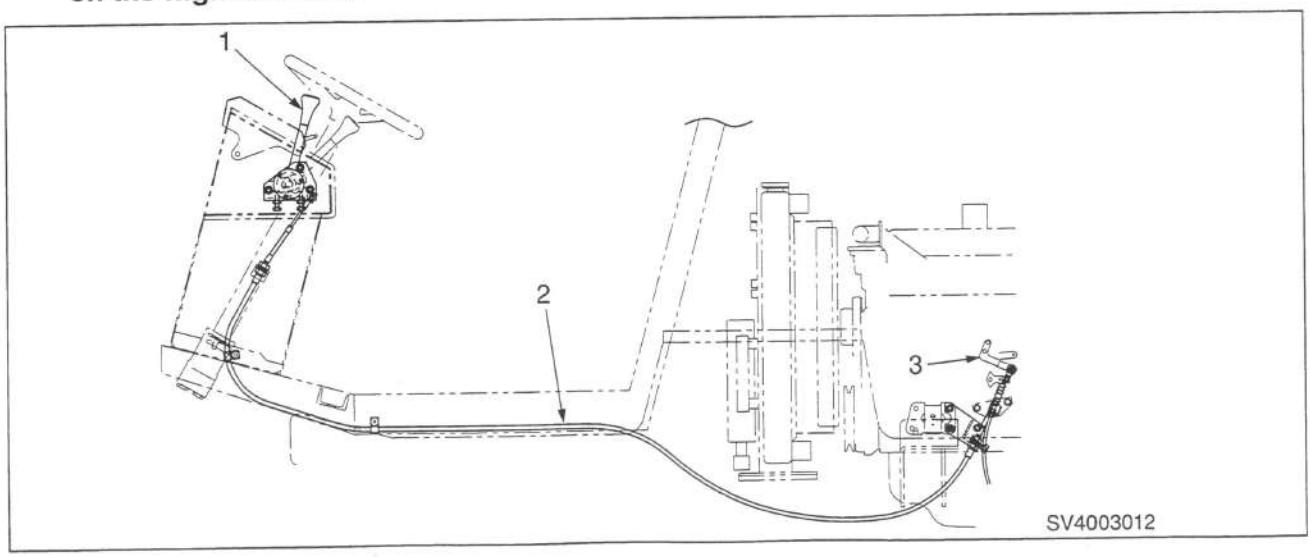


3) With throttle lever (1) set to full throttle, loosen locknut (7) and adjust stop bolt (8) so that governor lever (3) makes contact with stopper (6) on the full throttle side.

4) Start the engine. Check that the high idle rpm is to specification.
   ★ **High idle:**
   2280±50 min^{-1} (rpm)



◆ If high idle is lower than specified with governor lever (3) in contact with the stopper on the full throttle side, adjust the fuel injection nozzles or repair or renew the fuel injection pump.
   ★ **The engines of SV400 series are equipped with an exhaust gas control system, and are incapable of adjustment on the high idle side.**



2-9. Adjustment of F-R lever linkage

★ In case the propulsion pump or cable has been renewed (or reconnected) or if the pump fails to stay in the correct neutral position, adjust as described below:

1. Adjustment

1) Put F-R lever (1) in the neutral position. Connect cable (2) and fix cable (2) to bracket (6) with nuts (3).

2) Secure propulsion control lever (4) in the

2-10. Speed shift lever linkage adjustment

★ In case the propulsion motor or cable has been renewed, adjust as follows:

1. Adjustment

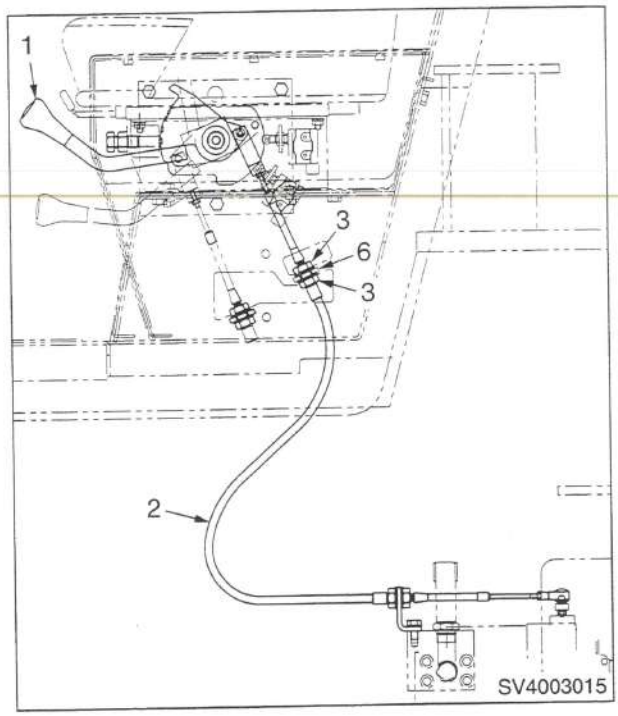
1) After making sure that the speed shift lever (1) is in the detent position, set the lever to the LOW speed position. Connect cable (2) and fix to bracket (6).

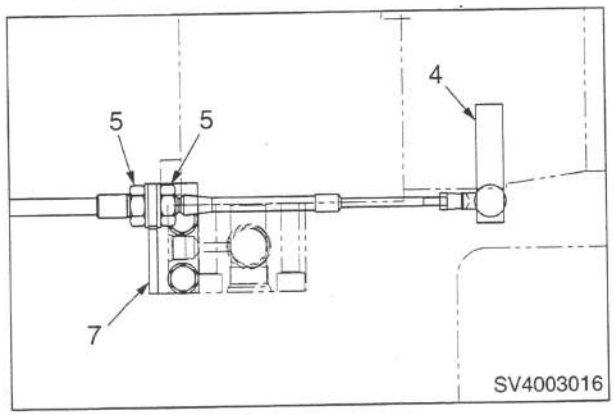
2) Check that motor lever (4) moves smoothly. Connect cable (2) while pushing lever (4) toward the axle. Fix cable (2) on bracket (7) with nuts (5).

3) Operate the speed shift lever to see if motor lever (4) surely follows the speed shift lever movement. Tighten nuts (3).

★ Stroke adjustment for lever (4) is made by nuts (3).

★ When adjustment is complete, propel the machine and check that speed is shifted correctly.





2-11. Parking brake adjustment

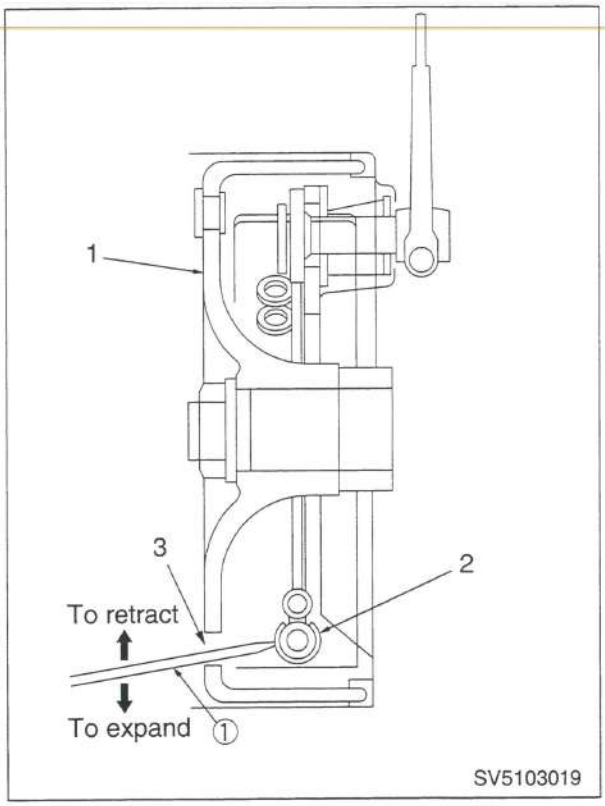
• If the brake is not applied properly or when the brake has been disassembled, adjust as follows:

1. Adjustment

★ When the brake has been disassembled, the adjustment should be made before fitting the brake cylinder.

1) Rotate brake drum (1) so that drum access hole (3) is positioned at star wheel (2) in the brake adjusting screw.

2) With screw driver ① inserted through the access hole, rotate the star wheel until the brake drum is dragged.From this position, turn back the star wheel 8 to 12 notches. This completes the adjustment.



MEMO

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.

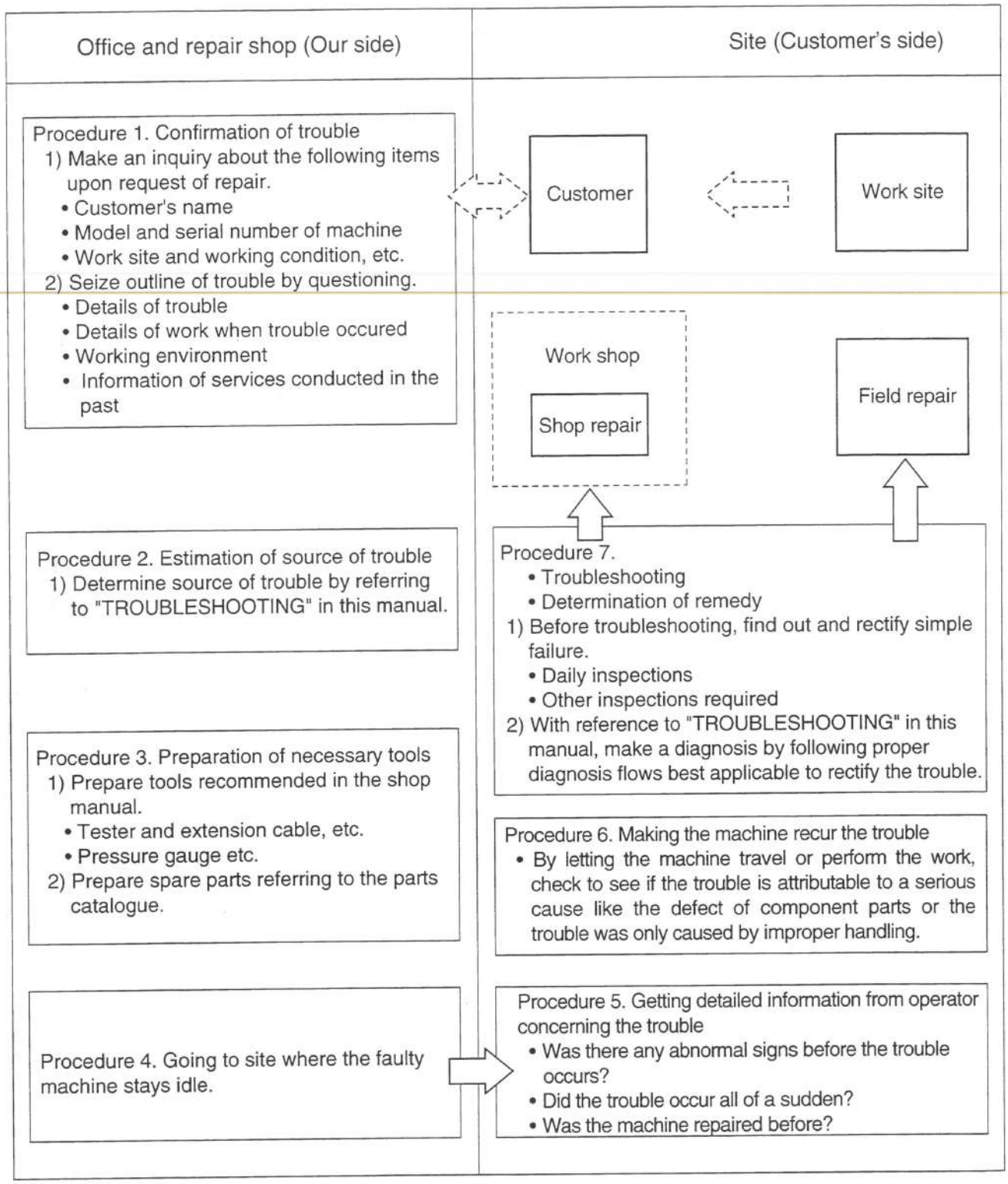
★ **The basic points of the diagnosis are:**

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-12
2) Hydraulic and mechanical systems: H-01 to H-10

2. How to follow the troubleshooting flow

★ See example shown on page 4-005.

① Troubleshooting code No.and fault symptom
On top of the flow chart are code No.and fault symptom.

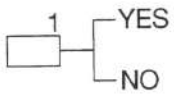
② General precautions
Under the code and fault symptom are precautions (with mark ★) common to the whole items in the flow chart. Though these precautions are not indicated inside each box (□) which contains checking instructions, pay attention to these precautions when making inspections described in the box (□).

③ Sub classification
To make diagnosis easier or for simplified flow chart, fault symptom is subclassed . Ex. a) Starter does not run

④ How to forward the diagnosis

- Each box (□) contains diagnosis procedure. Depending upon these 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 sequence in which diagnoses proceed.



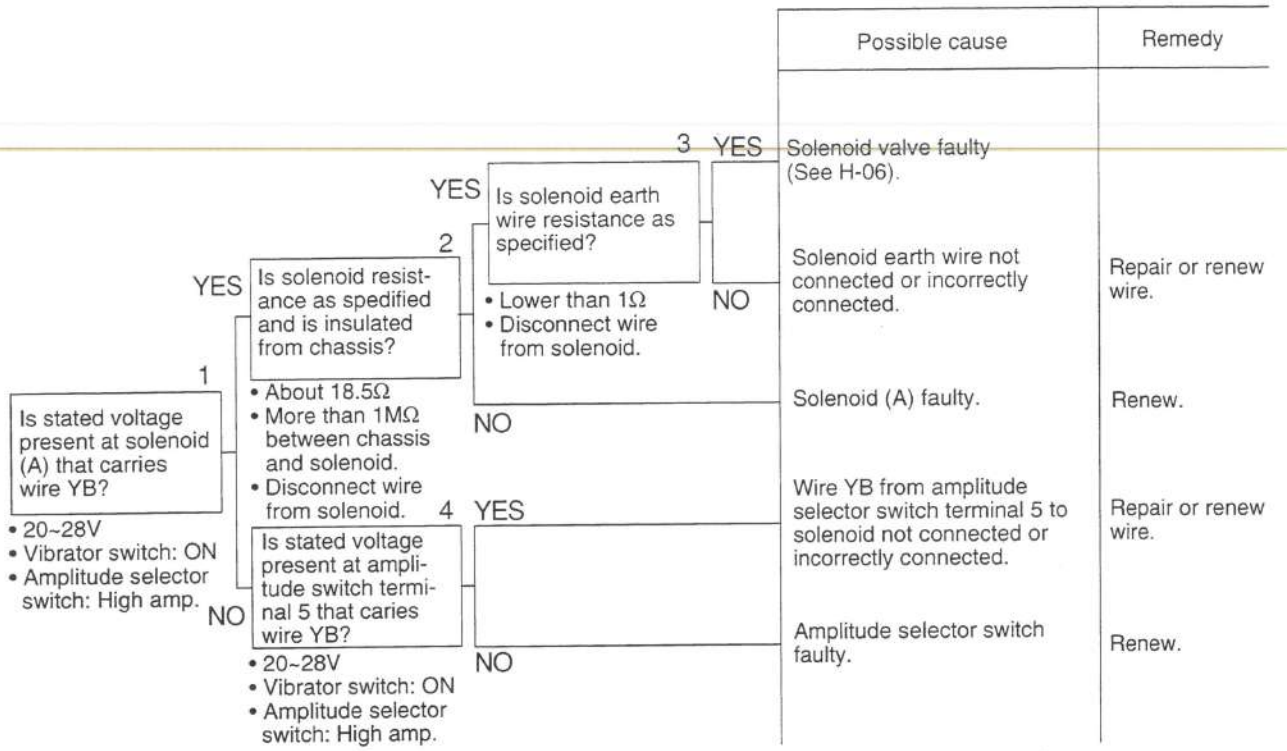
- As a result of a diagnosis, if YES line or NO line directly goes to the description in CAUSE column, take necessary action as indicated in REMEDY column.
- Under each box (□) are normal values and conditions necessary for inspection and adjustment. If the result gives an affirmative answer to the question in the box or agrees with 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 drawings which show locations of key units. Line colors mentioned in the flow charts are indicated in the electric wiring diagram shown under the flow charts. In the actual machine, each harness is identified by color.

① E-07 Vibrator does not work

② **★Take the voltage measurement with the starter switch ON.**
★First, ensure that the fuse has not burnt.

③ c). High amplitude mode is inoperative.

④



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 ····· 4-207
E-03 Glow plug does not become red-hot (difficult starting) ····· 4-208
E-04 No charging (charge indicator lamp on monitor display stays bright) ····· 4-209
E-05 Back-up buzzer does not operate ····· 4-210
E-06 Horn does not sound ····· 4-211
E-07 Vibrator does not work ····· 4-212
E-08 Parking brake is not released ····· 4-214
E-09 Fuel gauge reads wrong ····· 4-215
E-10 Coolant temperature gauge reads wrong ····· 4-216
E-11 Tachometer reads wrong ····· 4-217
E-12 Charge warning Lamp, engine oil pressure warning lamp, hydraulic filter warning lamp and parking brake indicator lamp do not light with starter switch ON ····· 4-218

Wire color code

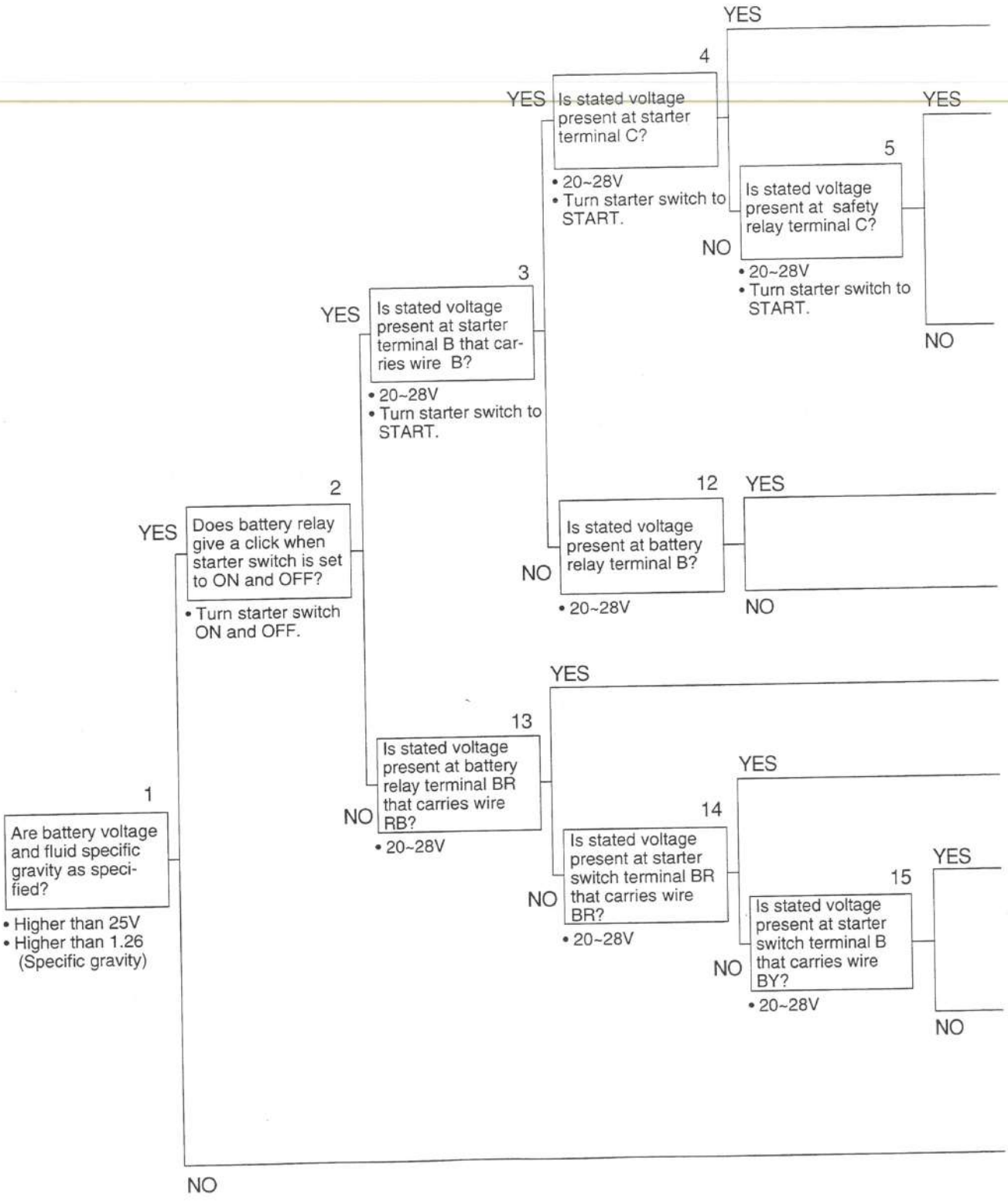
B	Black	BrY	Brown/ Yellow stripe	L	Blue	LgW	Light green/ White stripe	W	White	YG	Yellow/ Green stripe
BR	Black/ Red stripe	G	Green	LB	Blue/ Black stripe	LgY	Light green/ Yellow stripe	WB	White/ Black stripe	YL	Yellow/ Blue stripe
BW	Black/ White stripe	GB	Green/ Black stripe	LR	Blue/ Red stripe	R	Red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

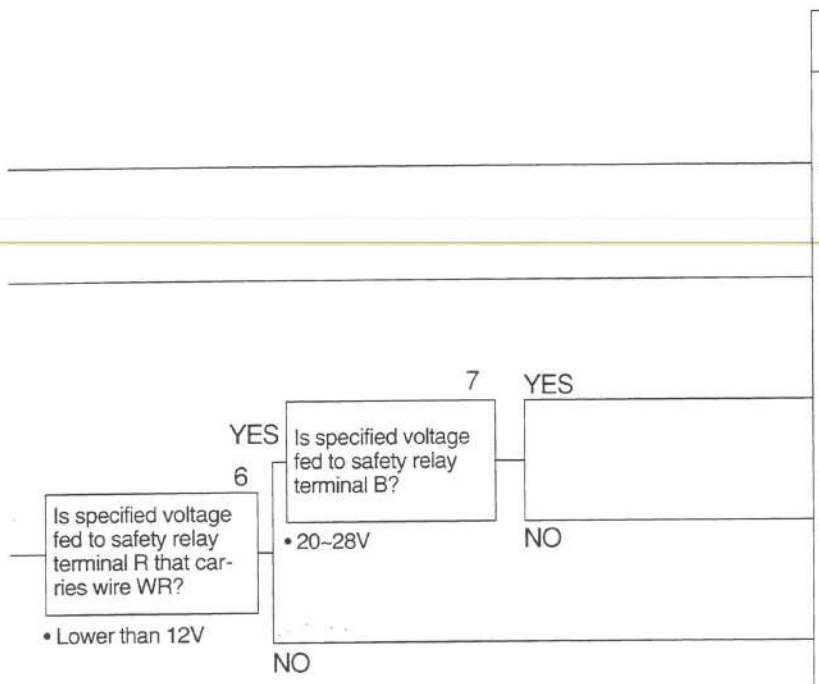
E-01 Engine does not start

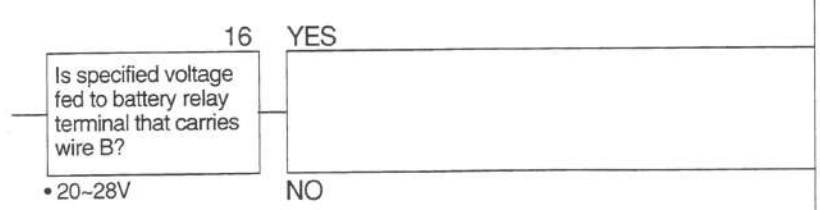
★Set the F-R lever to the neutral position.

★For voltage measurement, turn the starter switch ON.

a) Starter is inoperative. (1/2)

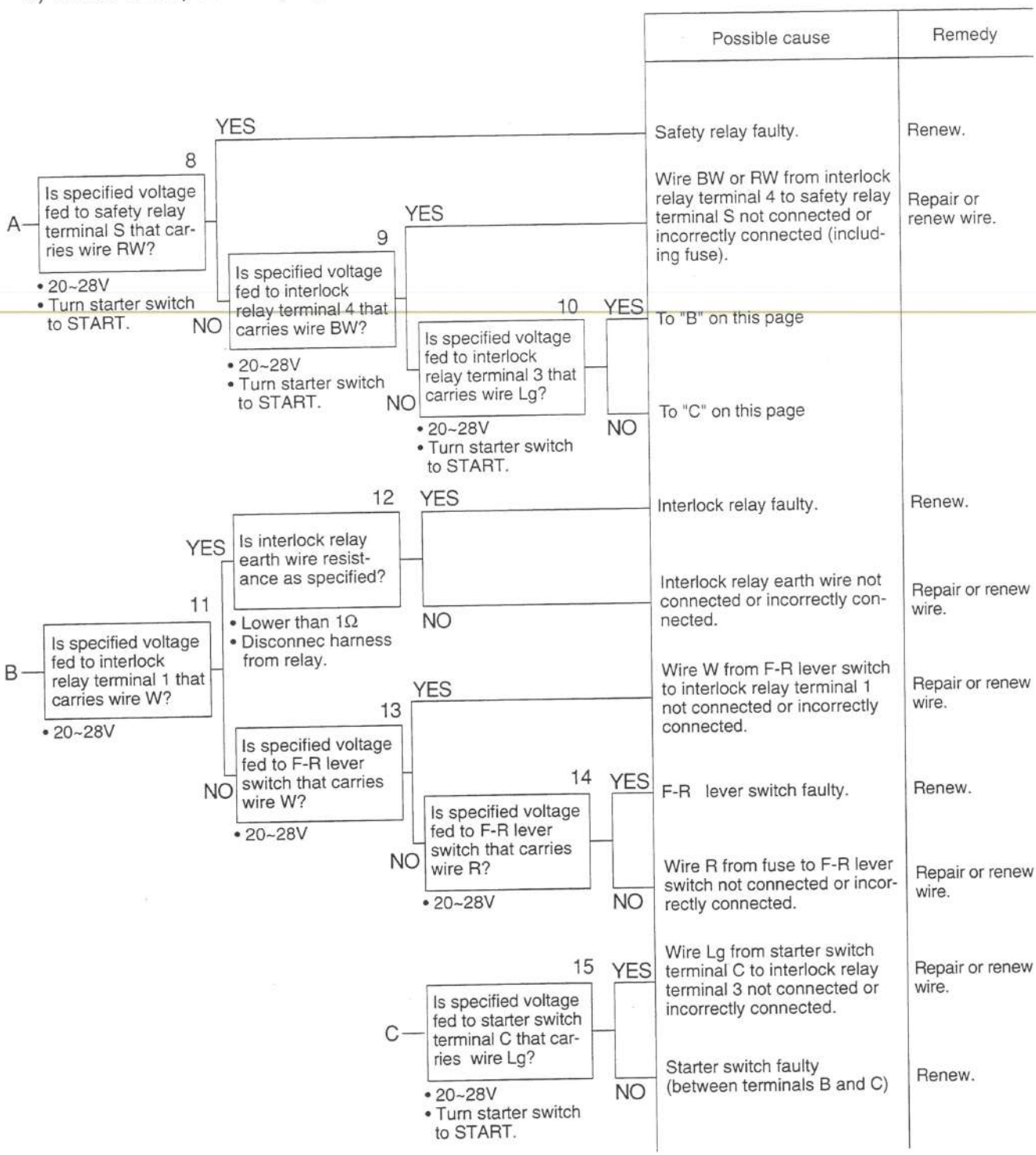




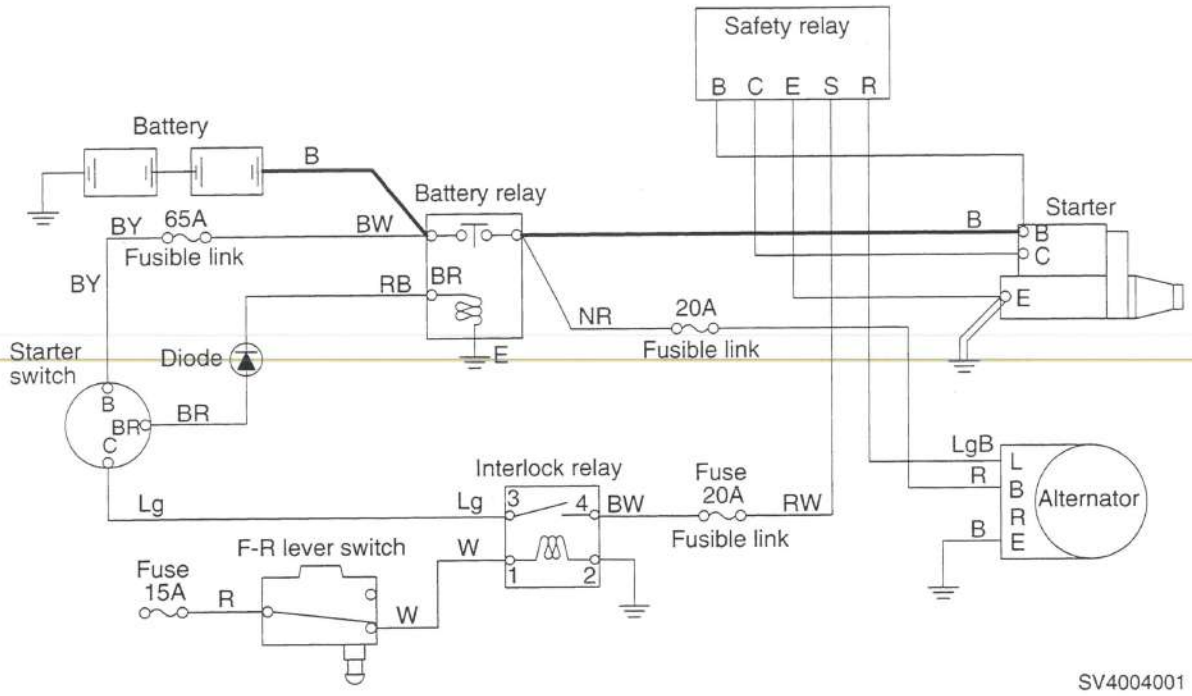


Possible cause	Remedy
Starter faulty.	Renew.
Wire from safety relay terminal C to starter terminal C not connected or incorrectly connected.	Repair or renew wire.
To A on page 4-204	
Wire from starter terminal B to safety relay termianl B not connected or incorrectly connected.	Repair or renew wire.
Alternator faulty (including regulator).	Renew.
Wire B from battery relay to starter terminal B not connected or incorrectly connected.	Repair or renew wire.
Battery relay contact faulty.	Renew.
Battery relay coil faulty.	Renew.
Wire BR or RB from starter switch terminal BR to battery relay terminal BR not connected or incorrectly connected (including diode).	Repair or renew wire.
Starter switch faulty (between terminals B and BR).	Renew.
Wire BY or BW from battery relay to starter switch terminal B not connected or incorrctly connected.	Repair or renew wire.
Wire from battery to battery relay not connected or incorrectly connected.	Repair or renew cable.
Battery capacity lowered.	Charge or renew.

a) Starter is inoperative. (2/2)



Electric wiring diagram for mode E-01-a)

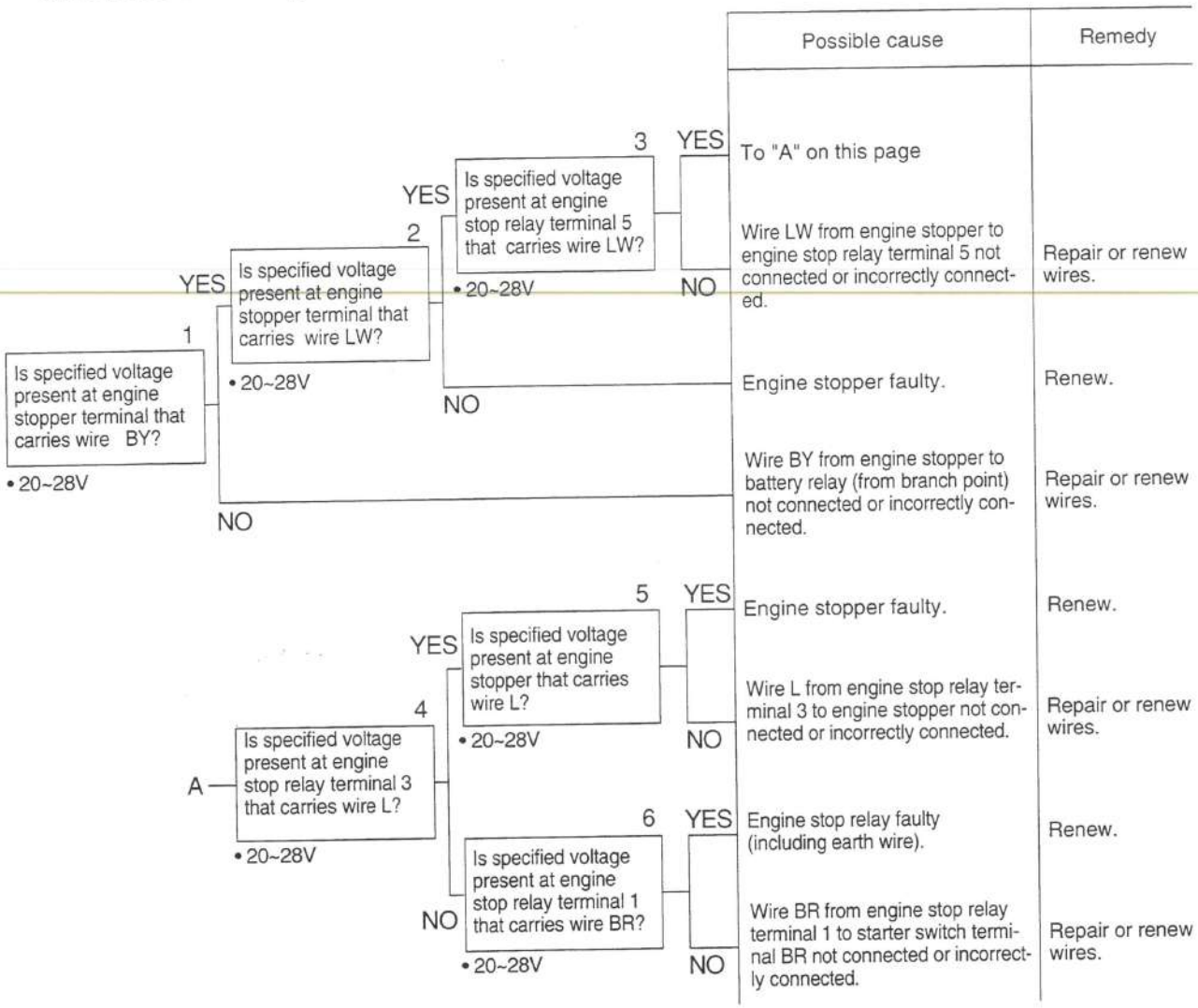


SV4004001

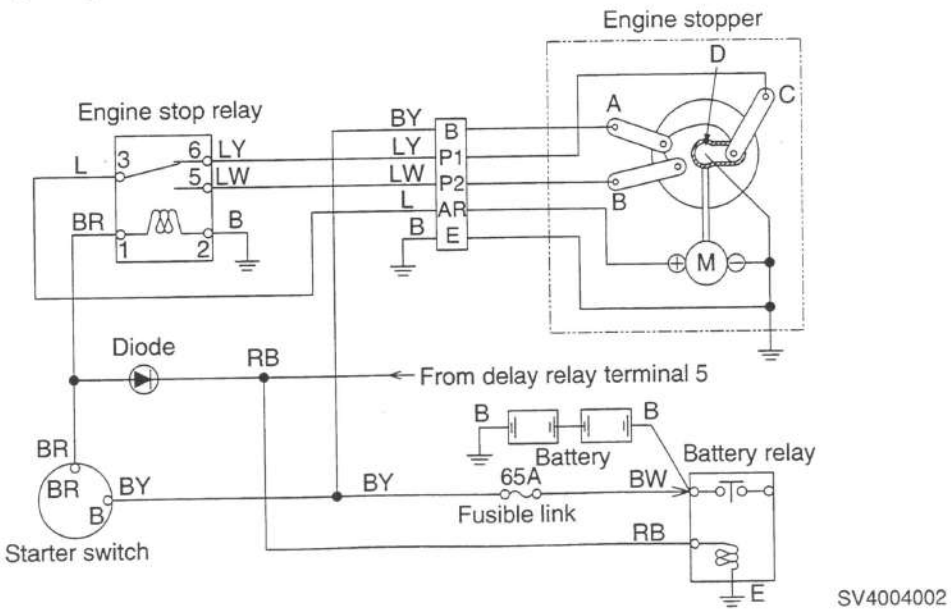
b) Engine stopper does not operate.

★It is assumed that the starter operation is normal.

★Measure the voltage with the starter switch ON.

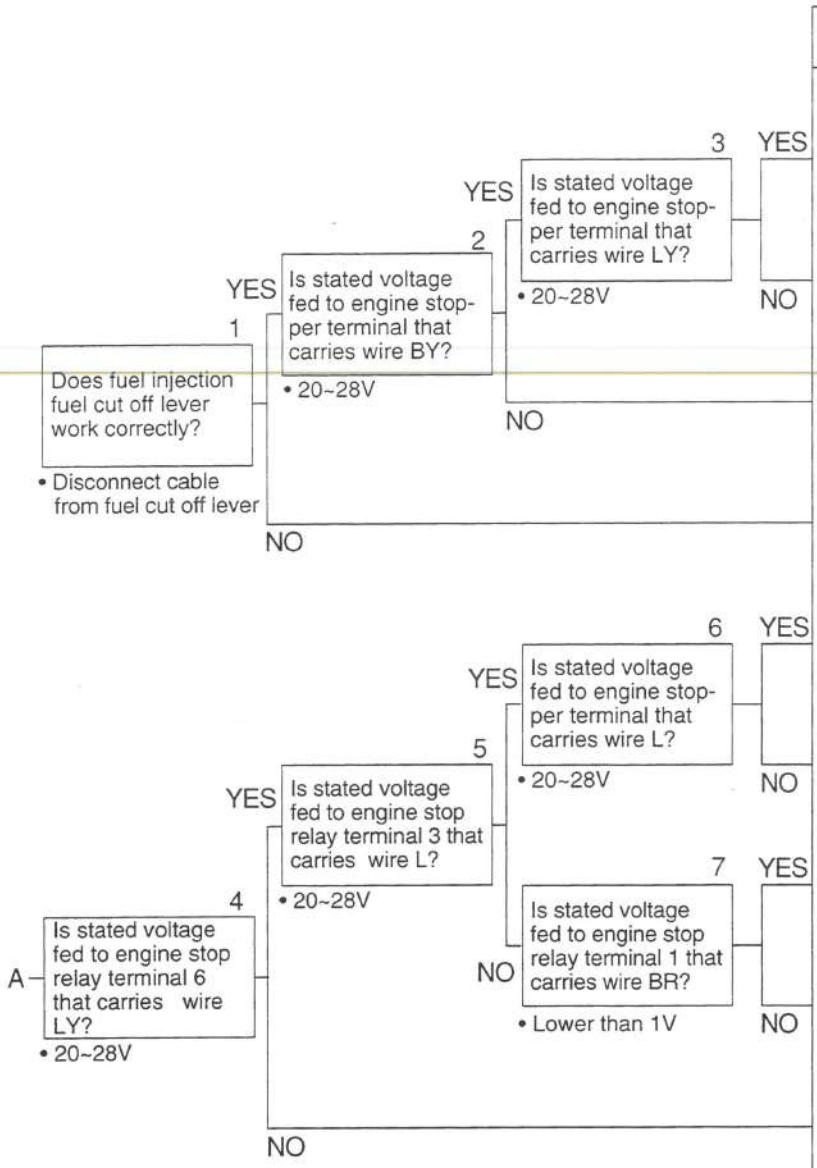


Electric wiring diagram for modes E-01-b) and E-02



E-02 Engine does not stop

★Measure the voltage with the starter switch OFF.



See electric wiring diagram on page 4-206.

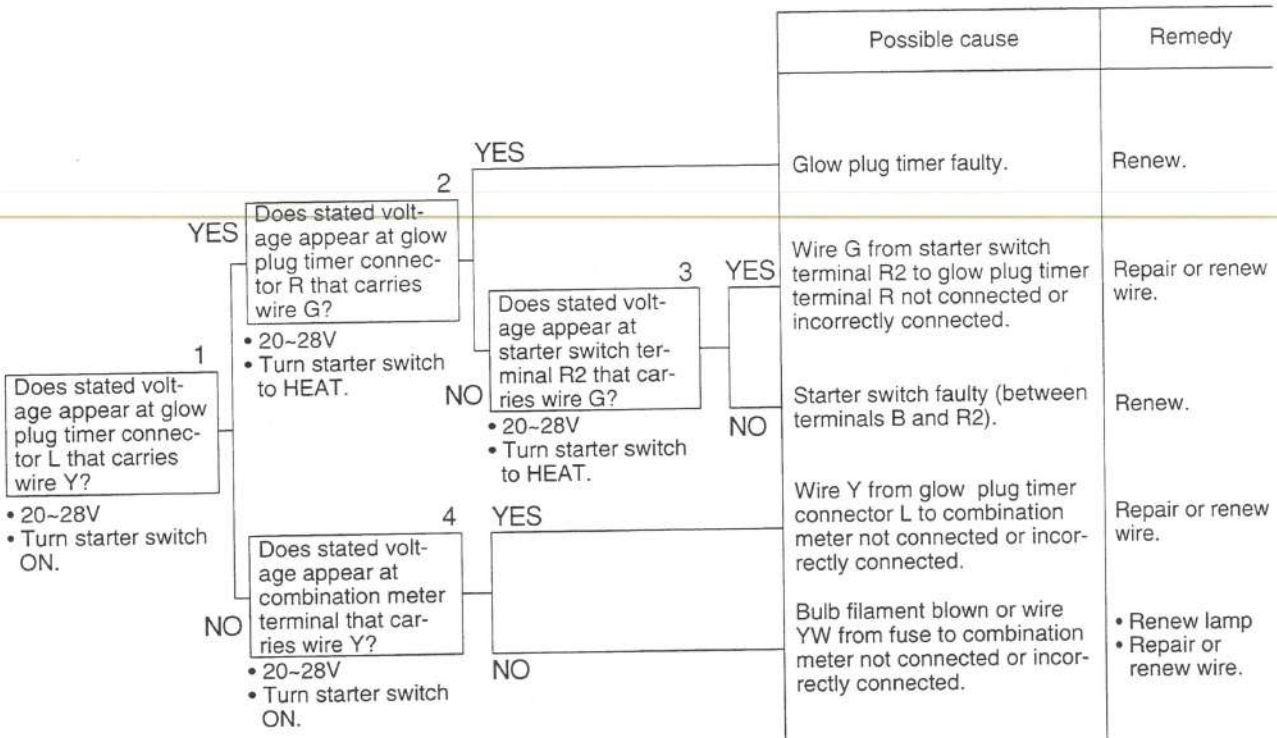
E-03 Glow plugs do not become red-hot (Engine is hard to start)

★It is assumed that the starter operation is normal.

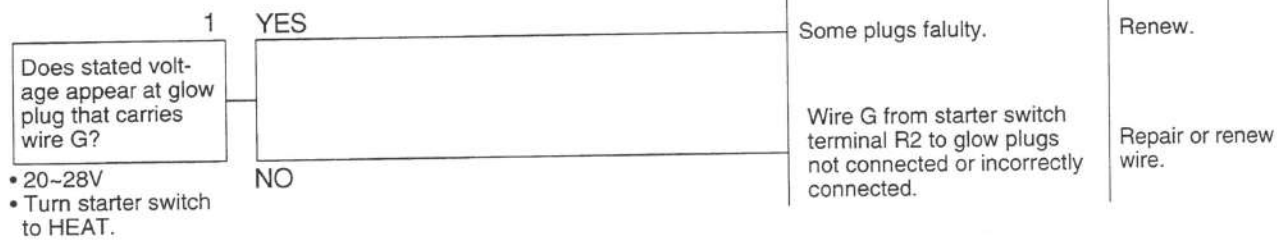
★Measure the voltage with the starter switch ON.

a) Glow indicator does not become bright.

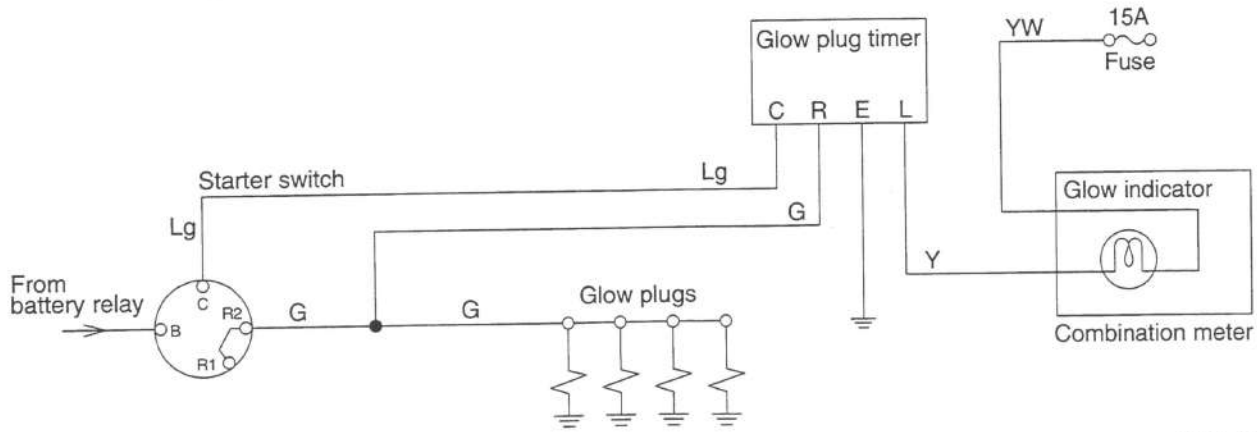
★The glow indicator should become bright when the starter switch is turned to the HEAT position, and come off when preheating is complete.



b) Indicator becomes bright, but engine does not start smoothly.



Electric wiring diagram for mode E-03

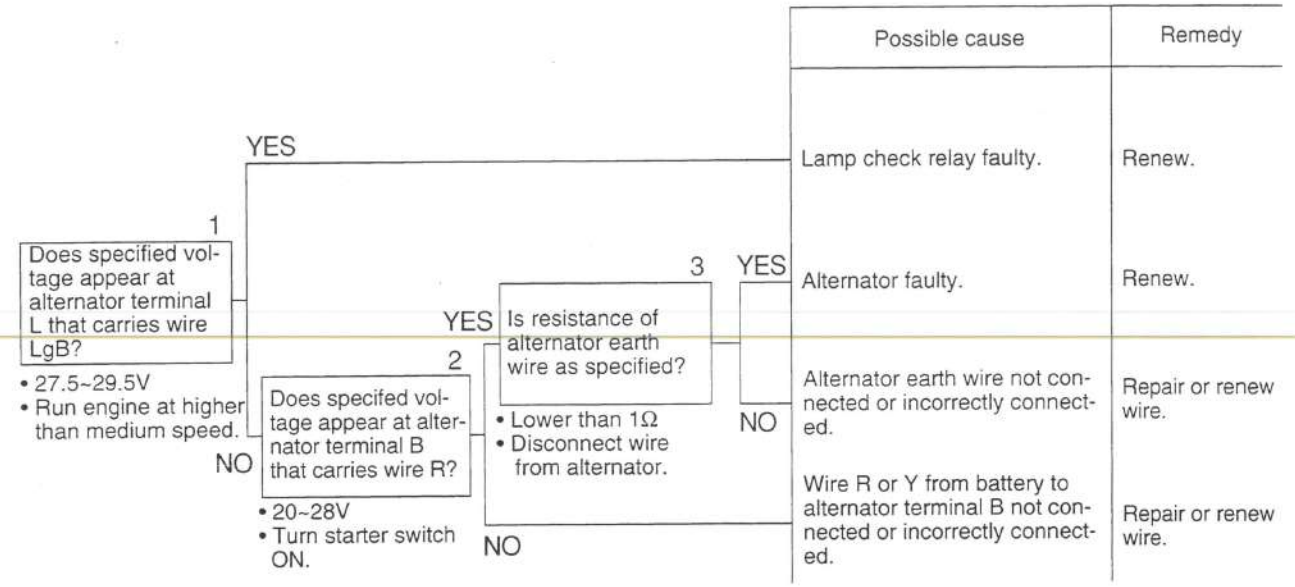


SV4004003

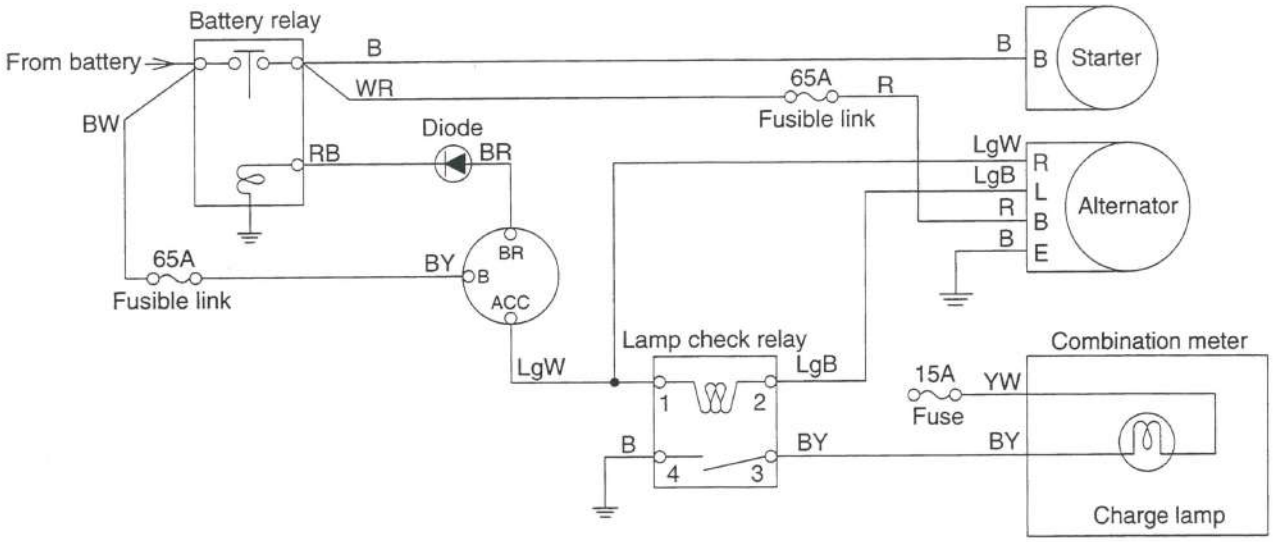
E-04 No charging (charge lamp stays bright.)

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

★First, check to see if fuse has burnt.



Electric wiring diagram for mode E-04

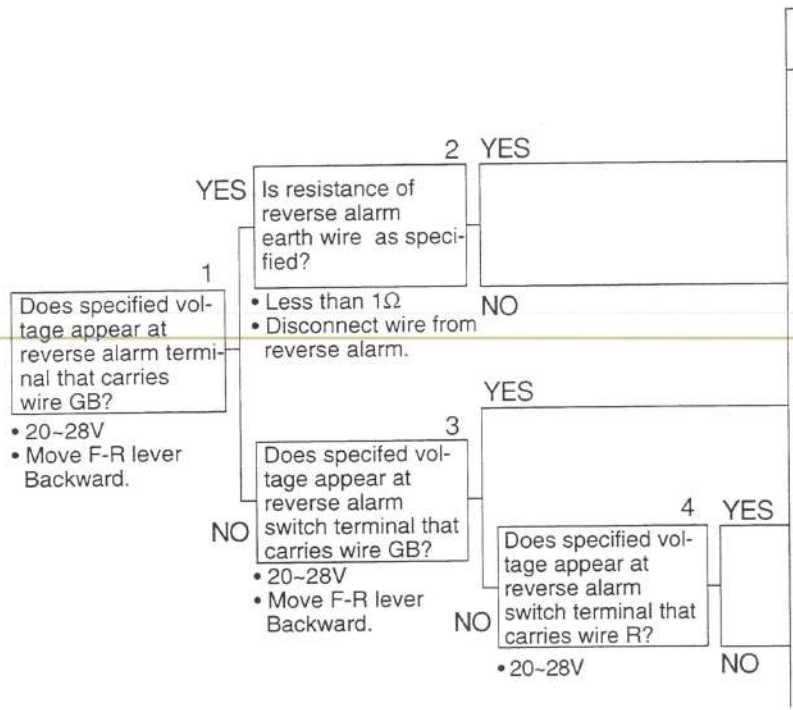


SV4004004

E-05 Reverse alarm does not sound

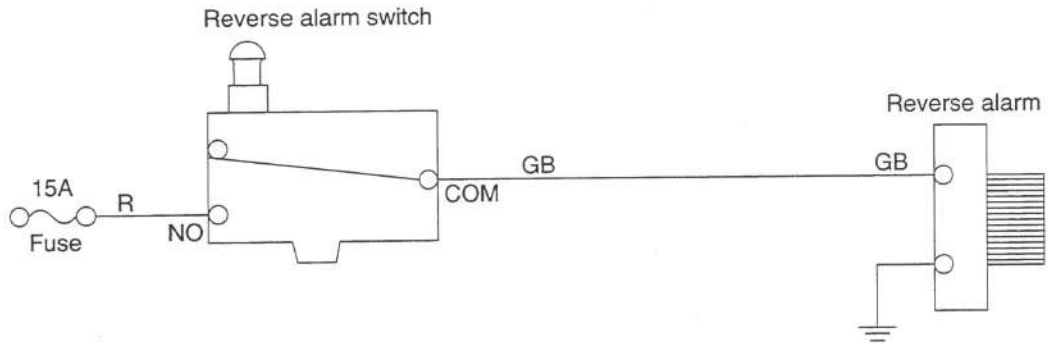
★First, check that the fuse is not blown.

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



Possible cause	Remedy
Reverse alarm faulty.	Renew.
Reverse alarm earth wire not connected or incorrectly connected.	Repair or renew wire.
Wire GB from reverse alarm switch to reverse alarm not connected or incorrectly connected.	Repair or renew wire.
Reverse alarm switch faulty.	Renew.
Wire R from reverse alarm switch to fuse not connected or incorrectly connected.	Repair or renew wire.

Electric wiring diagram for mode E-05

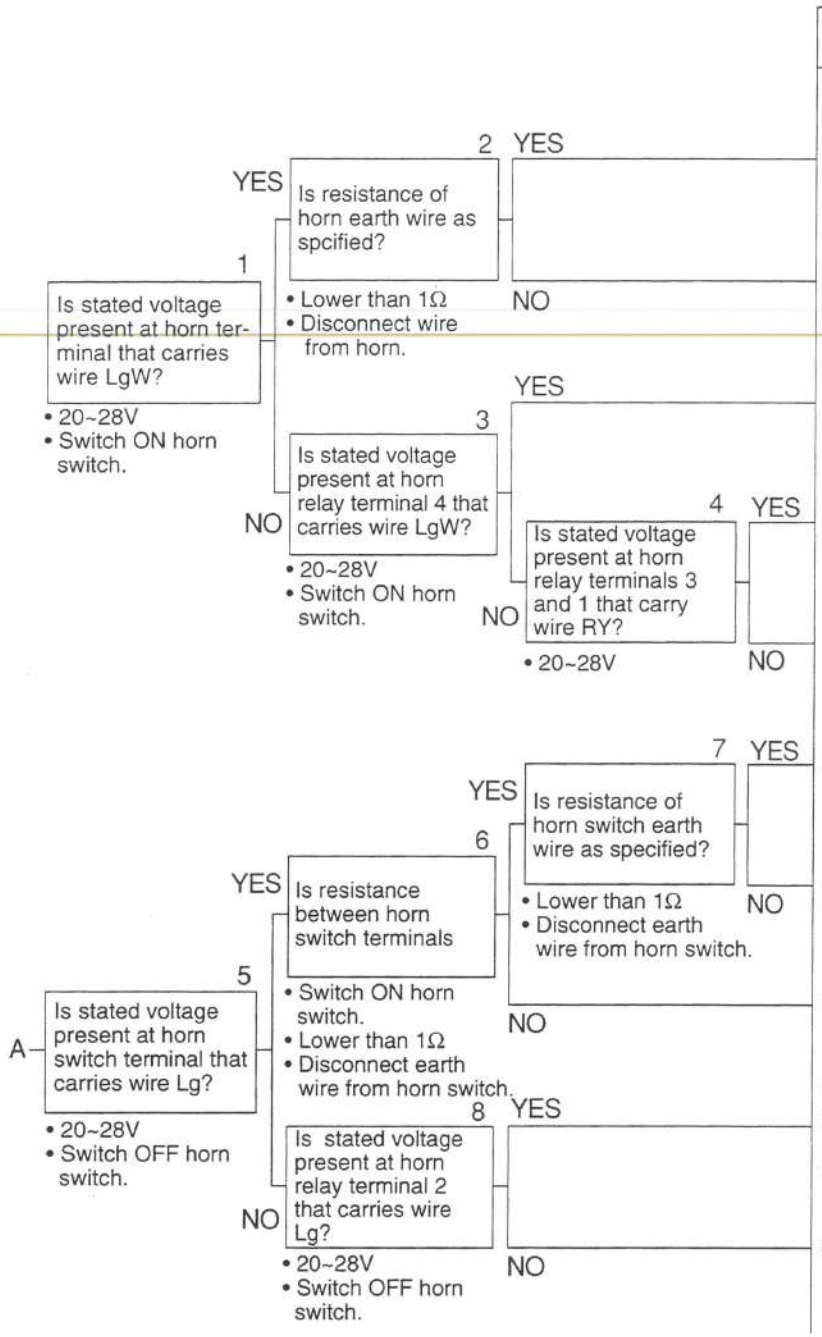


SV4004005

E-06 Horn does not sound

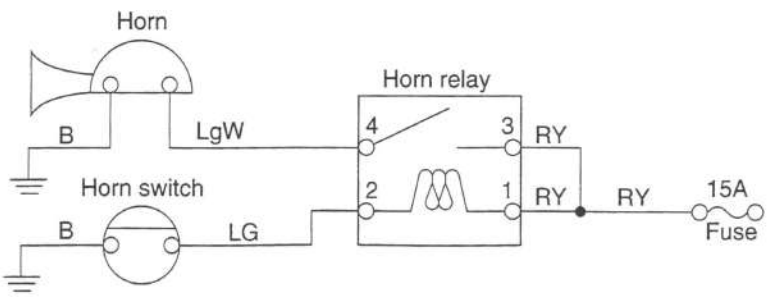
★First, check that fuse is not blown.

★Take the voltage measurement with the starter switch ON.



Possible cause	Remedy
Horn faulty.	Renew.
Horn earth wire not connected or incorrectly connected.	Repair or renew wire.
Wire LgW from horn to horn relay terminal 4 not connected or incorrectly connected.	Repair or renew wire.
To "A" on this page	
Wire RY from horn relay terminals 3 and 1 to fuse not connected or incorrectly connected.	Repair or renew wire.
Horn relay faulty.	Renew.
Horn switch earth wire not connected or incorrectly connected.	Repair or renew wire.
Horn switch faulty.	Renew.
Wire Lg from horn relay terminal 2 to horn switch not connected or incorrectly connected.	Repair or renew wire.
Horn relay faulty.	Renew.

Electric wiring diagram for mode E-06



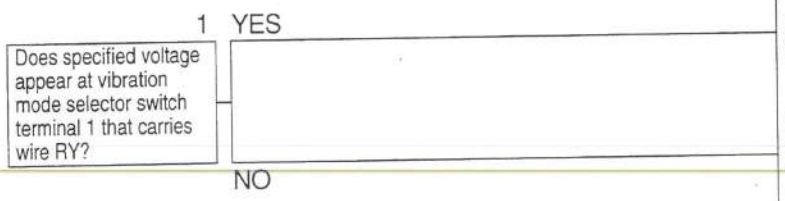
SV4004006

E-07 Vibrator does not operate

★Measure the voltage with the starter switch ON.

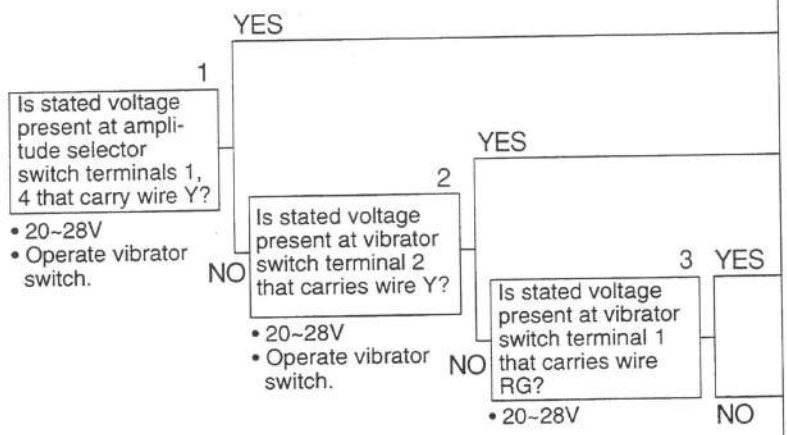
★First, check that fuse has not burnt.

a). Neither CONT mode nor MANUAL mode faulty.



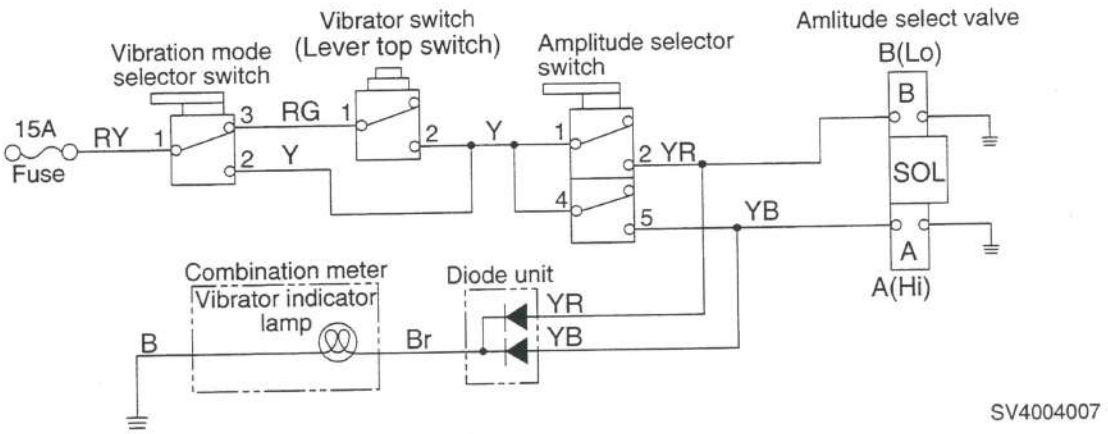
Possible cause	Remedy
Vibration mode selector switch faulty.	Renew.
Wire RY from fuse to vibratoion mode selector switch terminal 1 not connected or incorrectly connected (including fuse).	Repair or renew wire.

b). Both high and low amplitude modes are inopeative.

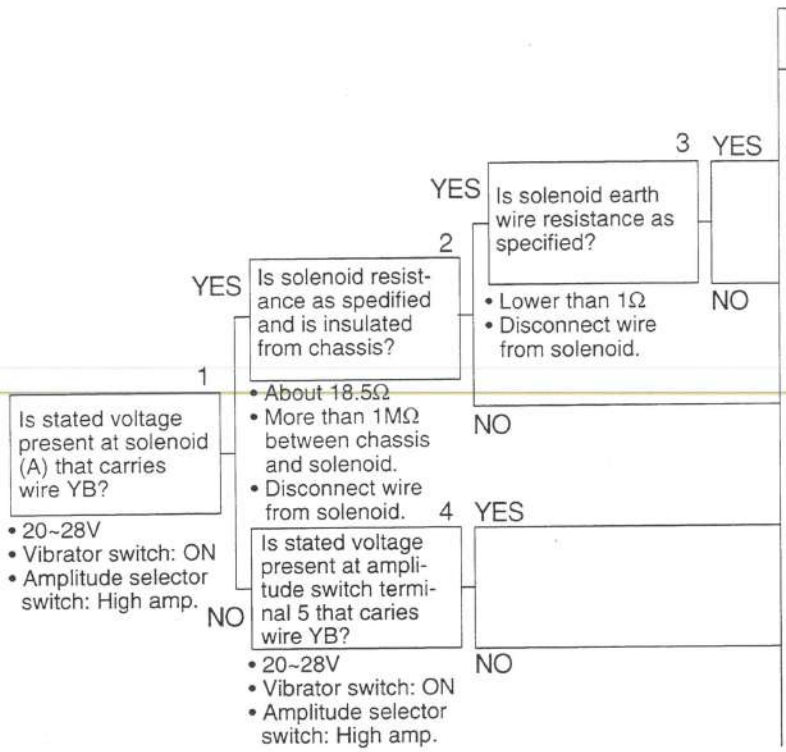


Possible cause	Remedy
Amplitude selector switch faulty.	Renew.
Wire Y from vibrator switch terminal 2 to amplitude selector switch terminals 1, 4 not connected or incorrectly connected.	Repair or renew wire.
Vibrator switch faulty.	Renew.
Wire RG from vibration mode selecter switch terminal 3 to vibrator switch terminal 1 not connected or incorrectly connected .	Repair or renew wire.

Electric wiring diagram for mode E-07

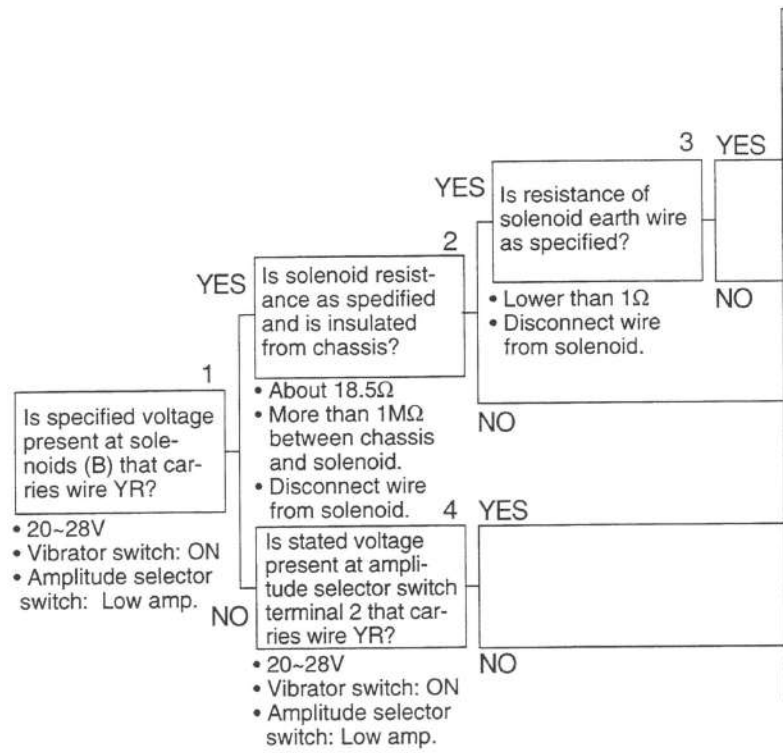


c). High amplitude mode is inoperative.



Possible cause	Remedy
Solenoid valve faulty (See H-06).	
Solenoid earth wire not connected or incorrectly connected.	Repair or renew wire.
Solenoid (A) faulty.	Renew.
Wire YB from amplitude selector switch terminal 5 to solenoid not connected or incorrectly connected.	Repair or renew wire.
Amplitude selector switch faulty.	Renew.

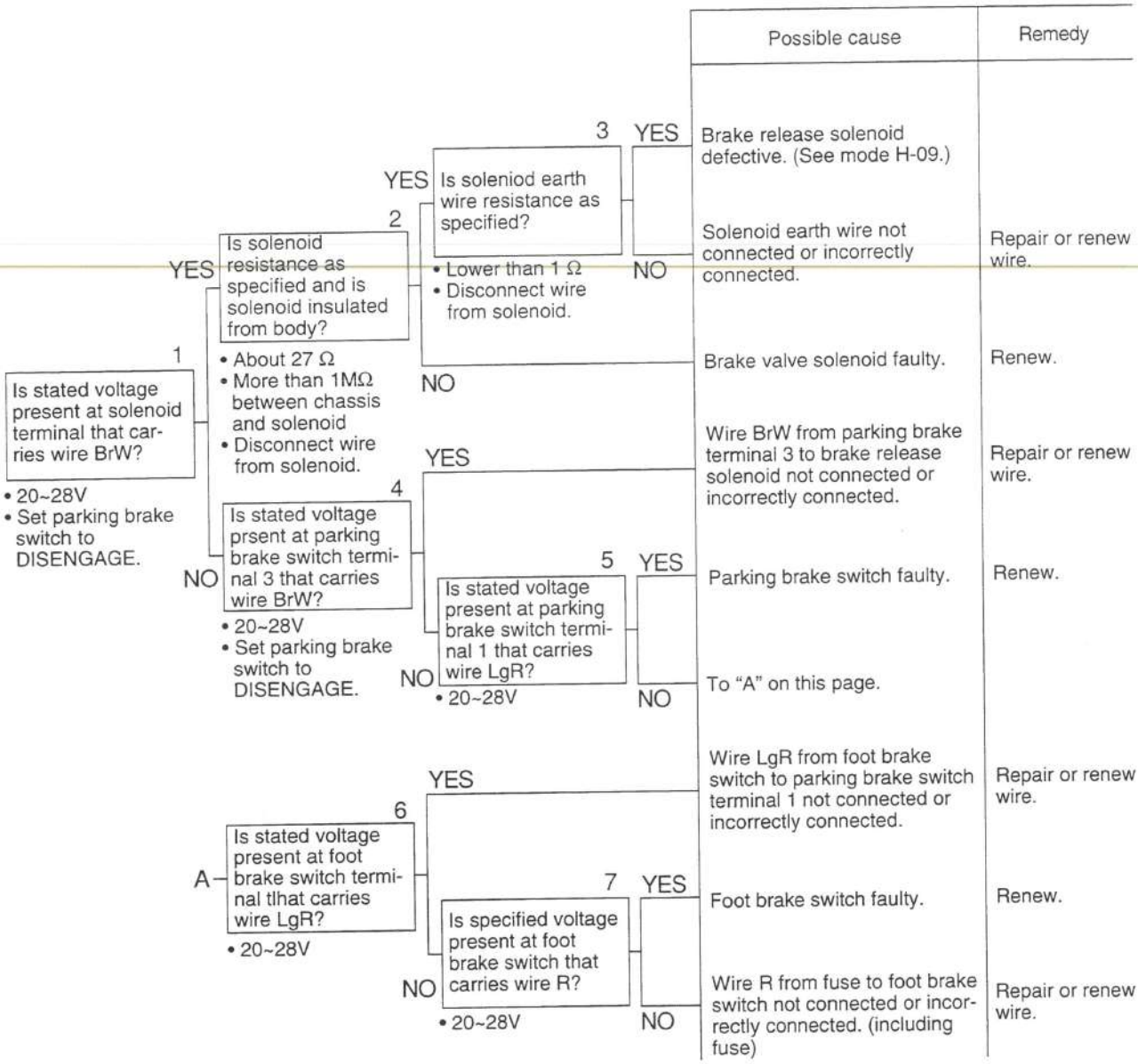
d). Low amplitude mode is inoperative.



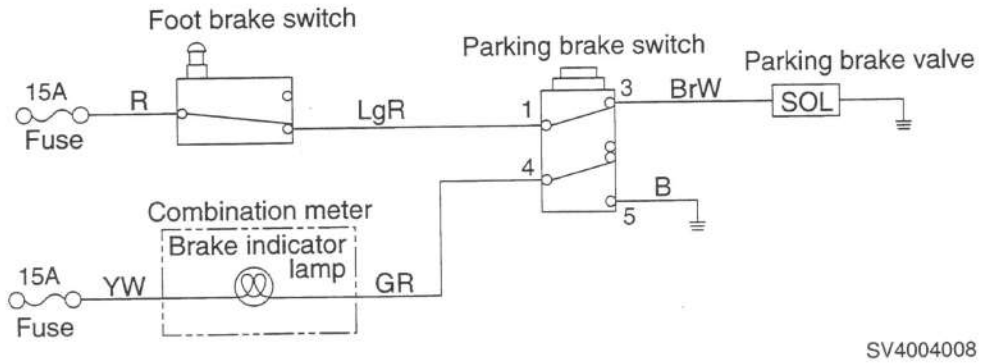
Possible cause	Remedy
Solenoid valve faulty (See H-06).	
Solenoid earth wire not connected or incorrectly connected.	Repair or renew wire.
Solenoid (B) faulty.	Renew.
Wire YR from amplitude selector switch terminal 2 to solenoid not connected or incorrectly connected.	Repair or renew wire.
Amplitude selector switch faulty.	Renew.

E-08 Parking brake not released

★First, check to see if fuse has burnt.
★Measure the voltage with the starter switch ON.
★Diagnose with the foot brake pedal not depressed.



Electric wiring diagram for mode E-08

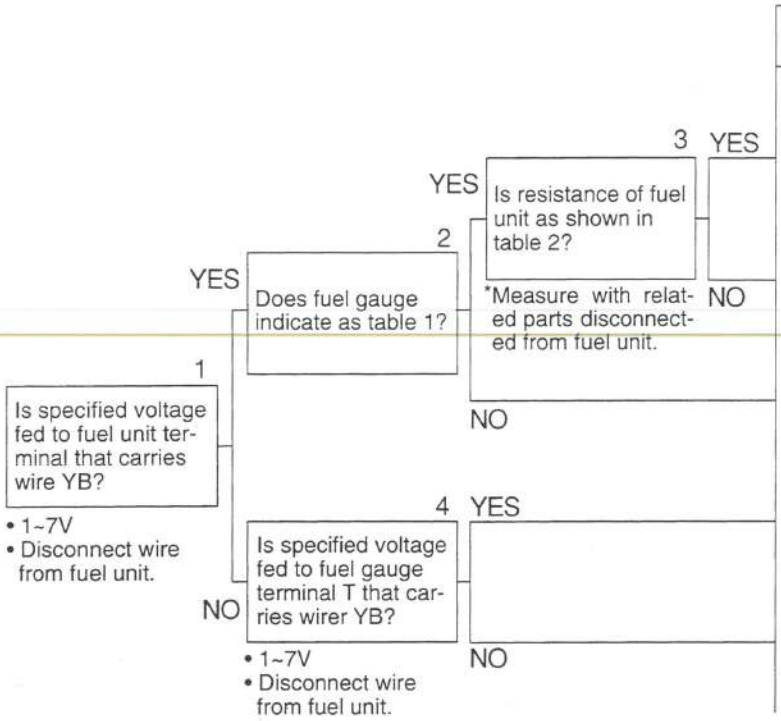


SV4004008

E-09 Fuel gauge reads wrong

★Other gauges and lamps are normal.

★Measure the voltage with the starter switch ON.



Possible cause	Remedy
Fuel unit earth wire is incorrectly connected or fuel unit malfunctions.	• Repair or renew wire. • Repair or renew fuel unit mounting.
Fuel unit is faulty.	Renew.
Fuel gauge faulty.	Renew.
Wire YB from fuel gauge to fuel unit not connected or incorrectly connected.	Repair or renew wire.
Fuel gauge faulty.	Renew.

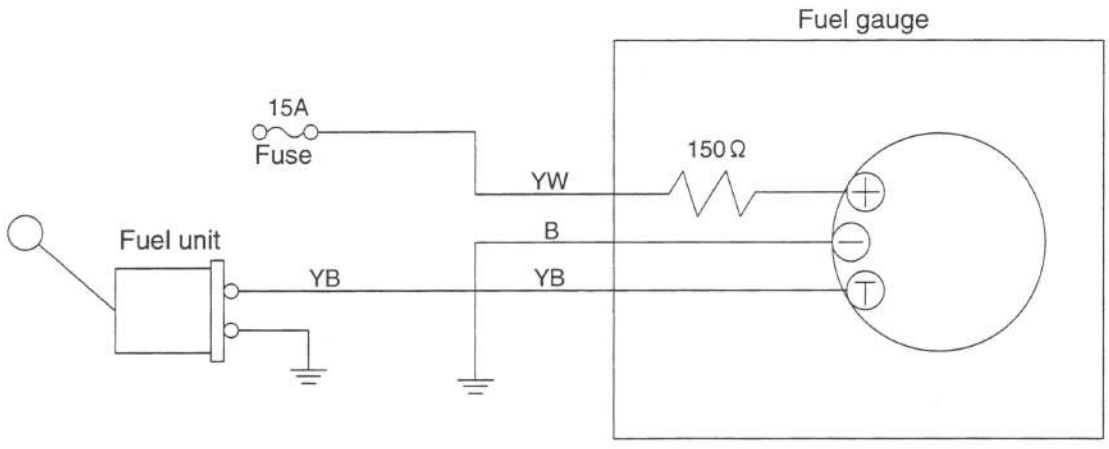
Table 1

Fuel unit wire YB	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-09



SV4004009

E-10 Coolant temperature gauge reads wrong

★Other gauges and lamps operate correctly.

★Measure the voltage with the starter switch ON.

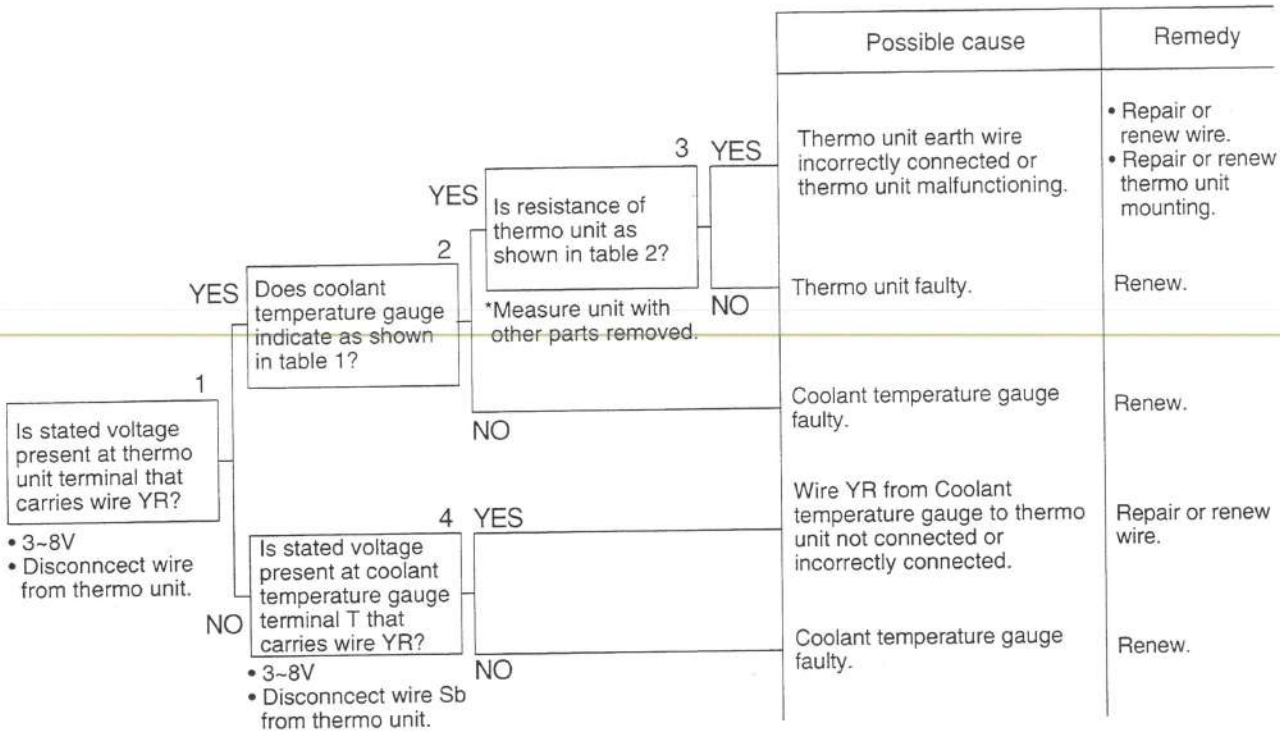


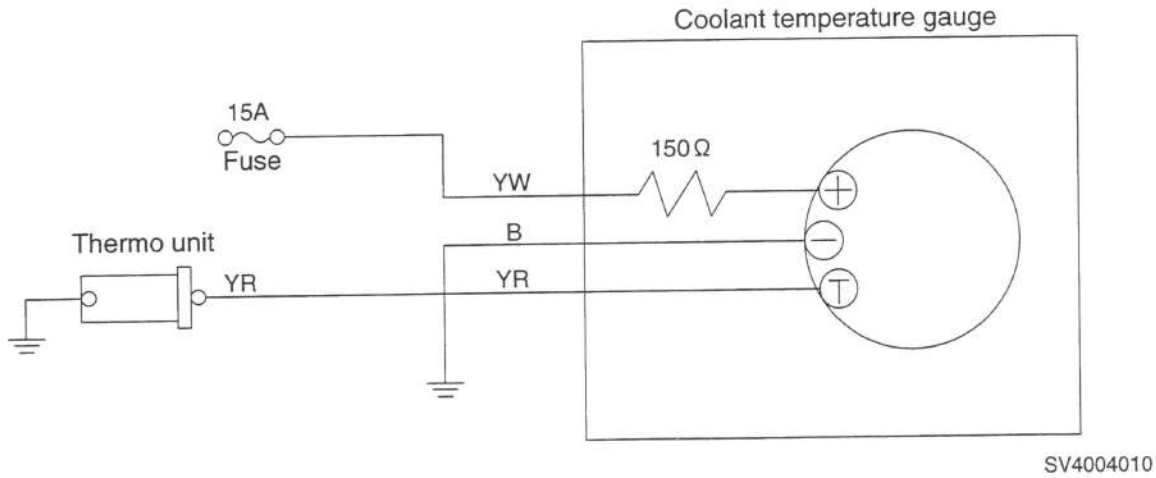
Table 1

Thermo unit terminal wire YR	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-10

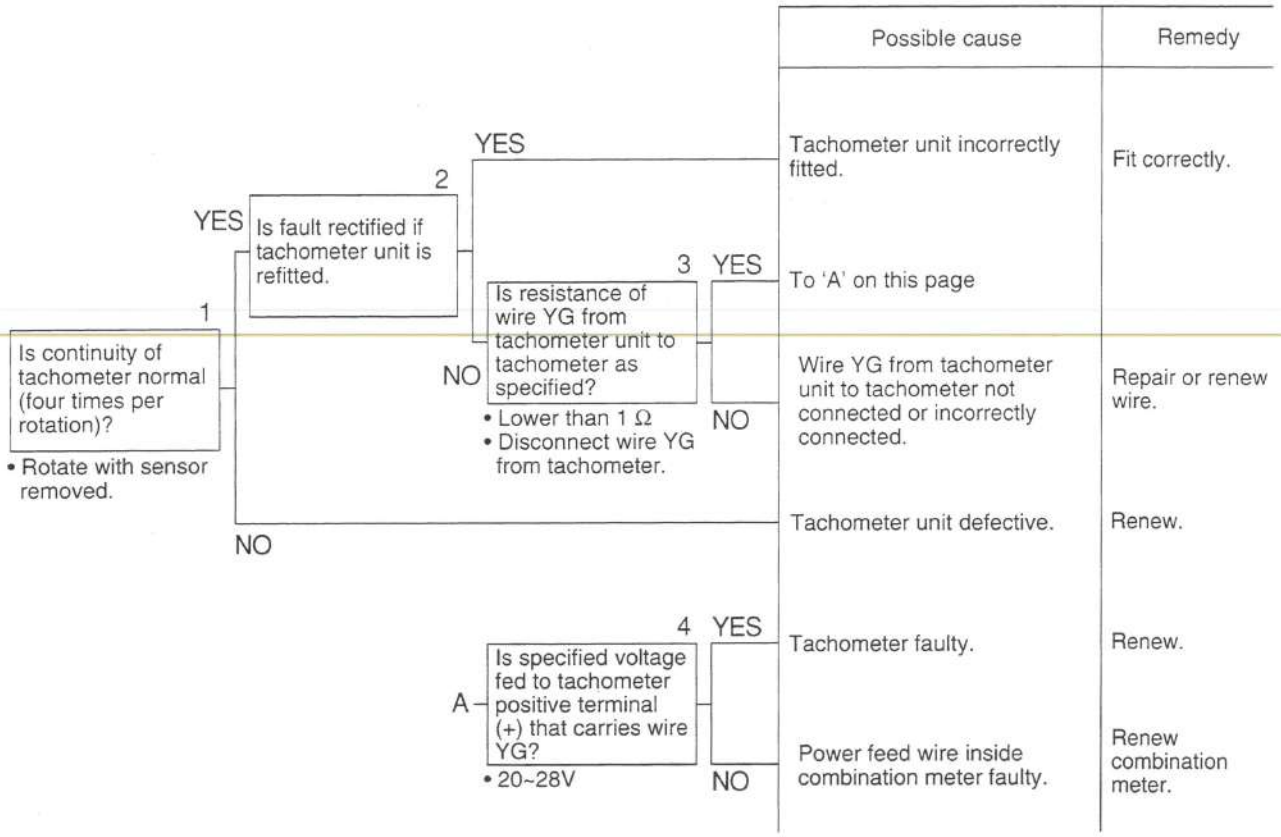


SV4004010

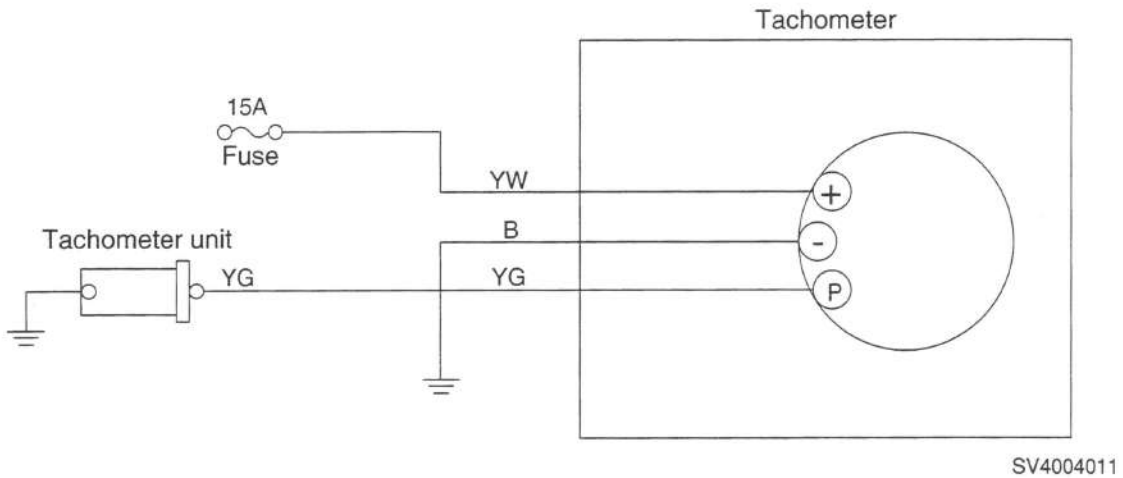
E-11 Tachometer reads wrong

★Other gauges and lamps operate correctly.

★Measure the voltage with the starter switch ON.



Electric wiring diagram for mode E-11

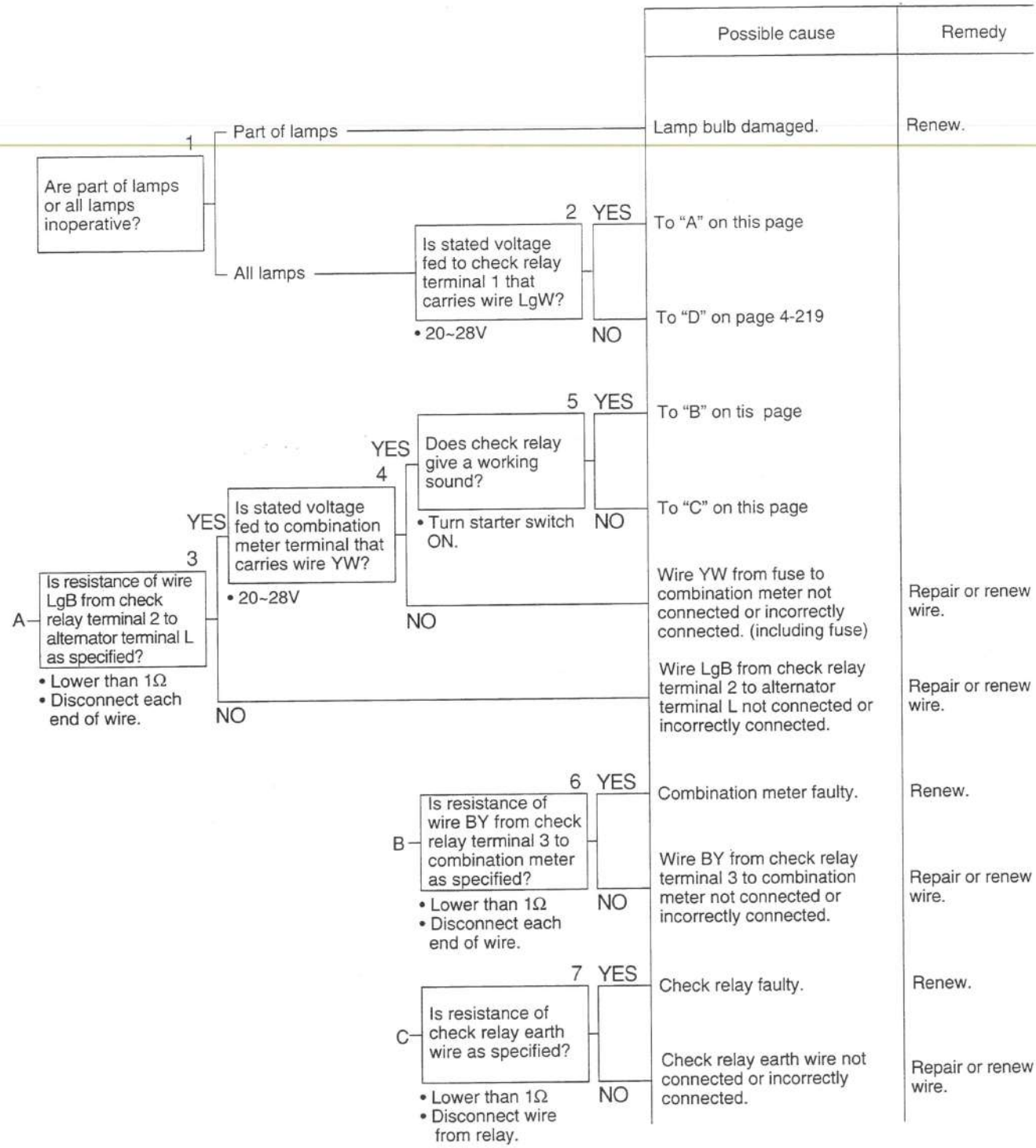


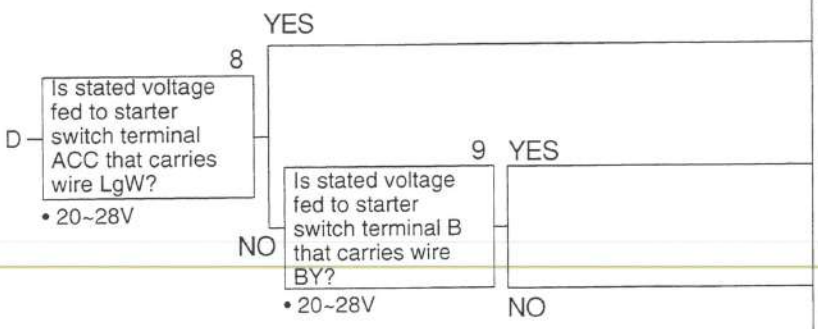
SV4004011

E-12 Charge warning lamp, engine oil pressure warning lamp, hydraulic oil filter warning lamp and parking brake indicator lamp do not come on with starter switch ON.

★These lamps illuminate only when the starter switch is turned to the ON position (for bulb failure check) and when unusual conditions have occurred.

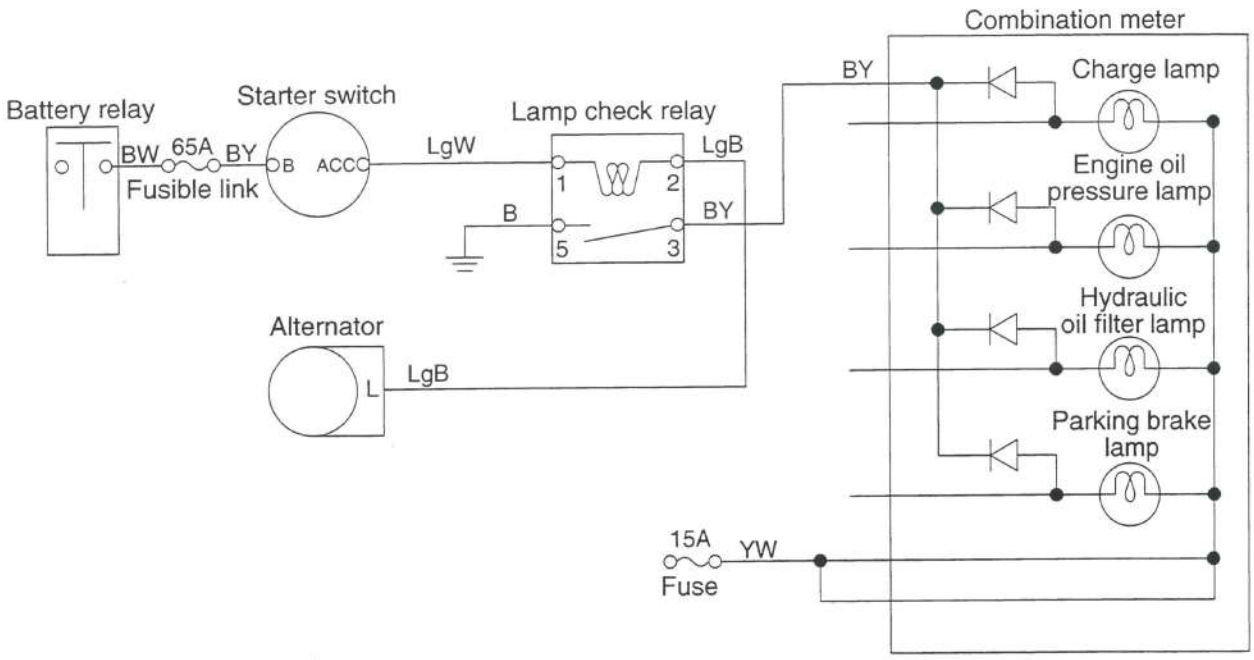
★Measure the voltage with the starter switch ON.





Possible cause	Remedy
Wire LgW from sarter switch terminal ACC to check relay terminal 1 not connected or incorrectly connected.	Repair or renew wire.
Starter switch faulty.	Renew.
Wire BY from starter switch terminal B to battery relay not connected or incorrectly connected.	Repair or renew wire.

Electric wiring diagram for mode E-12



SV4004012

MEMO

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

Fault modes for hydraulic and mechanic systems and source-of-trouble components ····· 4-402
H-01 Unusual sounds ····· 4-404
H-02 Hydraulic fluid too hot ····· 4-405
H-03 Machine not propelled ····· 4-406
H-04 Speed not gained or low traction ····· 4-410
H-05 Speed range not selected ····· 4-414
H-06 Vibrator inoperative ····· 4-415
H-07 Weak vibratory force ····· 4-416
H-08 Steering not performed ····· 4-417
H-09 Heavy or slow steering ····· 4-417
H-10 Poor parking brake function ····· 4-418
H-11 Parking brake not released ····· 4-418

Fault modes for hydraulic and mechanical systems and possible sources of troubles

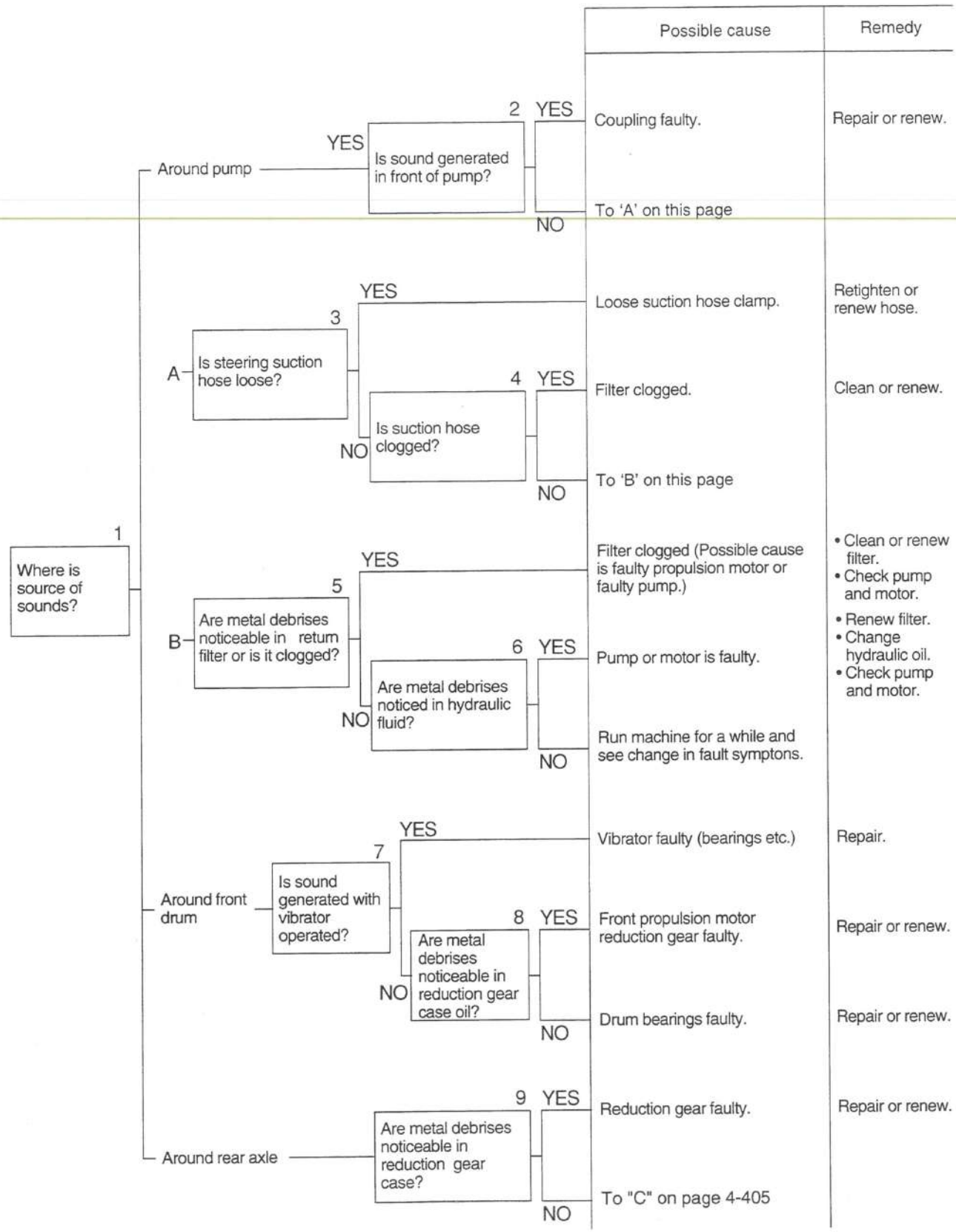
Possible source of trouble \ Fault mode				Unusual sounds	Hydraulic fluid too hot	Propulsion			
						Not propelled		Speed not gained or low traction	
						a) Forward and reverse	b) Either forward or reverse	a) Forward and reverse	b) Either forward or reverse
Propulsion	Propulsion pump		Inside of pump			●			
			Servo valve/servo linkage			●	●	●	●
			Multifunction valve				●		
			Charge relief valve			●		●	
	Rear drive	Motor	Inside of Motor			●		●	
			Control valve (speed range select)						
			Flushing valve			●		●	
		Rear axle	Reduction gear	●		●		●	
			Differential	●		●		●	
			Final drive	●		●		●	
			Parking brake			●		●	
	Brake valve					●		●	
	Brake cylinder					●		●	
	Front drive		Inside of motor			●		●	
			Reduction gear			●		●	
Vibrator	Pump		Pump						
			Amplitude select valve						
			High pressure relief valve						
			Charge relief valve			●		●	
	Motor unit								
	Vibrator			●					
Steering	Steering pump								
	Orbitrol (including pressure relief valve)								
	Steering cylinder								
	Steering mechanism								
	Steering column								
Others	Coupling			●		●			
	F-R lever linkage					●	●	●	
	Speed shift lever linkage							●	●
Clogged oil cooler					●				
Suction filter				●					
Diagnosis code				H-01	H-02	H-03a	H-03b	H-04a	H-04b

Propulsion	Vibrator				Steering		Parking brake	
Speed range not selected	Inoperative		Weak vibratory force					
	a) Neither low amp. nor high amp.	b) Either low amp. or high amp.	a) Neither low amp. nor high amp.	b) Either low amp. or high amp.	Not performed	Heavy or slow steering	Poor braking	Brake not released
								●
●	●		●					
●								
							●	●
								●
							●	●
	●	●	●	●				
	●	●	●	●				
		●		●				
●	●		●					●
	●		●					
	●		●					
					●	●		
					●	●		
					●	●		
					●	●		
						●		
	●				●			
●								
H-05	H-06a	H-06b	H-07a	H-07b	H-08	H-09	H-10	H-11

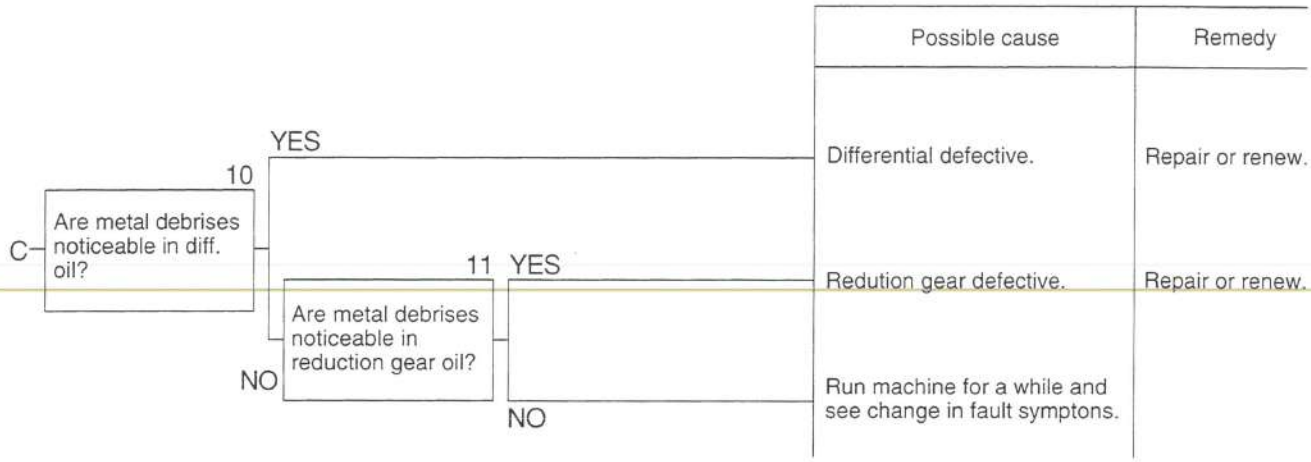
H-01 Unusual sounds

★Before diagnosis, check for oil level in the tank.

(1/2)

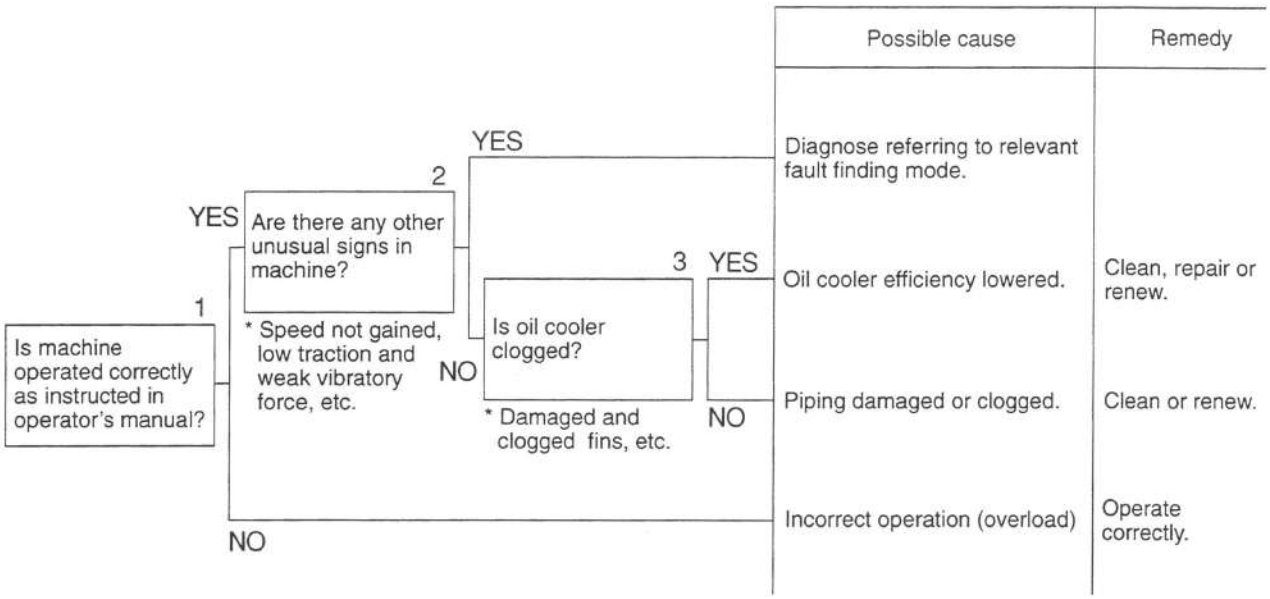


(2/2)



H-02 Hydraulic fluid too hot

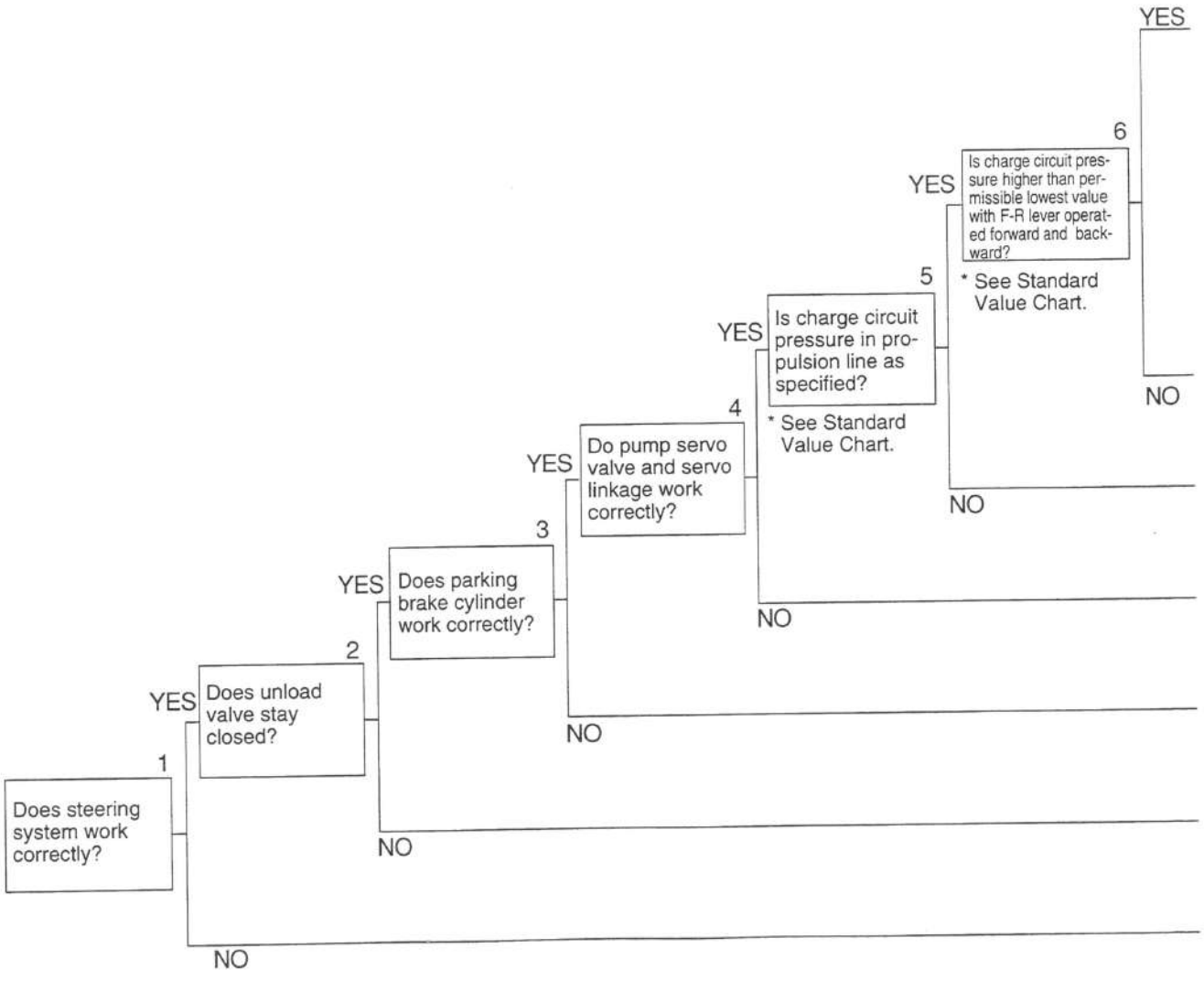
★Before diagnosis, check oil level in tank.

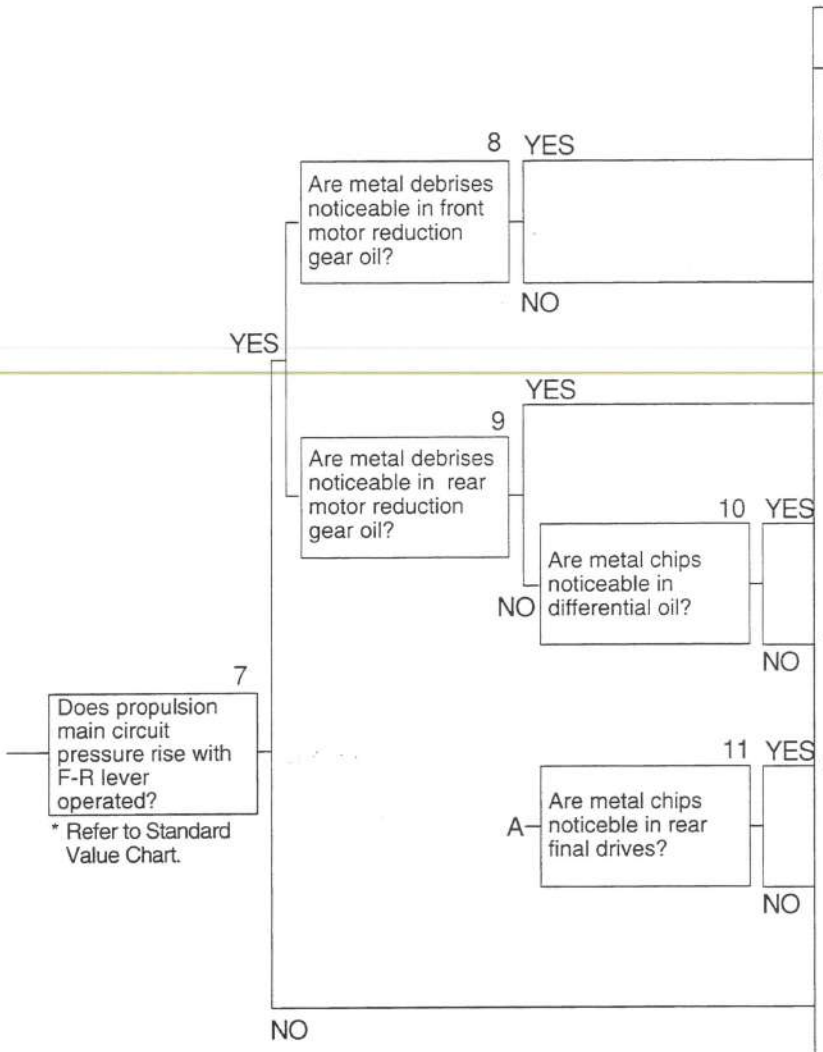


H-03 Not propelled

★Start with checking the oil level in the hydraulic tank.

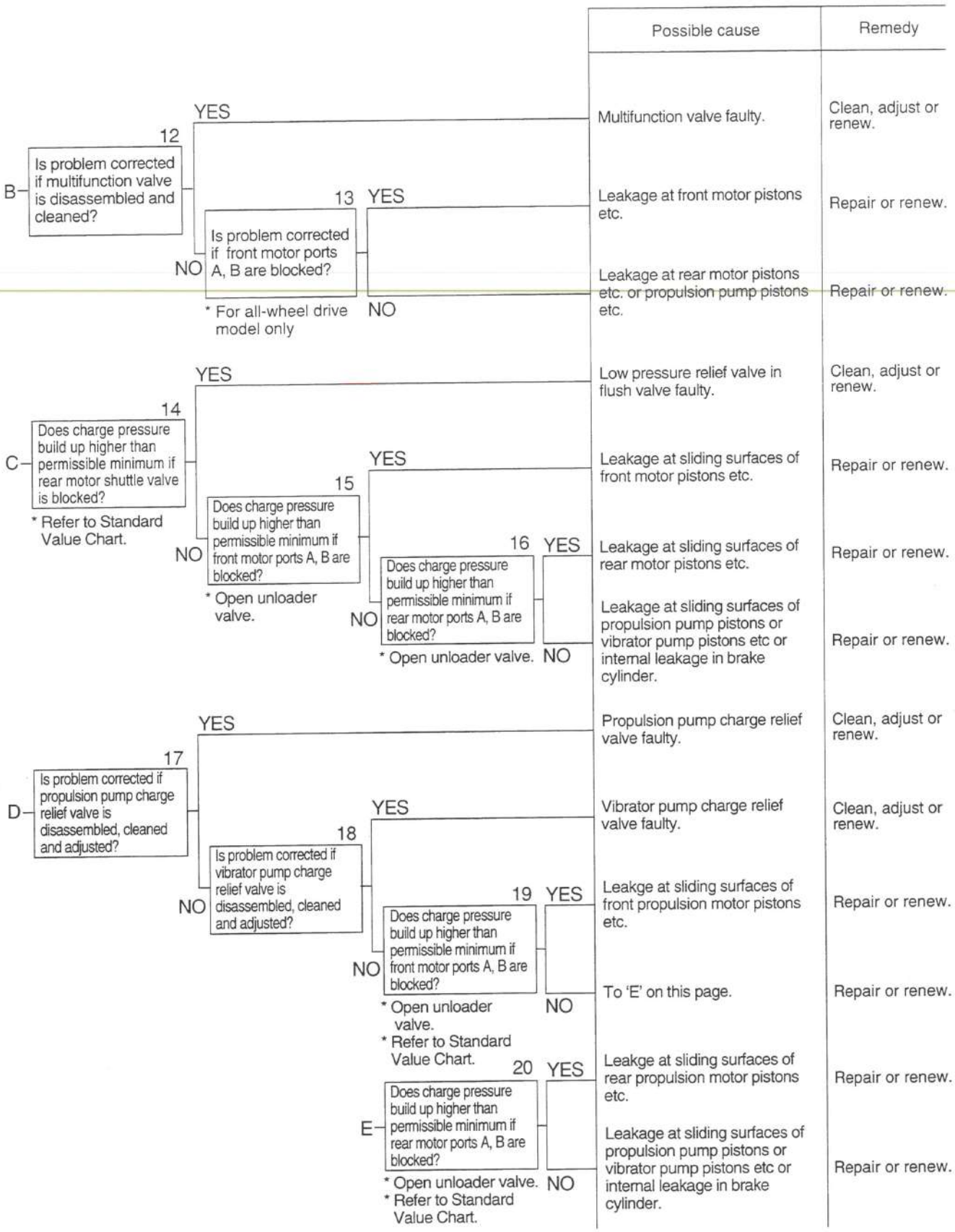
a) Not propelled in both directions (forward and backward).
(1/2)



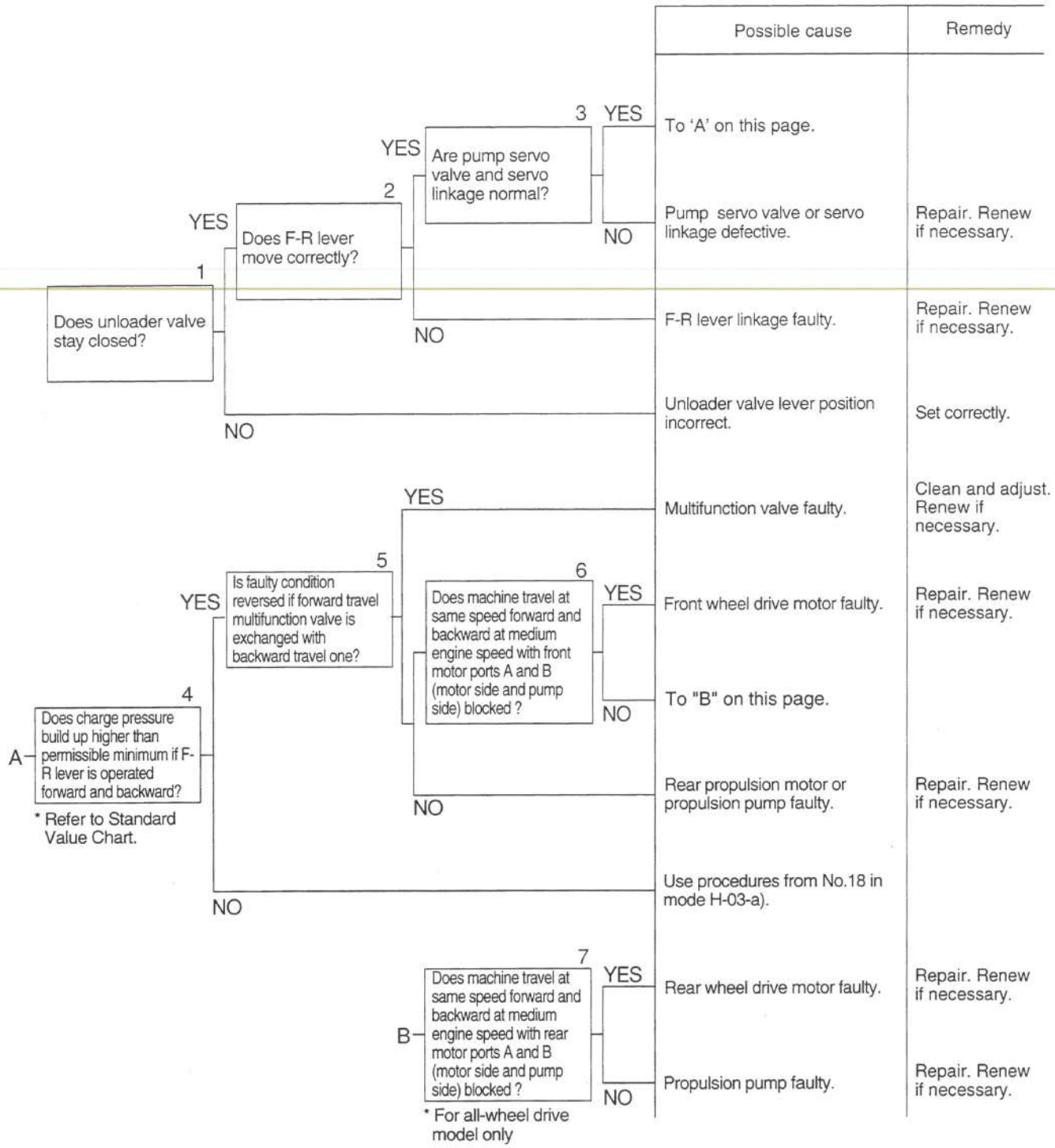


Possible cause	Remedy
Front motor reduction gear defective.	Repair or renew.
Front motor defective.	Repair or renew.
Rear reduction gear defective.	Repair or renew.
Differential damaged.	Repair or renew.
To 'A' on this page	
Rear final drives damaged.	Repair or renew.
Rear propulsion motor damaged.	Repair or renew.
To 'B' on page 4-408.	
To 'C' on page 4-408.	
To 'D' on page 4-408.	
Servo valve and servo linkage faulty.	Repair or renew.
Use procedures in "Parking brake not released". (H-11)	
Unload valve operated incorrectly.	Operate correctly.
Coupling or pump faulty.	Repair or renew.

(2/2)


Possible cause
Remedy
B
12
Is problem corrected if multifunction valve is disassembled and cleaned?
YES
Multifunction valve faulty.
Clean, adjust or renew.
13
Is problem corrected if front motor ports A, B are blocked?
YES
Leakage at front motor pistons etc.
Repair or renew.
NO
* For all-wheel drive model only
NO
Leakage at rear motor pistons etc. or propulsion pump pistons etc.
Repair or renew.
C
14
Does charge pressure build up higher than permissible minimum if rear motor shuttle valve is blocked?
* Refer to Standard Value Chart.
YES
Low pressure relief valve in flush valve faulty.
Clean, adjust or renew.
15
Does charge pressure build up higher than permissible minimum if front motor ports A, B are blocked?
YES
Leakage at sliding surfaces of front motor pistons etc.
Repair or renew.
NO
* Open unloader valve.
16
Does charge pressure build up higher than permissible minimum if rear motor ports A, B are blocked?
YES
Leakage at sliding surfaces of rear motor pistons etc.
Repair or renew.
NO
* Open unloader valve.
NO
Leakage at sliding surfaces of propulsion pump pistons or vibrator pump pistons etc or internal leakage in brake cylinder.
Repair or renew.
D
17
Is problem corrected if propulsion pump charge relief valve is disassembled, cleaned and adjusted?
YES
Propulsion pump charge relief valve faulty.
Clean, adjust or renew.
18
Is problem corrected if vibrator pump charge relief valve is disassembled, cleaned and adjusted?
YES
Vibrator pump charge relief valve faulty.
Clean, adjust or renew.
NO
19
Does charge pressure build up higher than permissible minimum if front motor ports A, B are blocked?
YES
Leakge at sliding surfaces of front propulsion motor pistons etc.
Repair or renew.
NO
* Open unloader valve.
* Refer to Standard Value Chart.
NO
To 'E' on this page.
Repair or renew.
E
20
Does charge pressure build up higher than permissible minimum if rear motor ports A, B are blocked?
YES
Leakge at sliding surfaces of rear propulsion motor pistons etc.
Repair or renew.
* Open unloader valve.
* Refer to Standard Value Chart.
NO
Leakage at sliding surfaces of propulsion pump pistons or vibrator pump pistons etc or internal leakage in brake cylinder.
Repair or renew.

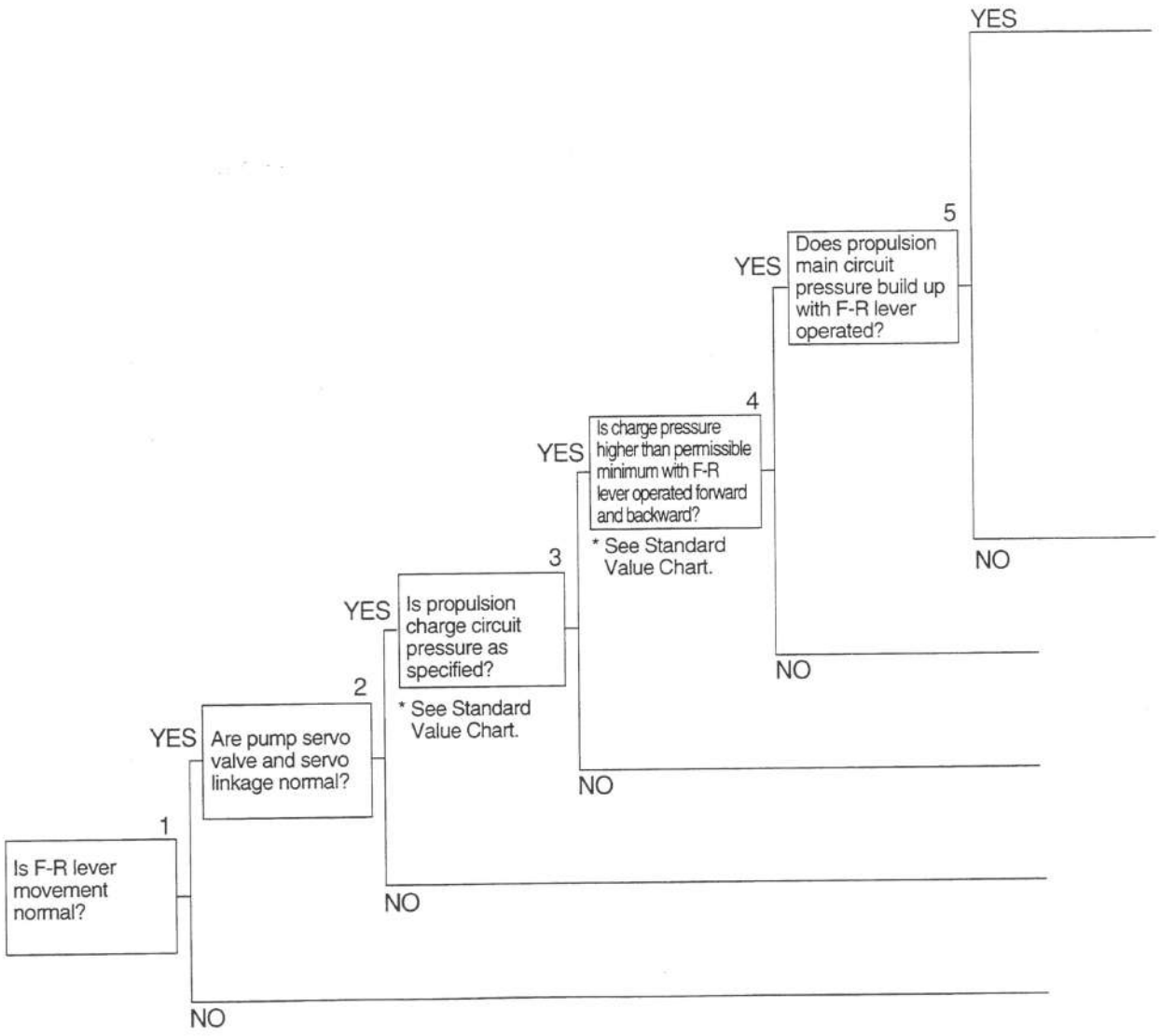
b) Machine travels in one direction alone (forward or backward).

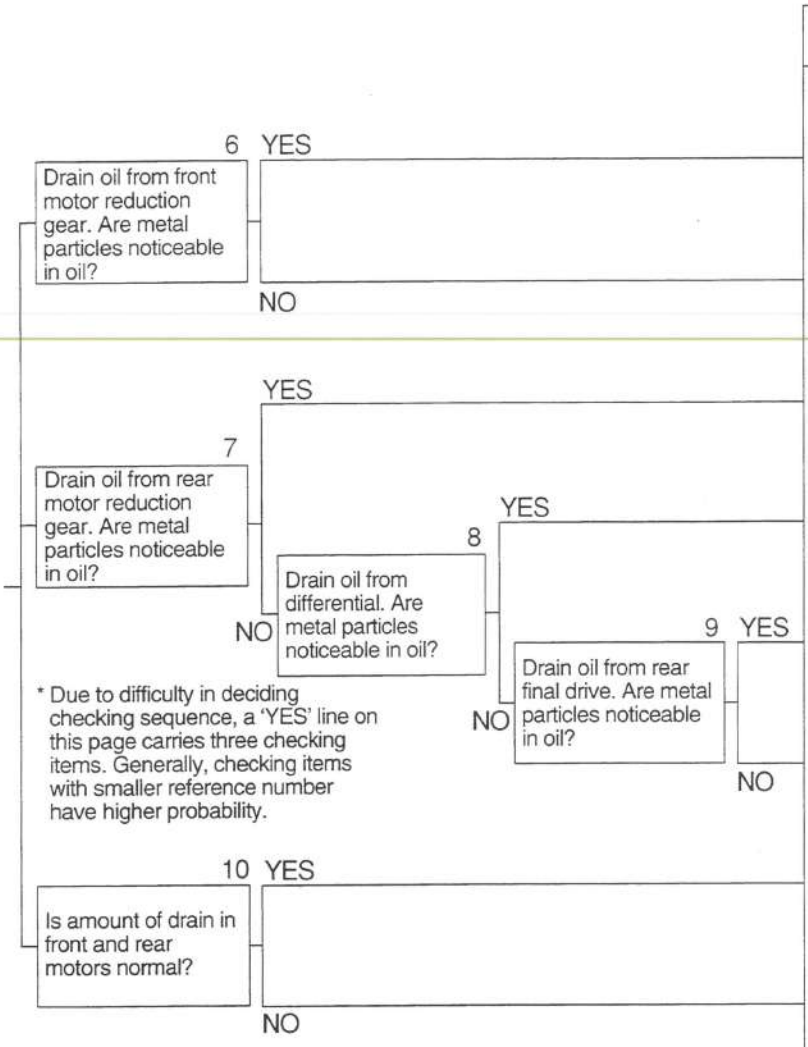


H-04 Travel speed not gained or low traction

★Check oil level in the hydraulic tank before proceeding to the following procedures.

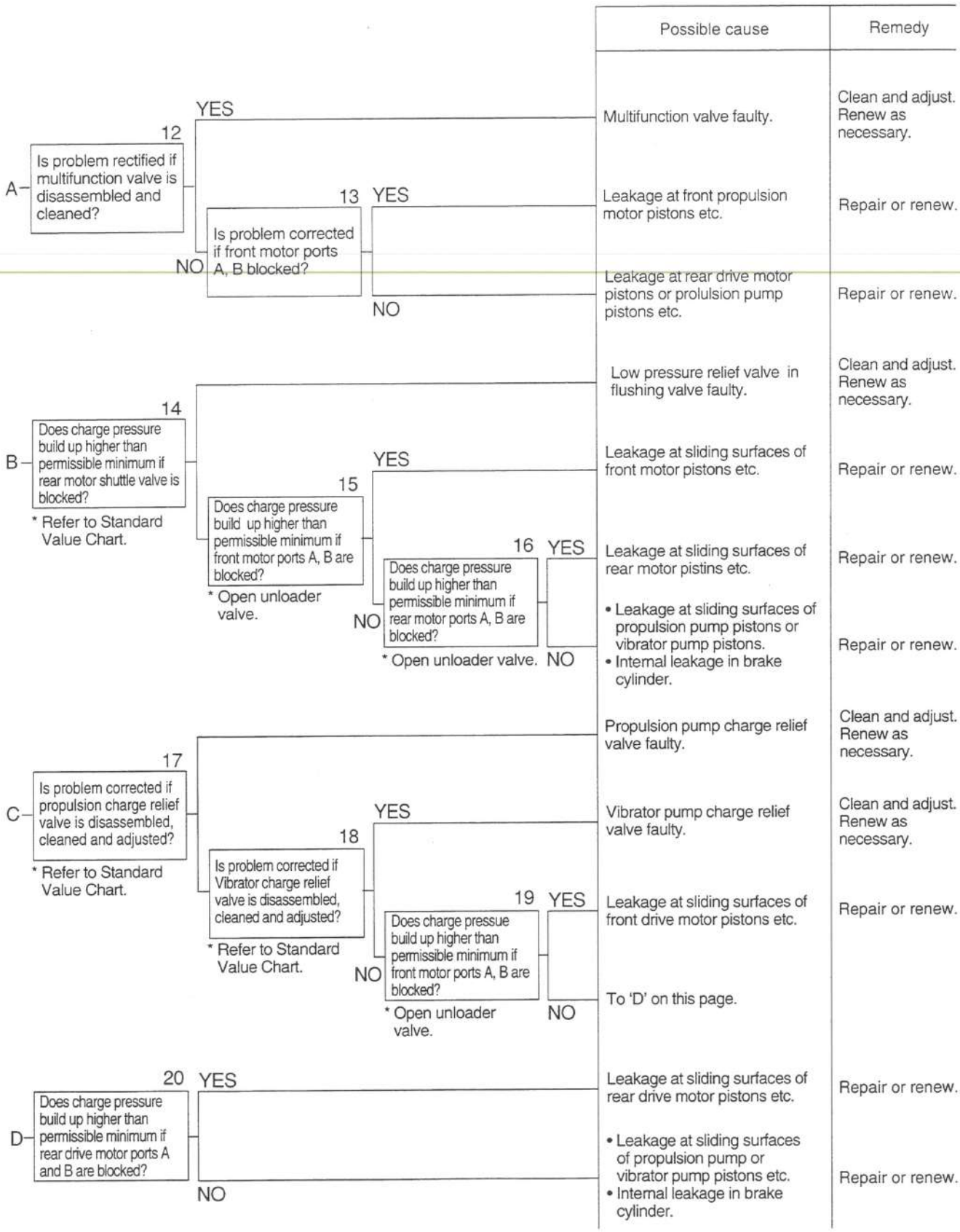
a) Speed not gained in both travel directions.
(1/2)



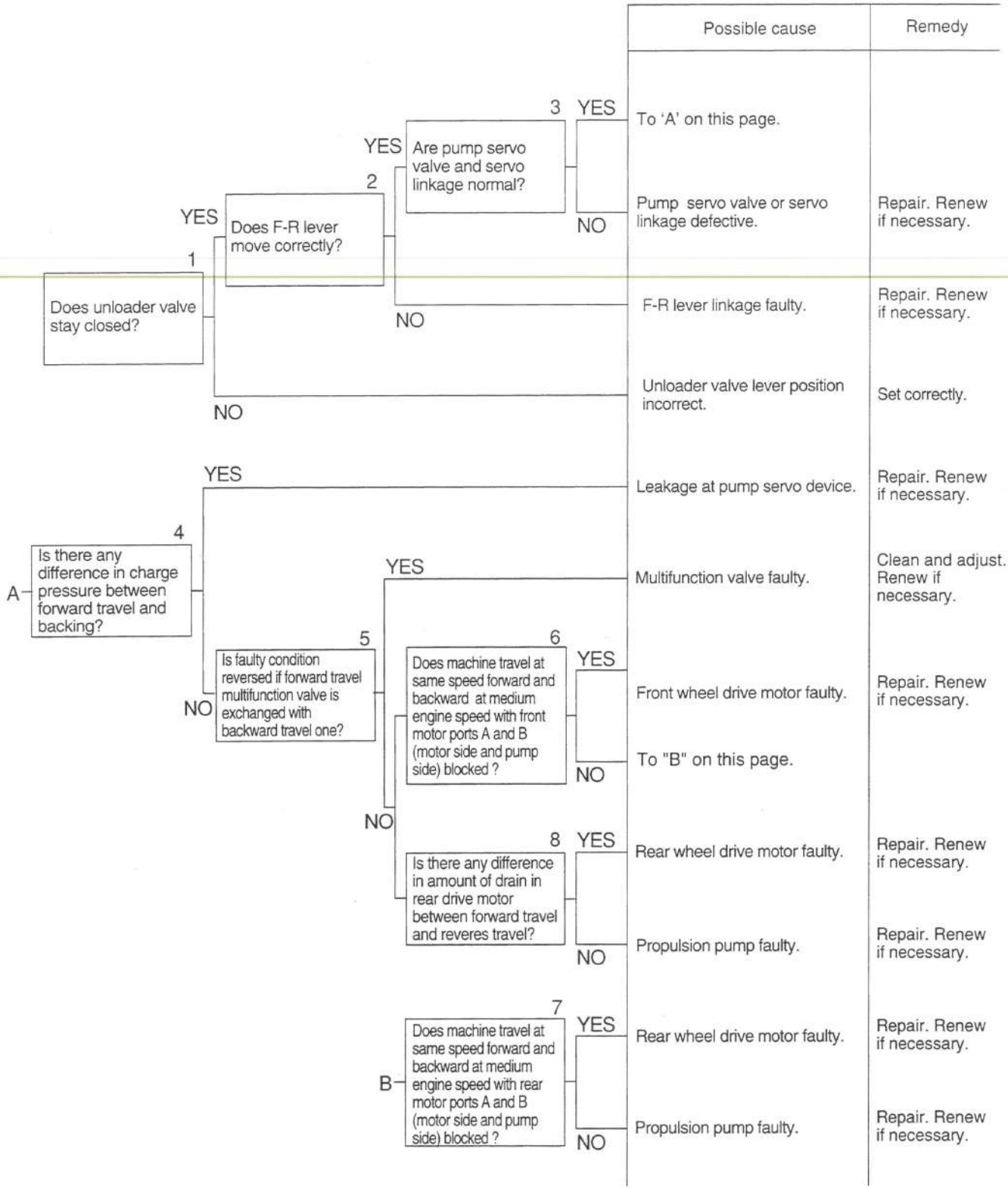


Possible cause	Remedy
Front wheel drive motor recuction gear damaged.	Repair. Renew as necessary.
Front drive motor damaged.	Repair. Renew as necessary.
Rear drive motor reduction gear damaged.	Repair. Renew as necessary.
Differential faulty.	Repair. Renew as necessary.
Rear final drive faulty.	Repair. Renew as necessary.
Rear motor damaged.	Repair. Renew as necessary.
Propulsion pump performance lowered.	Repair. Renew as necessary.
Propulsion motor performance lowered.	Repair. Renew as necessary.
To 'A' on page 4-412.	
To 'B' on page 4-412.	
To 'C' on page 4-412.	
Servo valve or servo linkage faulty.	Repair. Renew as necessary.
Unloader valve incorrectly operated.	Operte correctly.

(2/2)

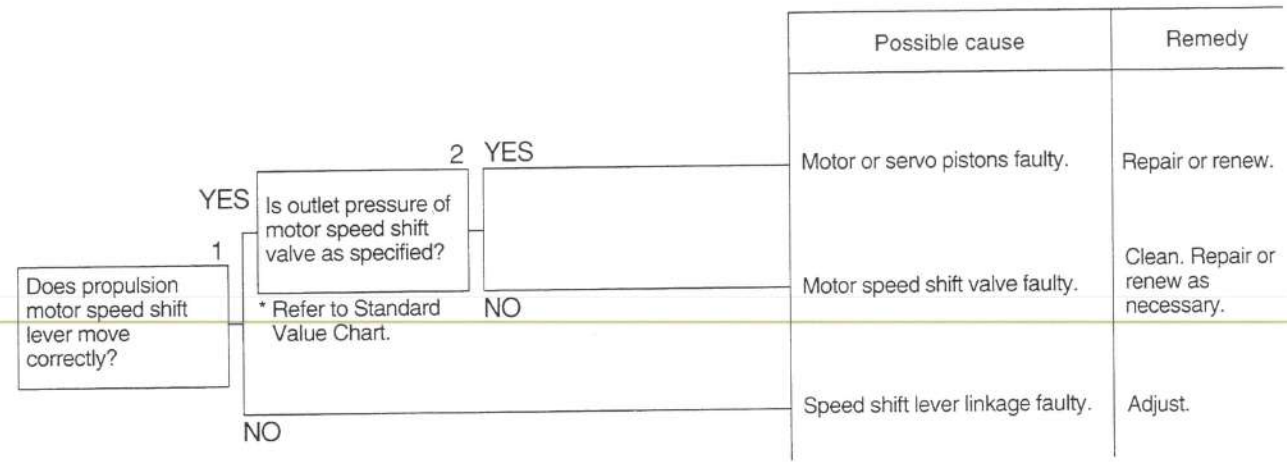

Possible cause
Remedy
A
12
Is problem rectified if multifunction valve is disassembled and cleaned?
YES
Multifunction valve faulty.
Clean and adjust. Renew as necessary.
NO
13
Is problem corrected if front motor ports A, B blocked?
YES
Leakage at front propulsion motor pistons etc.
Repair or renew.
NO
Leakage at rear drive motor pistons or prolulsion pump pistons etc.
Repair or renew.
B
14
Does charge pressure build up higher than permissible minimum if rear motor shuttle valve is blocked?
* Refer to Standard Value Chart.
Low pressure relief valve in flushing valve faulty.
Clean and adjust. Renew as necessary.
YES
15
Does charge pressure build up higher than permissible minimum if front motor ports A, B are blocked?
* Open unloader valve.
Leakage at sliding surfaces of front motor pistons etc.
Repair or renew.
NO
16
Does charge pressure build up higher than permissible minimum if rear motor ports A, B are blocked?
* Open unloader valve.
YES
Leakage at sliding surfaces of rear motor pistins etc.
Repair or renew.
NO
• Leakage at sliding surfaces of propulsion pump pistons or vibrator pump pistons.
• Internal leakage in brake cylinder.
Repair or renew.
C
17
Is problem corrected if propulsion charge relief valve is disassembled, cleaned and adjusted?
* Refer to Standard Value Chart.
Propulsion pump charge relief valve faulty.
Clean and adjust. Renew as necessary.
YES
18
Is problem corrected if Vibrator charge relief valve is disassembled, cleaned and adjusted?
* Refer to Standard Value Chart.
Vibrator pump charge relief valve faulty.
Clean and adjust. Renew as necessary.
NO
19
Does charge pressue build up higher than permissible minimum if front motor ports A, B are blocked?
* Open unloader valve.
YES
Leakage at sliding surfaces of front drive motor pistons etc.
Repair or renew.
NO
To 'D' on this page.
D
20
Does charge pressure build up higher than permissible minimum if rear drive motor ports A and B are blocked?
YES
Leakage at sliding surfaces of rear drive motor pistons etc.
Repair or renew.
NO
• Leakage at sliding surfaces of propulsion pump or vibrator pump pistons etc.
• Internal leakage in brake cylinder.
Repair or renew.

b) Speed not gained or low traction in either forward or backward travel.



H-05 Speed range not selected

★Check the oil level in the hydraulic tank before proceeding to the following procedures.

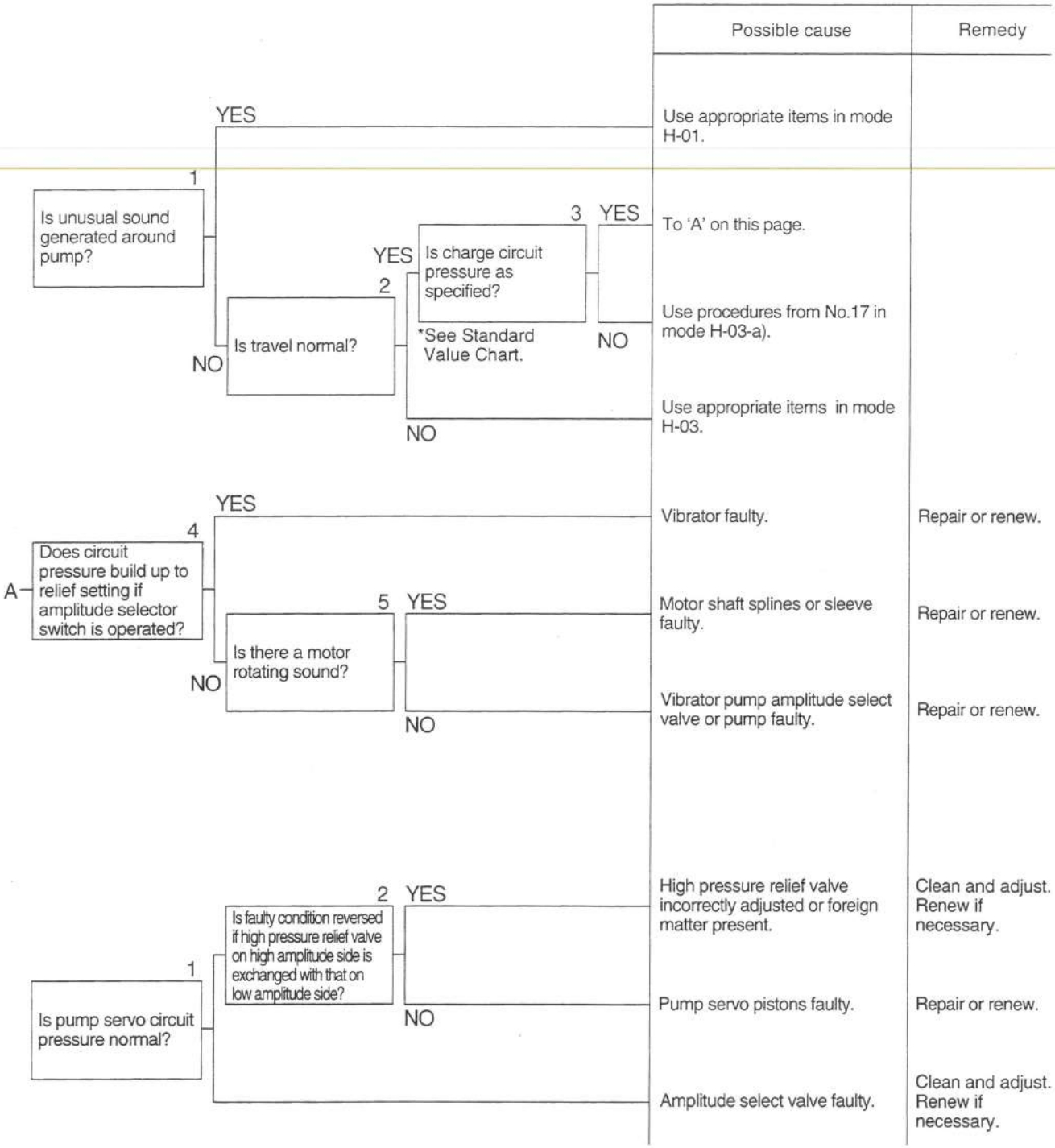


H-06 Vibrator does not work

★Diagnose electric systems first. If they are normal, then use procedures as instructed below:

★Check the oil level in the hydraulic tank before proceeding to the following procedures.

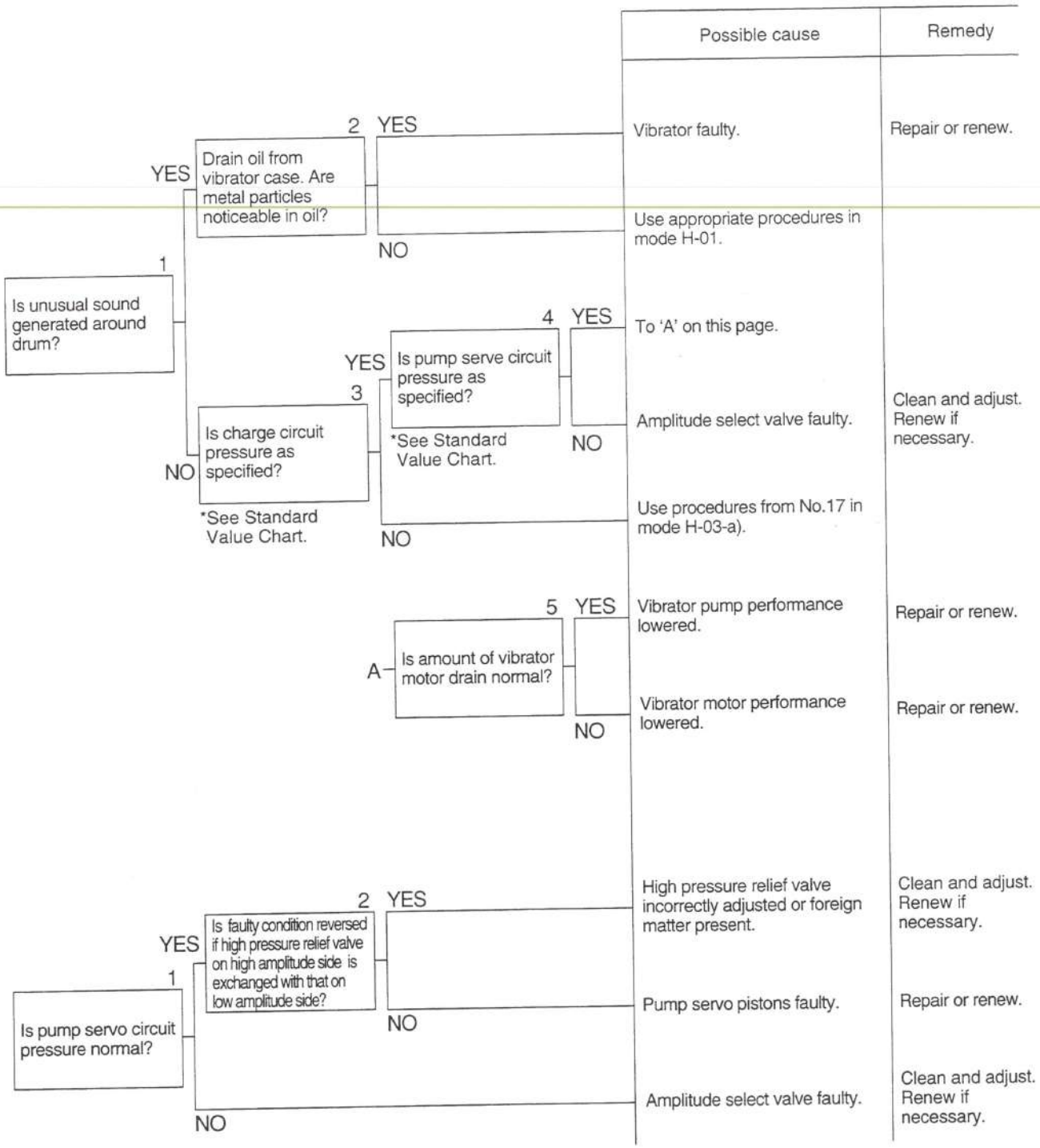
a) Both high and low amplitude modes are inoperative.



H-07 Weak vibratory force

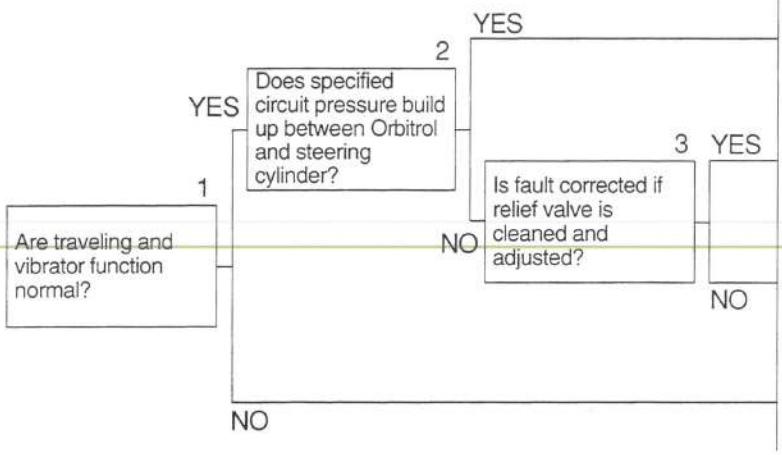
★Diagnose the electric systems first. If they are normal, use procedures as follows:
★Check the oil level in the hydraulic tank before proceeding to the following procedures.

a) Both high and low amplitude modes are faulty.



H-08 Steering not performed

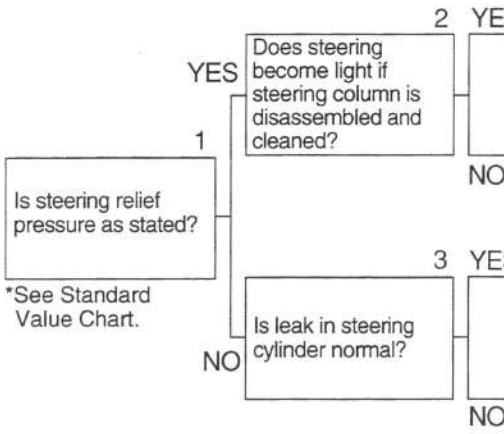
★Start with checking the oil level in the hydraulic tank.



Possible cause	Remedy
Steering system malfunctioning or steering cylinder fouling.	Repair or renew.
Steering relief valve faulty.	Clean and adjust. Renew if necessary.
Internal leakge in steering cylinder or steering pump faulty.	Repair or renew.
Pump coupling faulty.	Repair or renew.

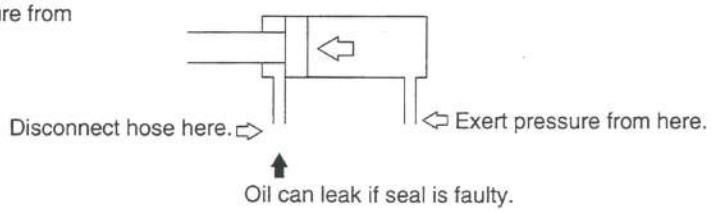
H-09 Heavy or slow steering

★Start with checking the oil level in the hydraulic tank.



Possible cause	Remedy
Streering column faulty.	Clean and adjust. Renew as necessary.
Steering mechanism in chassis malfunctions.	Repair.
Orbitrol relief valve setting lowered or foreign matter present or steering pump performance lowered.	Clean. Renew if necessary.
Steering cylinder faulty.	Repair. Renew if necessary.

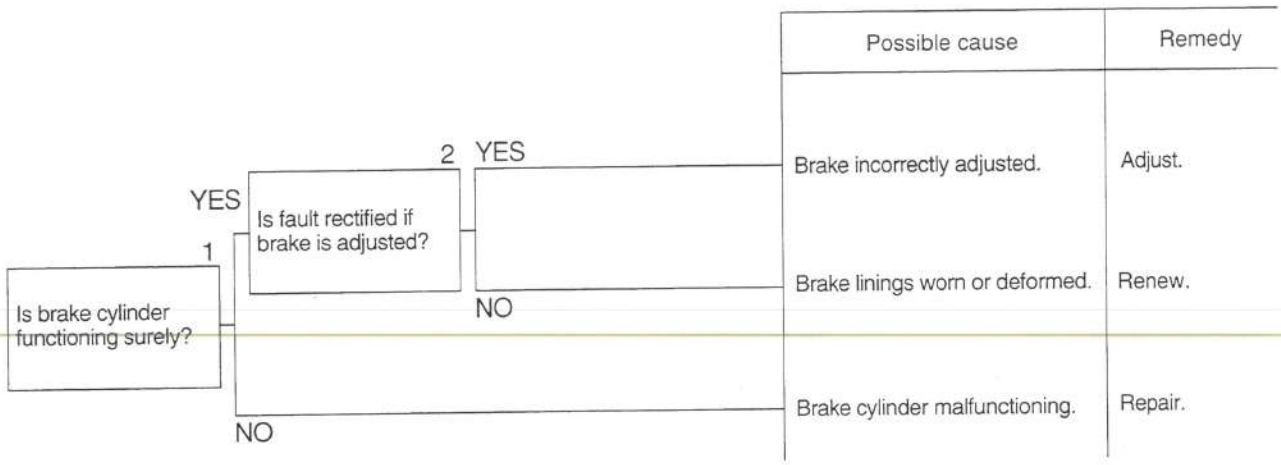
*Fully extend the steering piston rod, disconnect hose from piston rod side. Exert pressure from cylinder head side.



H-10 Parking brake not applied sufficiently

★Diagnose electric systems first. If they are normal, then use procedures stated as below:

★Start with checking the oil level in the hydraulic tank.



H-11 Parking brake not released

★Diagnose electric systems first. If they are normal, then use procedures stated as below:

★Start with checking the oil level in the hydraulic tank.