SHOP MANUAL

KOMATSU

PW200-7H
PW220-7H

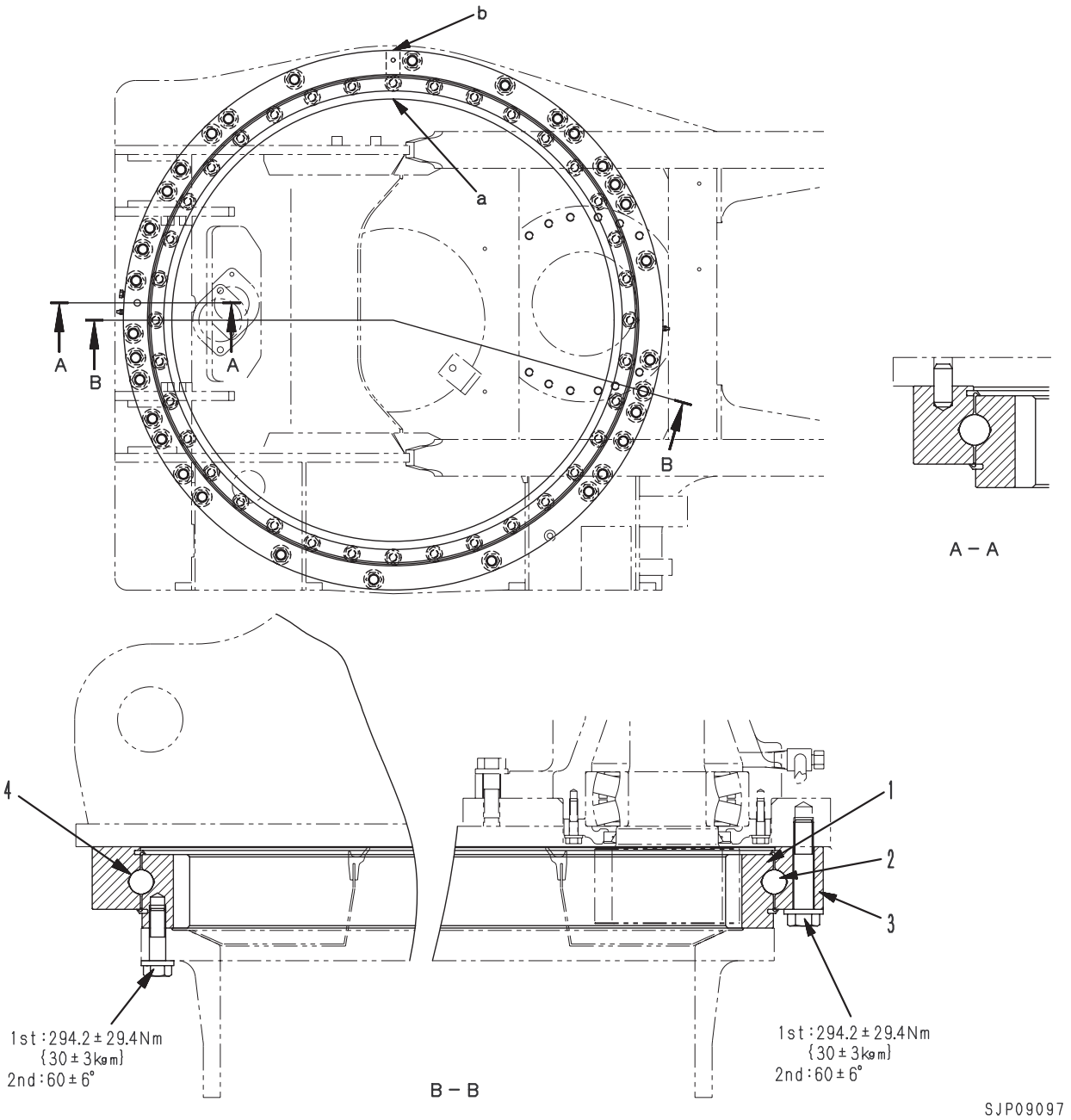
MACHINE MODEL	SERIAL NUMBER
PW200-7H	**H50051 AND UP**
PW220-7H	**H50051 AND UP**

- This shop manual may contain attachments and optional equipment that are not available in your area. Please consult your local Komatsu distributor for those items you may require.
  Materials and specifications are subject to change without notice.
- PW200/PW220-7H mount the SAA6D102E-2 engine.
  For details of the engine, see the 102 Series Engine Shop Manual.

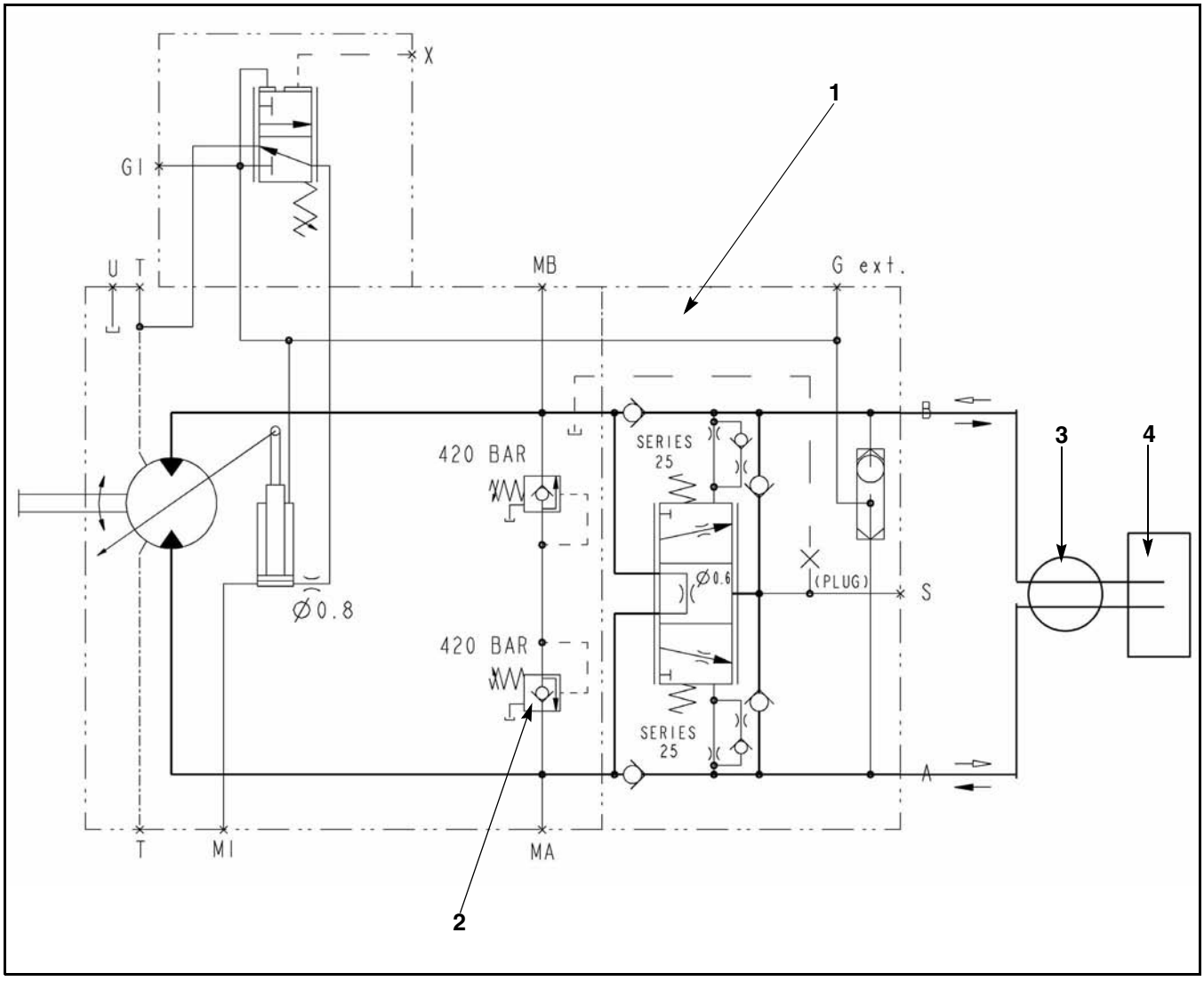
Printed in Europe

Machine model						PW200-7		PW220-7
Serial Number						H50051 and up		
Engine	Model Type No. of cylinders - bore x stroke Piston displacement			mm l {cc}		SAA6D102E-2-A 4-cycle, water-cooled, in-line, vertical, direct injection, with turbo charger 6 - 102 x 120 5.883 {5,883}		
	Performance	Flywheel horsepower Max. torque Max. speed at no load Min. speed at no load Min. fuel consumption		kW/rpm {HP/rpm} Nm/rpm {kgm/rpm} rpm rpm g/kWh {g/HPh}		106.7/1,950 {143/1,950} 610.0/1,500 {62.2/1,500} 2,150 1,030 215 {160}		
	Starting motor Alternator Battery					24V, 4.5 kW 24V, 45 A 12V, 110 Ah x 2		
	Radiator core type					Triple Cooler		
Hydraulic system	Hydraulic pump	Type x No. Delivery Set pressure		l/min MPa (kg/cm²)		HPV95+95, variable displacement Piston type: 214 x 2 Piston type: 37.2 {380}		
	Control valve	Type x No. Control method	1 Piece Boom			6-spool + 1 service spool type x 1 Hydraulic		
			2 Piece Boom			7-spool + 1 service spool type x 1 Hydraulic		
	Hydraulic motor	Travel motor Swing motor				A6VM140 HAXT/63W-V2B380A-SK, Piston type (with counter balance valve): x 1 KMF125ABE-5, Piston type (with safety valve, holding brake): x 1		
	Hydraulic culinder	1 Piece Boom	Type			Boom	Arm	Bucket
						Double acting piston	Double acting piston	Double acting piston
			Inside diameter of cylinder Diameter of piston rod Stroke Max. distance between pins Min. distance between pins	mm mm mm mm mm		120 85 1,334.5 3,204.5 1,870	135 95 1,490 3,565 2,075	115 80 1,120 2,800 1,680
		2 Pice Boom	Type		Adjust	Boom	Arm	Bucket
					Double acting piston	L.H / R.H Double acting piston	Double acting piston	Double acting piston
			Inside diameter of cylinder Diameter of piston rod Stroke Max. distance between pins Min. distance between pins	mm mm mm mm mm	185 120 626 1,824 1,198	135 95 966 2,521 1,555	135 95 1,490 3,565 2,075	115 80 1,120 2,800 1,680
	Hrdraulic tank Hydraulic filter Hydraulic cooler					Closed box type Tank return side CF40-1 (Air cooled)		

SWING CIRCLE



2.Control of speed downhill
At high speed when the machine is travelling downhill, machine speed must be limited to prevent overspeed of travel motor, transmission and axles. In the downhill condition the machine weight is driving the machine and pressure at the travel motor inlet becomes low. This low pressure is used to close the counterbalance valve.This allows the counterbalance valve springs to centralise the spool. The travel motor will rotate because it is driven from the wheels and so oil in the travel motor is circulated at high pressure through the brake valves. This oil circulated at high pressure through the brake valves slows the machine speed down.



1. Counterbalance valve
2. Relief valve
3. Swivel joint
4. Main control valve

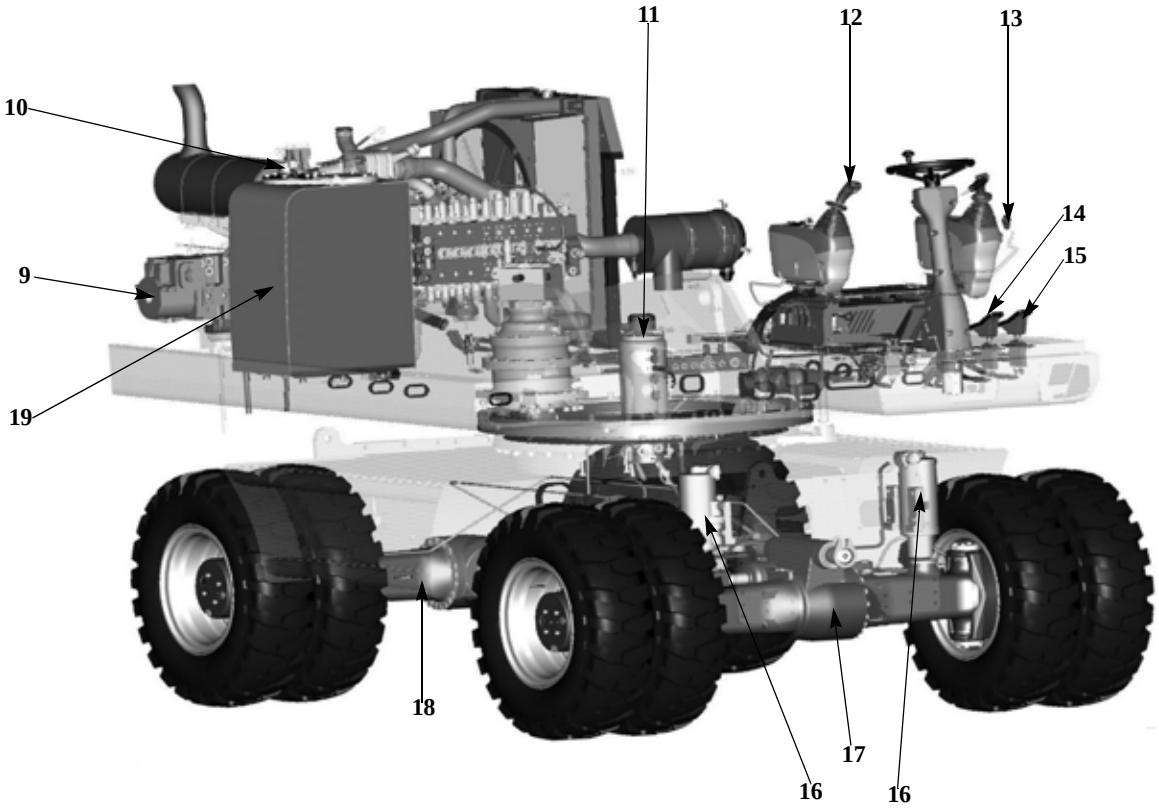
1. Hydraulic oil filter
2. Gear pump
3. Priority valve
4. Brake control valve
5. Accumulator - service brake (0.75 l.)
6. Accumulator - service brake (0.75 l.)
7. Accumulator - parking brake (0.75 l.)
8. Pressure switch - stop light (5 +/- 2 bar)
9. Pressure switch - accumulator (70 +/- 8 bar)
10. Two stage solenoid
11. Pressure switch (parking brake) - (40 +/- 1 bar) < less than activates
12. Brake pedal
13. Swivel joint
14. Service brake cylinder
15. Service brake cylinder
16. Small (high speed) clutch
17. Large (low speed) clutch
18. In line filter (cartridge type)
19. Accumulator (0.3 l.)

Structure and Function

The brake system is fully hydraulic. Hydraulic oil is supplied at high pressure by gear pump to a priority valve giving priority to the steering circuit first and secondly to the braking circuit when the steering is not being used.in the steering circuit. When braking oil is sent to the brake valve which provides braking pressure to two separate braking circuits (service brakes). In the event of failure of the power supply, the accumulators provide brake pressure to allow the machine to be safely stopped.

A parking brake is provided which is operated by selecting park brake switch in cab. This de-energises both high and low gear signals and locks the transmission gears.

If there is no pressure the parking brake will activate.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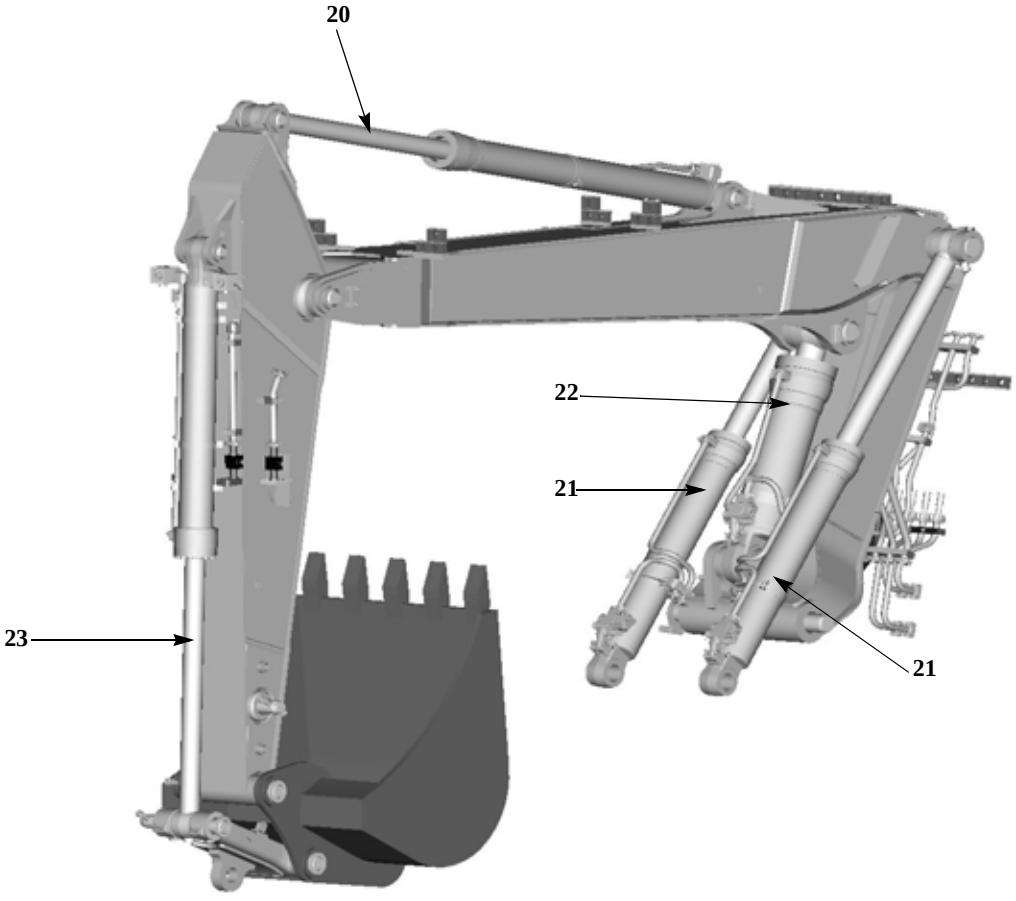
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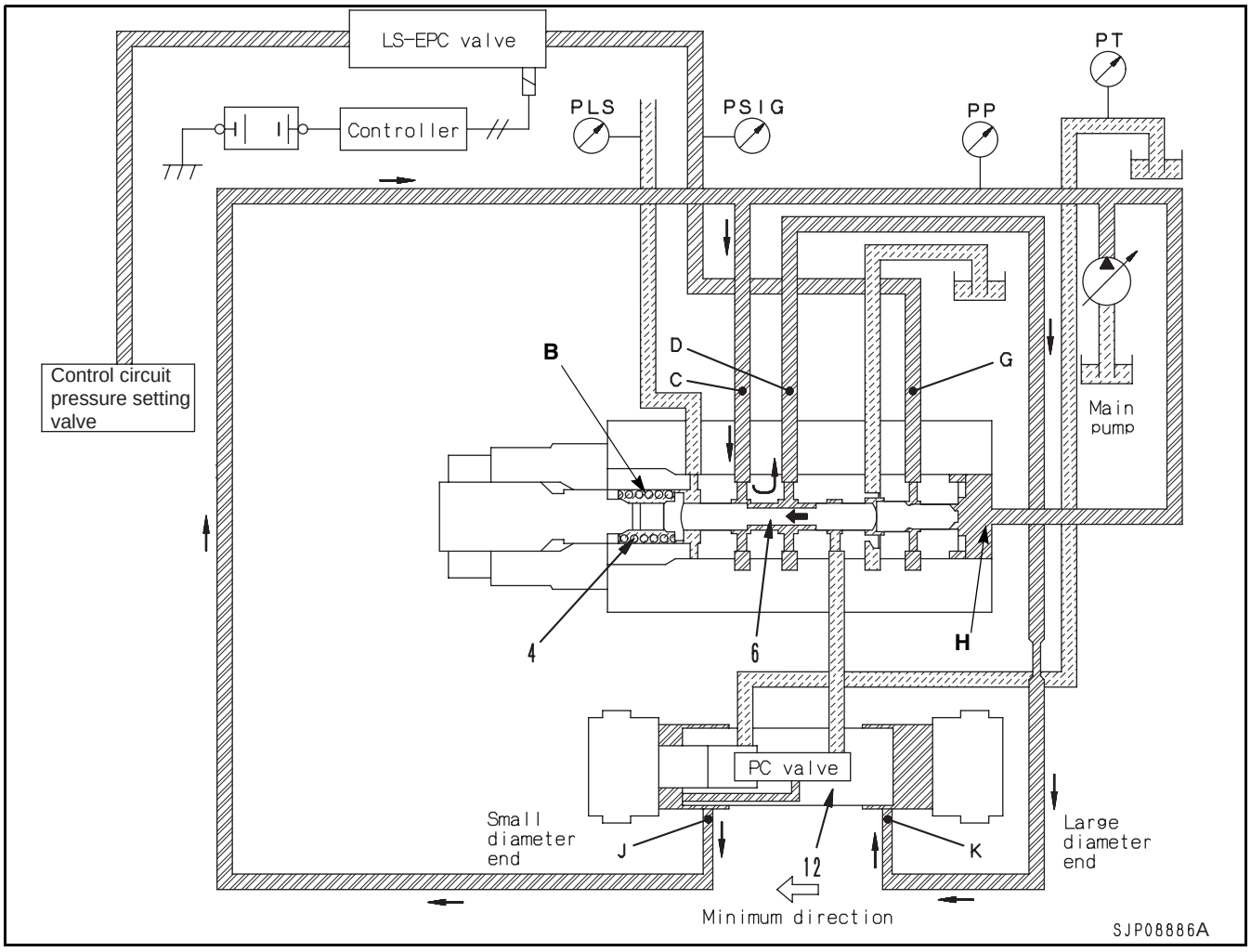
OPERATION

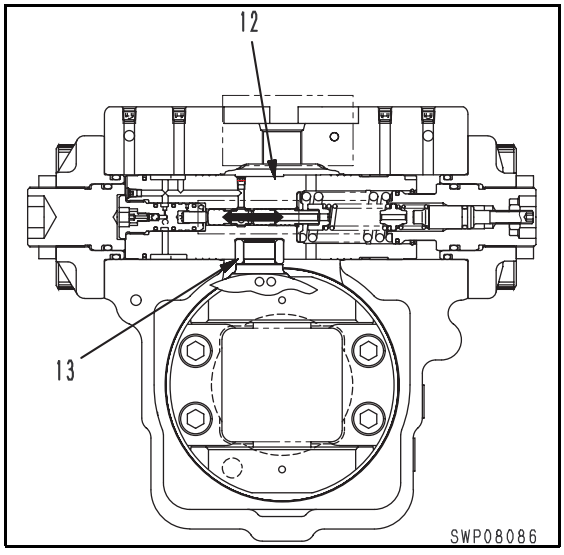


LS valve

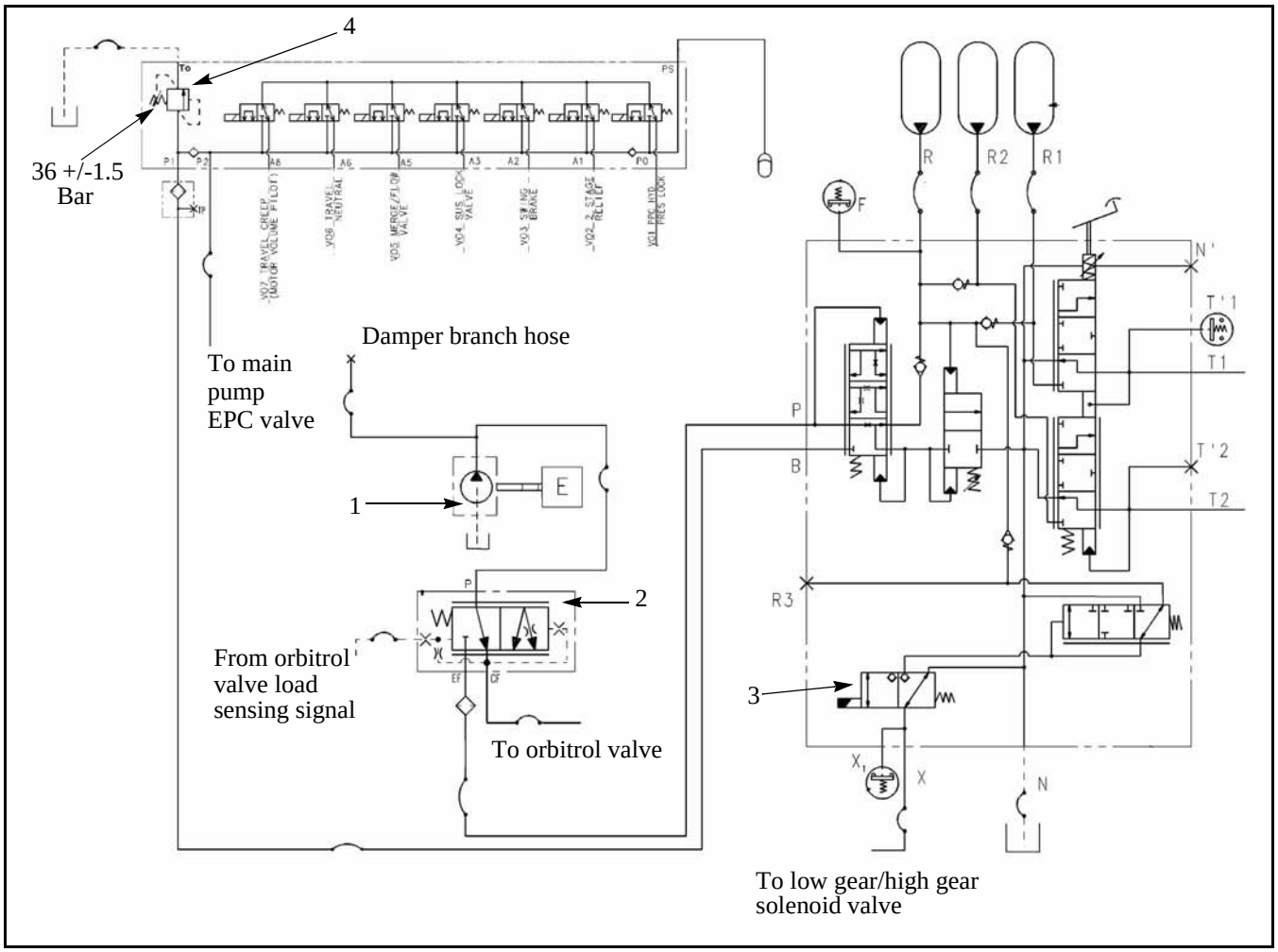
1. When control valve is at neutral position

- The LS valve is a three-way selector valve, with pressure **PLS** (LS pressure) from the inlet port of the control valve brought to spring chamber **B**, and main pump discharge pressure **PP** brought to port **H** of sleeve (8). The size of this LS pressure **PLS** + force **Z** of spring (4) and the main pump pressure (self pressure) **PP** determines the position of spool (6). However, the size of the output pressure **PSIG** (the LS selection pressure) of the EPC valve for the LS valve entering port **G** also changes the position of spool (6). (The set pressure of the spring changes).
- Before the engine is started, servo piston (12) is pushed to the right. (See the diagram on the right)
- When the engine is started and the control lever is at the neutral position, LS pressure **PLS** is 0 MPa {0 kg/cm²}. (It is interconnected with the drain circuit through the control valve spool.)

  At this point, spool (6) is pushed to the left,and port **C** and port **D** are connected. Pump pressure **PP** enters the large diameter end of the piston from port **K** and the same pump pressure **PP** also enters port **J** at the small diameter end of the piston, so the swash plate is moved to the minimum angle by the difference in the area of the piston (12).



PILOT PRESSURE CONTROL (PPC) SYSTEM



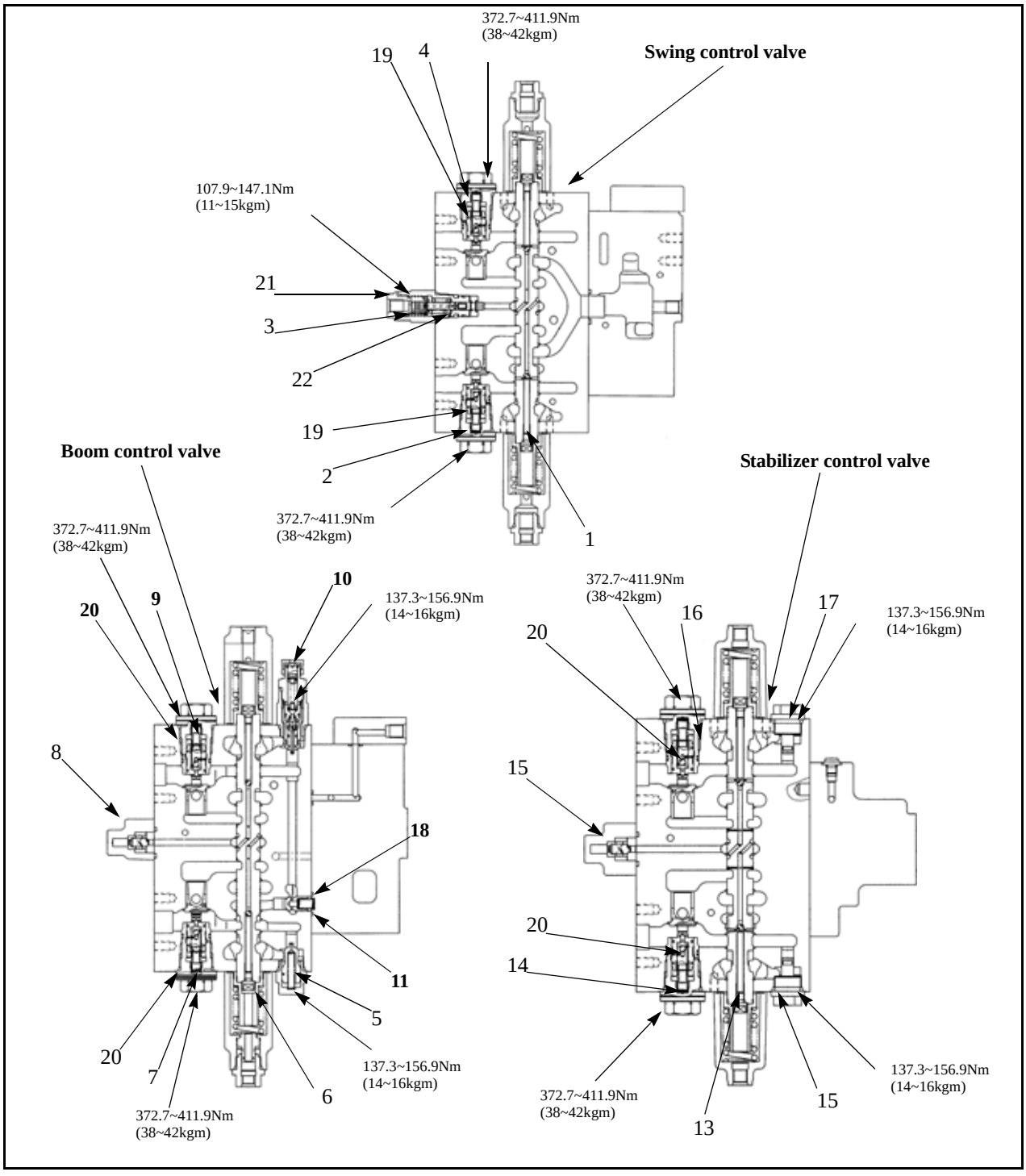
1. Gear Pump
2. Steering/Braking priority valve
3. Power Brake Valve
4. Pressure Reducing Valve
   Incorporated in Main Solenoid Valve Block

FUNCTION

- The PPC Pump less system discharges pressurised oil to operate the PPC circuit and solenoid valve assemblies.

OPERATION

- The PPC pump less system utilizes the return line oil from the power brake valve, oil is supplied to the steering / braking circuits from a gear pump driven by the engine. Oil is prioritised to the steering circuit via the priority valve with the remaining oil flow feeding the power brake valve. The return line from the brake valve passes through a relief valve to maintain a pressure of 36 +/- 1.5 BAR.

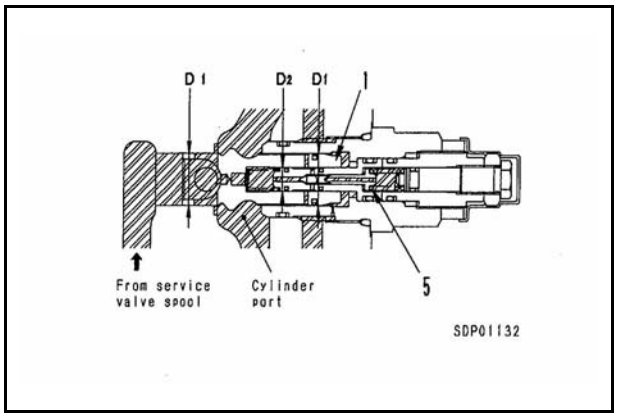


SWING CONTROL VALVE		BOOM CONTROL VALVE		STABILIZER VALVE	
1.	Spool	5.	Suction valve	12.	Suction valve
2.	Pressure compensation valve (Left)	6.	Spool	13.	Spool
3.	LS select valve	7.	Pressure compensation valve (Raise)	14.	Pressure compensation valve (Reverse)
4.	Pressure compensation valve (Right)	8.	LS shuttle valve	15.	LS shuttle valve
		9.	Pressure compensation valve (Lower)	16.	Pressure compensation valve (Forward)
		10.	Safety suction valve	17.	Suction valve
		11.	Check valve for regeneration circuit		

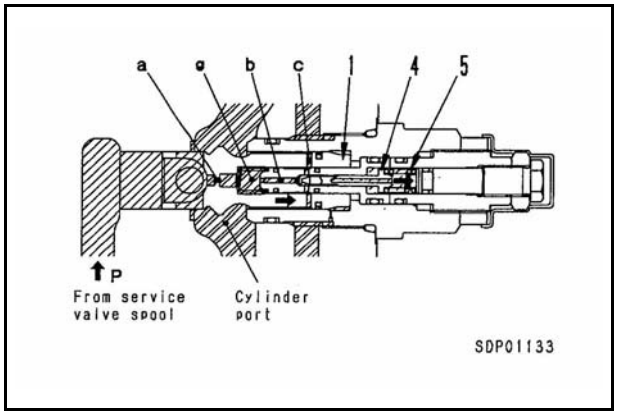
Operation

Simultaneous operation with work equipment under heavy load (boom RAISE, etc.)

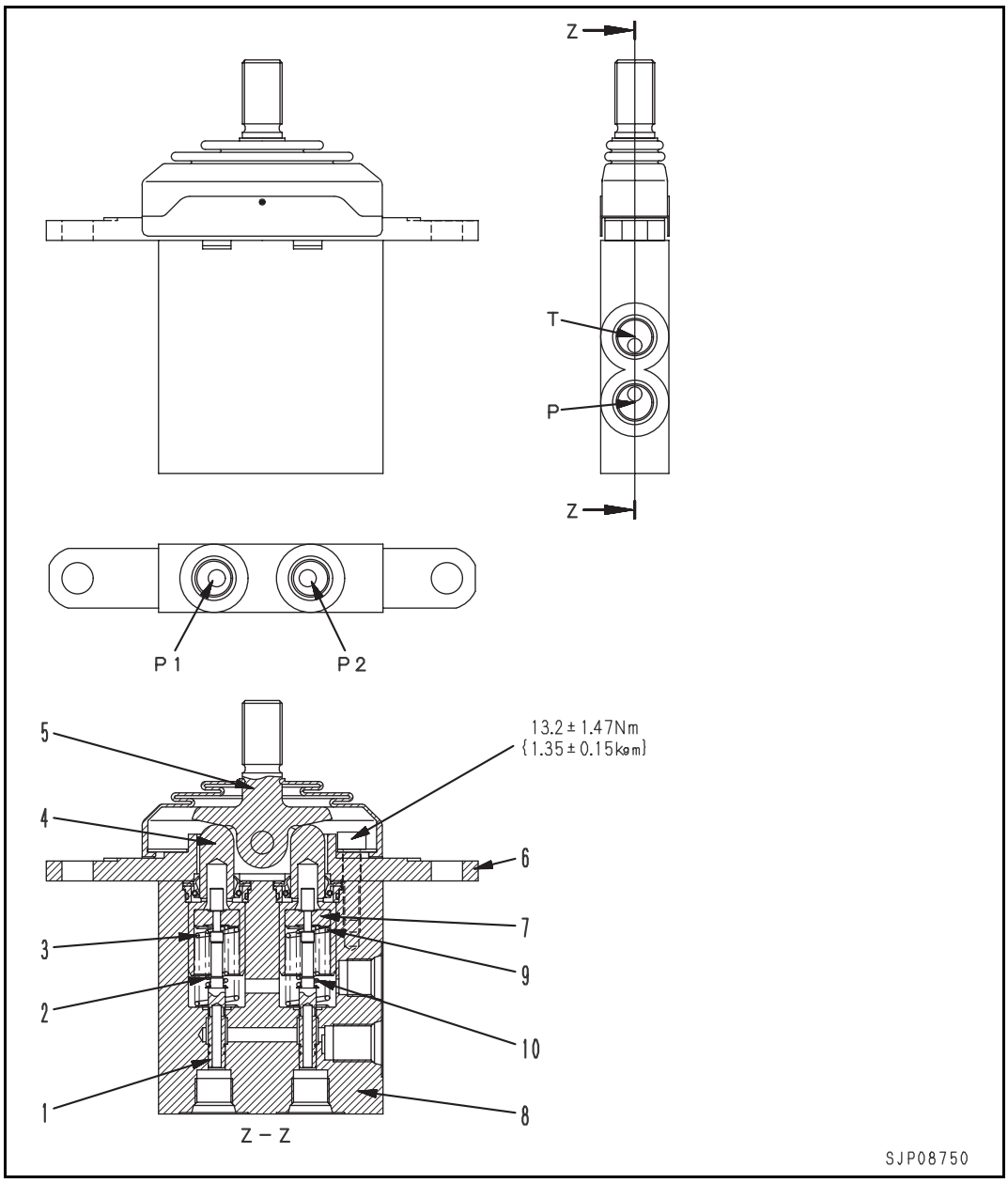
1. The pump pressure and **LS** pressure are determined by the pressure of the other work equipment, but the cylinder port pressure of the attachment.
   When the difference between the pump pressure and the cylinder pressure is less than the force of spring (5), then balance of the force acting on valve (1) is as follows.
   PxA1=A2++LS (A2-A1) +F
   A1: Cross-sectional area of diameter D1
   A2: Cross-sectional area of diameter D2
   F: Force of spring



2. If the difference between pump pressure **P** and the cylinder pressure becomes greater than the force of spring (5), poppet (4) is pushed to the right and the passage opens, so the pump passage is connected to the cylinder port through throttle **A,** chamber **G**, and passages **B** and **C**, and the oil flows to the cylinder port. When this happens, a differential pressure is formed between the upstream and downstream sides of throttle **A**, and the pressure in the chamber **G** goes down, so the force pushing valve (1) to the left is reduced. In other words, the area ratio becomes smaller, so valve (1) moves to the right and increases the flow from the pump to the cylinder.



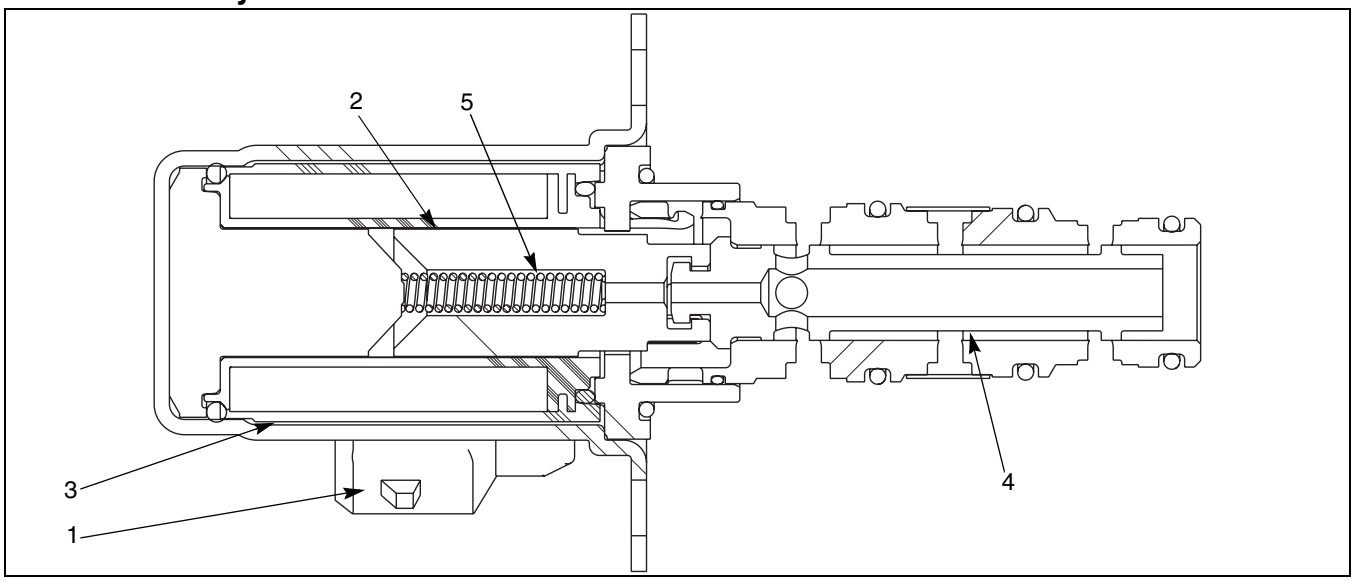
SERVICE PPC VALVE



1. Spool
2. Metering spring
3. Centering spring
4. Piston
5. Lever
6. Plate
7. Retainer
8. Body

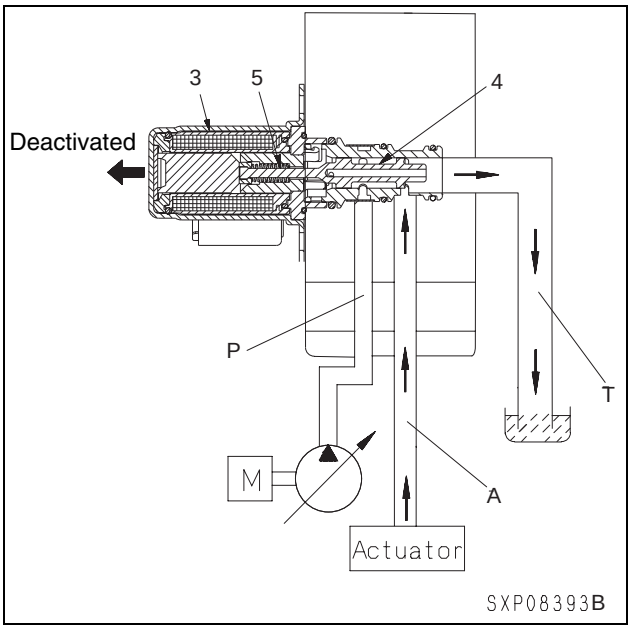
T. To tank
P. From main pump
P1. Port
P2. Port

2 Position 4 way valve



This solenoid valve is fitted to the following ports:

V08	Forward / reverse solenoid
V09	Boom / stabiliser down solenoid
V10	Boom / stabiliser up solenoid
V11	Transmission clutch control solenoid
V14	Clamshell solenoid
V15	2 stage back pressure solenoid



1. Connector
2. Plunger
3. Coil
4. Spool
5. Spring

OPERATION

When solenoid is deactivated

- Since the signal current does not flow from the controller, coil (3) is turned off
  Accordingly, spool (4) is pressed by spring (5) against the left side.
  By this operation, the passage from **P** to **A** is closed and the hydraulic oil from the control circuit does not flow into the actuator.
  At this time, the oil from the actuator is drained through ports **A** and **T** into the tank.

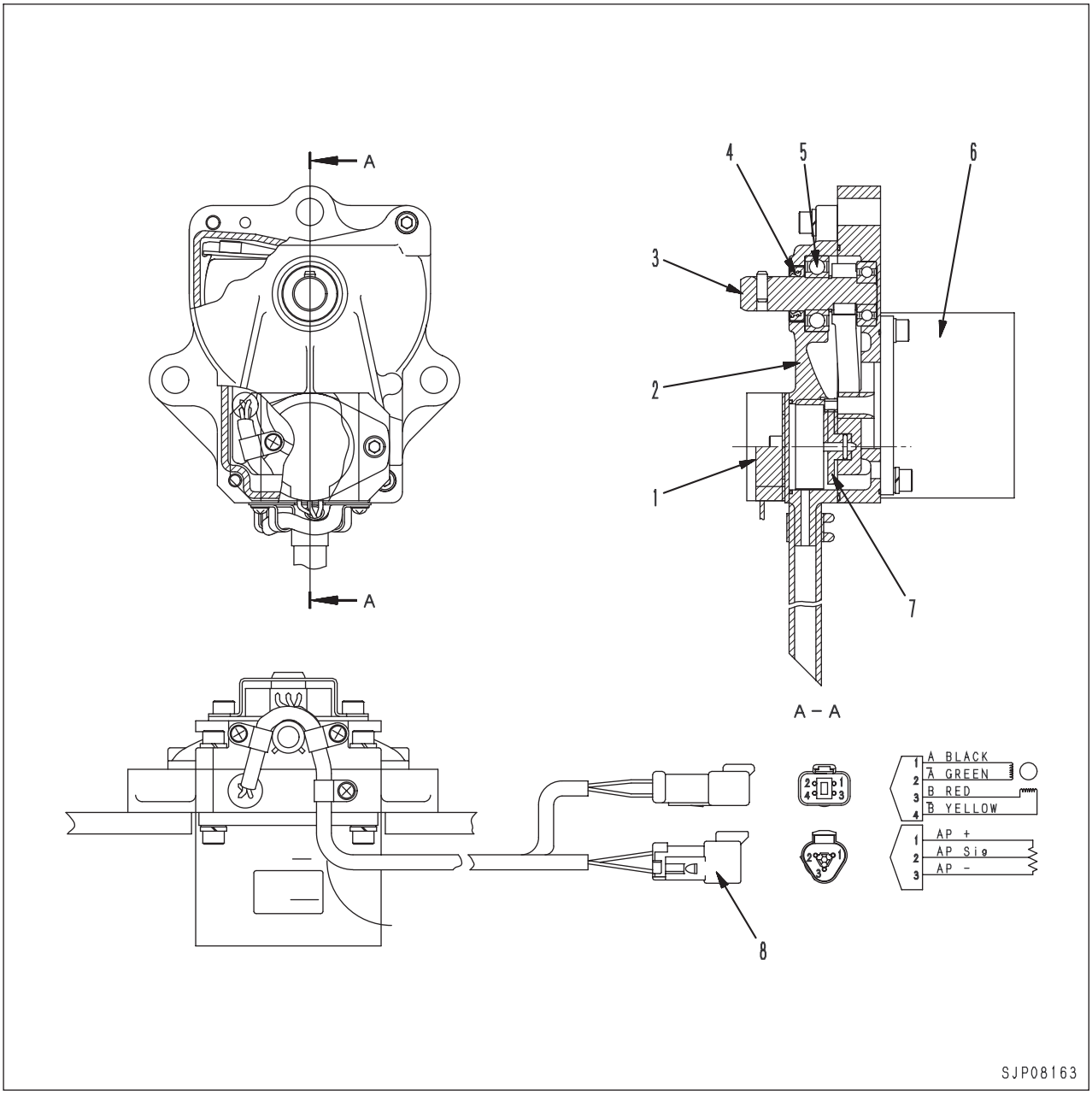
PW200/220-7

Work Equipment

Unit: mm

No.	Check item	Criteria					Remedy
		Standard size	Tolerance		Standard clearance	Clearance limit	
			Shaft	Hole			
1	Clearance between connecting pin and bushing of revolving frame and boom	90	-0.036 -0.071	+0.131 +0.074	0.110 ~ 0.202	1.0	Replace
2	Clearance between connecting pin and bushing of boom and arm	90	-0.036 -0.071	+0.166 +0.074	0.110 ~ 0.237	1.0	
3	Clearance between connecting pin and bushing of arm and link	70	-0.030 -0.076	+0.158 +0.078	0.108 ~ 0.234	1.0	
4	Clearance between connecting pin and bushing of arm and bucket	80	-0.030 -0.076	+0.137 +0.074	0.104 ~ 0.213	1.0	
5	Clearance between connecting pin and bushing of link and bucket	80	-0.030 -0.076	+0.166 +0.086	0.116 ~ 0.242	1.0	
6	Clearance between connecting pin and bushing of link and link	80	-0.030 -0.076	+0.154 +0.074	0.104 ~ 0.230	1.0	

Governor motor



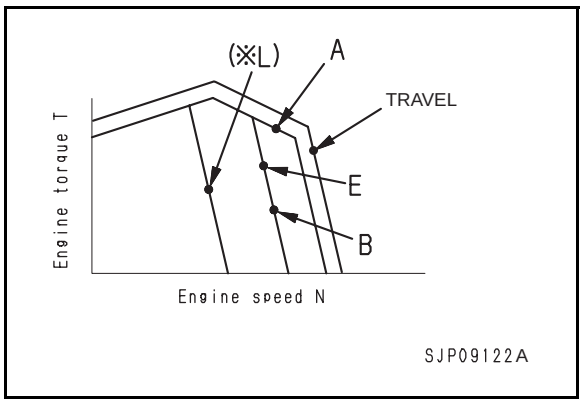
1. Potentiometer
2. Cover
3. Shaft
4. Dust seal
5. Bearing
6. Motor
7. Gear
8. Connector

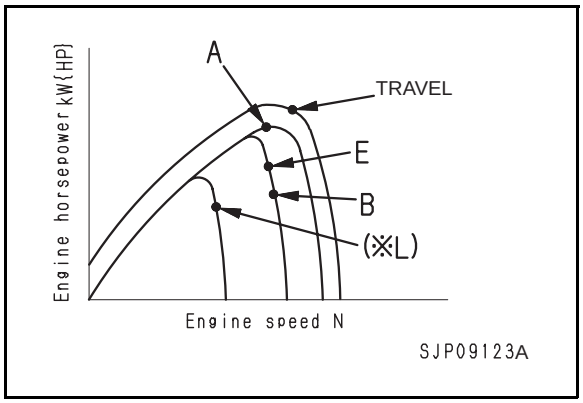
Function

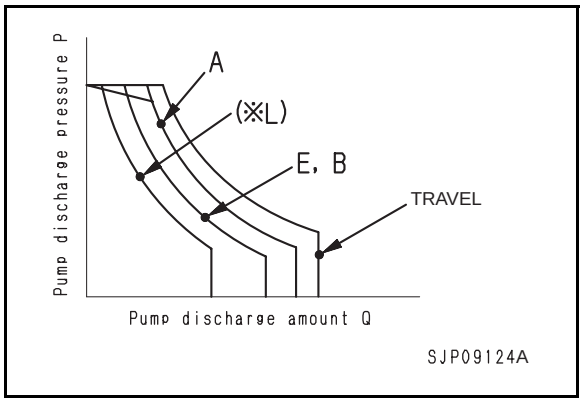
- The motor is turned according to the drive signal from the engine throttle and pump controller to control the governor lever of the fuel injection pump.
  This motor used as the motive power source is a stepping motor.
- A potentiometer for feedback is installed to monitor the operation of the motor.
- Revolution of the motor is transmitted through the gear to the potentiometer.

FUNCTION

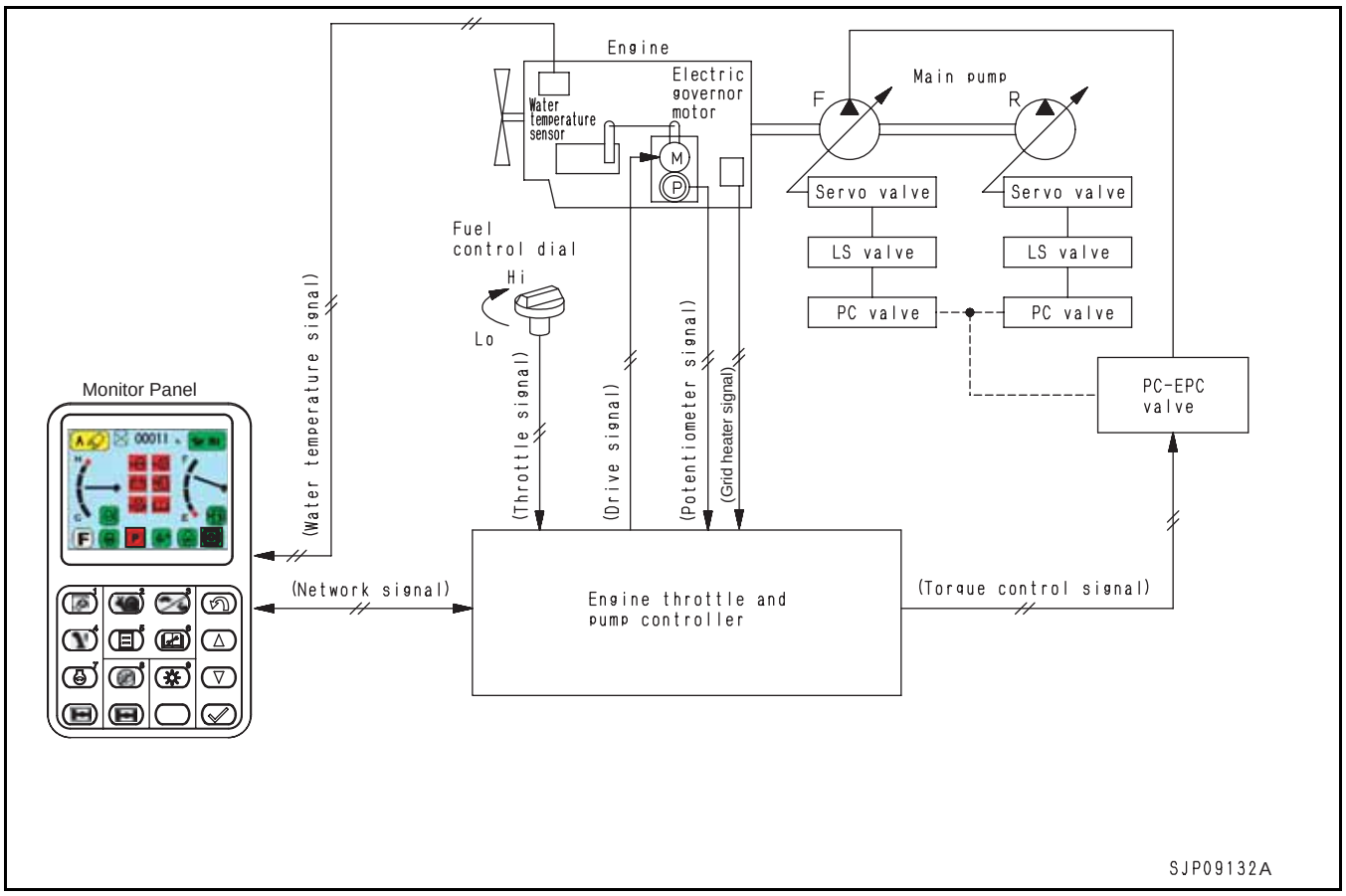
- The operator can set the work mode switch on the monitor panel to mode A, E, or B (or L) and select proper engine torque and pump absorption torque according to the type of work.
- The engine throttle and pump controller detects the speed of the engine governor set with the fuel control dial and the actual engine speed and controls them so that the pump will absorb all the torque at each output point of the engine, according to the pump absorption torque set in each mode.







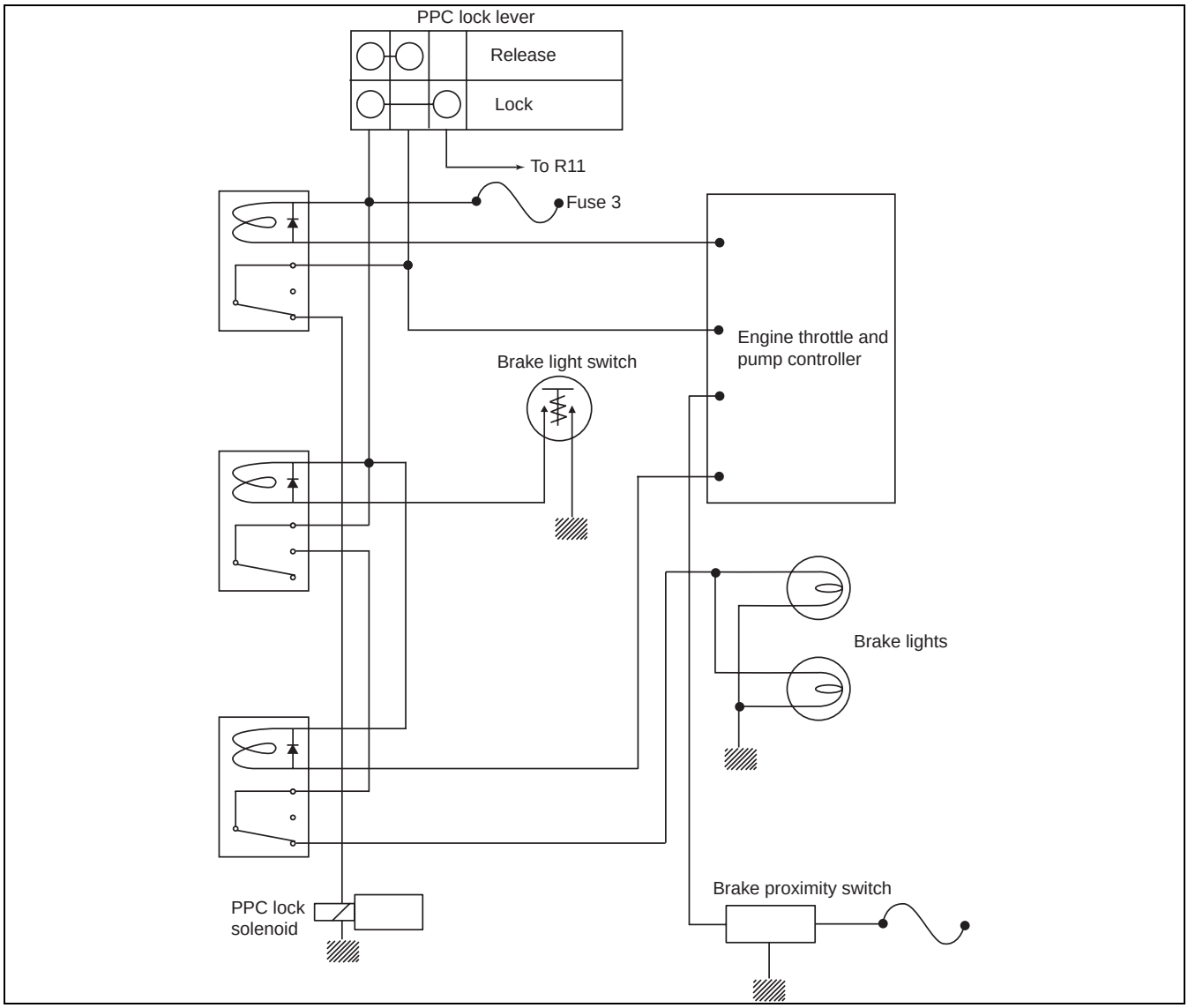
5) Auto-warm-up/Overheat and White Smoke prevention function



FUNCTION

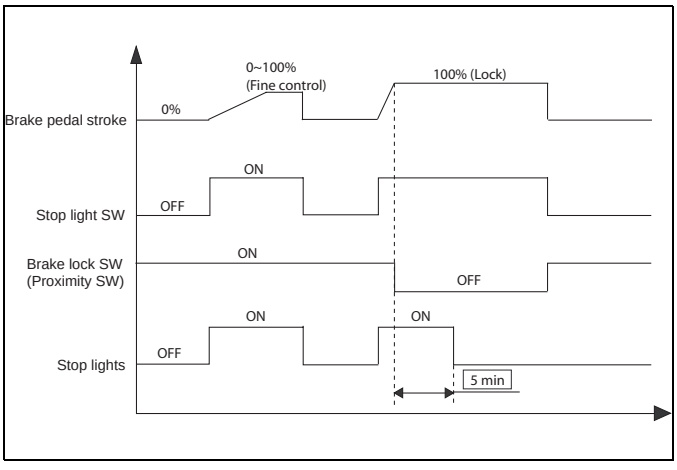
- After the engine is started, if the engine cooling water temperature is low, the engine speed is raised automatically to warm up the engine. If the engine cooling water temperature rises too high during work, the pump load is reduced to prevent overheating. To prevent white smoke the heater relay is activated for 100 seconds if the water temperature is below 30°C.

10.Brake light control function



		PPC lock lever	
		Release	Lock
PPC lock SW	OFF	O*	O*
	ON	O	O*

O: Always work
O*: Follow the logic below



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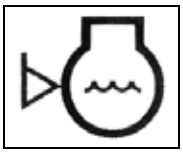
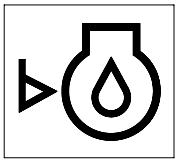
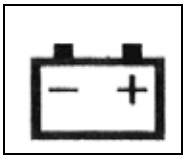
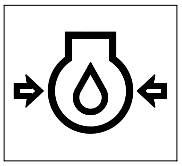
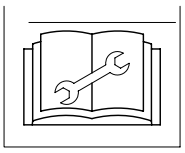
Item No.	Symbol	Display item	Check before starting item	When engine is stopped	When engine is running
13.		Radiator water level	Yes	Lights up when abnormal	When abnormal, lights up and buzzer sounds
14.		Engine oil level	Yes	Lights up when abnormal	--
15.		Battery charge	Yes	--	Lights up when abnormal
16.		Air filter blocked	Yes	--	Lights up when abnormal
17.		Engine oil pressure	Yes	--	When abnormal, lights up and buzzer sounds
18.		Service interval	No	Lights up when maintenance is due. Lights up for only 30 sec. after key is turned ON, then goes out.	
19.		Overload caution	Yes	When in L mode: Lights up when abnormal and buzzer sounds	

The problems that have occurred are displayed in order from the left.

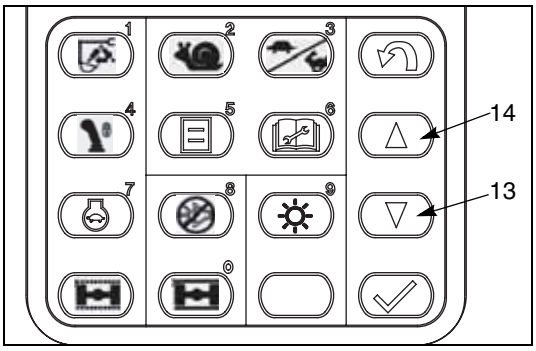
When the above cautions are displayed, if the hydraulic oil temperature is high or low, only the symbol is displayed.

Condition of hydraulic oil	**Colour of symbol**
Low temperature (below B6 or equivalent)	Black on white background
Normal (B6 - B2)	No display
High temperature (below B2)	White on red letters

13.SCROLL DOWN

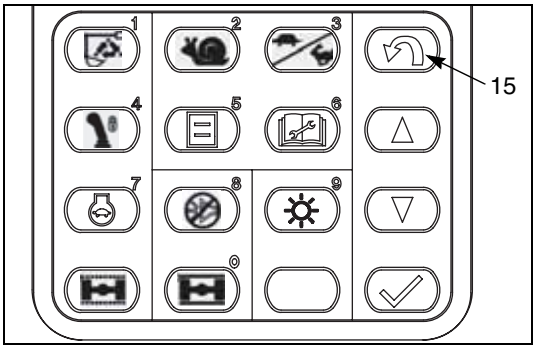
14.SCROLL UP

Press up switch (14) or down switch (13) when in the menu screens will allow you to move up and down the menu options.
In certain menus they can also be used to increase and decrease displayed values (i.e. breaker force)



15.UNDO SWITCH

Pressing switch (15) whilst in the monitor menu screens, will return you back to the previous screen displayed.



16.REAR LEFT OUTRIGGER/BLADE SWITCH

This switch enables selection of rear left outrigger or rear blade Light illuminates when active.

17.FRONT LEFT OUTRIGGER/BLADE SWITCH

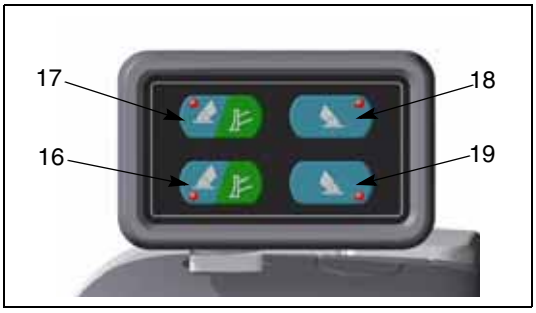
This switch enables selection of front left outrigger / front blade. Light illuminates when active.

18.FRONT RIGHT OUTRIGGER SWITCH

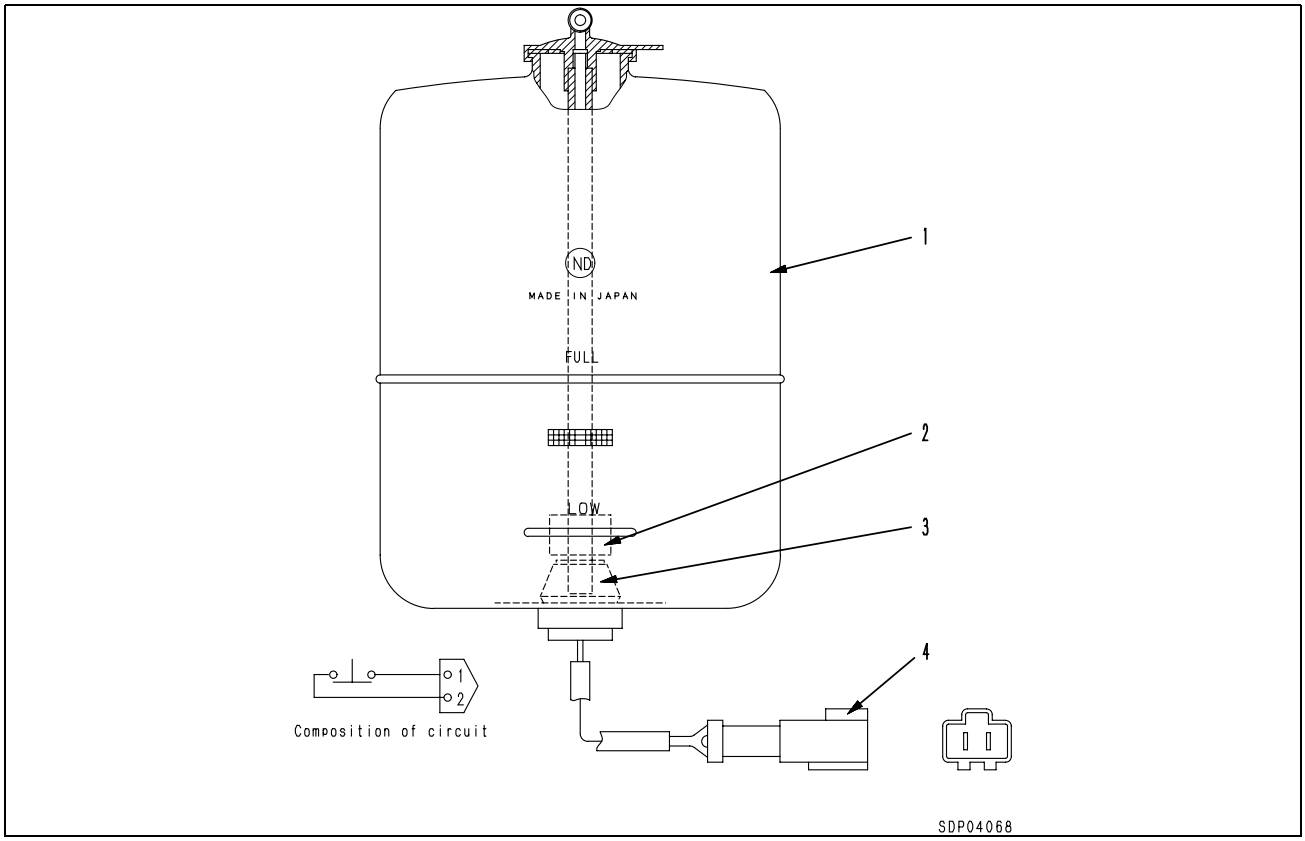
Allows operation of front right outrigger only.
Light on switch illuminates when activated.

19.REAR RIGHT OUTRIGGER SWITCH

Allows operation of rear right outrigger.
Light on switch illuminates when activated.

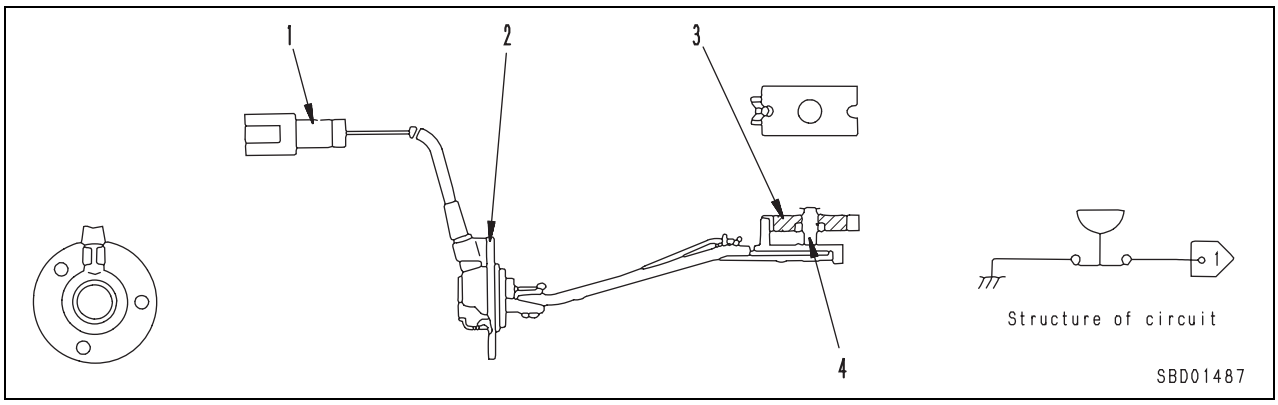


COOLANT LEVEL SENSOR



1. Sub-tank
2. Float
3. Sensor
4. Connector

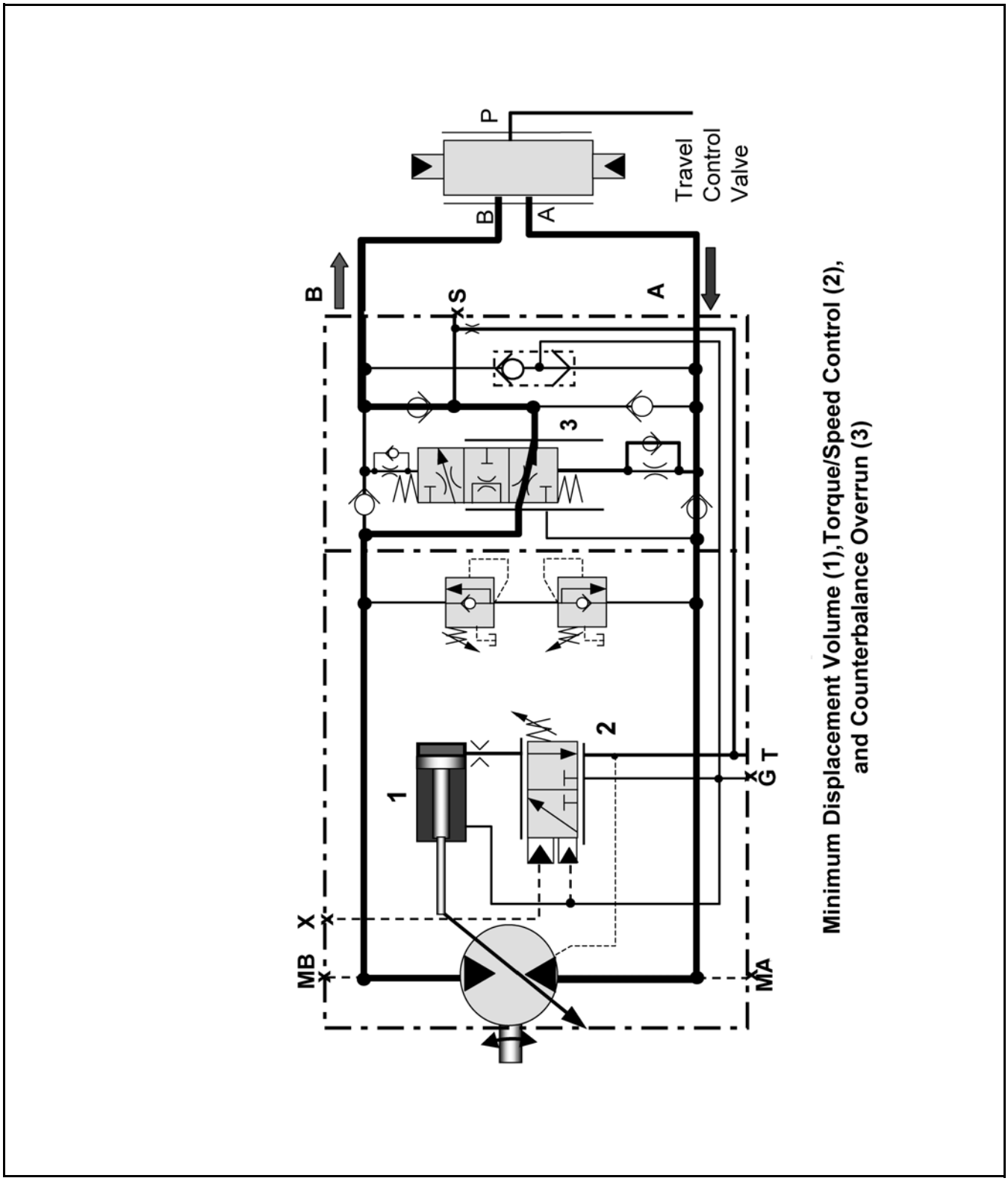
ENGINE OIL LEVEL SENSOR



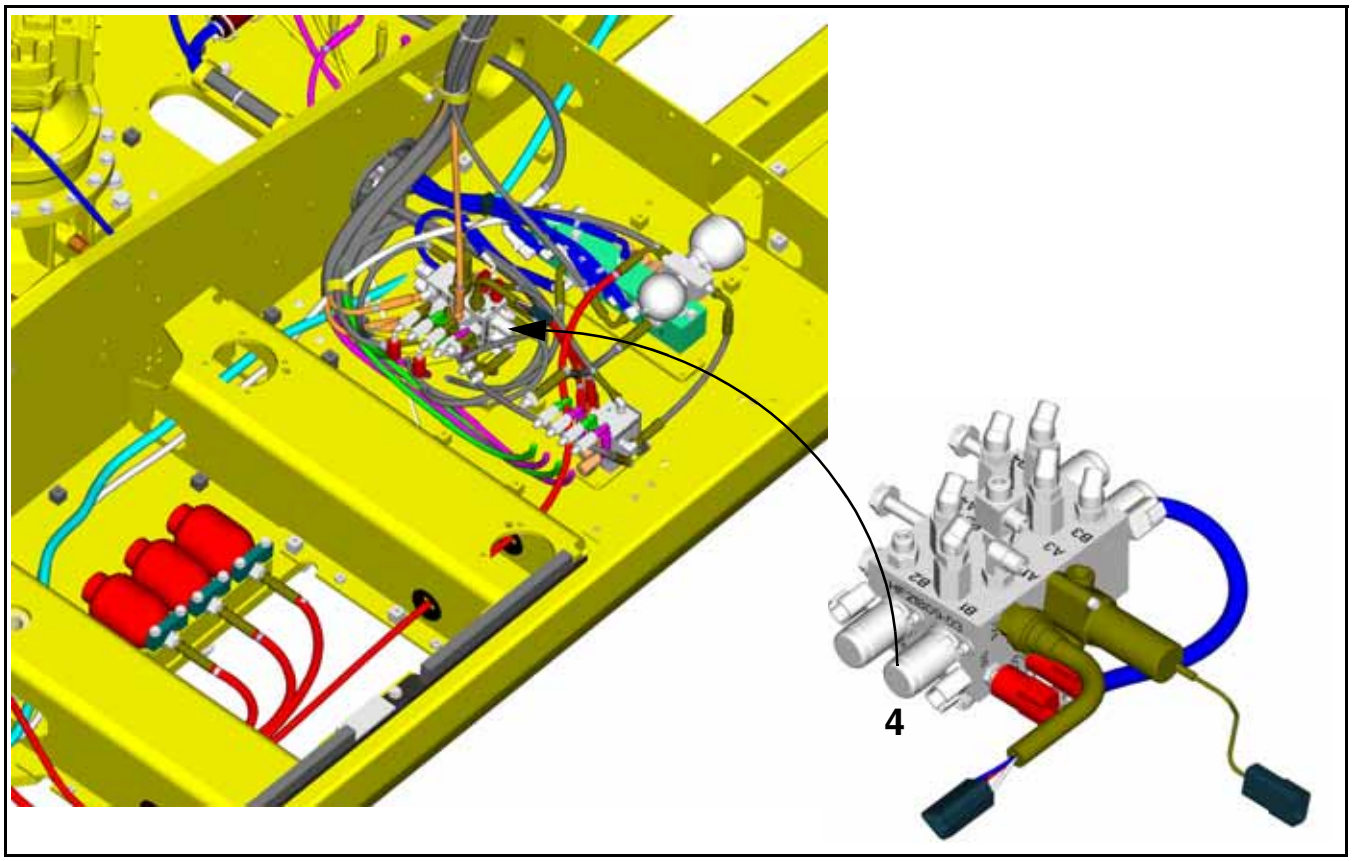
1. Connector
2. Bracket
3. Float
4. Switch

1. Travel Motor.

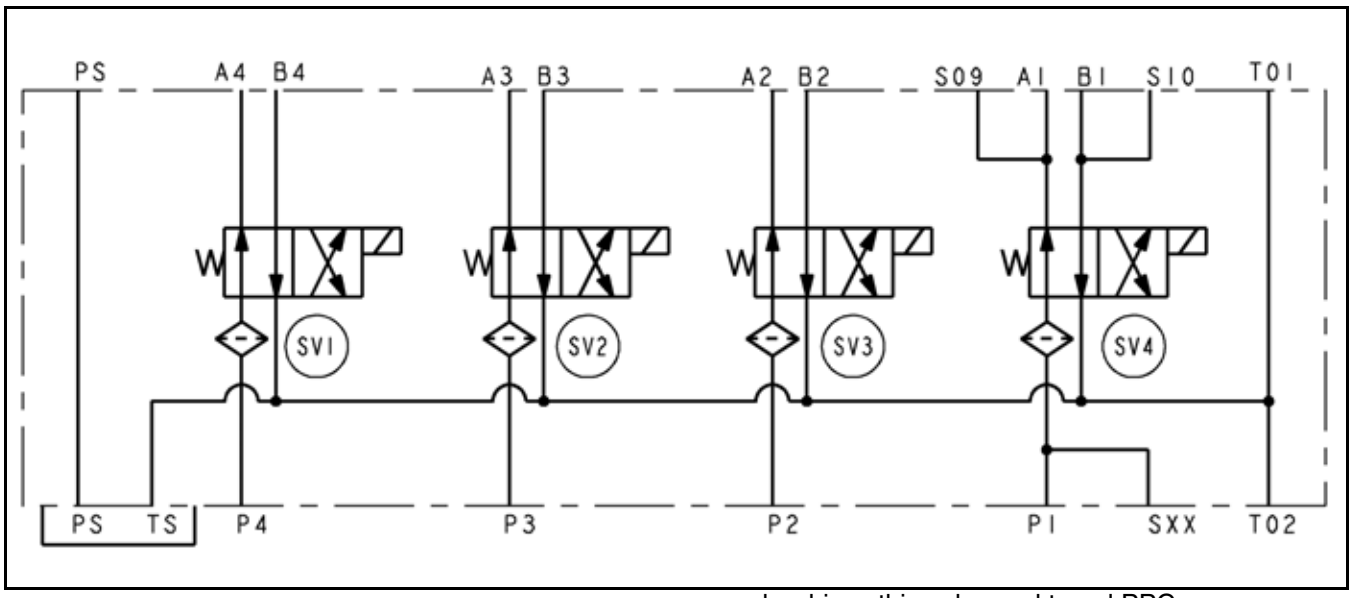
1.2 Flow path representing: Low Torque - High speed with counterbalance taking up an active position. (Default for Travel)
The counterbalance valve (3) is activated which allows a constant flow of oil around the circuit.
From port A through to port B the motor displacement is at minimum pending maximum speed. the speed of the machine is governed by the level of motor displacement.



4. Forward / Reverse Travel Solenoid

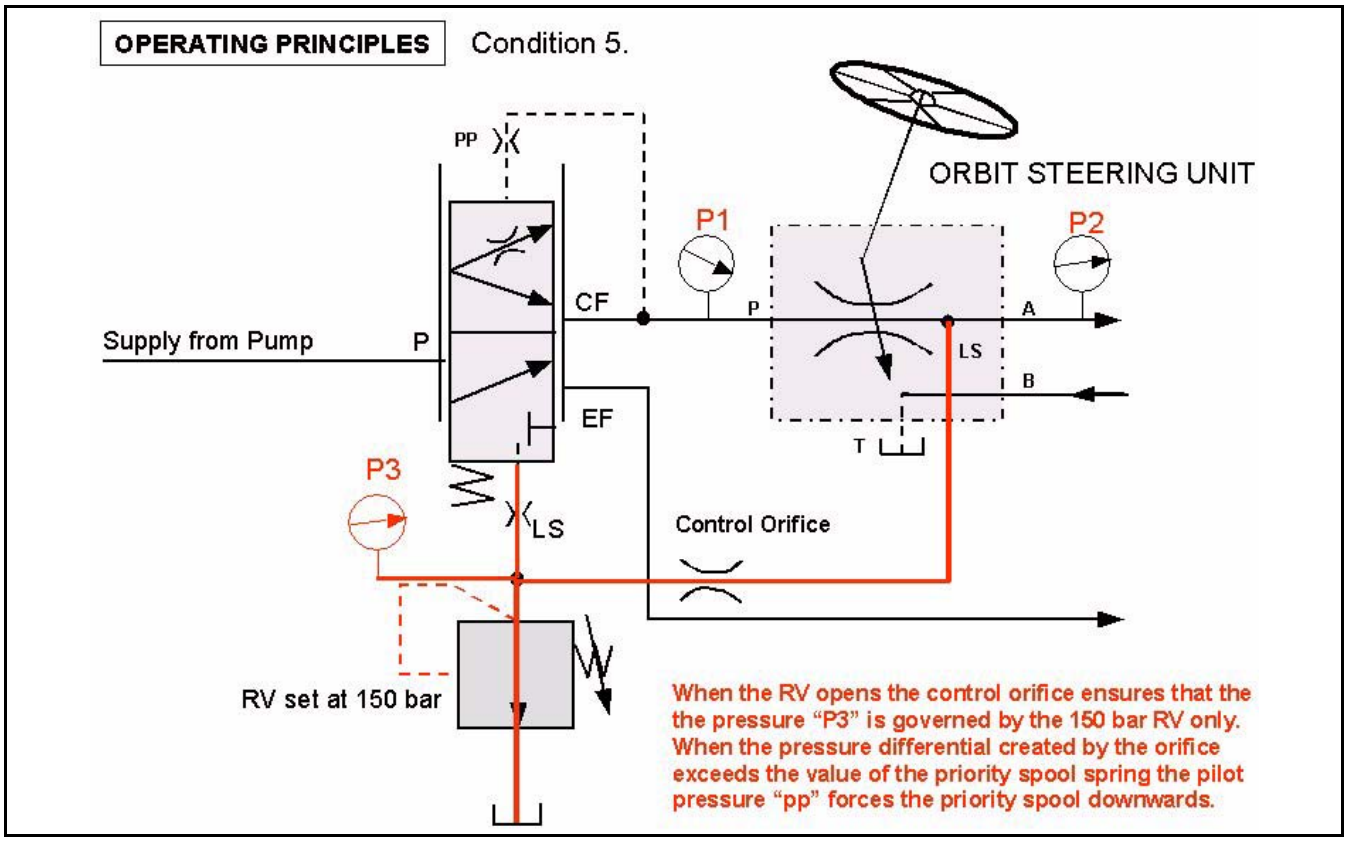


4.1 Forward / Reverse Travel Solenoid Schematic

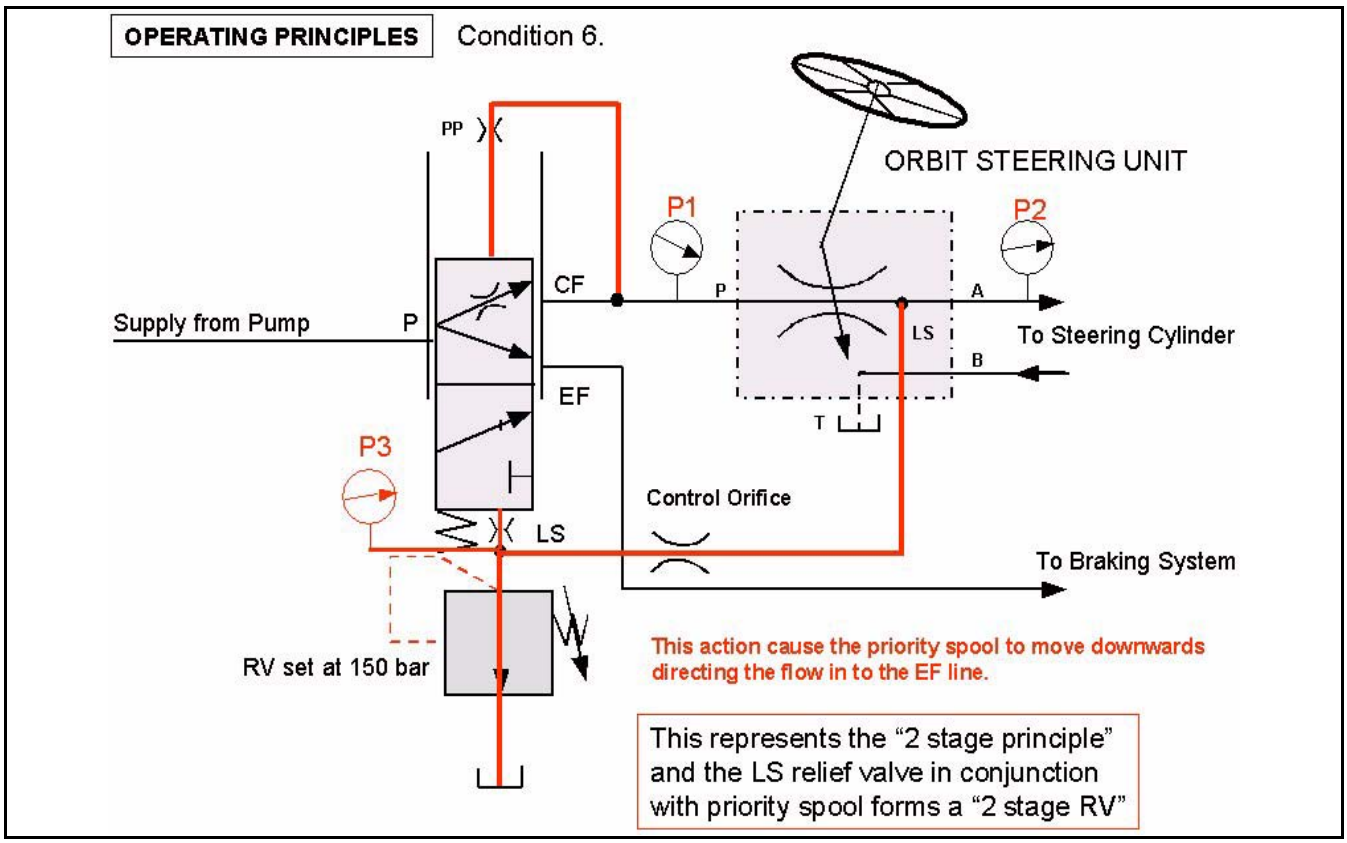


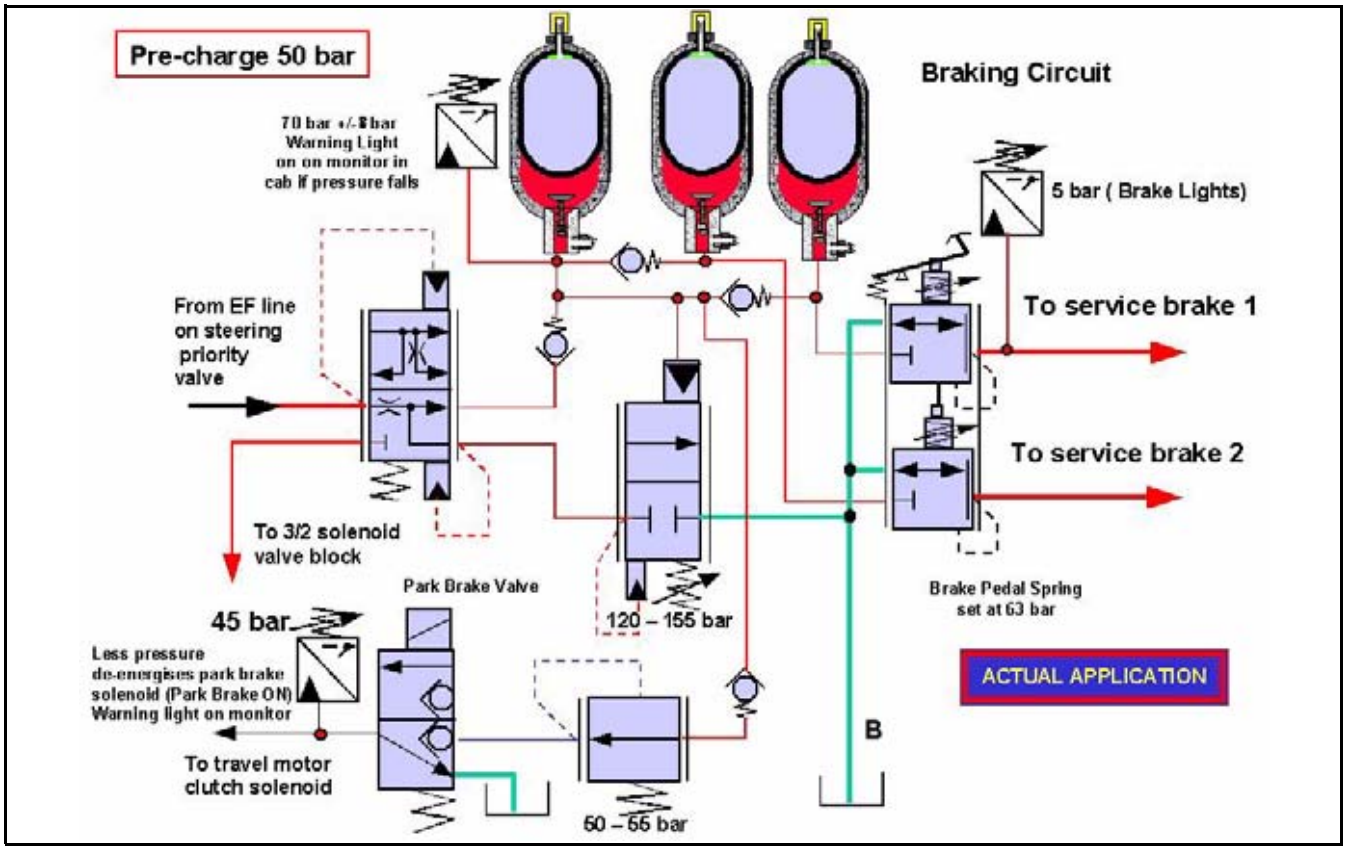
4.2 Forward / Reverse Travel Solenoid: Located on the 4-stage solenoid block in the service compartment at the rear of the operators cab. This device controls the travel motor direction (forward or reverse) by a signal from the F-N-R switch. Solenoid energised ~Forward or Reverse. Travel is engaged, this is interlocked with the travel neutral solenoid. If travel Reverse is selected, controller drives this valve and travel PPC pressure spool is reversed.

5. Condition 5.



6. Condition 6.




Pre-charge 50 bar
Braking Circuit
70 bar +/-8 bar
Warning Light
on on monitor in
cab if pressure falls
5 bar (Brake Lights)
From EF line
on steering
priority
valve
To service brake 1
To service brake 2
To 3/2 solenoid
valve block
Park Brake Valve
120 – 155 bar
Brake Pedal Spring
set at 63 bar
45 bar
Less pressure
de-energises park brake
solenoid (Park Brake ON)
Warning light on monitor
ACTUAL APPLICATION
B
To travel motor
clutch solenoid
60 – 65 bar

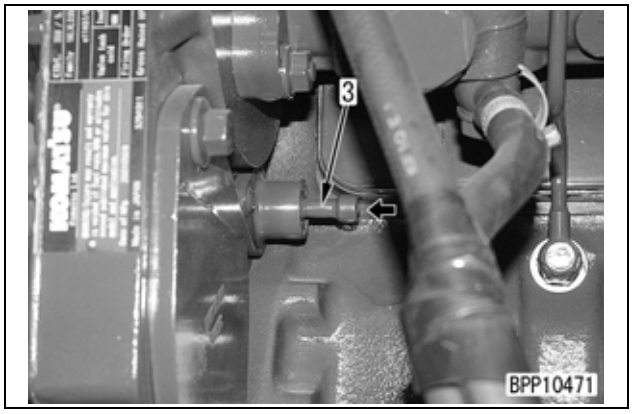
Applicable model					PW200, 220-7H	
Category	Item	Measurement Condition		Unit	Standard value	Permissible value
Travel	Travel speed (1)	 • Machine in road travel posture • Engine running at high idle • Hydraulic oil temperature 45~55°C • Run up for at least 200M or until the max travel speed is stabilised,then measure time taken to travel the next 50M on flat ground	CR		sec.	89.3±9	89.3±9
			LO			$18.9^{+2}/_{-0}$	$18.9^{+2}/_{-0}$
			Hi	20km/h		$9^{+1}/_{-0}$	$9^{+1}/_{-0}$
				35km/h		$5.1^{+0.5}/_{-0}$	$5.1^{+0.5}/_{-0}$
	Travel speed (2)	 • Raise machine road wheels off ground using work equipment and chassis attachments • Engine running at high idle • Service brake and park brake both disengaged • Fully depress travel pedal and measure propshaft rotations. • Hydraulic oil temperature 45~55°C. Within operation range	CR		rpm	222 ±22	222 ±22
			LO			$951^{+0}/_{-95}$	$951^{+0}/_{-95}$
			Hi	20km/h		$2368^{+0}/_{-238}$	$2368^{+0}/_{-238}$
				35km/h		$3400^{+0}/_{-340}$	$3400^{+0}/_{-340}$

20 TESTING AND ADJUSTING

ADJUSTMENT

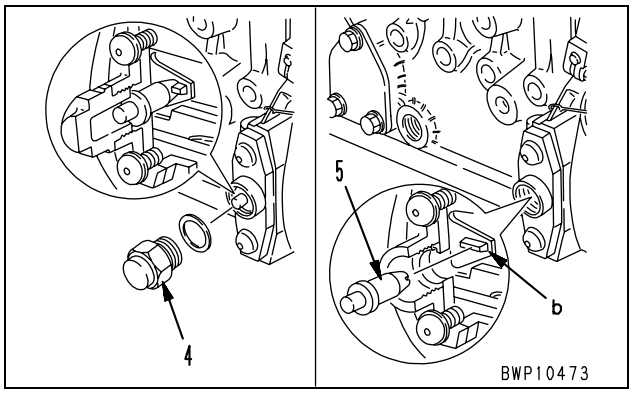
- If fuel injection timing is found incorrect, adjust it in the following manner.

1) Confirm that drive gear injection timing is fixed with driving gear timing pin (3).
   - If timing pin (3) was pulled back after the inspection had been completed, push it in again following the previous inspection procedures.



2) Dismantle the fuel injection pump.
   - For dismantling the fuel injection pump, see “FUEL INJECTION PUMP ASSEMBLY” on page 30- 11.

3) Reverse and push in timing pin (5) of the fuel injection pump, then match the pin cut-out portion and protruding portion "**b**" inside the fuel injection pump by turning the shaft.
   - After fuel timing has been set, fix it by fitting plug (4).

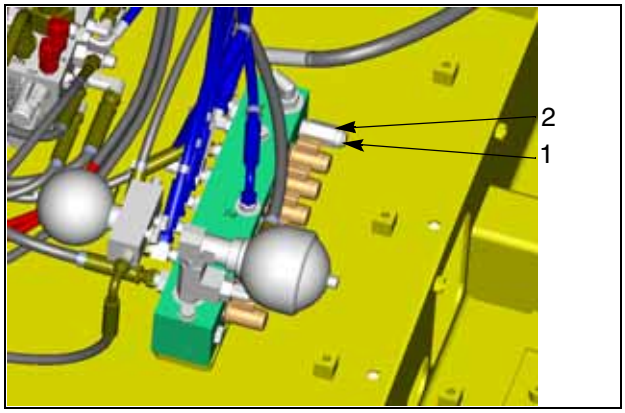


4) Mount the fuel injection pump.
   - For mounting the pump, refer to the same section mentioned in item 2 above.

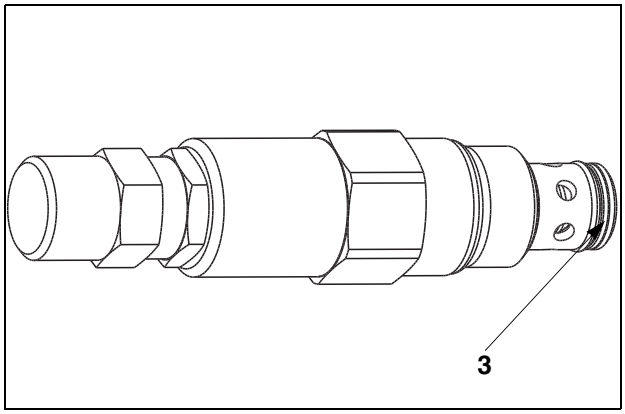
5) Detach the measurement tools after the adjustment, and make sure that the machine is back to normal condition.
   - Before starting the engine again, check that driving gear timing pin (3) and fuel injection pump timing pin (5) have been brought back to the pre-adjustment condition.

PROCEDURE FOR PRESSURE REDUCING ADJUSTMENT

1. Remove dust cap (1).
2. Loosen off adjusting screw nut (2).



3. Tighten adjusting screw (3) to increase pressure and loosen to decrease pressure.



4. When at correct pressure tighten adjusting screw nut (2) and replace dust cap (1).

7 - Stage solenoid block

Table for Functioning Conditions - PPC lock solenoid valve.

Functioning Condition		Functioning
Safety lock lever	Locked	OFF
	Released	ON

Table for Functioning Conditions - 2 stage relief solenoid valve.

Functiong Condition			Functioning
When overheat setting of 1st stage is ON			OFF
When overheat setting of 2nd stage is ON			
When all the signals for work equipment, swing and travel are OFF			
When swing lock switch is ON			ON
When travel signal is ON			
When working mode is L mode			
When boom LOWER signal is ON			
When working mode is A or E mode	When left knob is switched	If signals other than swing operation only ON	
		If swing operation only is ON	OFF
In conditions other than above			

Table for Functioning Conditions - Swing brake solenoid valve.

Functioning Condition		Functioning
Swing or work equipment lever operated	Brake cancelled	ON
All levers except travel at neutral (5 seconds after returning to neutral)	Brake ON	OFF
Swing lock switch in ON position		

Table for Functioning Conditions - Suspension lock solenoid valve.

Functioning Condition		Functioning
Suspension lock switch ON	Suspension lock actuated	ON
Suspension lock switch OFF	Suspension lock cancelled	OFF

TESTING TRANSMISSION CLUTCH CONTROL CIRCUIT

DESCRIPTION

The transmission contains two clutches which engage HI and LO gear. The clutches are engaged or disengaged by the clutch control solenoid valve. Energising the clutch control solenoid valve will select LO gear and de-energising the solenoid valve will select HI gear. When the solenoid valve is energised, port X is connected to tank (i.e. no pressure) and port Y is pressurised. In this condition the LO gear clutch (large diameter) is engaged and the HI gear clutch (small diameter) is disengaged. If the clutch control solenoid is de-energised, then port Y is connected to tank and port X is pressurised. In this condition, the HI gear clutch is engaged the LO gear clutch is disengaged.

LO gear = High torque (LO speed)
HI gear = Low torque (HI speed)

The actuation pressure for the transmission clutches is supplied from an accumulator via a pressure reducing valve and park brake solenoid valve mounted in the power brake valve. The park brake solenoid valve must be energised to feed the actuation pressure to either HI or LO clutch (via another accumulator to enhance gear shift). With the park brake valve de-energised, both clutches are engaged and so the park brake is engaged.

1. Measuring clutch actuation pressure

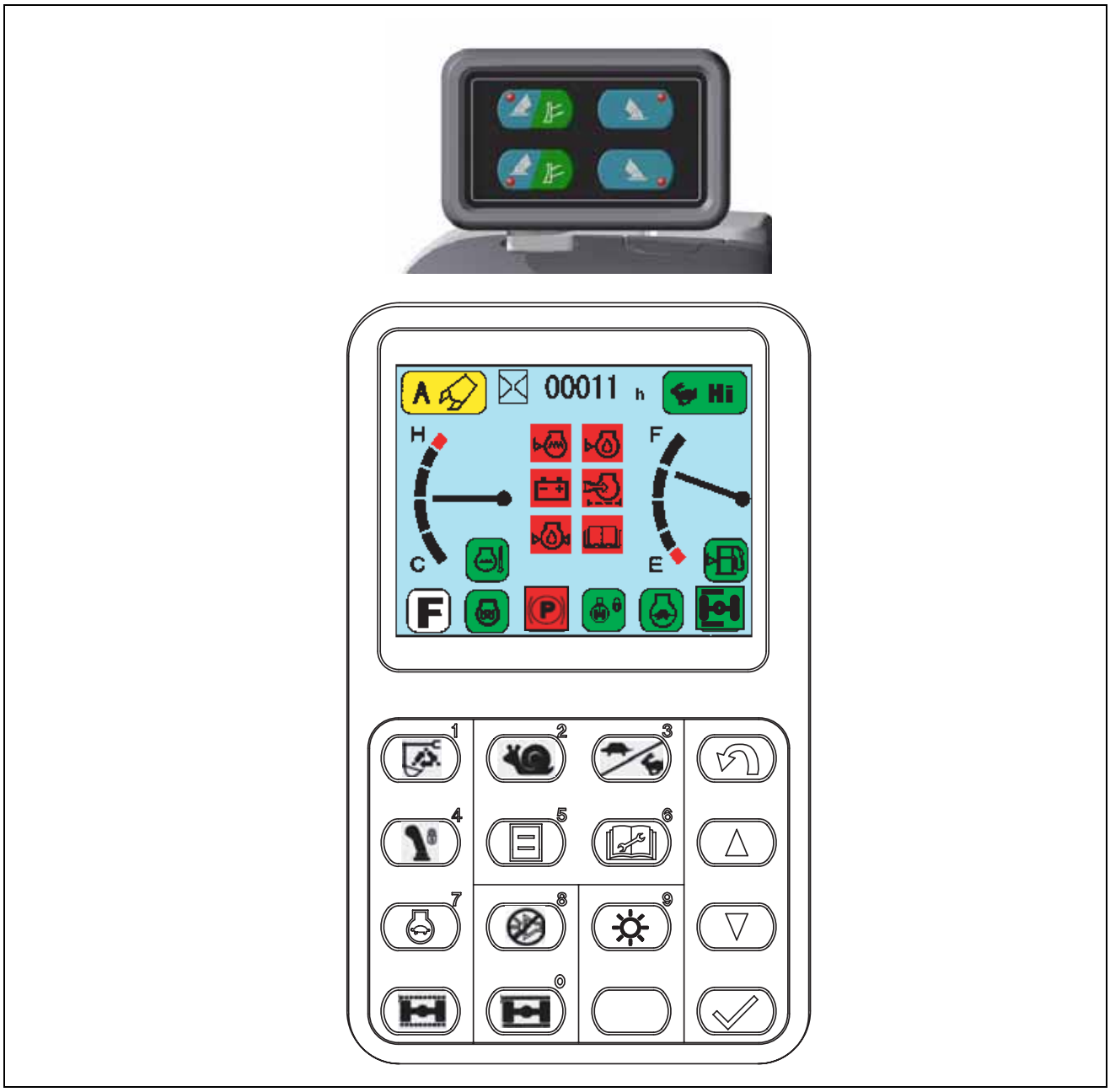
Oil temperature 45 ~ 55°C
Fit the tee's to clutch ports X and Y on the transmission. Fit 150 kg/cm² pressure gauge to the third leg of the tee. With the engine running and the park brake disengaged measure the pressure at port X and Y in the conditions shown in the judgment table.

- **Judgement table**

Travel mode	Pressure MPa (kg/cm^2)	
	Port X	Port Y
HI (Park brake off)	0	5.8 $^{+}$ / $^{-}$ 0.7 (59 $^{+}$ / $^{-}$ 7)
LO (Park brake off)	5.8 $^{+}$ / $^{-}$ 0.7 (59 $^{+}$ / $^{-}$ 7)	0
CREEP (Park brake off)	5.8 $^{+}$ / $^{-}$ 0.7 (59 $^{+}$ / $^{-}$ 7)	0
PARK BRAKE ON	0	0

If the pressure is low or high then the power brake valve must be changed (the pressure reducing valve is not adjustable).If the pressure is 0, check flow to power brake valve and accumulator charge pressure.

SPECIAL FUNCTION OF MONITOR PANEL



[1] Figure input switch 1
[2] Figure input switch 2
[3] Figure input switch 3
[4] Figure input switch 4
[5] Figure input switch 5
[6] Figure input switch 6
[7] Figure input switch 7
[8] Figure input switch 8
[9] Figure input switch 9
[0] Figure input switch 0

Undo switch
Scroll up switch
Scroll down switch
Input confirmation switch

User Code No.	Error Code		Failure Code			Failure Classification
	Code No.	Content	Code No.	Location	Phenomenon	
–	E223	LS-EPC sol. discontinuity - Hot short	DXE0KA			Electrical system
–	E224	F pump press sensor abnormality	DDHPAKP			
–	E225	R pump press sensor abnormality	DHPBMA			
–	E226	Press sensor power abnormality	DH10KS			
–	E227	Engine speed sensor abnormality	DLE2MA			
E02	E232	PC-EPC sol.	DXA0KB			
E02	E233	PC-EPC sol.	DXA0KA			
–	E236	2 stage back pressure sol.	DWK2KB			
–	E237	2 stage back pressure sol.	DWK2KA			
–	E245	Service EPC	DXE4KB			
–	E246	Service EPC	DXE4KA			
E20	E247	Travel F-N-R signal switch abnormality	DDWCKZ			
E20	E248	Boom/Outrigger SW select abnormality	DDC3KZ			
–	E251	Overload sensor abnormality	DHX1MA			
E20	E252	Travel PPC sensor abnormality	DHS5KX			
–	E253	Travel PPC press. SW abnormality	DDP4KX			
E20	E254	Speed sensor discontinuity	DLT4KA			
–	E256	Memory error	DA20KT			
E20	E257	Travel PPC press SW hydraulic abnormality	6B2JMA			
E20	E258	Brake lock proximity switch	DDB2KX			
–	E261	Service sol. relay	PD00KB			
–	E262	Service sol. relay	PD00KA			
E20	E263	Brake light cut relay	DDB2KB			
E20	E264	Brake light cut relay	DDB2KA			
E20	E274	Suspension lock relay	DW4AKB			
E20	E275	Suspension lock relay	DW4AKA			
–	E276	PPC lock relay	DW4CKB			
–	E277	PPC lock relay	DW4CKA			
–	E301	Engine speed low (under 500 rpm)	A000N2			
–	E302	Engine speed is over (travel + 150) rpm	A000N1			
–	E306	Gov. motor potentiometer abnormality	DK54KZ			
E05	E308	Fuel Dial Abnormality	DK10KZ			
–	E313	Auto lub. abnormal	DA80MA			
–	E315	Battery relay drive G_{ND} short	D110KB			
–	E316	Governor motor step out	DY10K4			
E05	E317	Governor motor discontinuity - Hot short	DY10KA			
E05	E318	Governor motor G_{ND} short	DY10KB			

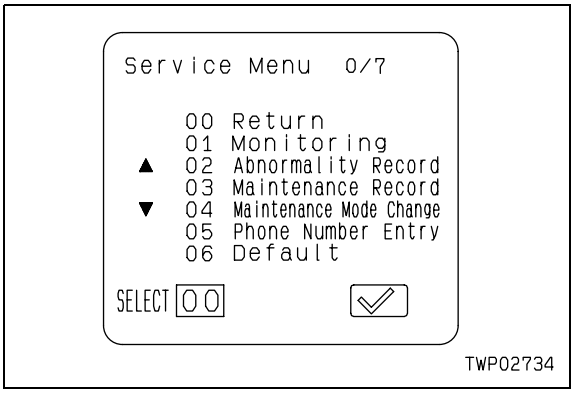
4) Function for Maintenance Mode Change [04]

Conditions set for controlling maintenance display function can be changed in the following manner.

- Turn the function effectual or ineffectual.
- Change the set interval for replacement.

4.1) Selection of menu

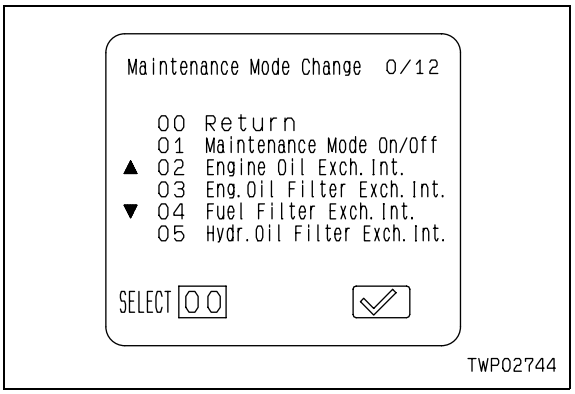
Select 04 Maintenance Mode Change in the initial display of Service Menu, and depress [√] switch.



4.2) Selection of item to be changed

Select an item to be changed in the display of Maintenance Mode Change Selecting Menu.

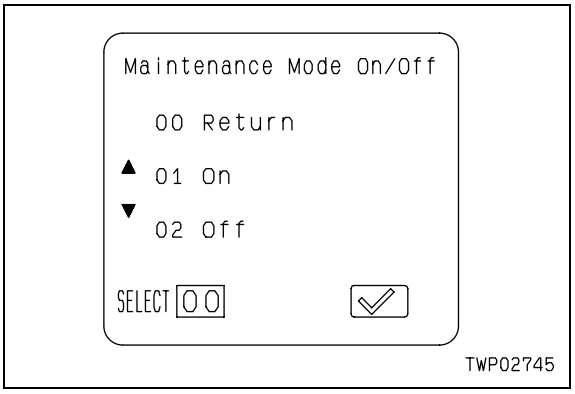
No.	Maintenance mode change item
00	Return
01	Maintenance Mode On/Off
02	Engine Oil Exch. Int.
03	Engine Oil Filter Exch. Int.
04	Fuel Filter Exch. Int.
05	Hydr. Oil Filter Exch. Int.
06	H/Tank Breather Exch. Int.
07	Corro. Resis. Exch. Int.
08	PTO Oil Service Int.
09	S/Machinery Oil Exch. Int.
10	Hydraulic Oil Exch. Int.
11	Transmission Oil Exch. Int.
12	Axle Oil Exch. Int.
13	Use Default Values



- 01 and 13 menus are provided for setting the whole maintenance mode, while those from 02 through 12 are for setting individual items.

4.3) Contents of Maintenance Mode On/Off

- Use: The maintenance display function of all oil and filter-related items are turned effectual. (Irrespective of whether "On" or "Off" set for individual items, this setting prevails)
- Do not use: The maintenance display function of all oil and filter-related items are turned ineffectual. (Irrespective of whether "On" or "Off" set for individual items, this setting prevails)



PREPARATIONS FOR TROUBLESHOOTING ELECTRICAL SYSTEM

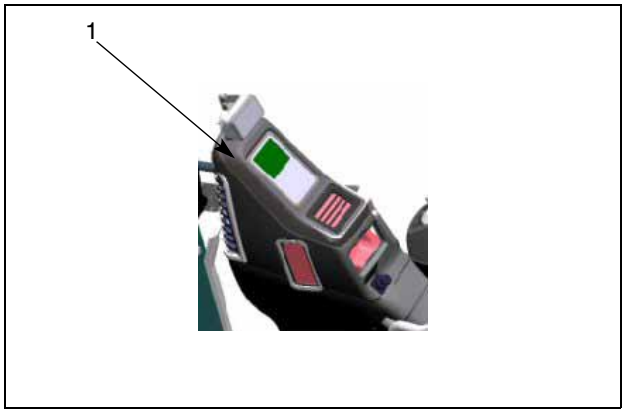
- When diagnosing electric circuits related to the monitor panel and governor pump controller, first open up the connector portions in the following manner.

1) Monitor panel

1.1) Take off cover (1).

- The cover is fixed with one upper and lower clip. Pull it up for the removal.

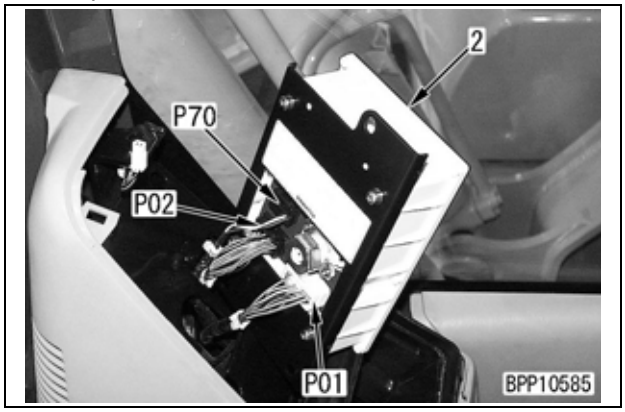
.



1.2) Remove the 3 mounting screws and disconnect monitor panel (2) from the mount.

- Take care not to drop the mounting screws in the console.

1.3) Insert or connect a T-adaptors for troubleshooting to connectors **P01**, **P02** and **P70** of the monitor panel.



1) Governor pump controller

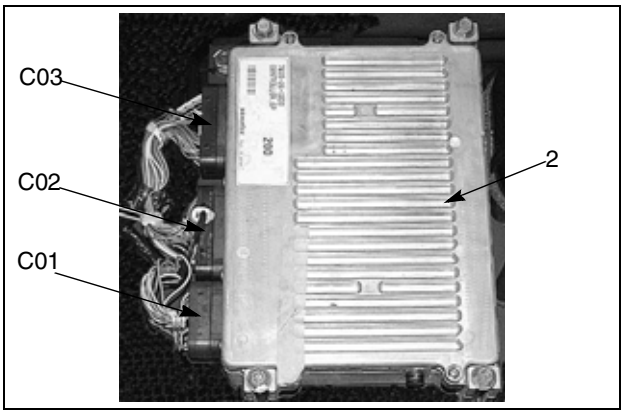
- The governor pump controller is installed inside the cover behind the operator's seat.

1.1) Take off cover (1).

1.2) Insert or connect a T-adapter for diagnosis with **C01**, **C02** and **C03** connectors of governor pump controller (2).

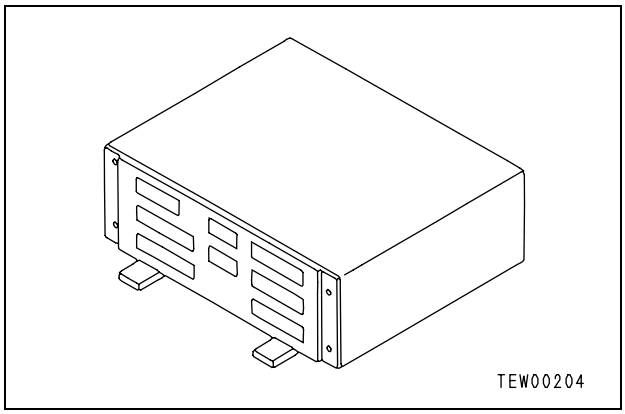
- The connectors are fixed with screws. Loosen the screws and detach the connectors.
- When putting the connectors back into position, tighten them to the specified torque.

N·m Screw: **2.82Nm {0.288 kgm}**

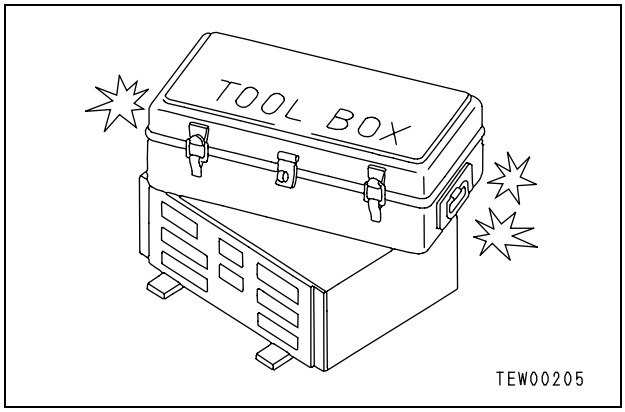


3) Handling control box

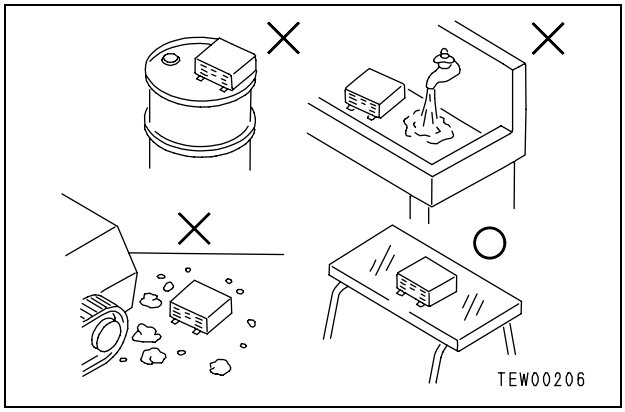
1) The control box contains a microcomputer and electronic control circuits. These control all of the electronic circuits on the machine, so be extremely careful when handling the control box.
2) Do not open the cover of the control box unless necessary.



3) Do not place objects on top of the control box.
4) Cover the control connectors with tape or a vinyl bag.
   Never touch the connector contacts with your hand.
5) During rainy weather, do not leave the control box in a place where it is exposed to rain.



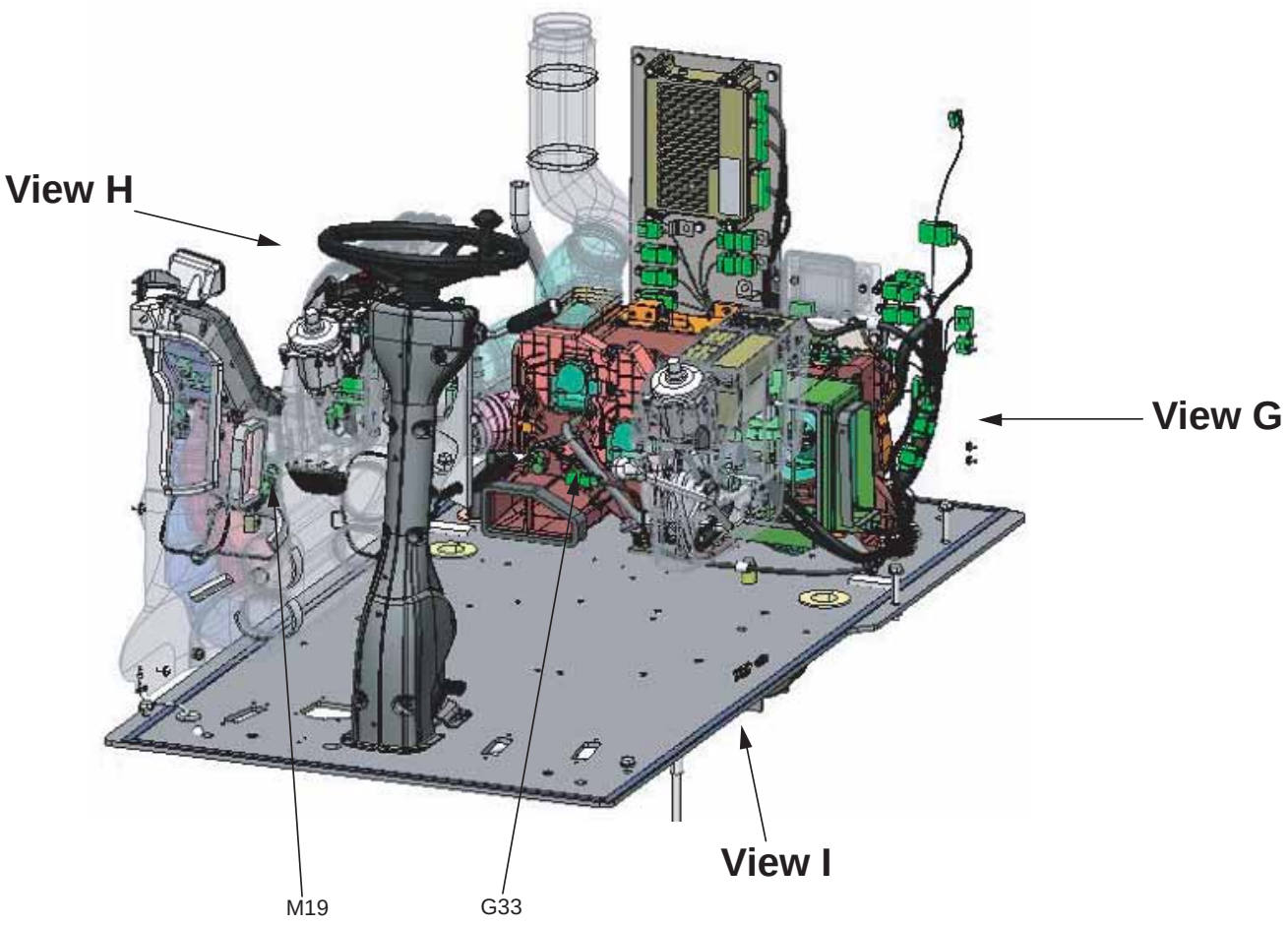
6) Do not place the control box on oil, water, or soil, or in any hot place, even for a short time.
   (Place it on a suitable dry stand).
7) Precautions when carrying out arc welding
   When carrying out arc welding on the body, disconnect all wiring harness connectors connected to the control box. Fit an arc welding ground close to the welding point.



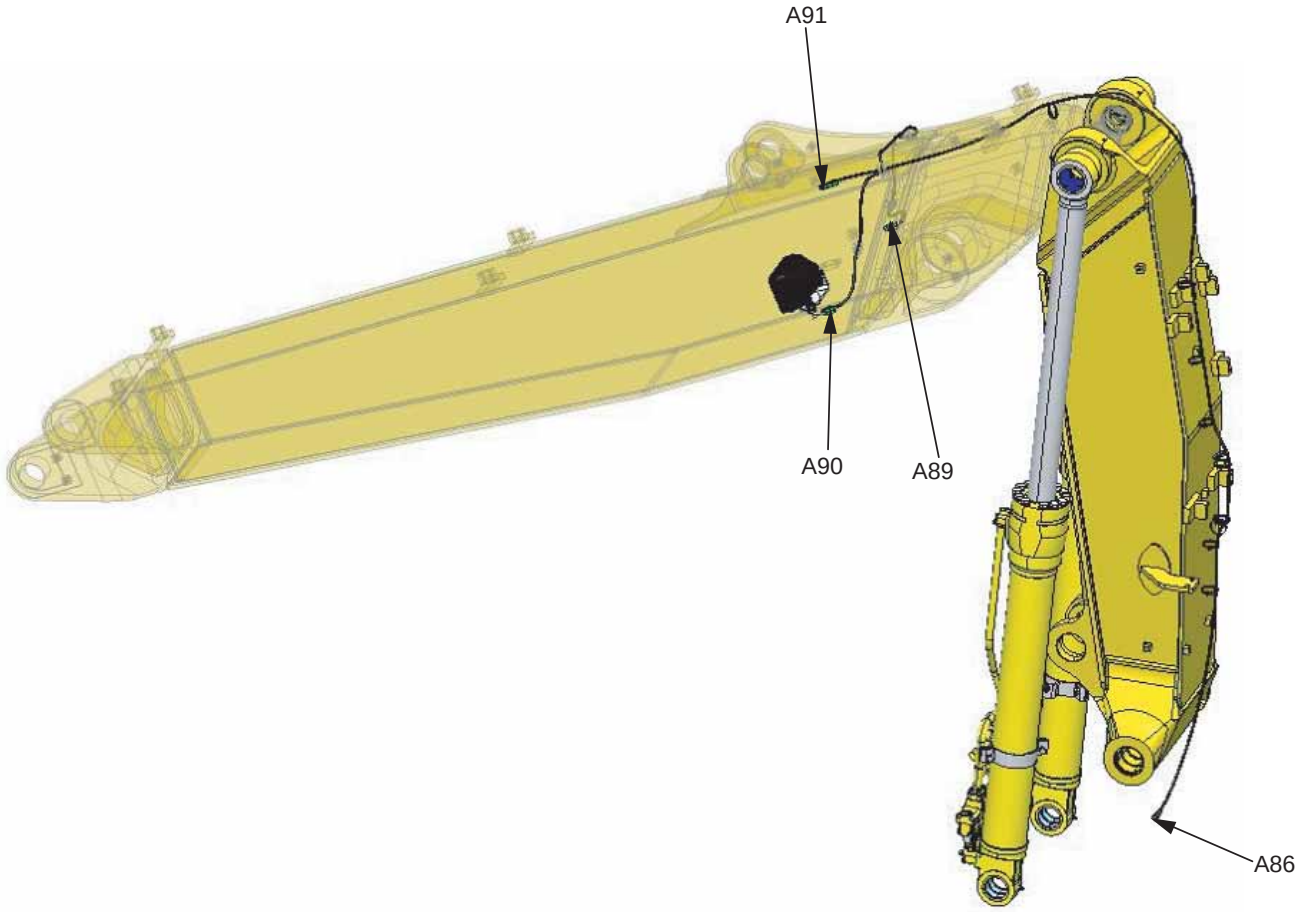
2. Points to remember when troubleshooting electric circuits

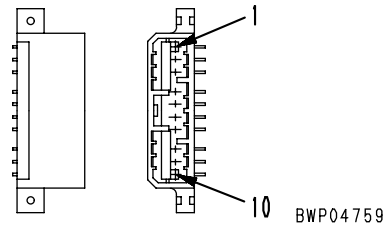
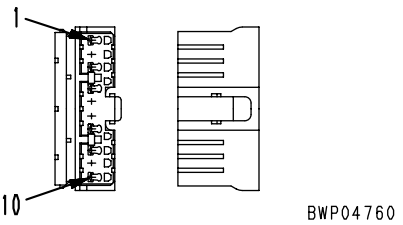
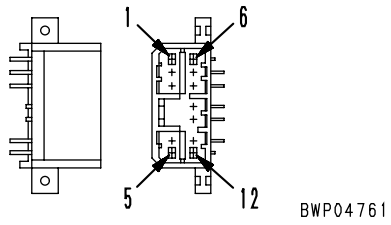
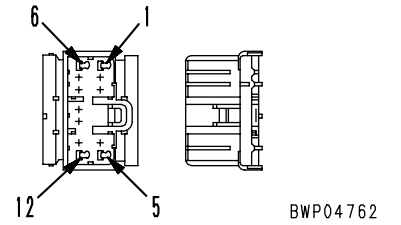
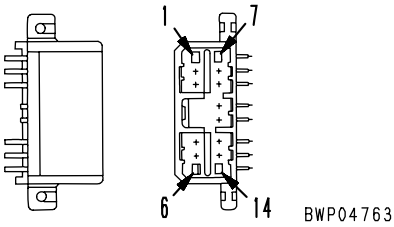
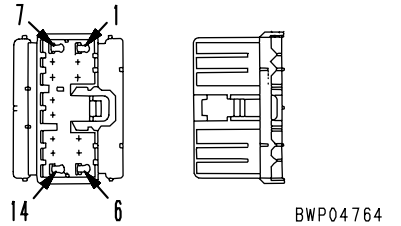
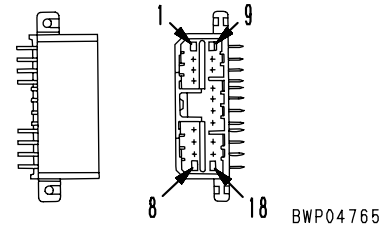
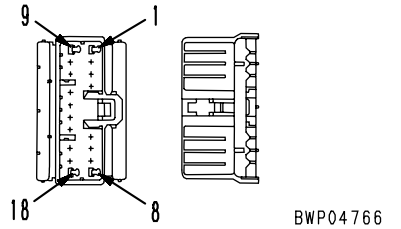
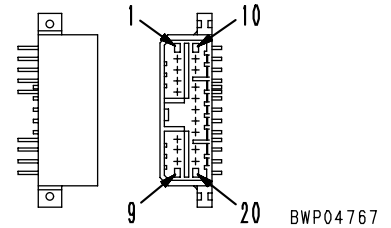
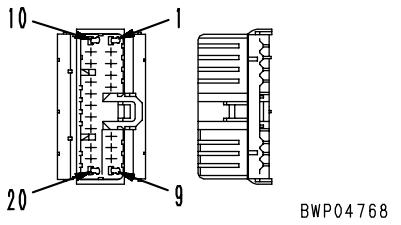
1) Always turn the power OFF before disconnecting or connect connectors.
2) Before carrying out troubleshooting, check that all the related connectors are properly inserted.
   ★ Disconnect and connect the related connectors several times to check.
3) Always connect any disconnected connectors before going on to the next step.
   ★ If the power is turned ON with the connectors still disconnected, unnecessary abnormality displays will be generated.
4) When carrying out troubleshooting of circuits (measuring the voltage, resistance, continuity, or current), move the related wiring and connectors several times and check that there is no change in the reading of the tester.
   ★ If there is any change, there is probably defective contact in that circuit.

Connector No.	Type	No.of Pin	Name of Device	Address				
				Sheet 1	Sheet 2	Sheet 3	Sheet 4	Sheet 5
A86	DT	2	Work Equipment Lights				O-4	
A89	KES1	1	Boom Light RH (OPT)				O-5	
A90(A)	KES1	1	Boom light LH (OPT)				P-5	
A90(B)	DT	3	Swing proximity switch				B-5	
A91(A)	DT	2	Arm Marker Light (OPT)				P-4	
A91(B)	DT	3	Brake proximity switch		H-23			
A99	SWP	8	Intermediate connector	J-2			N-2	
AS1	DT	3	Angle sensor (Japan spec.)	D-22				
C01	DRC	24	Governor Pump Controller	E-23				
C02	DRC	40	Governor Pump Controller	G-23				
C03	DRC	40	Governor Pump Controller	K-23				
C09	S	8	Model selection connector	B-6				
D01	SWP	8	Assembled type diode	P-16				
D02	SWP	8	Diode	P-14				
D03	KES1	2	Assembled type diode		K-19			
D04	KES1	2	Assembled type diode		O-13			
D05	KES1	2	Assembled type diode		O-14			
E01	Terminal	1	Suction type air heater (Grid Heater)				F-18	
E02	Terminal	1	Engine oil pressure switch				J-20	
E03	X	2	Engine oil level Switch				J-20	
E04	DT	2	Engine speed sensor				H-20	
E05	DT	2	Engine cooling water temperature sensor				J-20	
E06	X	1	Air Con comp. Electromagnetic switch				K-20	
E06	M	3	Fuel dial				M-17	
E10	DT	3	Governor potentiometer				I-21	
E11	DT	4	Goverenor motor				I-21	
E12	Terminal	2	Alternator (B + D)				F-20	
E13	Terminal	2	Engine Starter (B + C)				F-19	
E21	DT	12	Intermediate connector				J-18	
E22	DT	12	Intermediate connector				I-18	
FB1	-	20	Fuse Box			D-16		
F01	KES1	4	Flasher Unit		K-20			
F02(A)	Yazaki	2	Operator cab beacon			G-13		
F02(B)	DT	2	Operator cab beacon			J-13		
G02	DT	12	Steering Column		F-22			
G3	AMP	7	Steering Column switch assy		D-22			
G4	AMP	7	Steering Column switch assy		D-23			
G05	DT	12	Steering Column		F-19			
G7	DT	4	Rear Lights L.H				O-21	
G8	DT	4	Rear Lights R.H				N-21	
G10	X	2	Harness for licence No. plate				N-23	
G12	DT	6	Front light connector (R.H)				O-8	
G13	DT	6	Front light connector (L.H)				P-8	
G33	DT	4	Heated seat (OPT)			C-4		
G50	Bullet	1	Engine compartment lamp (OPT)				P-18	
G51	Bullet	1	Engine compartment lamp (OPT)				P-18	
G52	KES0	4	Lower wiper (OPT)				C-4	

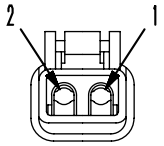
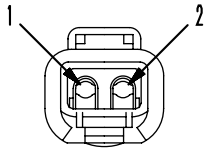
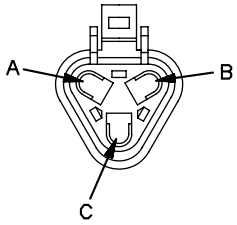
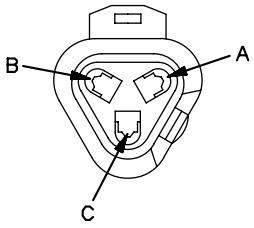
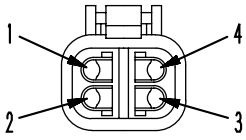
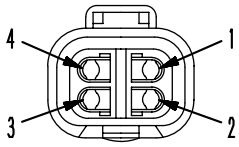
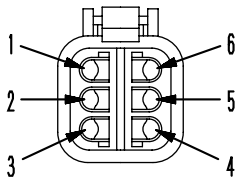
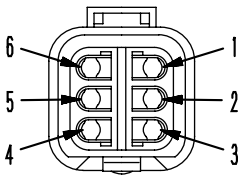

View H
View G
View I
M19
G33

Work Equipment



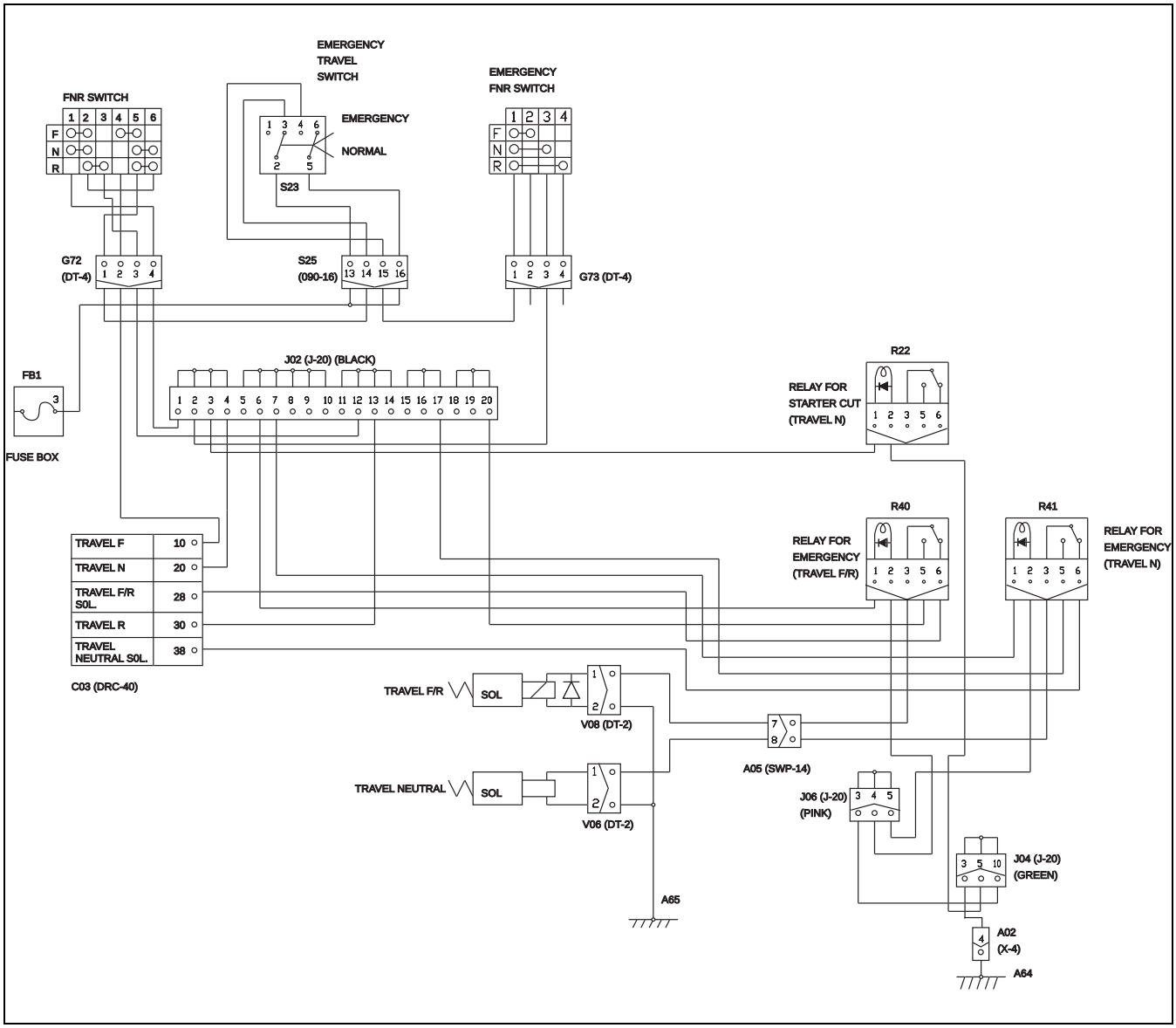
No.of pins	AMP070 type connector		
	Male (female housing)	Female (male housing)	T-adapter Part No.
10			799-601-7510
	—	Part No.: 08195-10210	
12			799-601-7520
	—	Part No.: 08195-12210	
14			799-601-7530
	—	Part No.: 08195-14210	
18			799-601-7540
	—	Part No.: 08195-18210	
20			799-601-7550
	—	Part No.: 08195-20210	

[The pin No. is also marked on the connector (electric wire insertion end)]

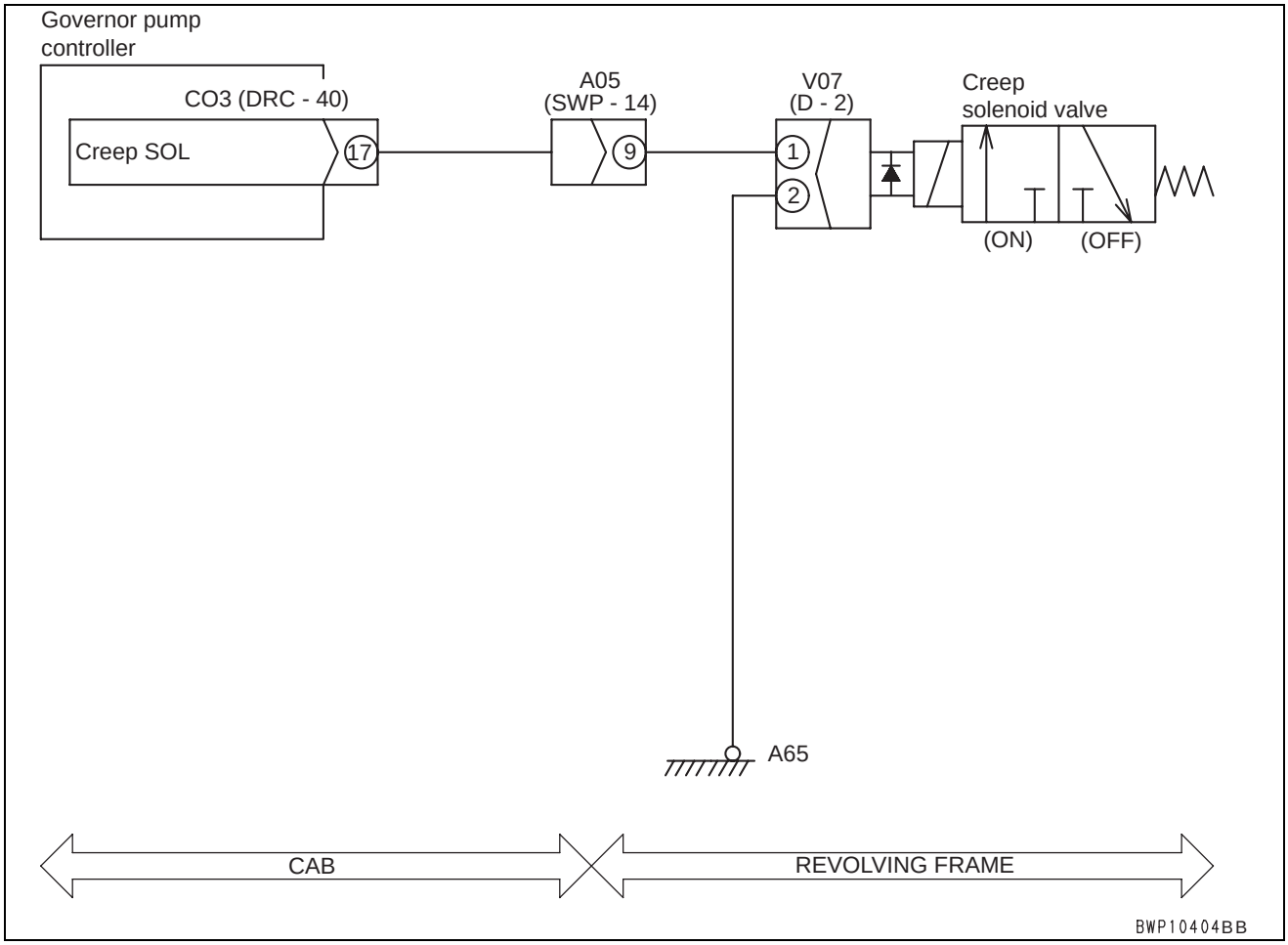
No.of pins	DT Series connector		
	Body (plug)	Body (receptacle)	T-adapter Part No.
2	 BWP05037	 BWP05038	799-601-9020
	Part No.: 08192-12200 (normal type) 08192-22200 (fine wire type)	Part No.: 08192-12100 (normal type) 08192-22100 (fine wire type)	
3	 BWP05039	 BWP05040	799-601-9030
	Part No.: 08192-13200 (normal type) 08192-23200 (fine wire type)	Part No.: 08192-13100 (normal type) 08192-23100 (fine wire type)	
4	 BWP05041	 BWP05042	799-601-9040
	Part No.: 08192-14200 (normal type) 08192-24200 (fine wire type)	Part No.: 08192-14100 (normal type) 08192-24100 (fine wire type)	
6	 BWP05043	 BWP05044	799-601-9050
	Part No.: 08192-16200 (normal type) 08192-26200 (fine wire type)	Part No.: 08192-16100 (normal type) 08192-26100 (fine wire type)	

TROUBLESHOOTING WHEN SERVICE CODE "ELECTRICAL SYSTEM" AND FAILURE CODE "MECHANICAL SYSTEM" ARE INDICATED

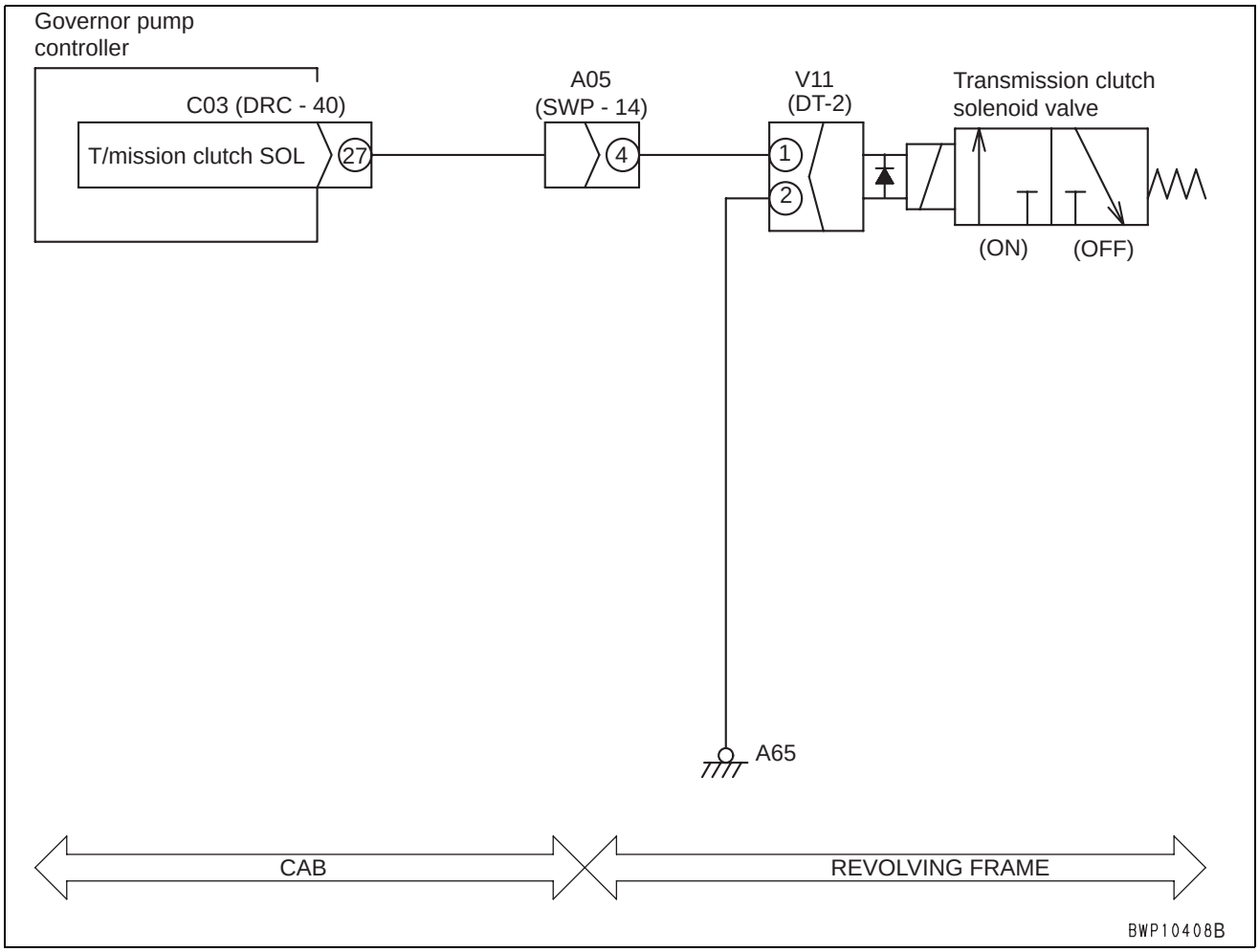
Electrical Circuit for Travel Neutral Solenoid in Governor Pump Controller



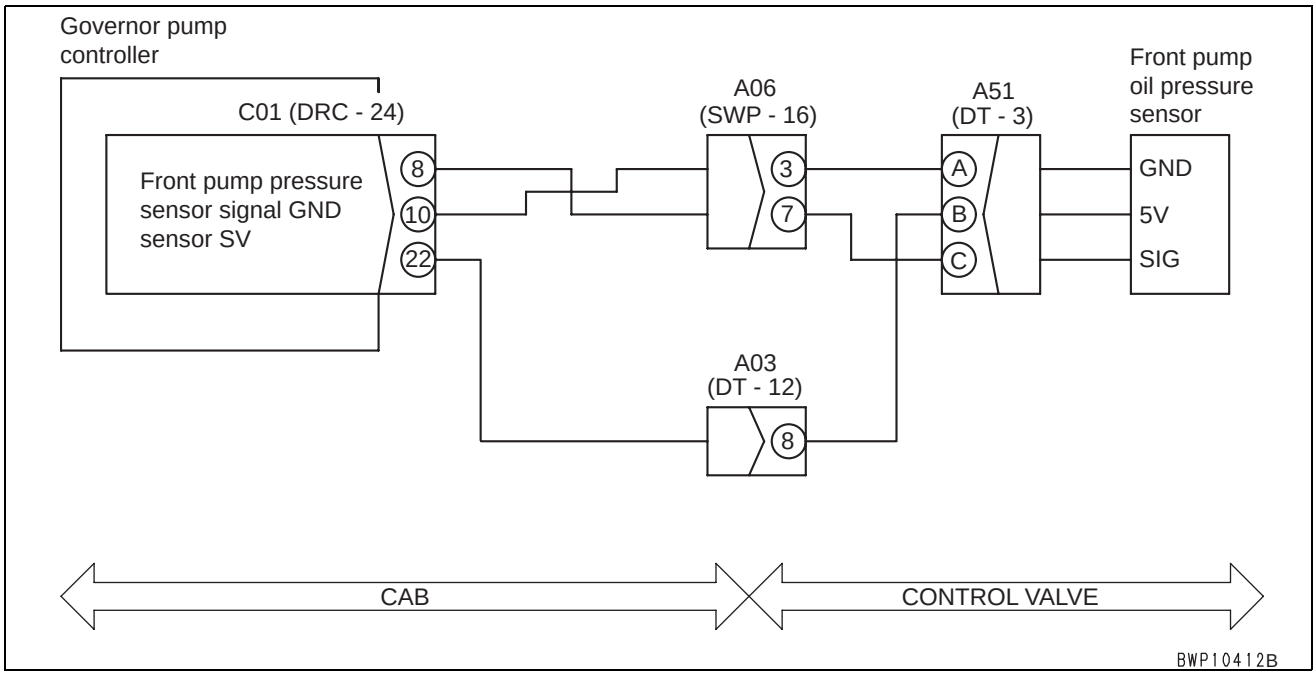
Electrical Circuit Diagram for Creep Solenoid in Governor Pump Controller



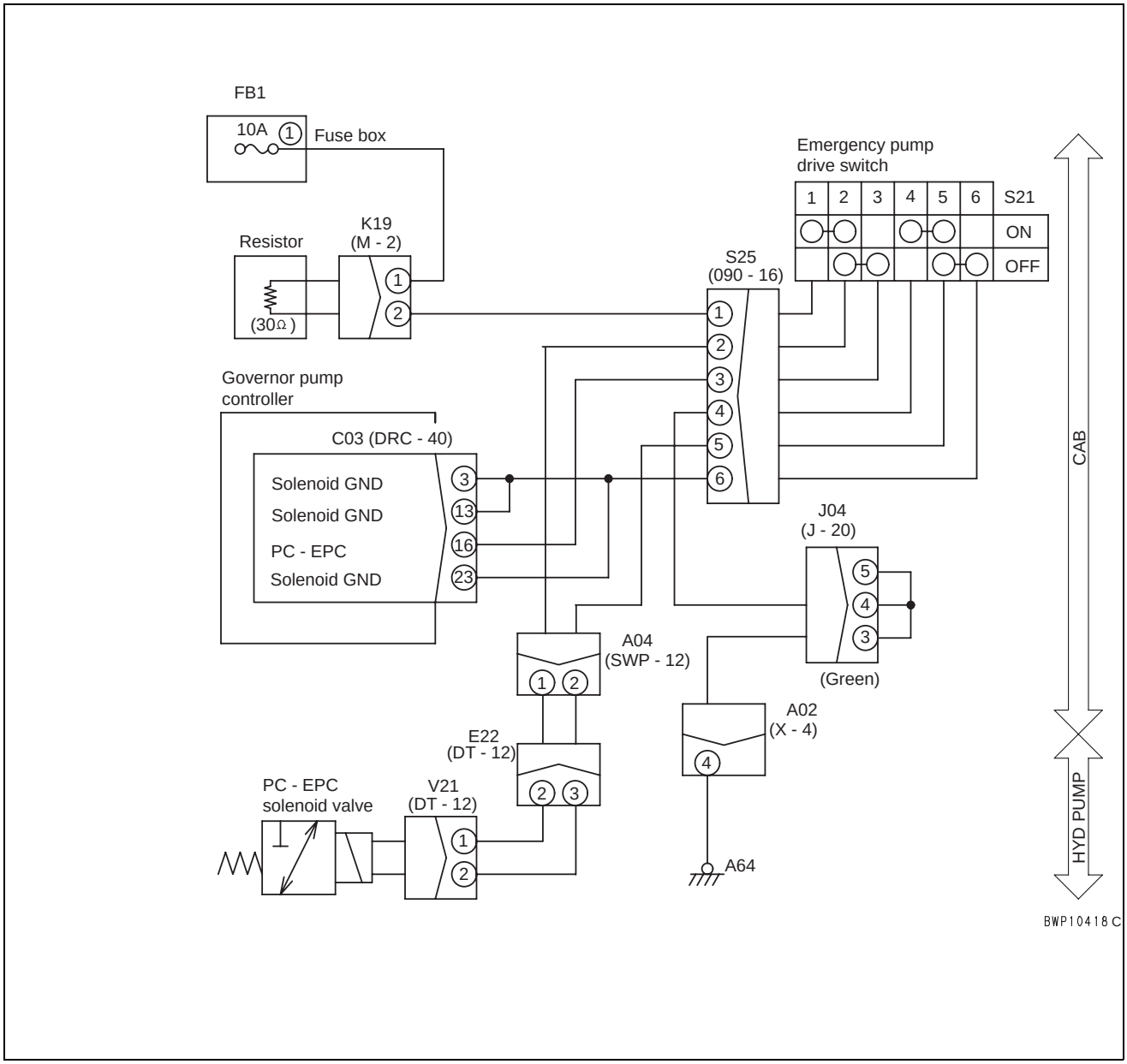
Electrical Circuit Diagram for Transmission Clutch Solenoid in Governor • Pump Controller



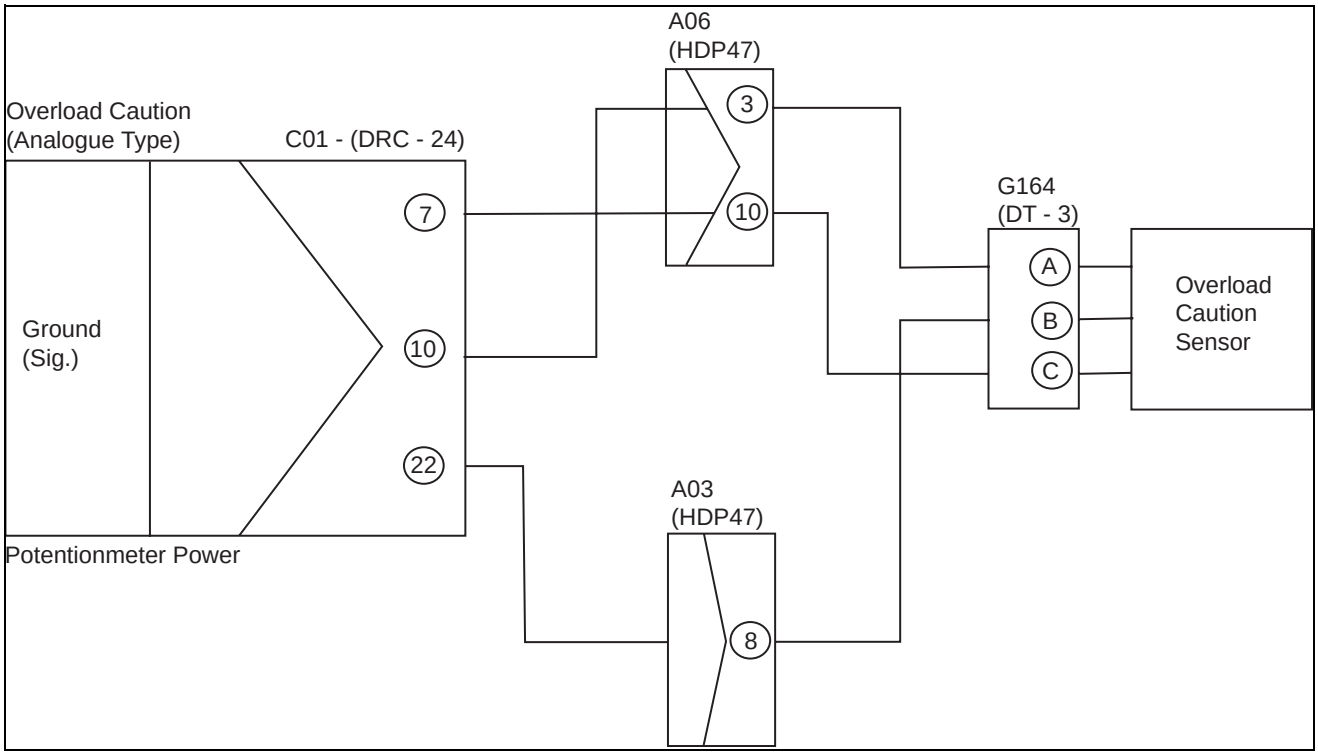
Electrical Circuit Diagram for Pump Pressure Sensor in Governor • Pump Controller



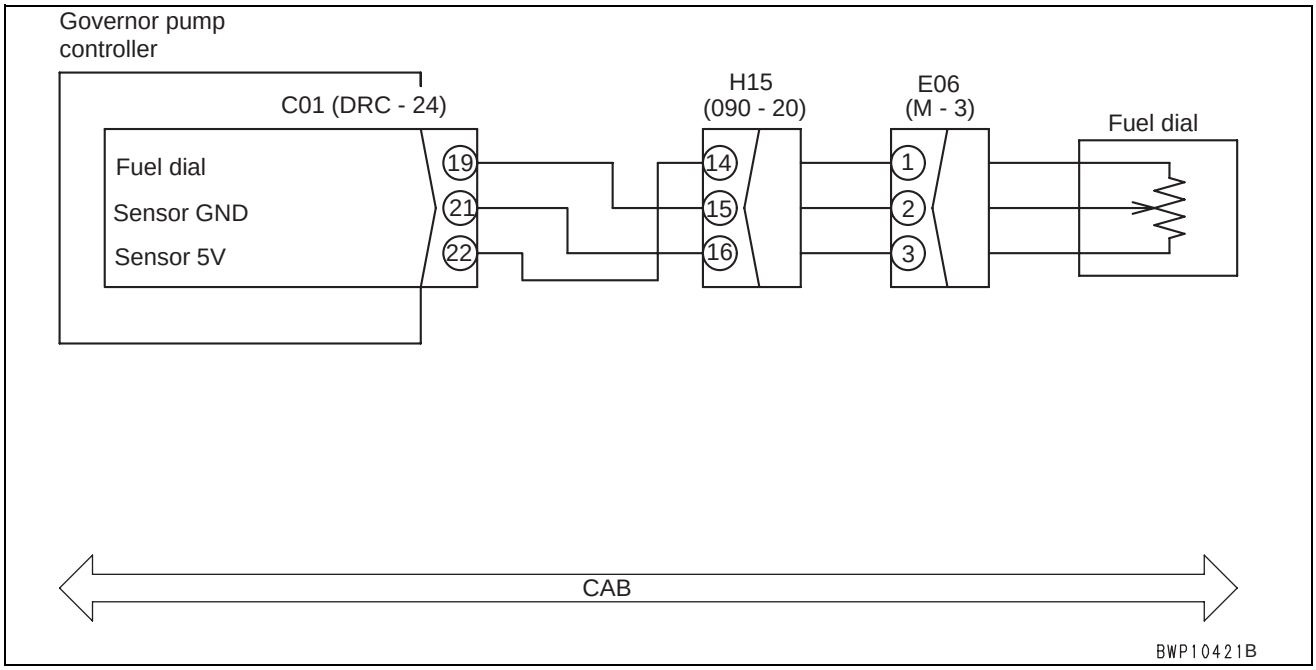
Electrical Circuit Diagram for PC-EPC Solenoid in Governor • Pump Controller



Electrical Circuit Diagram for Overload Caution



Electrical Circuit Diagram for Fuel Dial in Governor • Pump Controller

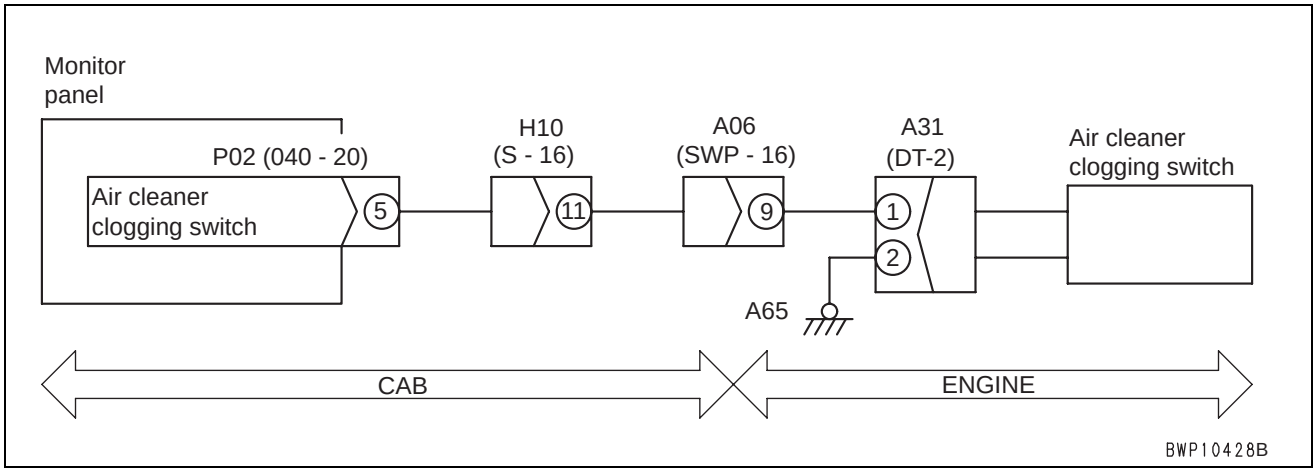


Failure Code in Mechanical System AA10NX (Air cleaner clogging)

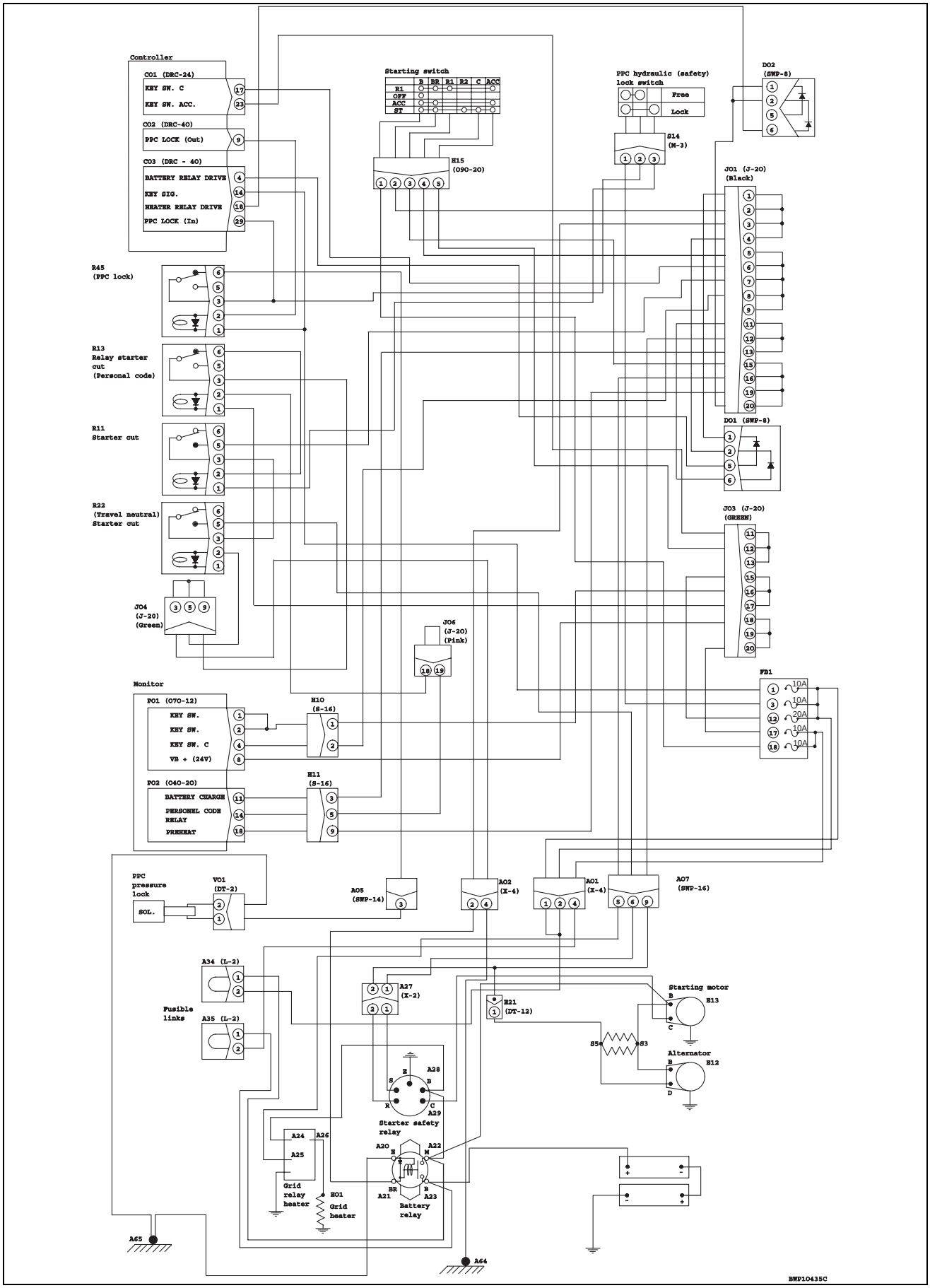
User Code	Service Code	Failure Code	Failure phenomenon	Air cleaner clogged (in mechanical system)
—	—	**AA10NX**		
Failure content	➢ While the engine was running, the signal circuit in the air cleaner clogging switch was opened (i.e. disconnected from grounding circuit).			
Response from controller	➢ None in particular			
Phenomenon occurring on machine	➢ There is a possibility that the engine is damaged, if it is used continuously without corrective action.			
Relative information	➢ This Failure Code is recorded, when the air cleaner clogging caution symbol is displayed in the monitor panel while the engine is running. ➢ Input from the air cleaner clogging switch (ON or OFF) can be confirmed in the monitor panel. (Code No. 046: Monitor input 2)			

Presumed cause and standard value in normal		Cause	Standard value in normal and references for troubleshooting			
	1	Air cleaner clogged (when the system is in normal condition)	➢ Check the air cleaner for clogging. If it is clogged, clean or replace it with new one.			
	2	Air cleaner clogging switch defective (Internal disconnection)	➢ Turn the engine starting switch OFF for the preparations, and keep the engine running during the troubleshooting.			
			A31 (male)	Air cleaner	Resistance value	
			Between ① and ②	When in normal condition	Below 1 Ω	
				When clogged	Above 1 MΩ	
	3	Disconnection of wiring harness (Disconnection or defective contact with connector)	➢ Turn the engine starting switch OFF for the preparations, and hold it running during the troubleshooting.			
			Wiring harness between P02 (female) ⑤ and A31 (female) ①		Resistance value	Below 1 Ω
			Between wiring harness A31 (female) ② and grounding		Resistance value	Below 1 Ω
	4	Monitor panel defective	➢ Turn the engine starting switch OFF for the preparations, and keep the engine running during the troubleshooting.			
			P02	Air cleaner	Voltage	
			Between ⑤ and grounding	When in normal condition	Below 1 V	
				When clogged	20 – 30 V	

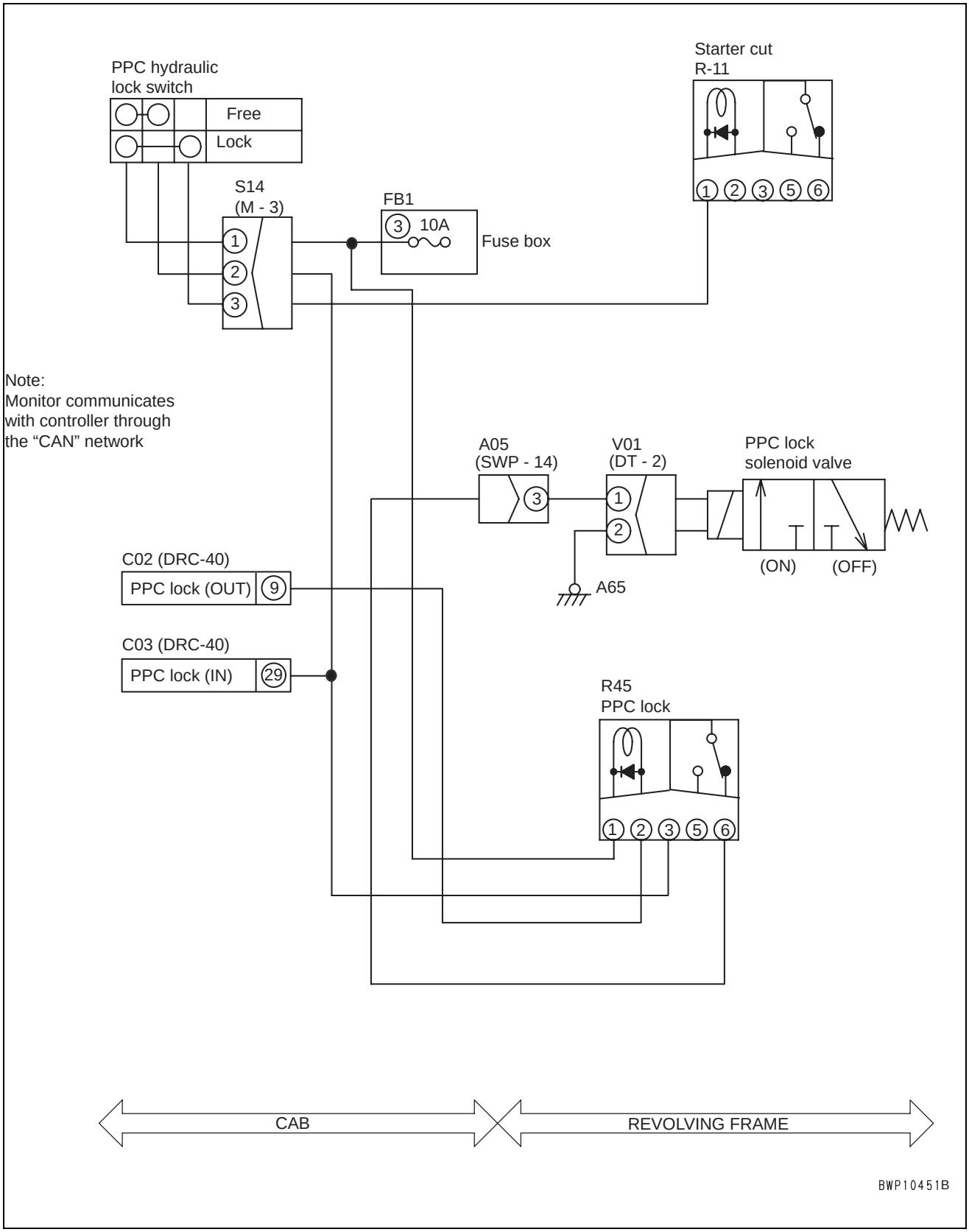
Electrical Circuit for Air Cleaner Clogging Switch in Monitor Panel



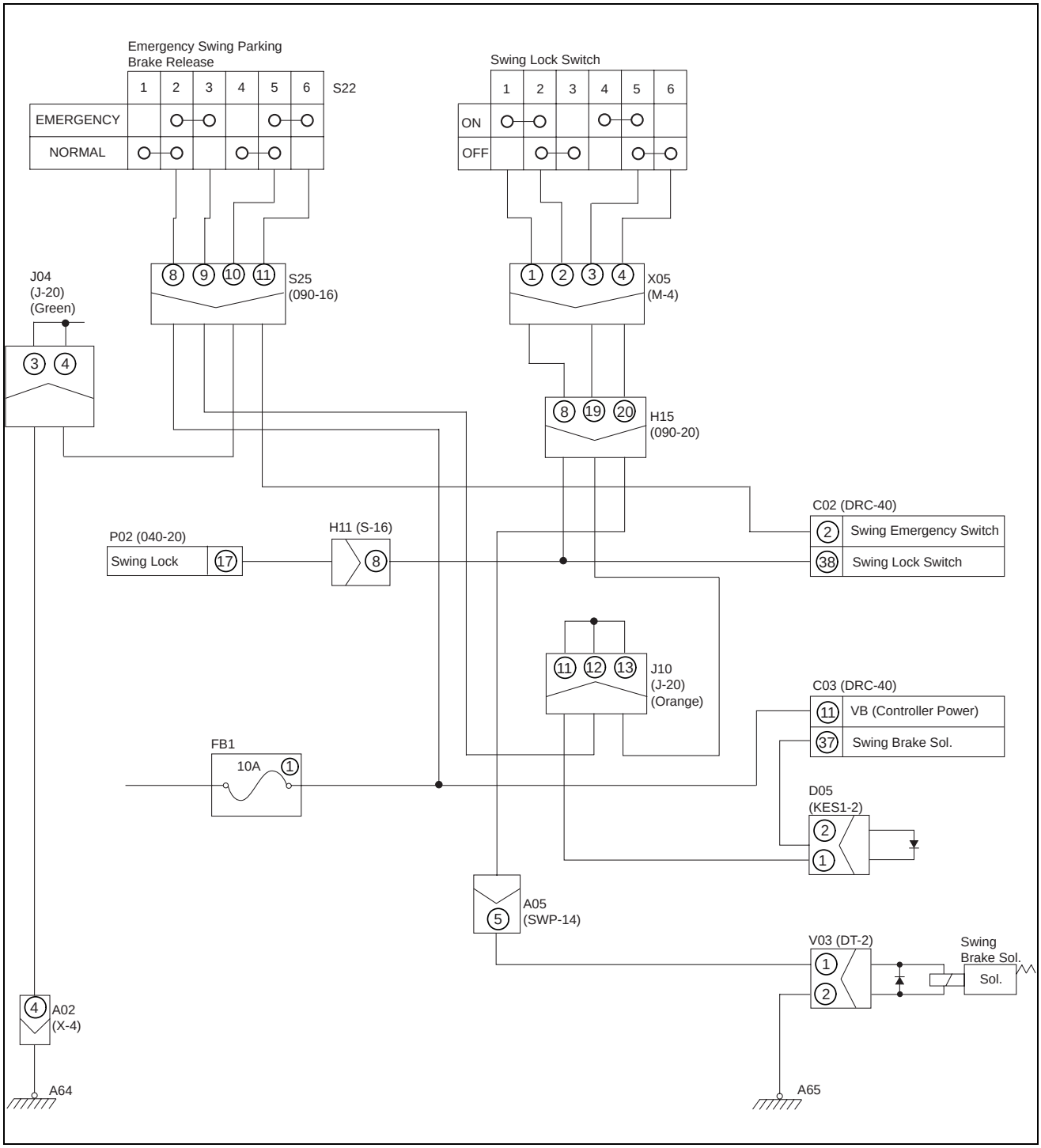
Electrical Circuit Diagram for Engine Start and Stop and Battery Charging



Electrical Circuit Diagram for PPC Lock Solenoid



Electrical Circuit Diagram for Swing Lock Switch



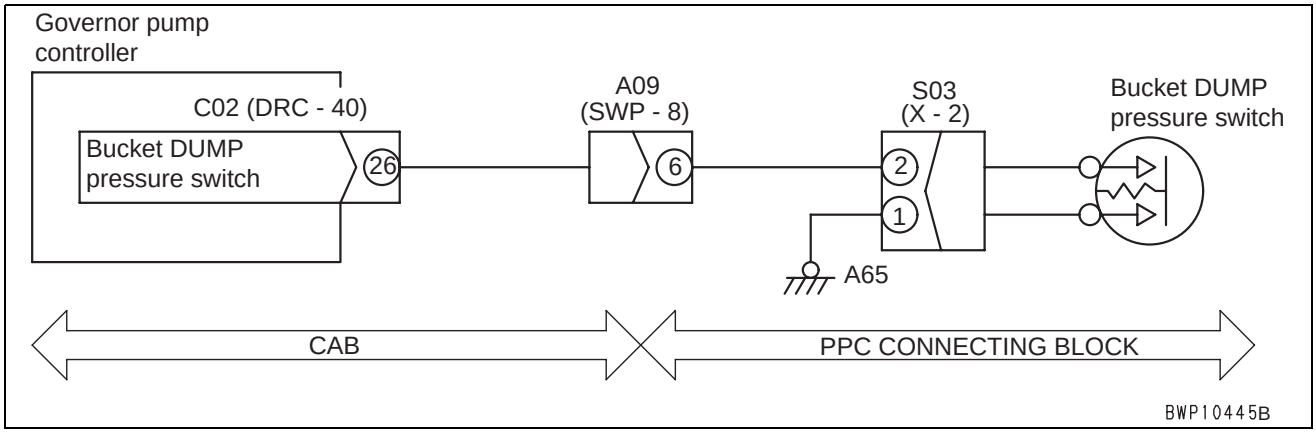
E-26 "Bucket DUMPING" is not correctly displayed in monitor function

Failure information	• "Bucket DUMPING" is not correctly displayed in the monitor function (special function) on the monitor panel.
Relative information	—

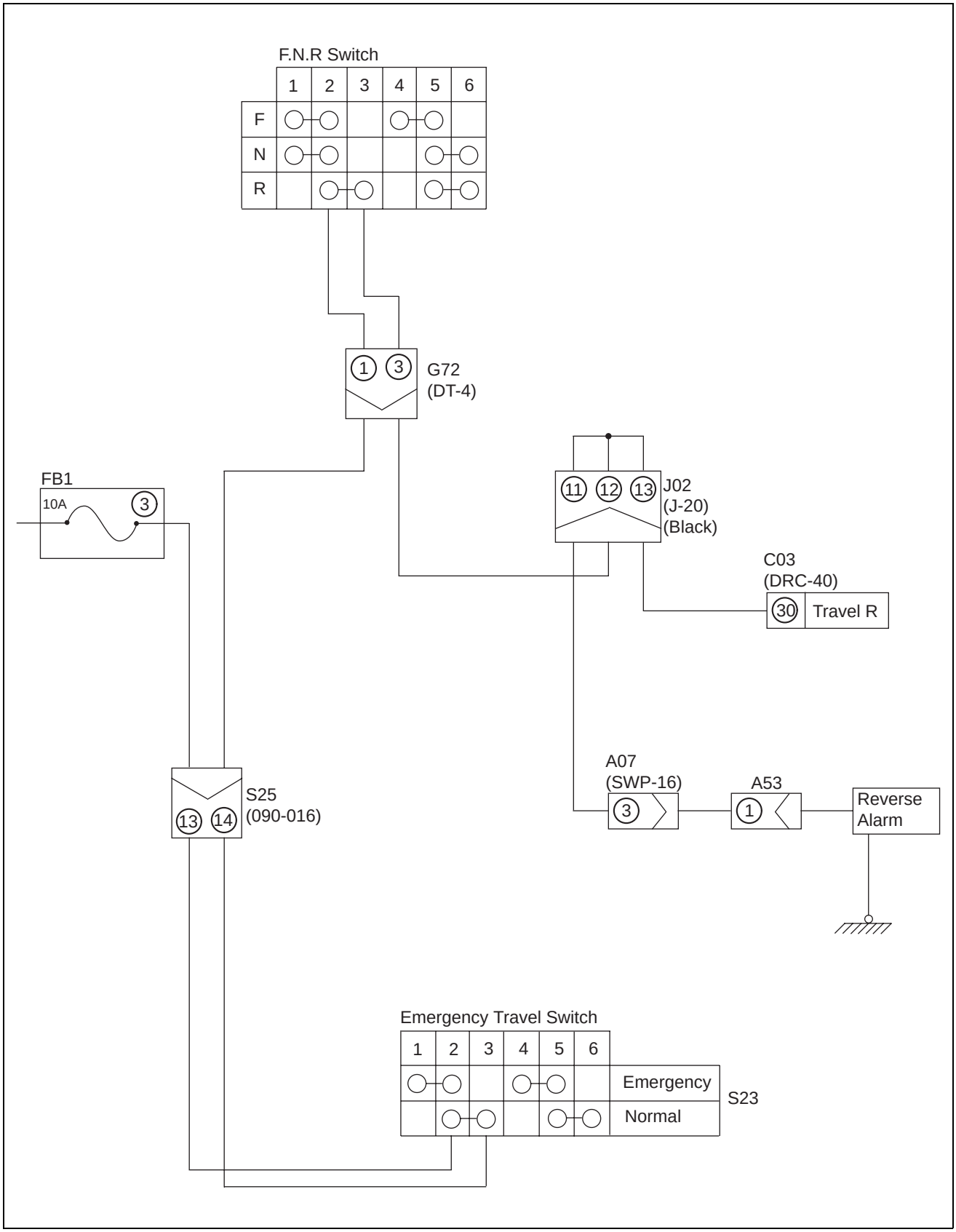
Presumed cause and standard value in normal

	Cause	Standard value in normal and references for troubleshooting			
1	Bucket DUMPING PPC hydraulic switch fault (Internal disconnection and short-circuiting)	• Turn the engine starting switch OFF for the preparations, and keep the engine running during the troubleshooting.			
		S03 (male)	Bucket control lever	Resistance value	
		Between ① and ②	NEUTRAL	Above 1 MΩ	
			DUMPING	Below 1 Ω	
2	Disconnection of wiring harness (Disconnection or defective contact with connector)	• Turn the engine starting switch OFF for the preparations, and hold it in the OFF position during the troubleshooting.			
		Wiring harness between C02 (female) ㉖ and S03 (female) ②		Resistance value	Below 1 Ω
		Wiring harness between S03 (female) ① and grounding		Resistance value	Below 1 Ω
3	Grounding fault of wiring harness (Contact with grounding (GND) circuit)	• Turn the engine starting switch OFF for the preparations, and hold it in the OFF position during the troubleshooting.			
		Wiring harness between C02 (female) ㉖ and S03 (female) ② and grounding		Resistance value	Above 1 MΩ
4	Short-circuiting of wiring harness (Contact with 24 V circuit)	• Turn the engine starting switch OFF for the preparations, and hold it in the ON position during the troubleshooting.			
		Wiring harness between C02 (female) ㉖ and S03 (female) ② and grounding		Voltage	Below 1 V
5	Governor • pump controller defective	• Turn the engine starting switch OFF for the preparations, and hold it in the ON position during the troubleshooting.			
		C02	Bucket control lever	Voltage	
		Between ㉖ and grounding	NEUTRAL	20 – 30 V	
			DUMPING	Below 1 V	

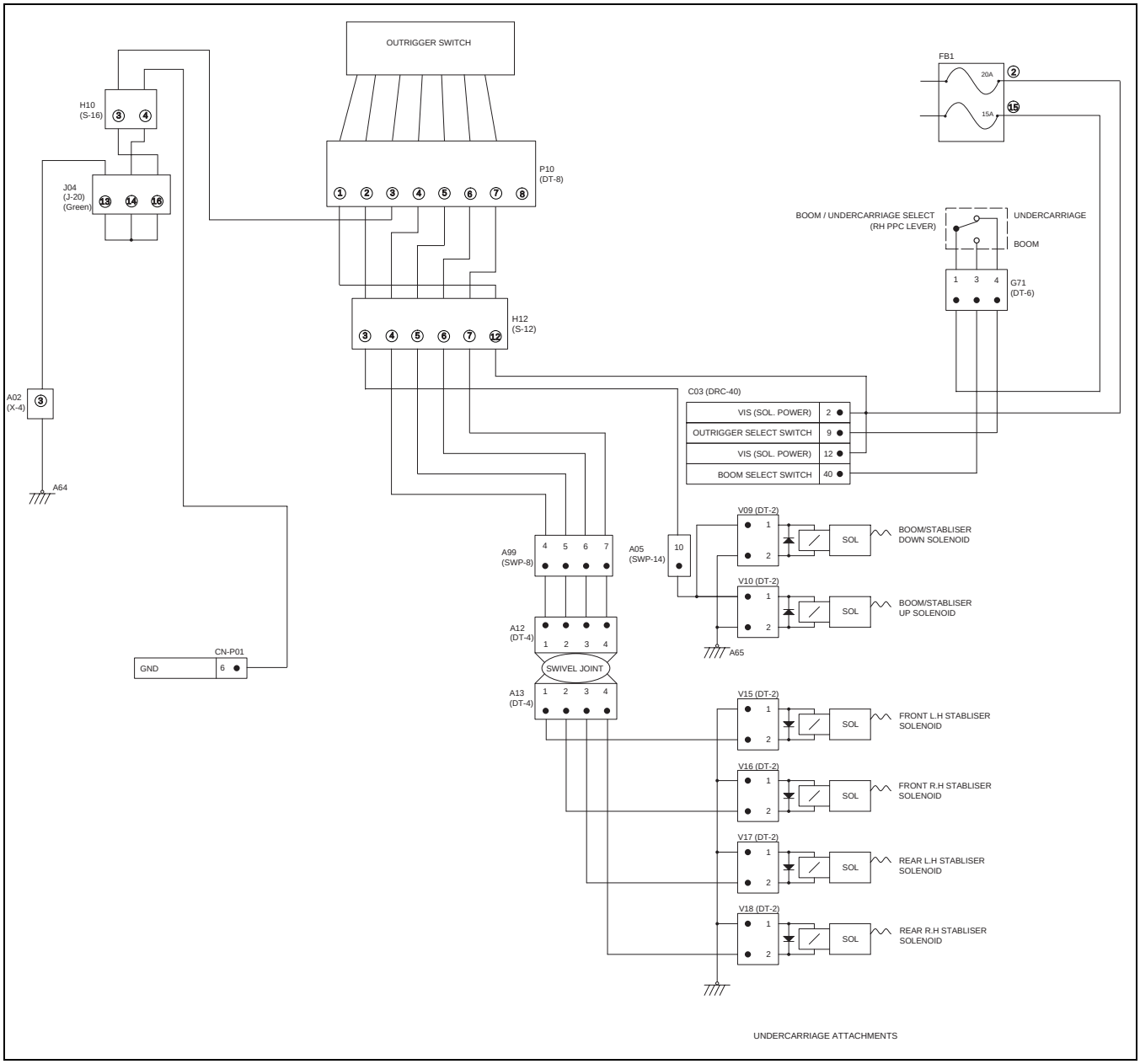
Electrical Circuit Diagram for Bucket DUMPING PPC hydraulic Switch



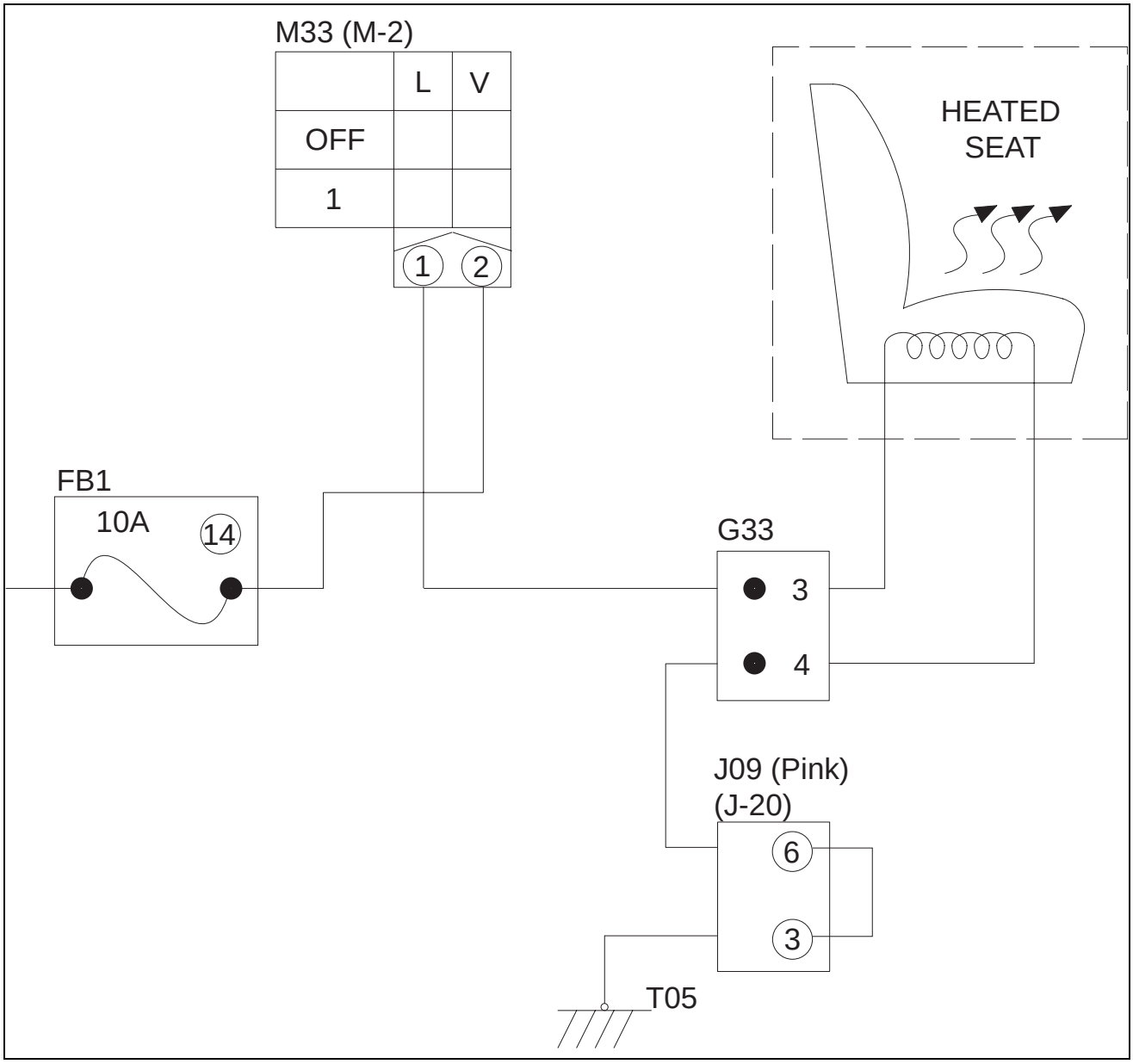
Electrical Circuit Diagram for Travel Reverse Alarm System



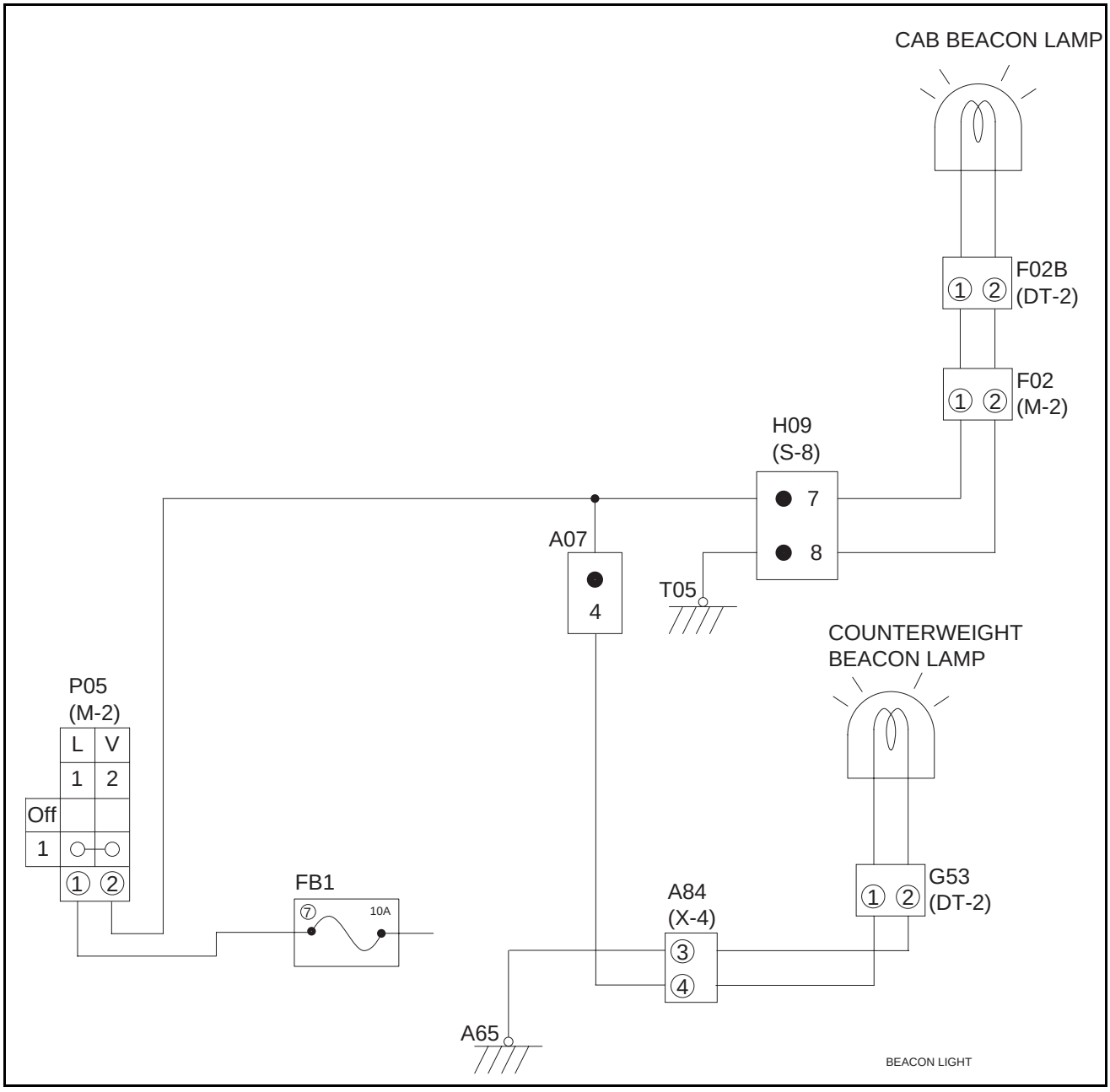
Circuit Diagram for Undercarriage Attachments - Mode Selection



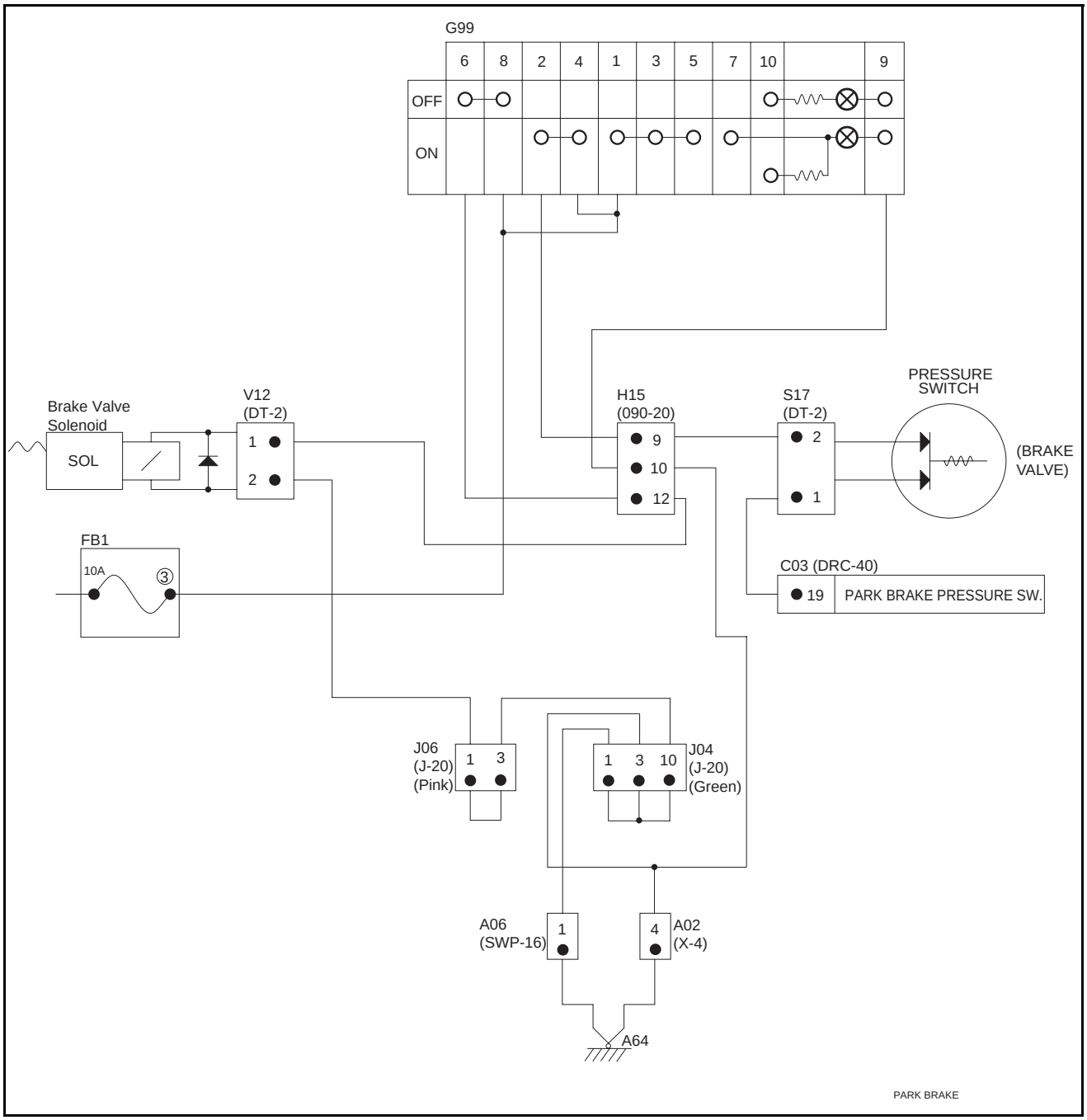
Circuit Diagram for the Heated Seat



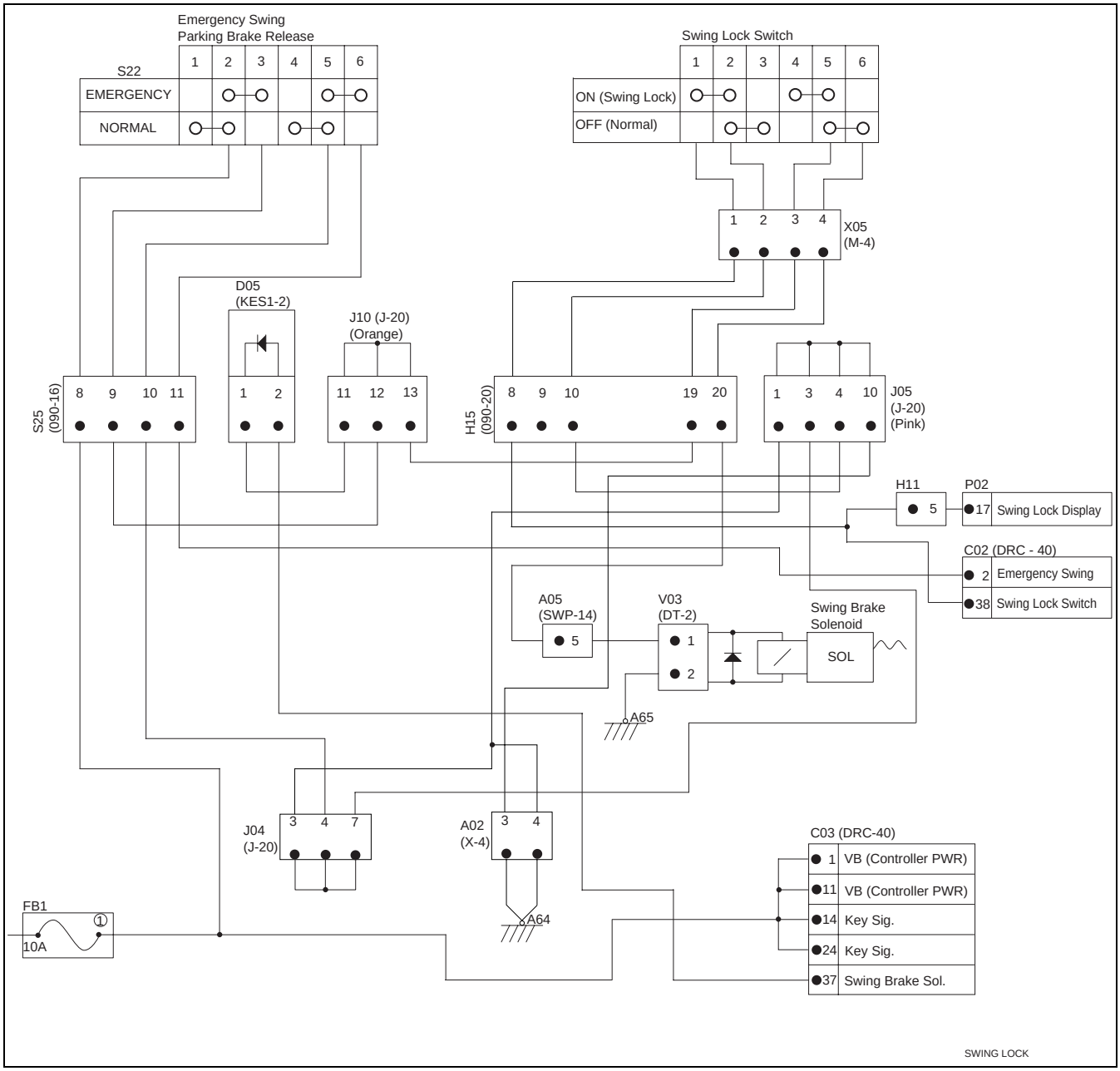
Circuit Diagram for Cab & Counterweight Beacon Light



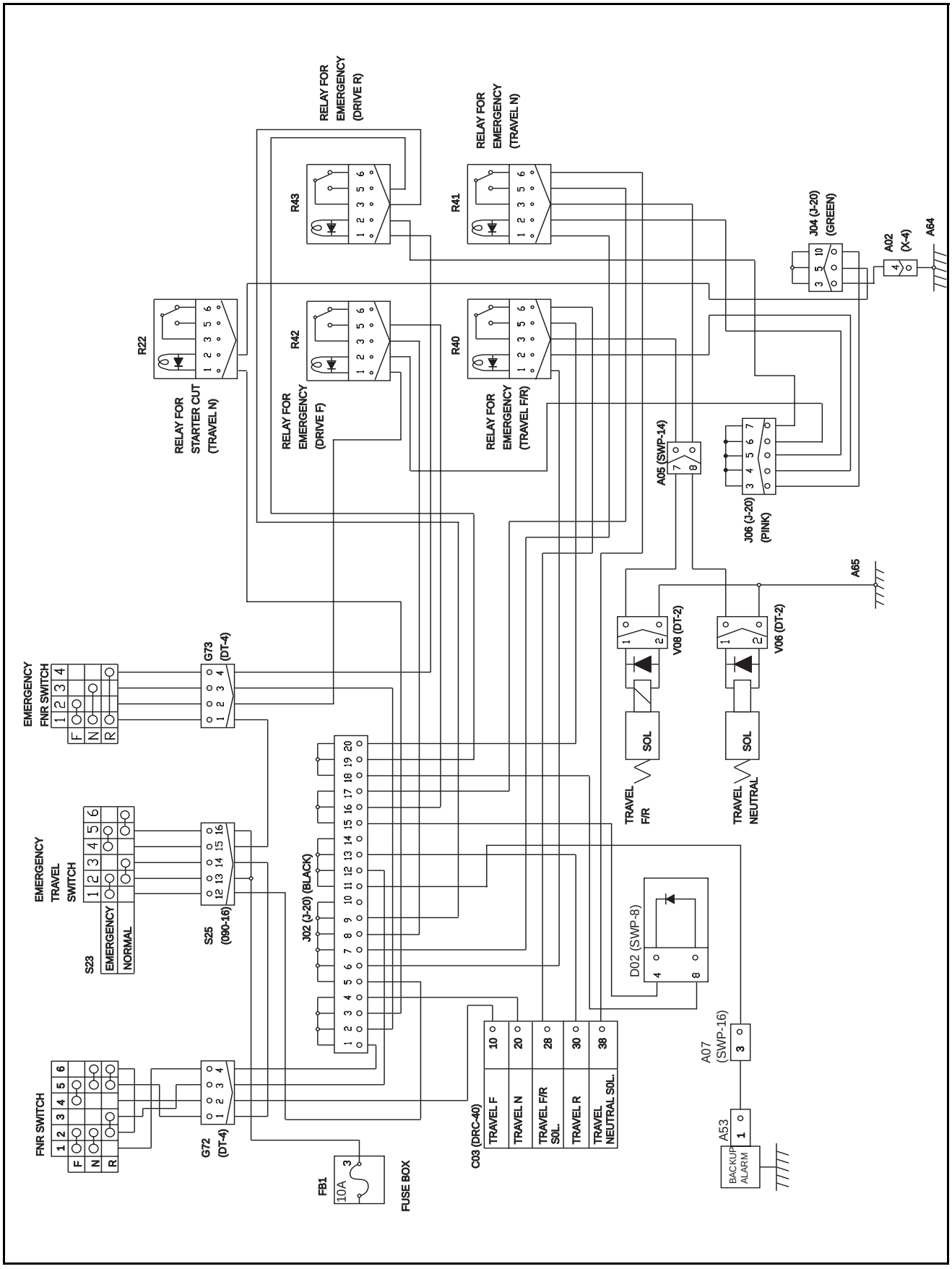
Circuit Diagram for Park Brake



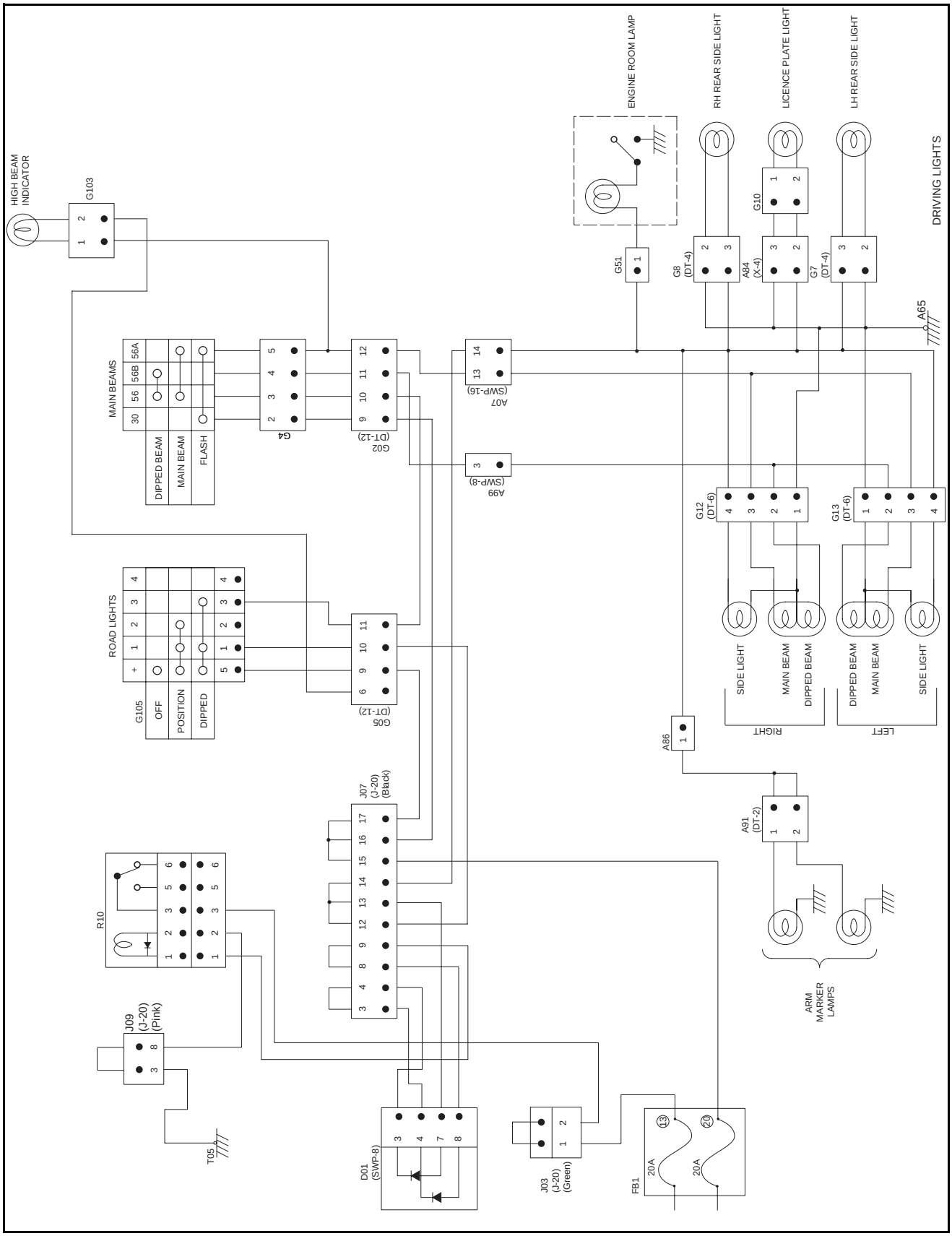
Circuit Diagram for Swing Lock



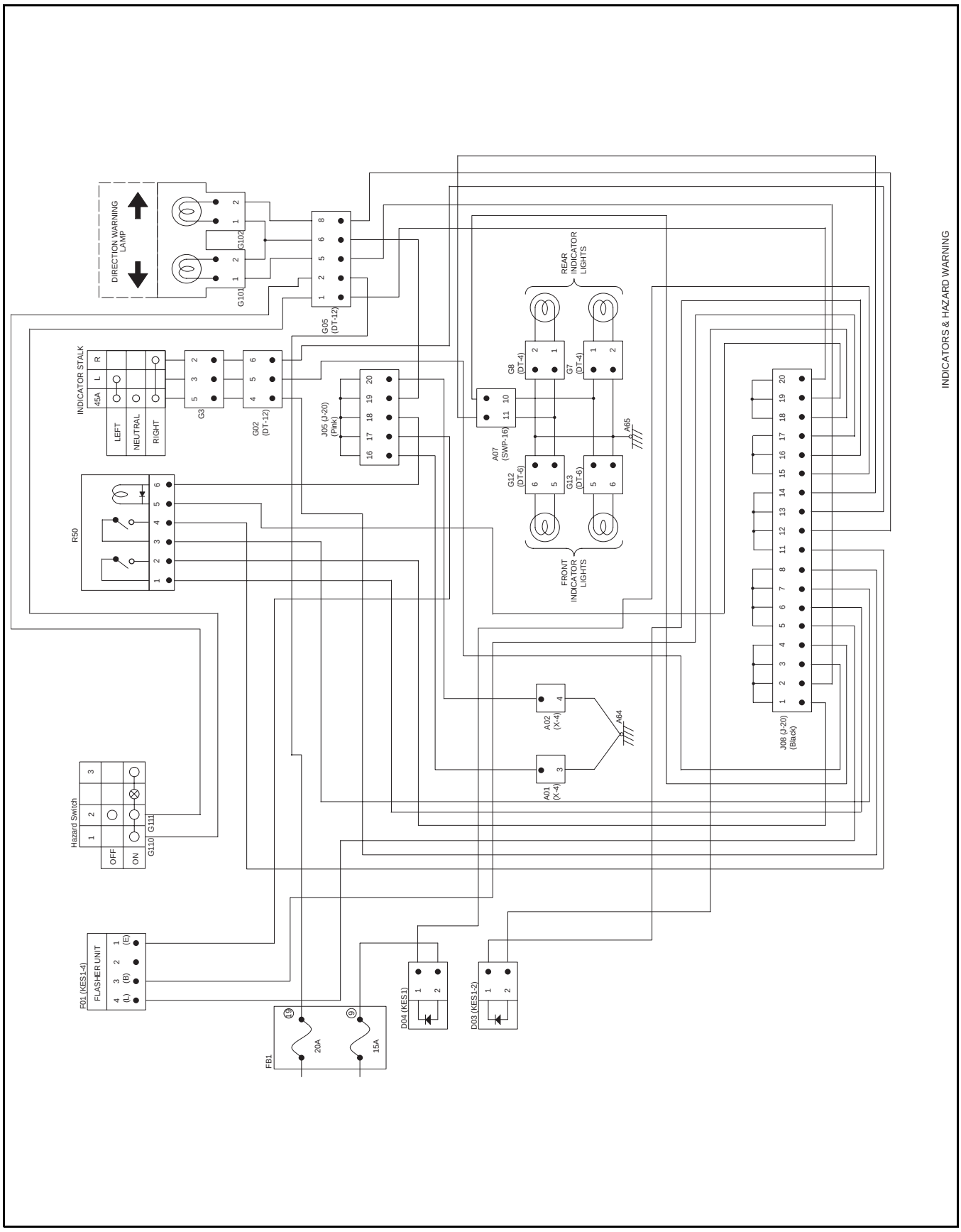
Circuit Diagram for Travel Direction Control



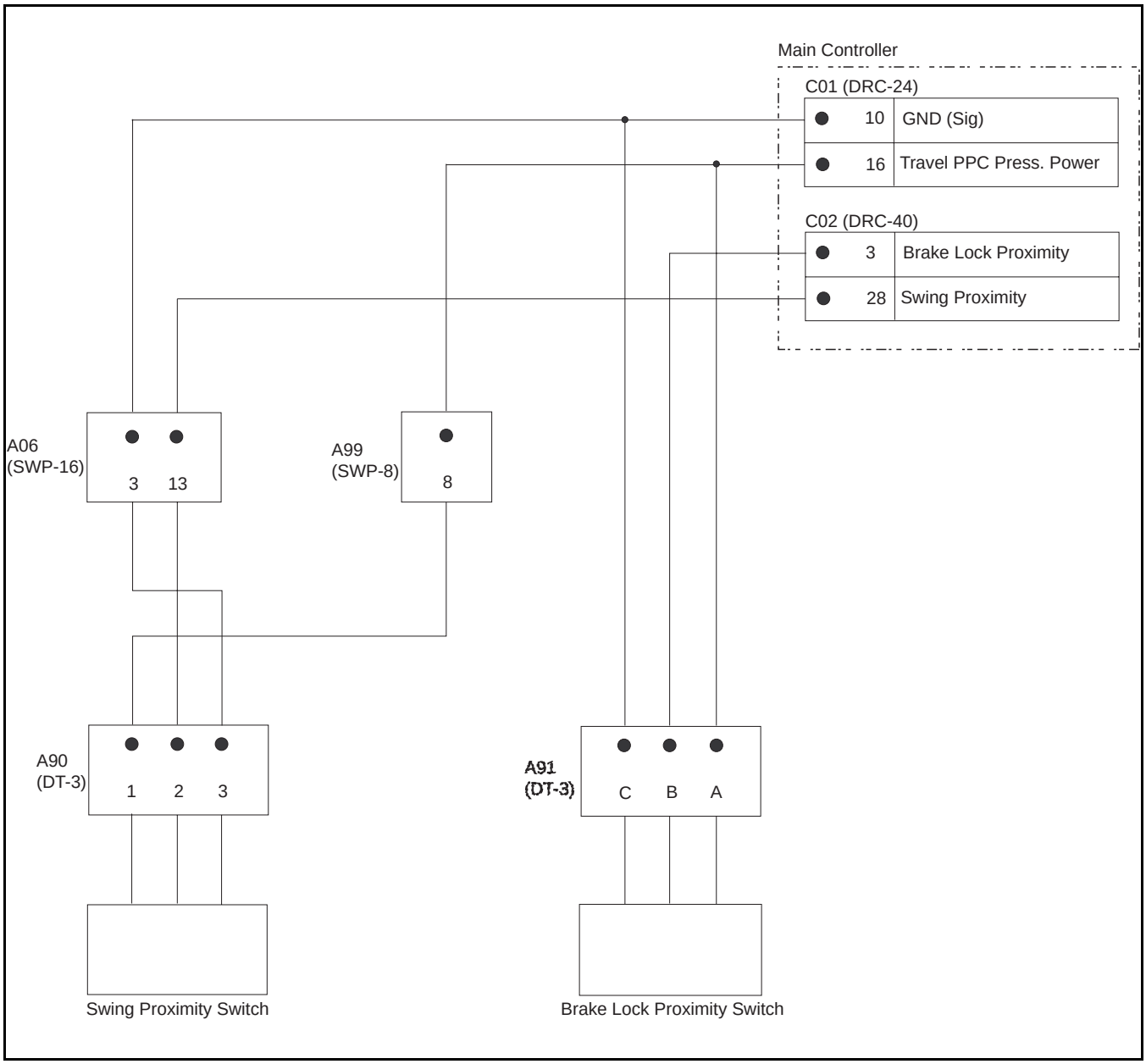
Circuit Diagram for Driving Lights



Circuit Diagram for Indicators & Hazard Warning



Brake and Swing Lock Proximity Switches



H-3 No work equipment, travel or swing move

Failure information	• No work equipment or travel and swing functions can be set in motion.
Relative information	• Set the working mode at A mode for the troubleshooting.

Presumed cause and standard value in normalcy		Cause	Standard value in normalcy and references for troubleshooting	
	1	Malfunctioning of PPC lock solenoid valve	★Stop engine for preparations. Start troubleshooting at engine high idling.	
			Safety lock lever	Main relief pressure
			Locked	0{0}
			Released	2.84 – 3.43 MPa {29 – 35kg/cm^2}
	2	Malfunction of relief valve in solenoid valve block.	★Stop engine for preparations. Start troubleshooting at engine high idling.	
			Control lever	Control circuit source pressure
			All control levers in NEUTRAL position	2.83 – 3.43 MPa {29 – 35kg/cm^2}
	3	Piston pump defective	The piston pump is suspected of malfunctioning or an internal failure. Diagnose it in the following manner. • Remove the oil pressure measurement plug and crank the engine. If oil flows out, it is in normal condition.	
	4	Damper defective	It is presumed that the pump shaft does not rotate due to some internal failure of the damper. Check the damper itself.	

H-4 Abnormal noise is heard from around hydraulic pump

Failure information	• An abnormal noise is heard from around the hydraulic pump.
Relative information	—

Presumed cause and standard value in normalcy		Cause	Standard value in normalcy and references for troubleshooting
	1	Hydraulic oil level lowered	Make a visual check.
	2	Quality of hydraulic oil bad	Air may have mixed with the oil. Make a visual check.
	3	Hydraulic tank cap breather clogged	It is presumed that the breather in the cap of hydraulic tanks is clogged, thereby causing negative pressure inside the tank. Make a visual check.
	4	Hydraulic tank strainer clogged	It is presumed that the strainer in the hydraulic tank is clogged, thereby causing negative pressure in the suction circuit. Make a visual check.
	5	Piston pump defective	The piston pump is suspected of an internal failure. Check the pump itself.

H-20 Machine does not swing

Failure information (1)	• The machine swings neither to the right nor to the left.
Relative information	• Set the working mode at A mode for the troubleshooting.

Presumed cause and standard value in normalcy		Cause	Standard value in normalcy and references for troubleshooting
	1	Malfunctioning of swing parking brake solenoid valve	★Stop engine for preparations. Start troubleshooting at engine high idling.
			Swing: NEUTRAL / Solenoid valve: 0 {0}
			Swing: Operation / Solenoid valve: 2.84 – 3.43 MPa {29 – 35 kg/cm^2}
	2	Malfunctioning of swing motor (parking brake)	The parking brake portion of the swing motor is presumed to malfunction. Check it directly.
	3	Improper adjustment or malfunctioning of swing motor (safety valve)	★Stop engine for preparations. Start troubleshooting at engine high idling.
			Swing lock switch: ON / Swing control lever: Swing relief / Swing relief pressure: 28.9 – 32.9 MPa {295 – 335 kg/cm^2}
			If the oil pressure does not return to normalcy even after the adjustment, the safety valve is presumed to malfunction, or suspected of an internal failure. Check the valve itself.
	4	Swing motor defective	★Stop engine for preparations. Start troubleshooting at engine high idling.
			Swing control lever: Swing relief / Amount of oil leakage from swing motor: Below 10 l/min
	5	Swing machinery defective	The swing machinery is suspected of an internal failure. Check the inside of the swing machinery directly. ★A failure inside the swing machinery may well be determined by an abnormal noise from within, abnormal heat generated or metal dust or chips contained in the drained oil.

Failure information (2)	• The machine does not swing in one direction.
Relative information	• Set the working mode at A mode for the troubleshooting.

Presumed cause and standard value in normalcy		Cause	Standard value in normalcy and references for troubleshooting
	1	Malfunctioning of PPC valve	★Stop engine for preparations. Start troubleshooting at engine high idling.
			Left control lever: NEUTRAL / PPC valve output pressure: 0 {0}
			Left control lever: Swing operation / PPC valve output pressure: Above 2.7 MPa {Above 28 kg/cm^2}
	2	Malfunctioning of swing control valve (spool)	The spool in the swing control valve is presumed to malfunction. Check the spool itself.
	3	Swing motor (suction valve) seal defective	The seal in the suction valve of the swing motor is suspected of defect. Check the seal itself. ★Whether the seal is defective or not may well be determined by swapping the right and left suction valves and watching if there is any change.
	4	Swing motor (check valve) seal defective	The seal in the check valve of the swing motor is suspected of defect. Check the seal itself. ★Whether the seal is defective or not may well be determined by swapping the right and left check valves and watching the result.

LIST OF TOOLS

Part Number	Part Name	Area Used on Machine
799-203-8001	Multi Tachometer	Setting of engine revs
799-201-2202	Boost Gauge Kit	Air boost pressure
799-101-5210	Fitting (PT 1/4)	Air boost pressure
799-201-9000	Handy Smoke Checker	Measurement of exhaust colour
795-799-1131	Gear	Adjustment of valve clearance
795-799-1900	Pin Assembly	Adjustment of valve clearance
799-201-1504	Blow By Kit	Measurement of blow by
795-790-1950	Tool (Nozzle)	Measurement of blow by
795-799-1131	Gear	Adjustment of fuel injection timing
795-799-1900	Pin Assembly	Adjustment of fuel injection timing
795-799-1950	Lock Pin	Adjustment of fuel injection timing
799-101-5002	Hydraulic Tester	Measurement of engine oil pressure
790-261-1203	Digital Type Hydraulic Tester	Measurement of engine oil pressure
799-401-2320	Hydraulic Tester	Measurement of engine oil pressure
673-281-3170	Joint	Measurement of engine oil pressure
621-581-9710	O-Ring	Measurement of engine oil pressure
796-627-1130	Wear Gauge	Inspection of wear on the sprocket
799-101-5220	Nipple (10 x 1.25mm)	Hydraulic testing
799-101-1340	Differential Pressure Gauge	Hydraulic testing
799-401-2910	Nipple (Size 02)	Solenoid valve output
799-401-2920	Nipple (Size 03)	Measurement of solenoid valve output
795-502-1205	Compression Gauge	Cylinder compression
795-502-1700	Adapter	Cylinder compression

※2

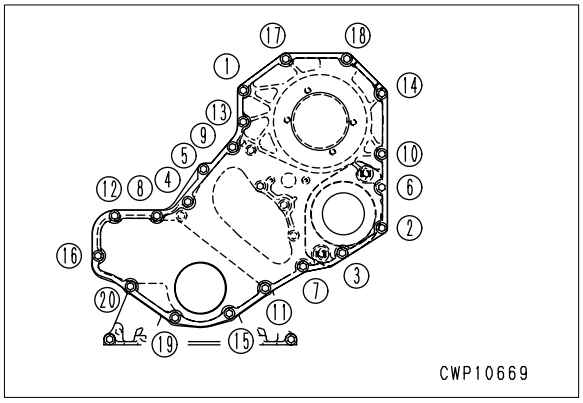
★ Protrusion of the gear housing gasket from the oil pan installation face should be kept less than 0.25 mm.

★ Coat the gasket installation face of the cover with Three Bond 1207D or an equivalent (with a bead diameter of 1 - 2 mm).

★ Install the gasket on the cover and mount the cover on the engine.

N·m Cover mounting bolt:
24 ± 4 Nm (2.45 ± 0.41 kgm)

★ Tighten the 20 cover mounting bolts in the sequence of (1) through (20) as illustrated below.

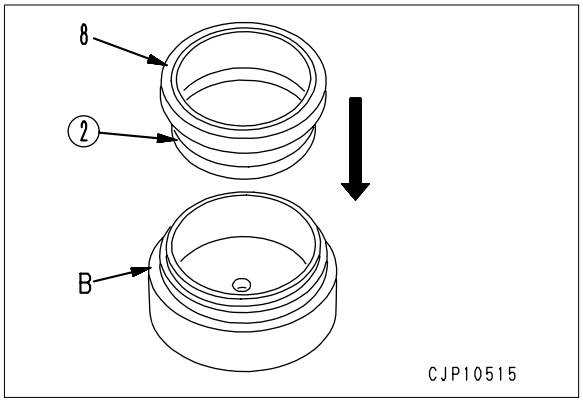


※3

★ Install the oil seal in the following manner.

1) Install pilot (2) to oil seal (8).

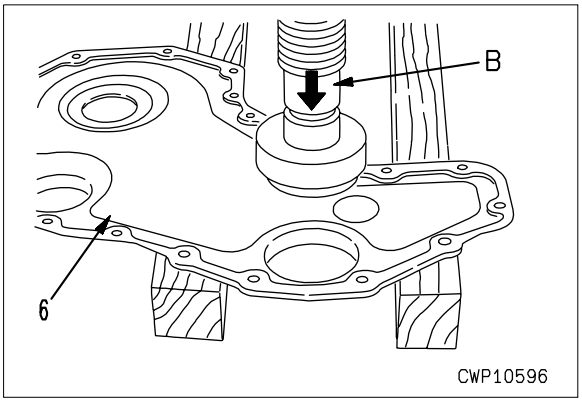
2) Place the oil seal onto tool **B** with the dust and lip faces turned upward.



3) Push the oil seal into cover (6) from the inside to the outside.

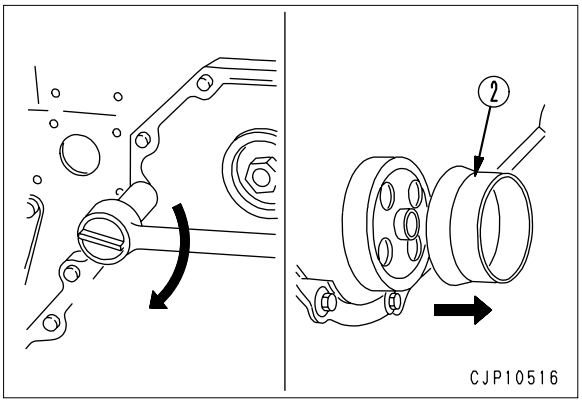
★ Push the oil seal in until tool **B** contacts the bottom of cover (6).

★ Clean the crankshaft sealing face to prevent oil leakage. Completely remove all oil and dry it thoroughly.

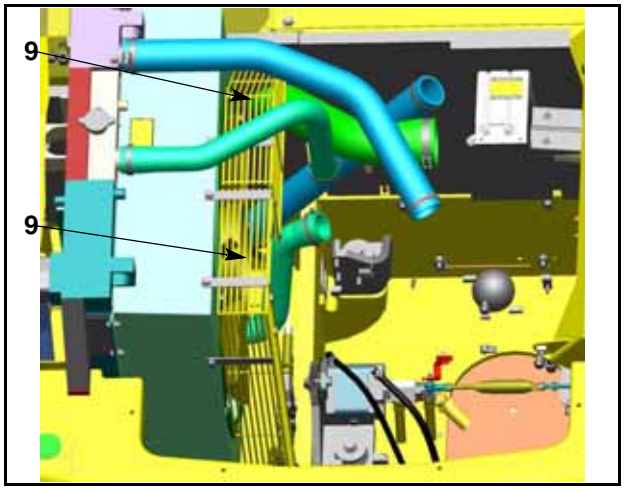


4) Apply the cover seal with pilot (2) still attached to the crankshaft, then tighten the cover mounting bolts to the specified torque and detach pilot (2).

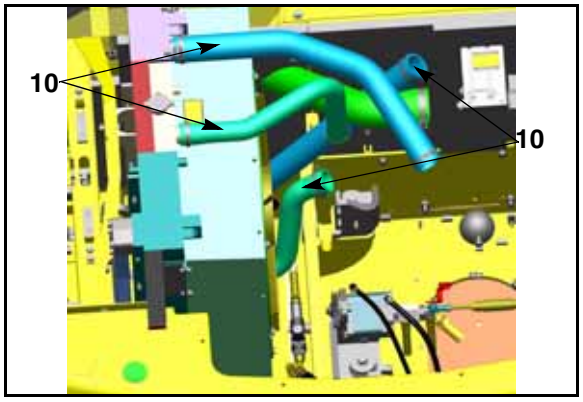
Cover installing face:
Gasket sealant (LG-6)



8. Remove guards (9).
.

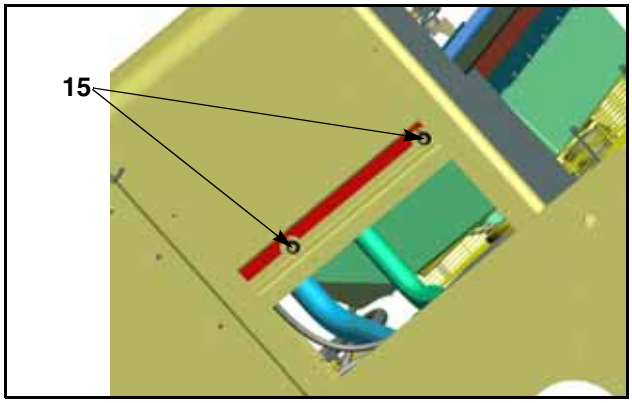


9. Remove 4 hoses (10).



10. Sling radiator assembly with two lifting hooks.

11. Remove two mounting bolts (15) and lift radiator assembly out.



INSTALLATION

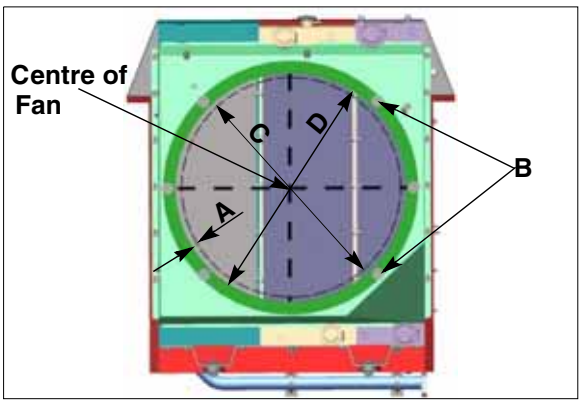
- Install in reverse order of removal.

N·m Radiator hose clamp bolt:
0.55 - 0.65 kgm

★ To maintain the heat balance, make sure that sponge sheets are assembled in the original position.

★ Adjust clearance **A** between the cooling fan circumference and the shroud, adjuster ring using oblong hole **B** for mounting the bell mouth shroud, adjuster ring so that the clearance may be even all around the circumference.

★ Check that clearance **A** shows the following value, measured at four points on the right, left, top and bottom sides.
  - Standard clearance **A** (on all the circumference): More than 10 mm
  - Fan diameter **C**: ∅720
  - Shroud inner diameter **D**: ∅740



DISASSEMBLY AND ASSEMBLY OF TRANSMISSION

SPECIAL TOOLS

Part Number	Part Name	Quantity
2897005	Seal Assembly	1
2897008	Snap Ring Assembly	1
2897039	Handle	1

DISASSEMBLY

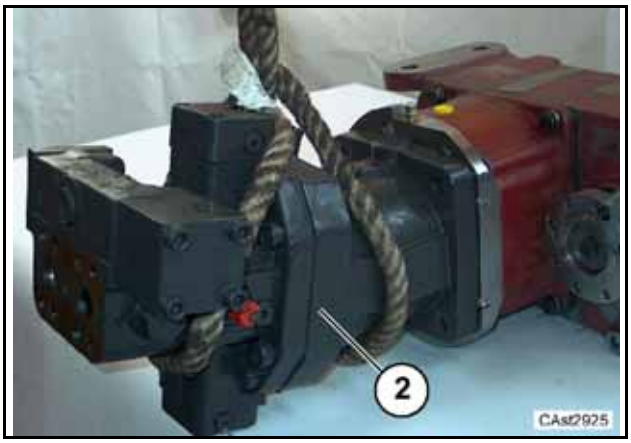
Removal of Travel Motor

1. Remove drain plug and drain oil from transmission and travel motor.

Transmission: Approx. 2.9 l

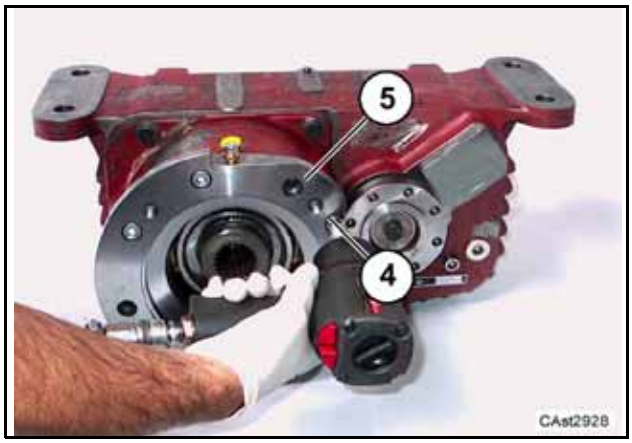
2. Remove screws (1).

3. Remove the motor (2).

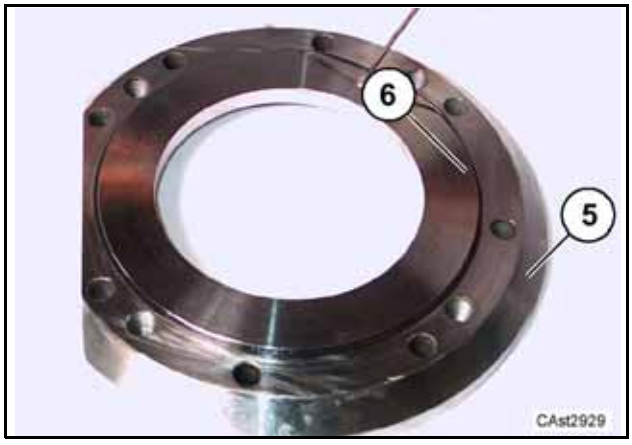


4. Remove O-ring (3).

5. Remove screws (4) and flange (5).



6. Remove O-ring (6) from flange (5).



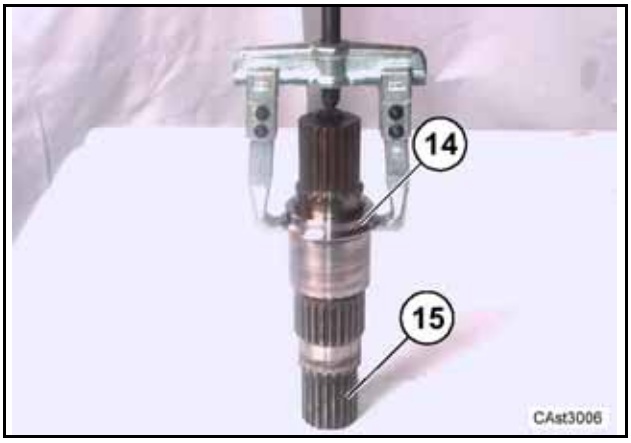
Installation of Travel Motor

- Install in reverse order of removal.
- Tightening torque for bolt (1): 117 Nm.
- Tightening torque for bolt (4+5): 117 Nm.

13. Remove oil tank (19).

14. By means of an extractor remove bearing (13) from shaft (15).

15. By means of an extractor remove the spacer (14) from the shaft (15).

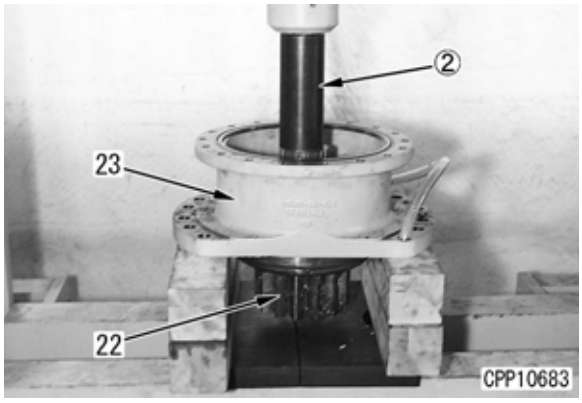


Installation of Output Shaft

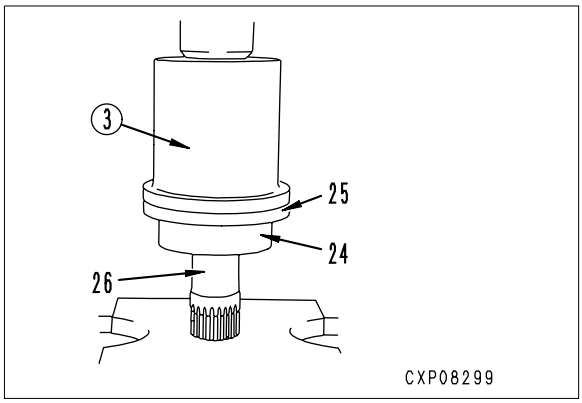
- Install in reverse order to removal.
- When fitting seal ring use tool 2897005.
- Apply loctite 510 to seal ring.
- Apply loctite 242 to screws.

9. Shaft assembly

1) Set the shaft case assembly to a press, and push shaft assembly (22) out of shaft case assembly (23), using push tool c.

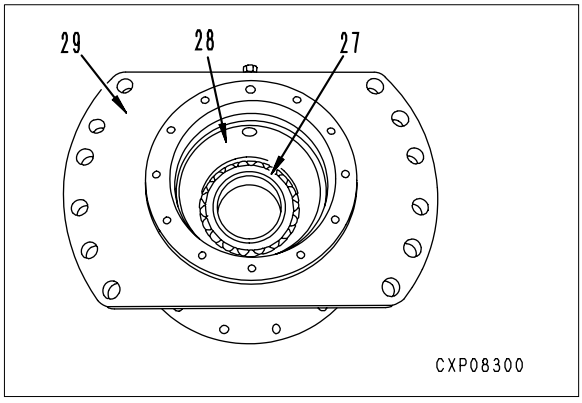


2) Disassemble the shaft assembly in the following manner.
Detach bearing (24) and plate (25) from shaft (26), using push tool d.



10. Bearing

Take bearing (27) and oil seal (28) out of case (29), using a push tool.



ASSEMBLY

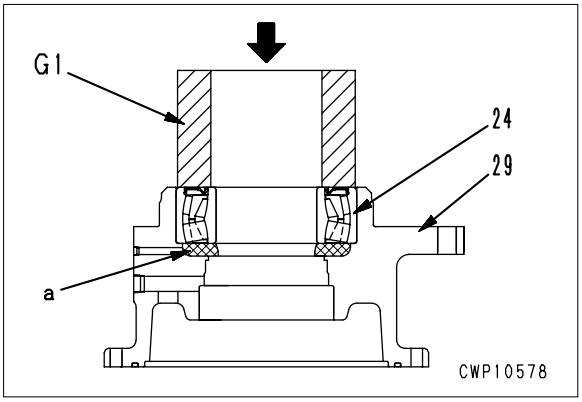
★ Clean all related parts and check that there is no dust or damage on the surface. Coat sliding surfaces with engine oil and then assemble the parts.

1. Bearing

1) Fill the hatched area (Part **a**) with grease (G2-LI).

Injected grease amount:
Approx. 115 - 190 g

2) Press-fit bearing (24) into case (29), using push tool **G1**.



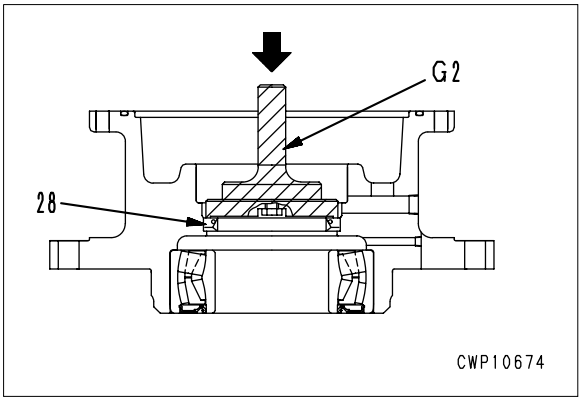
2. Oil seal

Press-fit oil seal (28), using tool **G2**.

Oil seal circumference:
Gasket sealant (LG-6)

★ When press-fitting, take care so that gasket sealant (LG-6) will not stick to the lip surface of the oil seal.

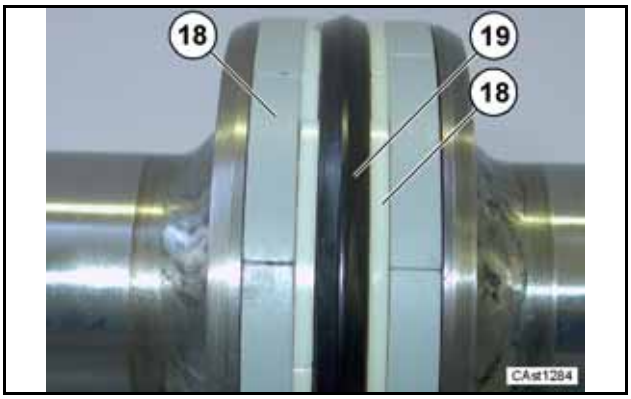
Oil seal lip surface: Grease (G2-LI)



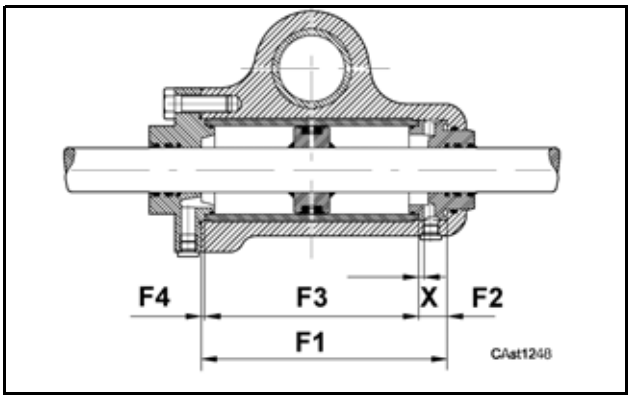
Assembly of steering cylinder

1. Fit the gaskets (21) and (22) and the scraper ring.

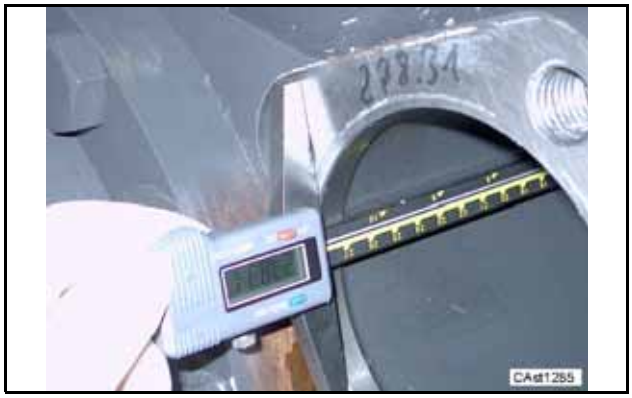
2. Fit the piston gaskets (18) and (19).
WARNING! The gasket cuts (18) should not coincide.



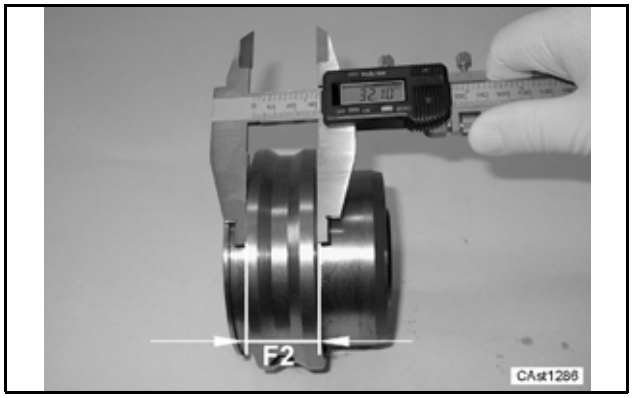
3. Thicknesses to be fitted.



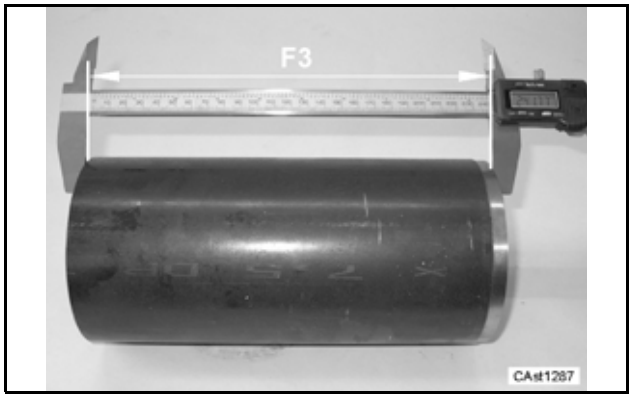
4. Measuring of value **F1.**



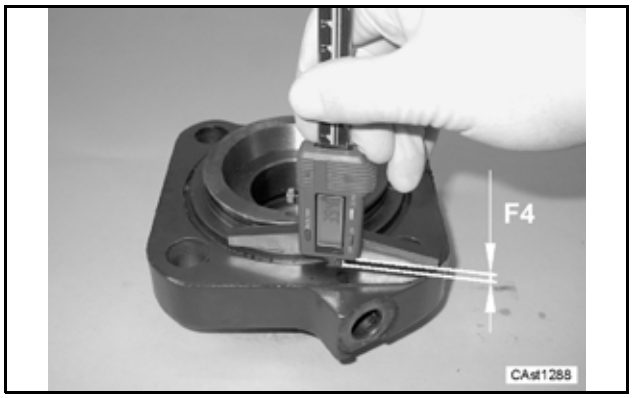
5. Measuring of value **F2.**



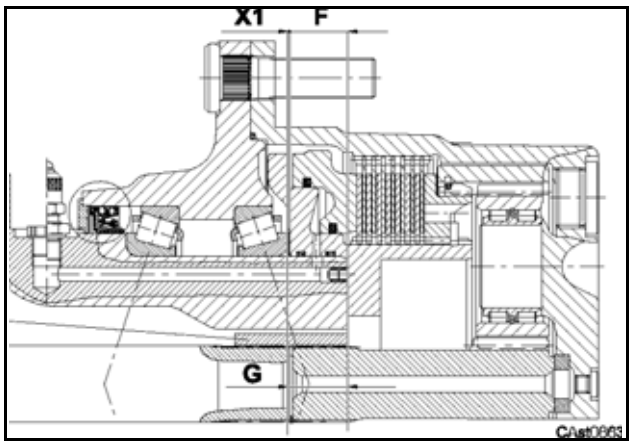
6. Measuring of value **F3.**



7. Measuring of value **F4.**



13. Calculate shims X1 of adjustment shims by using the following procedure: X1 (G-F) + 0.05.



14. Assemble previously calculated shims (26) X1.

15. Assemble O-rings (9) and (10) on piston (8).

16. Assemble O-rings (13) and (14) on brake carrier (12).

17. Fit piston (8) on brake carrier (12) with springs (15) and screws (7). Apply loctite 638 on the screws (7).

Assembly of joint box

1. Assemble the disk (20).
   Pay attention to assembling direction.

2. Assemble the O-ring (19).

3. Assemble the bush (18).
   Use tool 2897017.

4. Assemble the O-ring (22) and the disk (23). Pay attention to assembling direction.

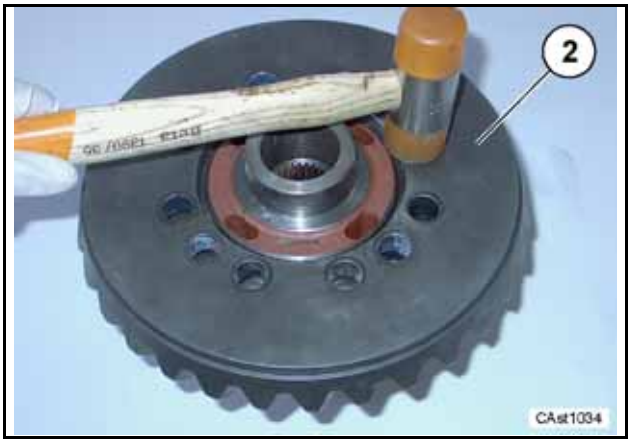
5. Assemble the bush (21).
   Use tool 2897017.

6. Assemble the bush (25).
   Use tool 2897017.

7. Fit the two half boxes of differential unit (11) and (12).

WARNING! Carefully check that the marks of both differential half boxes coincide.

8. Fit ring bevel gear (2) by using a hammer.

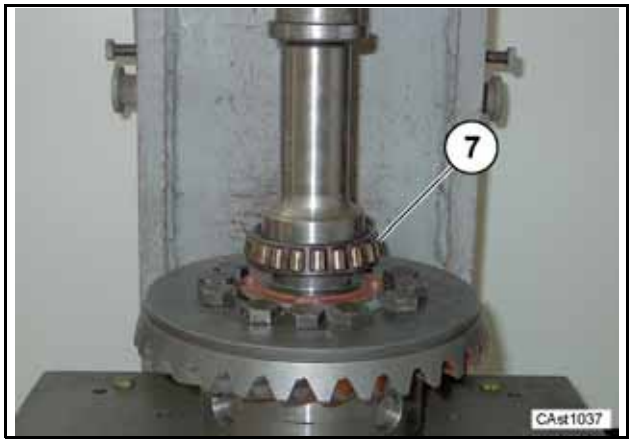


9. Apply Loctite 242 on thread of screws (10).

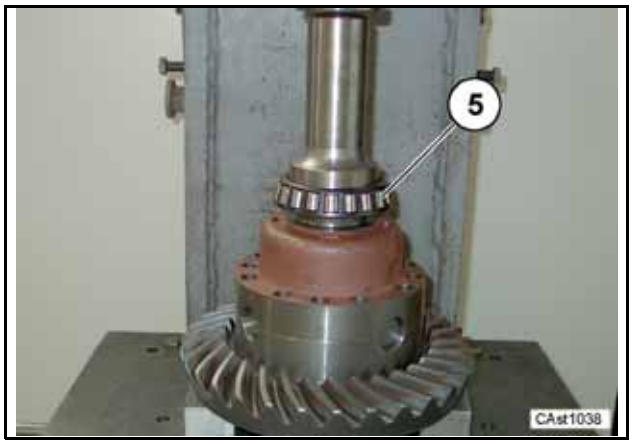
10. Tighten screws (10)
Torque - 205 Nm (21 kgf-m)

Note: Fix differential housing in the vice.

11. Press bearing (7) or assemble after preheating.



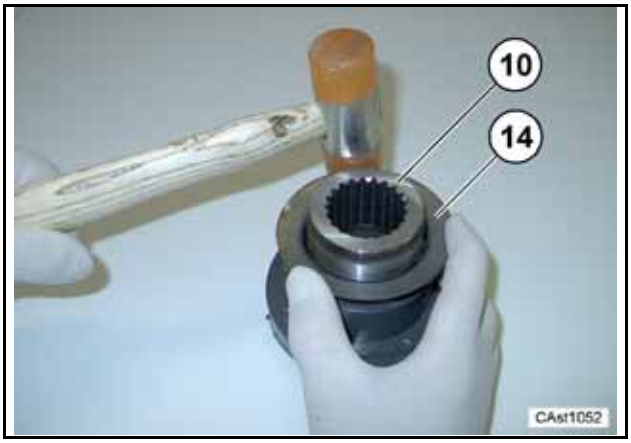
12. Press bearing (5) assemble after the preheating.



17. Assemble the oil seal by slightly striking with a plastic hammer.
    Note: Clean the box with a rolling brush.

18. Apply Loctite 242 on nut (6).

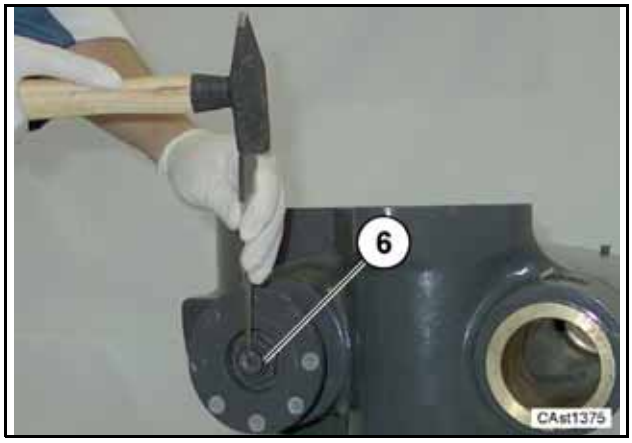
19. Use a hammer to assemble flange (10) together with guard (14).



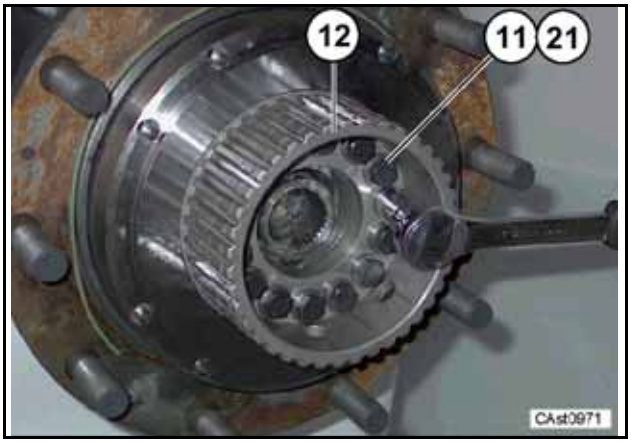
20. Assemble the flange (10) and the nut (6).

21. Apply tool 2987001.
    Torque - 340 Nm (35 kgf-m)

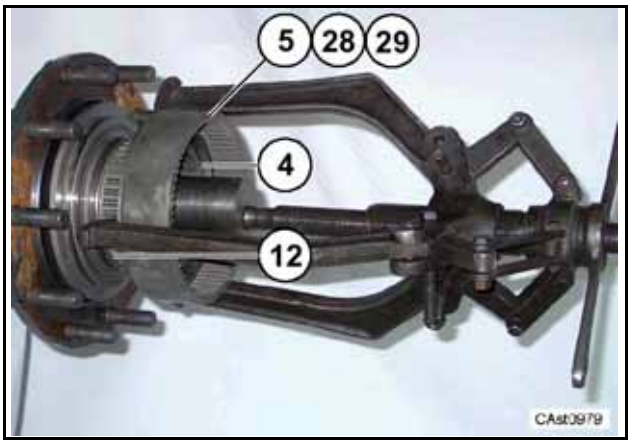
22. Drive the nut (6)with a tool.



11. Remove screws (11) and washers (21) from brake carrier (12).



12. Fit ring bevel gear (5) complete with carrier (28) and with split ring (29). Fit split ring (4) and remove brake carrier (12) with three-position extractor.

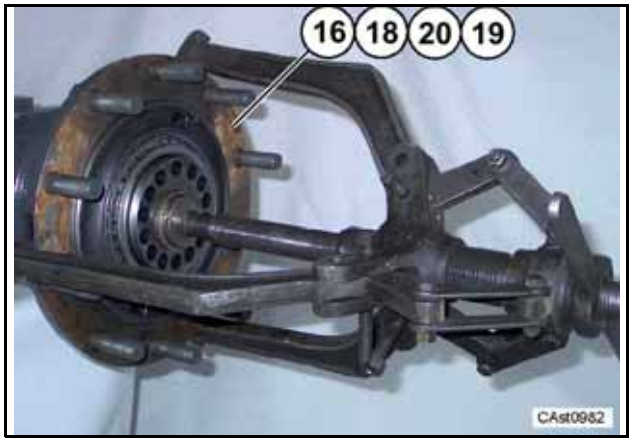


13. Remove bushes (22).

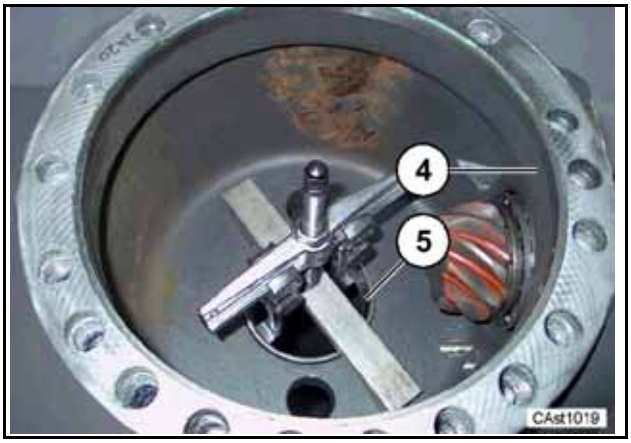
14. Remove seal rings (13) and (14) from brake carrier (12).

15. Remove shims (26).

16. Remove wheel hub (16) with bearings (19) and (20) and seal ring (19).



7. Use an extractor and remove from housing (4) the outer cup of bearing (5).

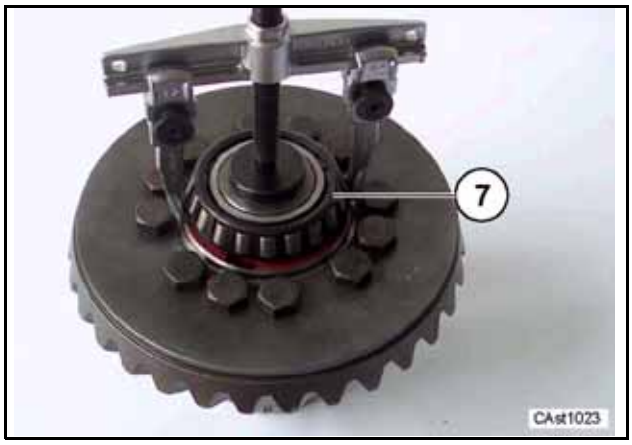


8. Remove shims (6).

9. Use an extractor and remove from housing (3) the outer cup of bearing (7).

10. Remove shims (8).

11. Use and extractor to remove bearing (7) from differential unit.

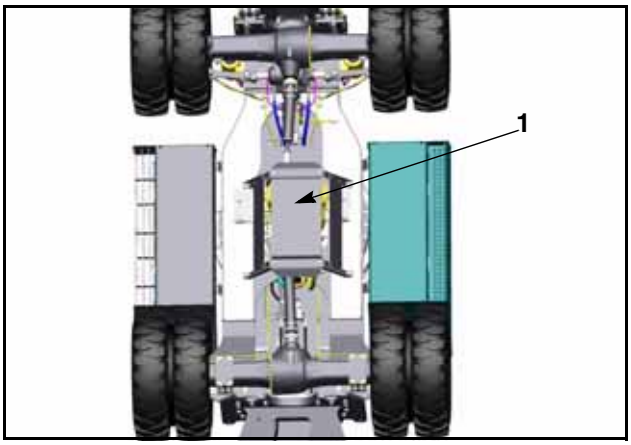


12. Use an extractor to remove bearing (5) from differential unit.

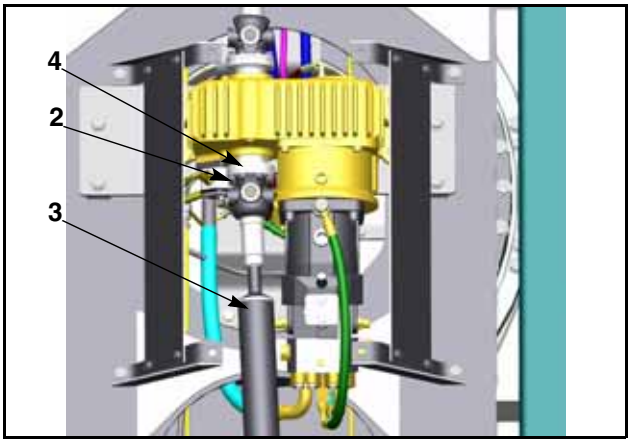
REMOVAL AND INSTALLATION OF PROPSHAFT

Removal

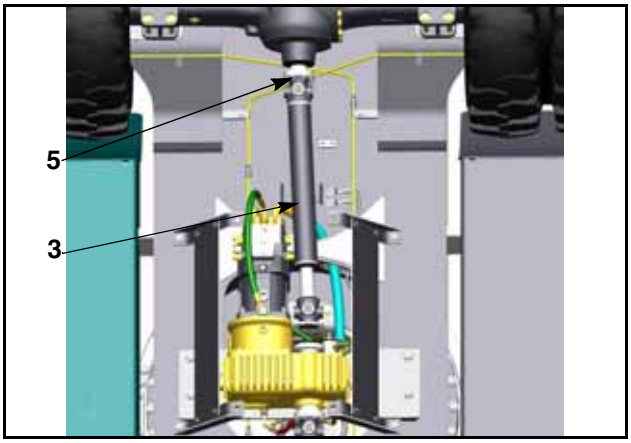
1. Remove plate (1).



2. Remove nuts (2), then retract propshaft (3) away from surface (4).



3. Remove nuts (5), then remove propshaft (3).

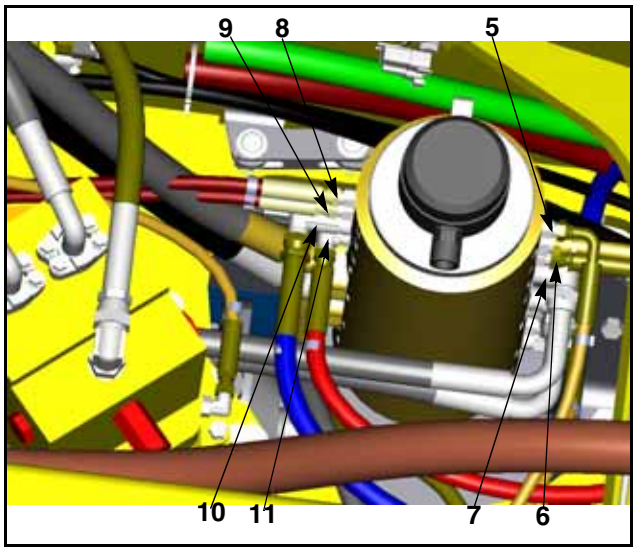


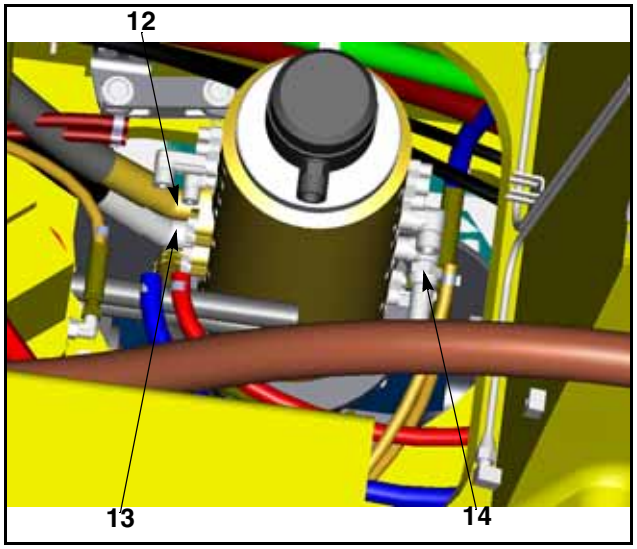
- Removal of front propshaft follow same procedure.

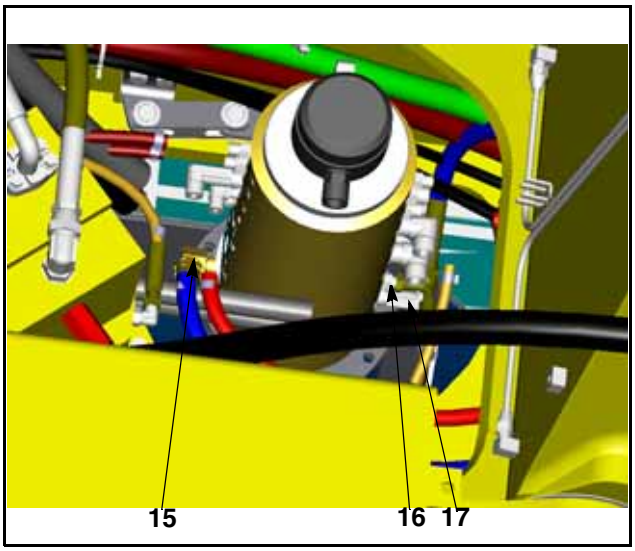
Installation

- Install in reverse order of removal.
- Tightening torque of propshaft nuts (58.8-73.5 Nm)

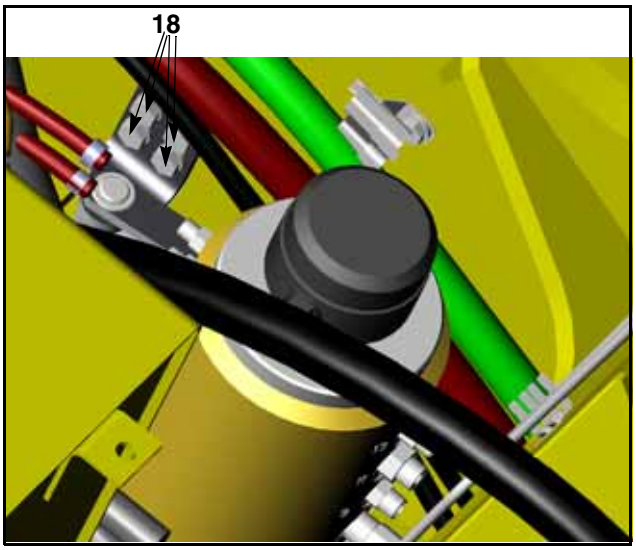
7. Disconnect the 13 hoses on the swivel joint assembly at the swivel joint side.
   (5): Suspension lock
   (6): Brake 2
   (7): Attachment bottom
   (8): 2nd clutch
   (9): 1st clutch
   (10): Steer right
   (11): Brake 1
   (12): Travel B
   (13): Travel A
   (14): Attachment Head
   (15): Drain
   (16): Motor volume pilot
   (17): Steer left



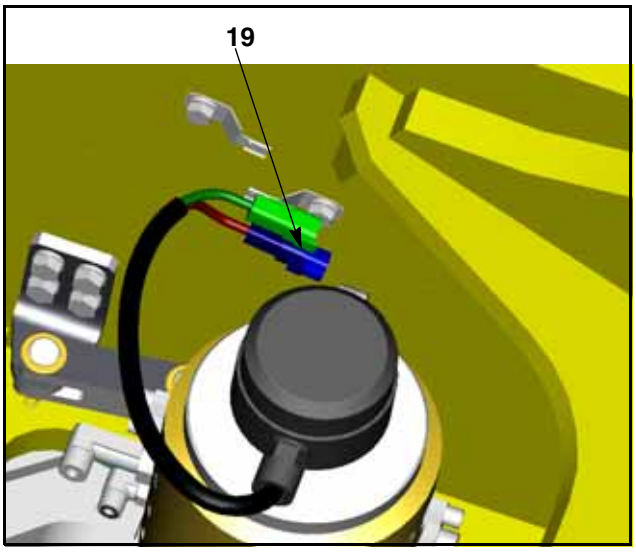




8. Remove 4 bolts (18) from revolving frame.



9. Disconnect connector (19).



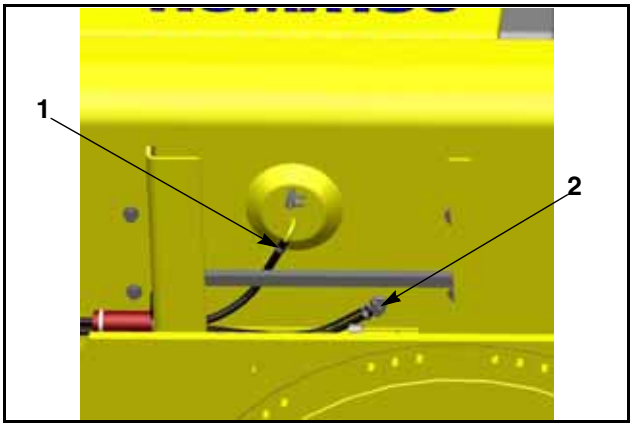
REMOVAL AND INSTALLATION OF FUEL TANK

REMOVAL

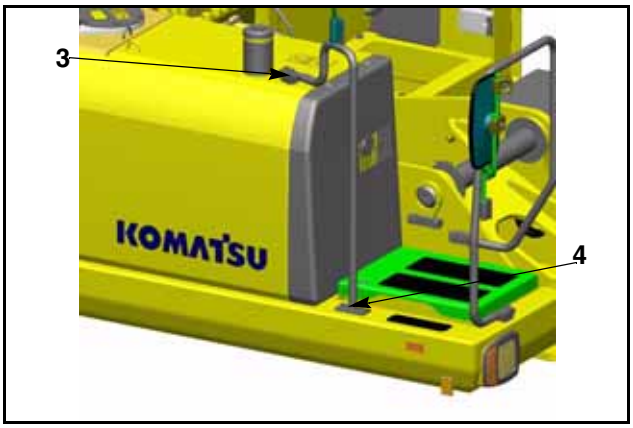
1. Empty fuel tank.

Fuel Tank: 370 l

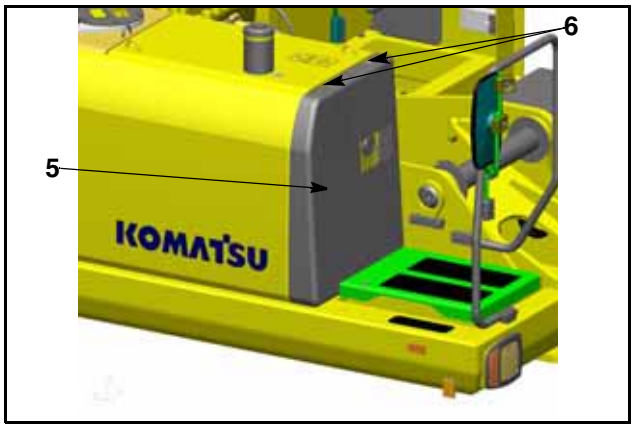
2. Disconnect hoses (1) and (2).



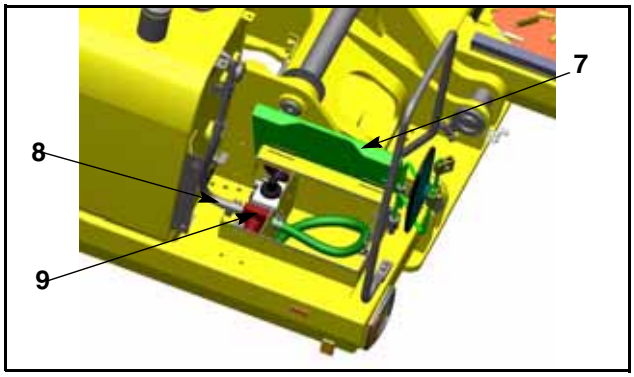
3. Remove handrail at points (3) and (4).



4. Remove cover (5) by removing bolts (6).



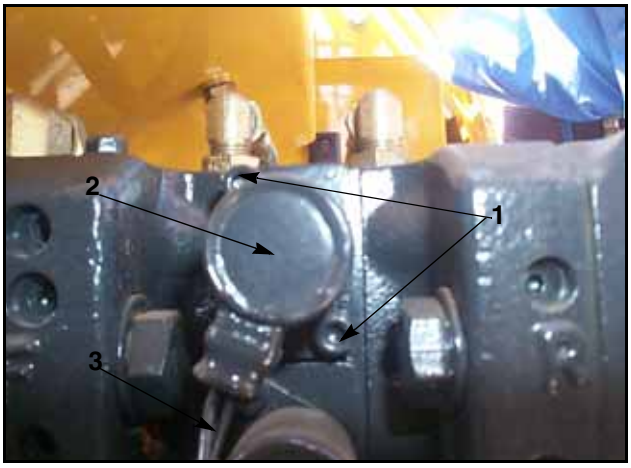
5. Open compartment (7) remove hose (8) from refuel pump (9).



REMOVAL AND INSTALLATION OF EPC SOLENOID VALVE ASSEMBLY

REMOVAL

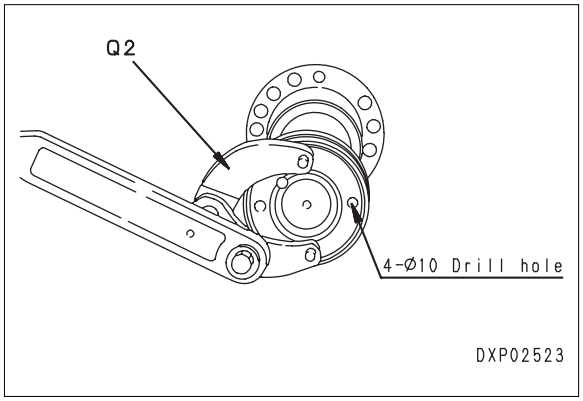
1. Remove bolts (1).
2. Carefully remove EPC solenoid valve (2) without stretching wire (3).



INSTALLATION

- Install in reverse order of removal.
- Tightening torque for EPC solenoid valve bolts (1): 11.8 - 14.7 Nm.
- When installing apply loctite.

6) Assemble piston assembly (4) as follows.
   - When using rod piston (2) again:
     - ★ Wash thoroughly and remove all metal particles and dirt.
     - i) Screw in piston assembly (4), then use tool **Q2** to tighten piston assembly (2) so the position of the screw thread hole matches
       - ★ Remove all burrs and flashes with a file.

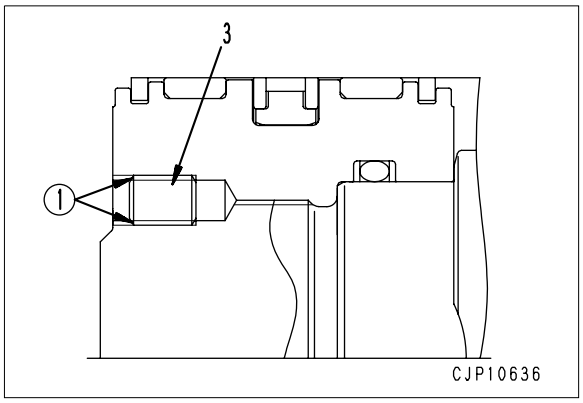


ii) Tighten screw (3).

Screw thread: Loctite No. 262

Screw: 58.9 - 73.6 Nm {6 - 7.5 kgm}

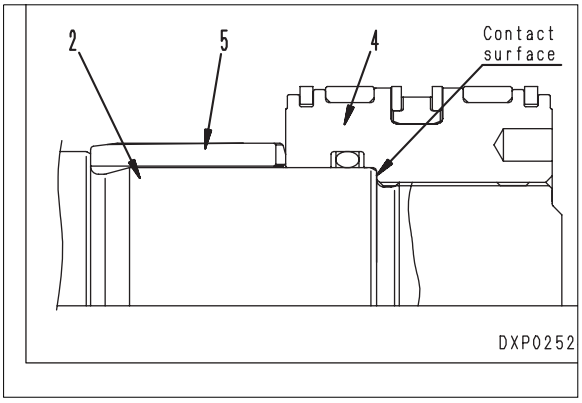
iii) Caulk thread at 2 places with punch.



- When using a new part for either or both of rod piston assembly (2)
  - ★ For the rod with bottom cushion, mark the cushion plug position on the end of the rod.
  - Arm cylinder only
  - i) Screw in until piston assembly (4) contacts end face of rod, then use tool to tighten.

Piston assembly: **294 ± 29.4 Nm {30 ± 3.0 kgm)**

- ★ After tightening the piston, check that there is play in plunger (5).
- Boom, arm cylinder only

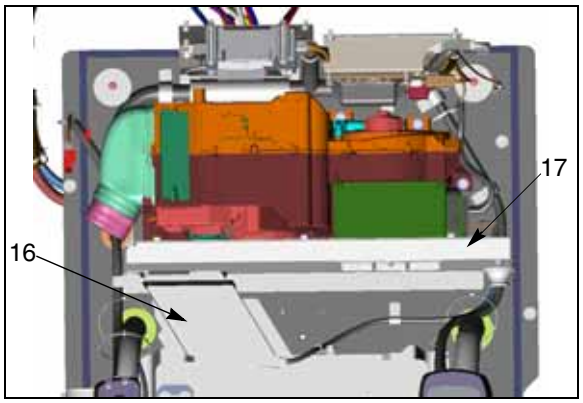


ii) Machine one of the holes used to install screw (3).
- ★ Align a drill horizontal with the V-groove of the thread of rod (2) and piston (4), then carry out machining.
- ★ For the cylinder with bottom cushion (arm cylinder), avoid the cushion plug position when machining.
- Screw machining dimension (mm)

Drill diameter	Bottom hole depth	Tap used	Tap depth
10.3	27	12 x 1.75	20

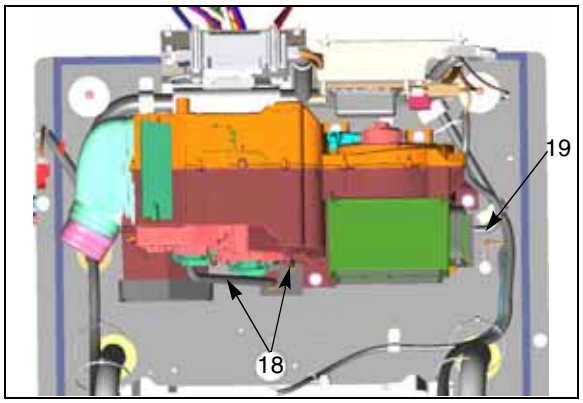
14. Remove duct (16).

15. Remove cover (17).

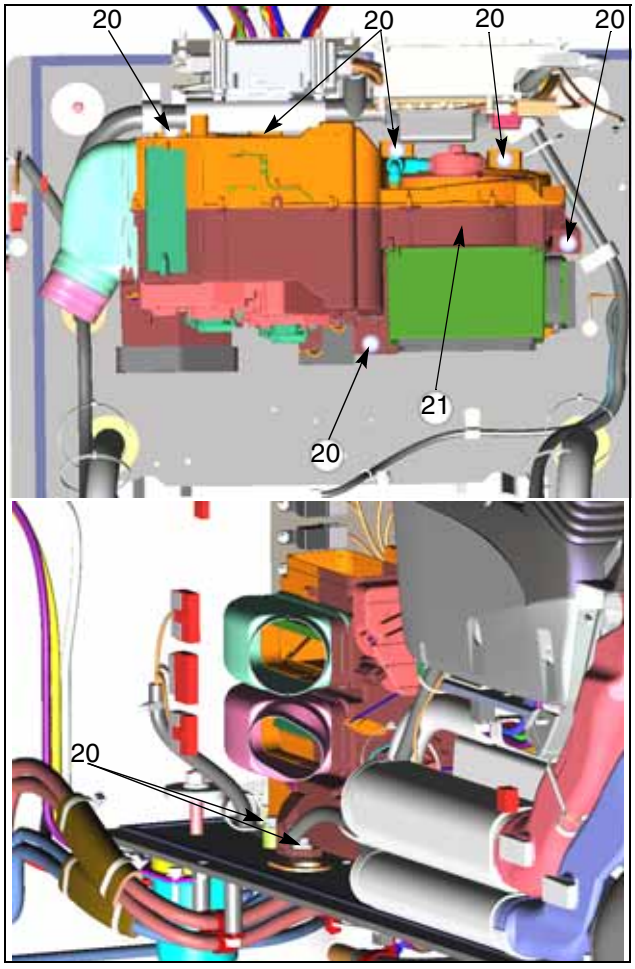


16. Disconnect connectors at the following seven points. (Refer to TROUBLESHOOTING section on “CONNECTOR LOCATION CHART AND ELECTRICAL CIRCUIT DIAGRAM BY SYSTEM” on page 20-218)
    - D01
      (Assembled-type diode connector)
    - D02
      (Assembled-type diode connector)
    - C09 (Model selection switch connector)
    - Air conditioner unit connector
      From top to bottom, M26, M27, M28 and M33 option power source connector

17. Remove 2 hoses (18) and remove connector (19).



18. Remove the 8 mounting bolts (20) and remove air conditioner unit assembly (21) carefully.
    ★ When removing the air conditioner unit assembly, do not forget to disconnect the two air conditioner hoses connected to the bottom.



Installation

- Install in reverse order of removal.

ELECTRICAL CIRCUIT DIAGRAM 1/5