SHOP MANUAL

KOMATSU

PC210, 210LC, 210NLC
PC240LC, 240NLC-7K

MACHINE MODEL	SERIAL NUMBER
PC210-7K	**K40001 AND UP**
PC210LC-7K	**K40001 AND UP**
PC210-NLC-7K	**K40001 AND UP**
PC240LC-7K	**K40001 AND UP**
PC240NLC-7K	**K40001 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.

Printed in Belgium 06-02

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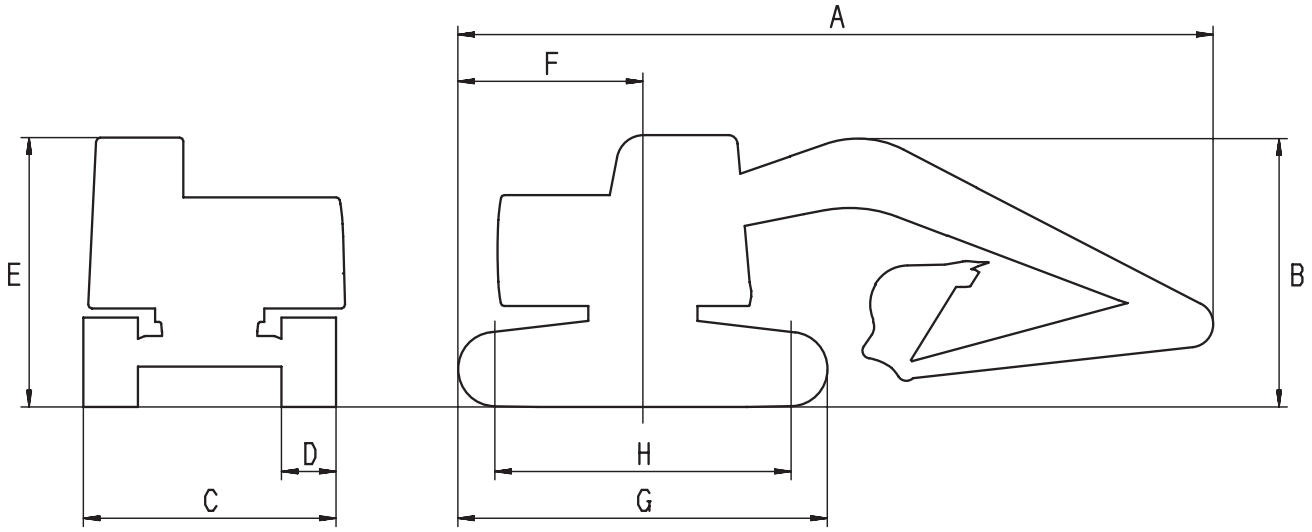
01 GENERAL

SPECIFICATION DIMENSION DRAWINGS
PC210-7K, PC210LC-7K, PC210NLC-7K

DIMENSIONS



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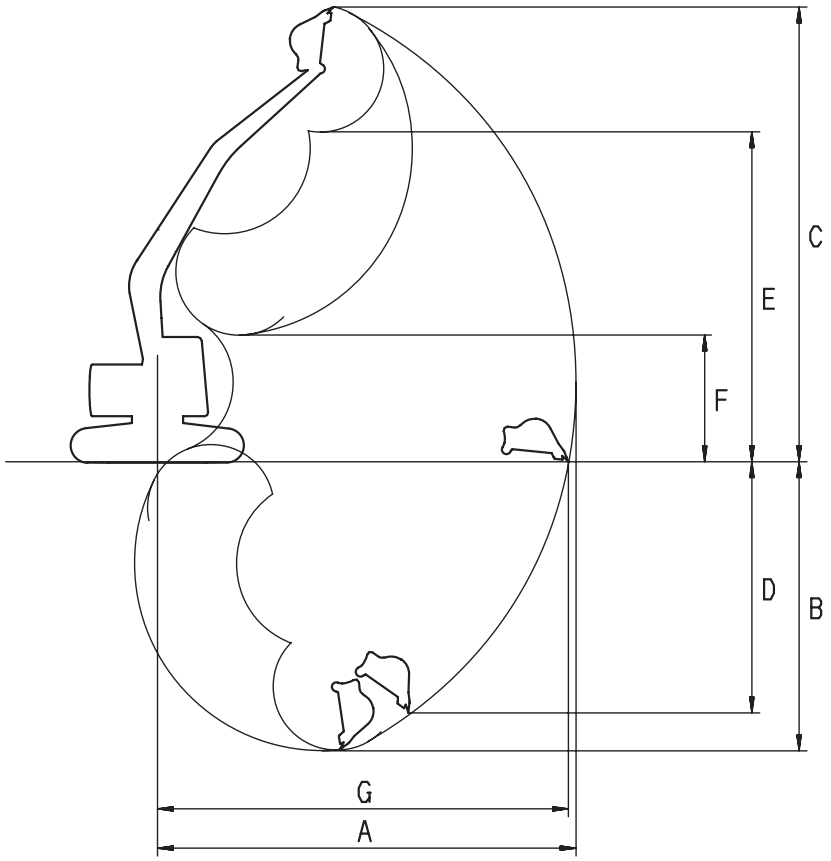
WORKING RANGES



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DIMENSIONS

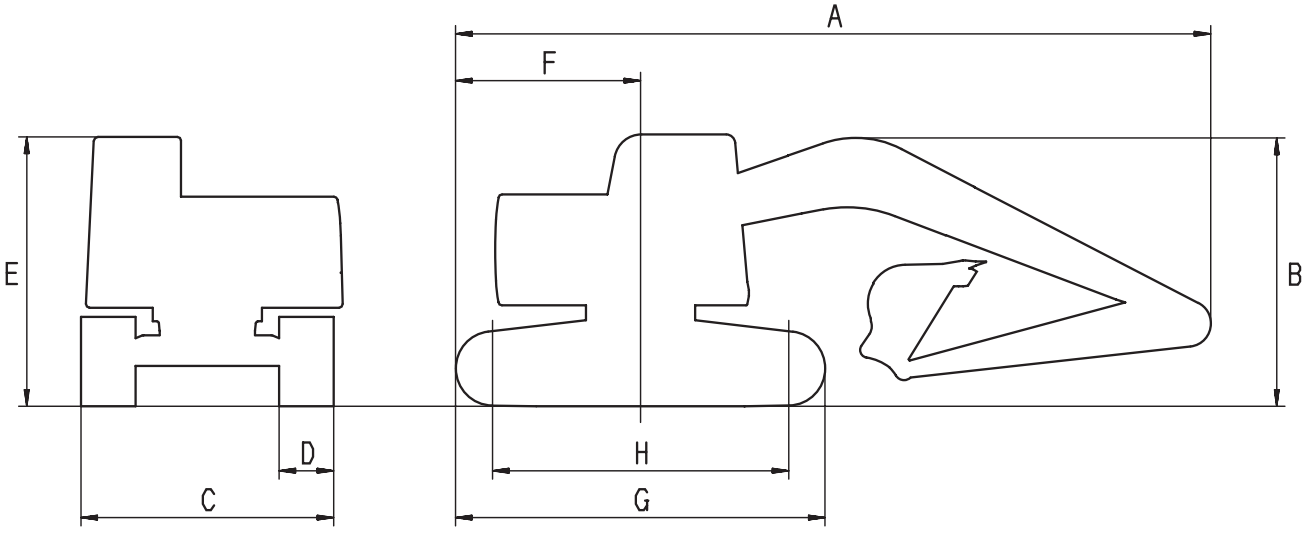
	Item	Unit	PC210-7K	PC210LC-7K	PC210NLC-7K
A	Overall length	mm	9,425		
B	Overall height	mm	3,000		
C	Overall width	mm	2,800	3,080	2,540
D	Track shoe width	mm	600	700	500
E	Height of cab	mm	3,000		
F	Tail swing radius	mm	2,750		
G	Track overall length	mm	4,080	4,450	4,450
H	Length of track on ground	mm	3,270	3,640	3,655
	Min. ground clearance	mm	440		

WORKING RANGES

	Item	Unit	PC210-7K	PC210LC-7K	PC210NLC-7K
A	Max. digging reach	mm	9,875		
B	Max. digging depth	mm	6,620		
C	Max. digging height	mm	10,000		
D	Max. vertical wall depth	mm	5,980		
E	Max. dumping height	mm	7,110		
F	Min. dumping height	mm	2,645		
G	Max. reach at ground level	mm	2,645		

PC240LC-7K, PC240NLC-7K

DIMENSIONS



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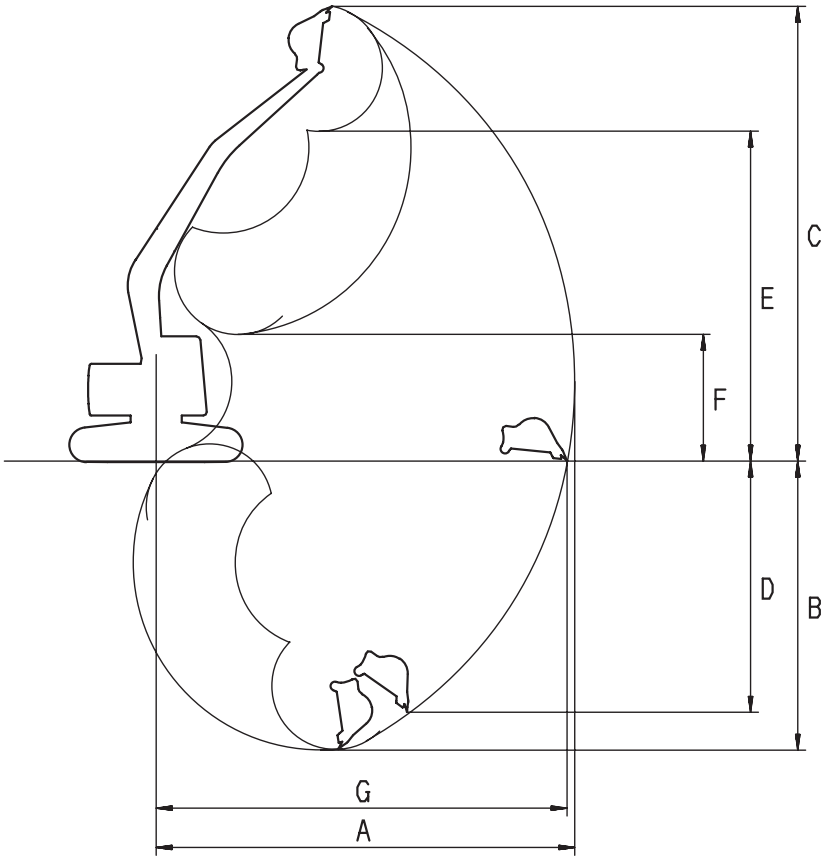
WORKING RANGES



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DIMENSIONS

	Item	Unit	PC240LC-7K	PC240NLC-7K
A	Overall length	mm	9,885	9,885
B	Overall height	mm	3,160	3,160
C	Overall width	mm	2,980	3,280
D	Track shoe width	mm	600	700
E	Height of cab	mm	3,015	3,015
F	Tail swing radius	mm	2,940	2,940
G	Track overall length	mm	4,250	4,640
H	Length of track on ground	mm	3,460	3,845
	Min. ground clearance	mm	440	400

WORKING RANGES

	Item	Unit	PC240LC-7K	PC240NLC-7K
A	Max. digging reach	mm	10,180	10,180
B	Max. digging depth	mm	6,920	6,920
C	Max. digging height	mm	10,000	10,000
D	Max. vertical wall depth	mm	6,010	6,010
E	Max. dumping height	mm	7,035	7,035
F	Min. dumping height	mm	2,530	2,530
G	Max. reach at ground level	mm	10,020	10,020

SPECIFICATIONS
PC210-7K, PC210LC-7K, PC210NLC-7K

Machine model				PC210-7K	PC210LC-7K	PC210NLC-7K
Serial Number				K40001 and up		
Bucket capacity			m^3	0.8		
Operating weight			kg	19,300	20,700	
Performance	Working ranges	Max. digging depth	mm	6,620		
		Max. vertical wall depth	mm	5,980		
		Max. digging reach	mm	9,875		
		Max. reach at ground level	mm	9,700		
		Max. digging height	mm	10,000		
		Max. dumping height	mm	7,110		
	Max. digging force		kN {kg}	138.3 {14,100}		
	(using power max. function)			(149.1 {15,200})		
	Swing speed		rpm	12.4		
	Swing max. slope angle		deg.	20		
	Travel speed		km/h	Lo: 3.0 (※ Mi: 4.1)		
				Hi: 5.5		
	Gradeability		deg.	35		
	Ground pressure		kPa {kg/cm²}	36.3 {0.37}		
	[standard shoe width]		[mm]	[700]		
Dimensions	Overall length (for transport)		mm	9,425	9,425	9,425
	Overall width		mm	2,800	3,080	2,540
	Overall width of track		mm	2,800	3,080	2,540
	Overall height (for transport)		mm	3,000	3,000	3,000
	Overall height to chassis		mm	3,000	3,000	3,000
	Ground clearance to bottom of upper structure		mm	1,085	1,085	1,085
	Min. ground clearance		mm	440	440	440
	Tail swing radius		mm	2,750	2,750	2,750
	Min. swing radius of work equipment		mm	3,040	3,040	3,040
	Height of work equipment at min. swing radius		mm	8,005	8,005	8,005
	Length of track on ground		mm	3,270	3,655	3,655
	Track gauge		mm	2,200	2,380	2,040
	Height of machine cab		mm	2,335	2,335	2,335

※ : The "Mi" mode is on the multi-monitor specification machine only.

Machine model				PC210-7K	PC210LC-7K	PC210NLC-7K
Serial Number				K40001 and up		
Engine	Model			SAA6D102E-2-A		
	Type			4-cycle, water-cooled, in-line, vertical, direct injection, with turbo charger		
	No. of cylinders - bore x stroke		mm	6 - 102 x 120		
	Piston displacement		l {cc}	5.883 {5,883}		
	Performance	Flywheel horsepower	kW/rpm {HP/rpm}	106.7/1,950 {143/1,950}		
		Max. torque	Nm/rpm {kgm/rpm}	610.0/1,500 {62.2/1,500}		
		Max. speed at no load	rpm	2,150		
		Min. speed at no load	rpm	1,030		
		Min. fuel consumption	g/kWh {g/HPh}	215 {160}		
	Starting motor			24V, 4.5 kW		
	Alternator			24V, 35 A		
	Battery			12V, 110 Ah x 2		
	Radiator core type			Corrugated CWX-4		
Under-carriage	Carrier roller			2 on each side		
	Track roller			7 on each side	9 on each side	
	Track shoe			Assembly-type triple grouser, 45 on each side	Assembly-type triple grouser, 49 on each side	
Hydraulic system	Hydraulic pump	Type x No.		HPV95+95, variable displacement		
		Delivery	l/min	Piston type: 214 x 2		
		Set pressure	MPa (kg/cm²)	Piston type: 37.2 {380}		
	Control valve	Type x No.		6-spool type x 1		
		Control method		Hydraulic		
	Hydraulic motor	Travel motor		HMV110ADT-2, Piston type (with brake valve, parking brake): x 2		
		Swing motor		KMF125ABE-5, Piston type (with safety valve, holding brake): x 1		
	Hydraulic culinder	Type		Boom: Double acting piston	Arm: Double acting piston	Bucket: Double acting piston
		Inside diameter of cylinder	mm	120	135	115
		Diameter of piston rod	mm	85	95	80
		Stroke	mm	1,334.5	1,490	1,120
		Max. distance between pins	mm	3,204.5	3,565	2,800
		Min. distance between pins	mm	1,870	2,075	1,680
	Hrdraulic tank			Closed box type		
	Hydraulic filter			Tank return side		
	Hydraulic cooler			CF40-1 (Air cooled)		

PC240LC-7K, PC240NLC-7K

Machine model				PC240LC-7K	PC240NLC-7K
Serial Number				K40001 and up	
Bucket capacity			m^3	1.0	1.0
Operating weight			kg	22,700	24,130
Performance	Working ranges	Max. digging depth	mm	6,920	6,920
		Max. vertical wall depth	mm	6,010	6,010
		Max. digging reach	mm	10,180	10,180
		Max. reach at ground level	mm	10,020	10,020
		Max. digging height	mm	10,000	10,000
		Max. dumping height	mm	7,035	7,035
	Max. digging force (using power max. function)		kN {kg}	158.9 {16,200} (171.6 {17,500})	158.9 {16,200} (171.6 {17,500})
	Swing speed		rpm	11.7	11.7
	Swing max. slope angle		deg.	25	25
	Travel speed		km/h	Lo: 3.1 (※ Mi: 4.2) Hi: 5.5	Lo: 3.1 (※ Mi: 4.2) Hi: 5.5
	Gradeability		deg.	35	35
	Ground pressure [standard shoe width]		kPa {kg/cm²} [mm]	50.0 {0.51} [600]	41.2 {0.42} [700]
Dimensions	Overall length (for transport)		mm	9,885	9,885
	Overall width		mm	2,980	3,280
	Overall width of track		mm	2,980	3,280
	Overall height (for transport)		mm	3,160	3,160
	Overall height to chassis		mm	3,015	3,015
	Ground clearance to bottom of upper structure		mm	1,110	1,110
	Min. ground clearance		mm	440	440
	Tail swing radius		mm	2,940	2,940
	Min. swing radius of work equipment		mm	3,450	3,450
	Height of work equipment at min. swing radius		mm	8,110	8,110
	Length of track on ground		mm	3,460	3,845
	Track gauge		mm	2,380	2,580
	Height of machine cab		mm	2,390	2,390

※ : The "Mi" mode is on the multi-monitor specification machine only.

Machine model				PC240LC-7K	PC240NLC-7K
Serial Number				K40001 and up	
Engine		Model		SAA6D102E-2-C	
		Type		4-cycle, water-cooled, in-line, vertical, direct injection, with turbo charger	
		No. of cylinders - bore x stroke	mm	6 - 102 x 120	
		Piston displacement	l {cc}	5.883 {5,883}	
	Performance	Flywheel horsepower	kW/rpm {HP/rpm}	125/2,000 {167/2,000}	
		Max. torque	Nm/rpm {kgm/rpm}	686/1,500 {70/1,500}	
		Max. speed at no load	rpm	2,260	
		Min. speed at no load	rpm	1,060	
		Min. fuel consumption	g/kWh {g/HPh}	212 {153}	
	Starting motor			24V, 4.5 kW	
	Alternator			24V, 35 A	
	Battery			12V, 110 Ah x 2	
	Radiator core type			Corrugated CF19-5	
Under-carriage	Carrier roller			2 on each side	
	Track roller			8 on each side	10 on each side
	Track shoe			Assembly-type triple grouser, 47 on each side	Assembly-type triple grouser, 51 on each side
Hydraulic system	Hydraulic pump	Type x No.		HPV95+95, variable displacement	
		Delivery	l/min	Piston type: 214 x 2	
		Set pressure	MPa (kg/cm²)	Piston type: 37.2 {380}	
	Control valve	Type x No.		6-spool type x 1	
		Control method		Hydraulic	
	Hydraulic motor	Travel motor		HMV110ADT-2, Piston type (with brake valve, parking brake): x 2	
		Swing motor		KMF125ABE-5, Piston type (with safety valve, holding brake): x 1	
	Hydraulic culinder	Type		Boom: Double acting piston	Arm: Double acting piston / Bucket: Double acting piston
		Inside diameter of cylinder	mm	130	140 / 130
		Diameter of piston rod	mm	90	100 / 90
		Stroke	mm	1,335	1,635 / 1,020
		Max. distance between pins	mm	3,205	2,235 / 2,625
		Min. distance between pins	mm	1,870	3,870 / 1,605
	Hrdraulic tank			Closed box type	
	Hydraulic filter			Tank return side	
	Hydraulic cooler			CF40-1 (Air cooled)	

WEIGHT TABLE
PC210-7K, PC210LC-7K, PC210NLC-7K

This weight table is for use when handling components or when transporting the machine.

Unit: kg

Machine model	PC210-7K	PC210LC-7K	PC210NLC-7K
Serial Number	K40001 and up		
Engine assembly	749		
• Engine	598		
• Damper	6		
• Hydraulic pump	145		
Radiator oil cooler assembly	110		
Hydraulic tank, filter assembly (excluding hydraulic oil)	123		
Fuel tank (excluding fuel)	121		
Revolving frame	1,729		
Operator's cab	278		
Operator's seat	35		
Counterweight	3,735		
Swing machinery	160		
Control valve	263		
Swing motor	60		
Travel motor	98 x 2		
Center swivel joint	36		
Track frame assembly	4,712		
• Track frame	2,534		
• Swing circle	273		
• Idler	99 x 2		
• Idler cushion	135 x 2		
• Carrier roller	16 x 4		
• Track roller	36 x 18		
• Final drive (including travel motor)	343 x 2		

Unit: kg

Machine model	PC210-7K	PC210LC-7K	PC210NLC-7K
Serial Number	K40001 and up		
Track shoe assembly			
• Standard triple grouser shoe (600 mm)	1,215x2	1,325 x 2	1,325 x 2
• Standard triple grouser shoe (700 mm)	1,405x5	1,530 x 2	1,530 x 2
• Wide triple grouser shoe (800 mm)	1,530x2	1,670 x 2	-
• Road liner (rubber pad type) (600 mm)	1,470x2	1,600 x	-
Boom assembly	1,408		
Arm assembly	653		
Bucket assembly	628		
Boom cylinder assembly	172 x 2		
Arm cylinder assembly	226		
Bucket cylinder assembly	136		
Link assembly (large)	81		
Link assembly (small)	22 x 2		
Boom pin	48 + 8 x 2 + 31 + 10 + 26		
Arm pin	11 + 8		
Bucket pin	20 x 2		
Link pin	13 x 2		

PC240LC-7K, PC240NLC-7K

Unit: kg

Machine model	PC240LC-7K	PC240NLC-7K
Serial Number	K40001 and up	K40001 and up
Engine assembly	749	749
• Engine	598	598
• Damper	6	6
• Hydraulic pump	145	145
Radiator oil cooler assembly	119	119
Hydraulic tank, filter assembly (excluding hydraulic oil)	123	123
Fuel tank (excluding fuel)	121	121
Revolving frame	2,048	2,048
Operator's cab	278	278
Operator's seat	35	35
Counterweight	5,056	5,056
Swing machinery	237	237
Control valve	263	263
Swing motor	60	60
Travel motor	98 x 2	98 x 2
Center swivel joint	36	36
Track frame assembly	4,828	5,460
• Track frame	2,558	3,046
• Swing circle	293	293
• Idler	99 x 2	99 x 2
• Idler cushion	135 x 2	135 x 2
• Carrier roller	16 x 4	16 x 4
• Track roller	36 x 16	36 x 20
• Final drive (including travel motor)	362 x 2	362 x 2

Unit: kg

Machine model	PC240LC-7K	PC240NLC-7K
Serial Number	K40001 and up	K40001 and up
Track shoe assembly		
• Standard triple grouser shoe (600 mm)	1,340 x 2	1,455 x 2
• Standard triple grouser shoe (700 mm)	1,470 x 2	1,595 x 2
• Wide triple grouser shoe (800 mm)	1,600 x 2	1,735 x 2
• Road liner (rubber pad type) (600 mm)	1,535 x 2	1,665 x 2
Boom assembly	1,825	1,825
Arm assembly	1,213	1,213
Bucket assembly	722	722
Boom cylinder assembly	195 x 2	195 x 2
Arm cylinder assembly	262	262
Bucket cylinder assembly	161	161
Link assembly (large)	82	82
Link assembly (small)	22 x 2	22 x 2
Boom pin	50 + 10 x 2 + 31 + 10 + 26	50 + 10 x 2 + 31 + 10 + 26
Arm pin	11 + 10	11 + 10
Bucket pin	20 x 2	20 x 2
Link pin	17 x 2	17 x 2

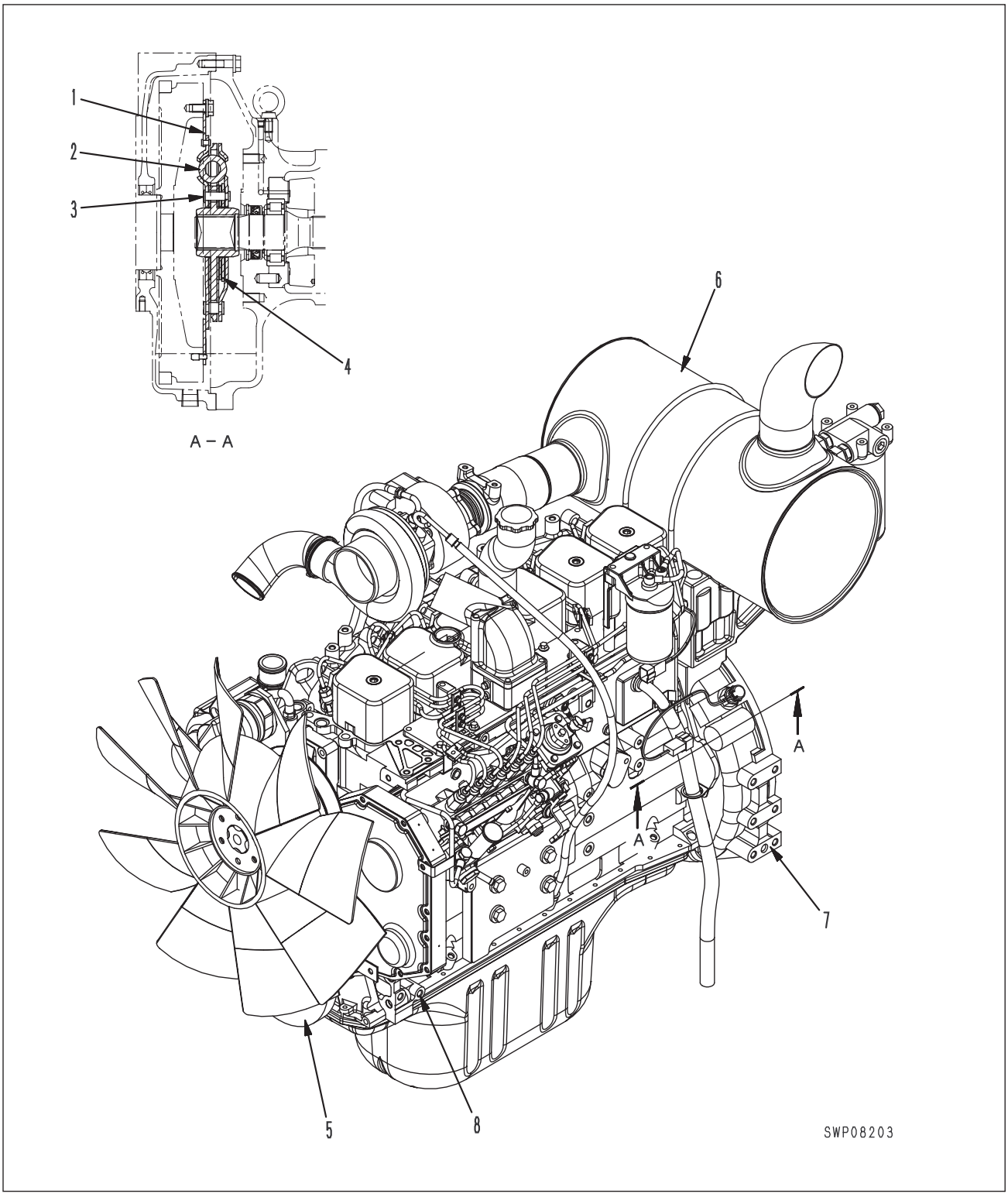
FUEL, COOLANT, AND LUBRICANTS

RESERVOIR	KIND OF FLUID	AMBIENT TEMPERATURE -22 -4 14 32 50 68 86 104°F -30 -20 -10 0 10 20 30 40°C	CAPACITY (l) Specified	CAPACITY (l) Refill
Engine oil pan	Engine oil	SAE 30 / SAE 10W / SAE 10W-30 / SAE 15W-40	26.3	24
Damper case	Engine oil	SAE 30 / SAE 10W / SAE 10W-30 / SAE 15W-40	0.75	—
Swing machinery case	Engine oil	SAE 30 / SAE 10W / SAE 10W-30 / SAE 15W-40	6.6	6.6
Final drive case (each side)	Engine oil	SAE 30 / SAE 10W / SAE 10W-30 / SAE 15W-40	4.7	4.5
Idler (1 each)	Engine oil	SAE 30 / SAE 10W / SAE 10W-30 / SAE 15W-40	0.07-0.08	0.07-0.08
Track roller (1 each)	Engine oil	SAE 30 / SAE 10W / SAE 10W-30 / SAE 15W-40	0.19-0.20	0.19-0.20
Carrier roller (1 each)	Engine oil	SAE 30 / SAE 10W / SAE 10W-30 / SAE 15W-40	0.075-0.085	0.075-0.085
Hydraulic system	Engine oil	SAE 10W / SAE 10W-30 / SAE 15W-40	240	143
	Hydraulic oil	H046-HM (★)		
Fuel tank	Diesel fuel	ASTM D975 No. 2 / ASTM D975A No.1	400	—
Cooling system	Coolant	Add antifreeze	PC210, PC210LC, PC210NLC-7: 22.4 PC240LC, PC240NLC-7: 30.9	PC210, PC210LC, PC210NLC-7: 22.4 PC240LC, PC240NLC-7: 30.9

★ For the H-046-HM, use the oil recommended by Komatsu.

10 STRUCTURE, FUNCTION, AND MAINTENANCE STANDARD

ENGINE RELATED PARTS

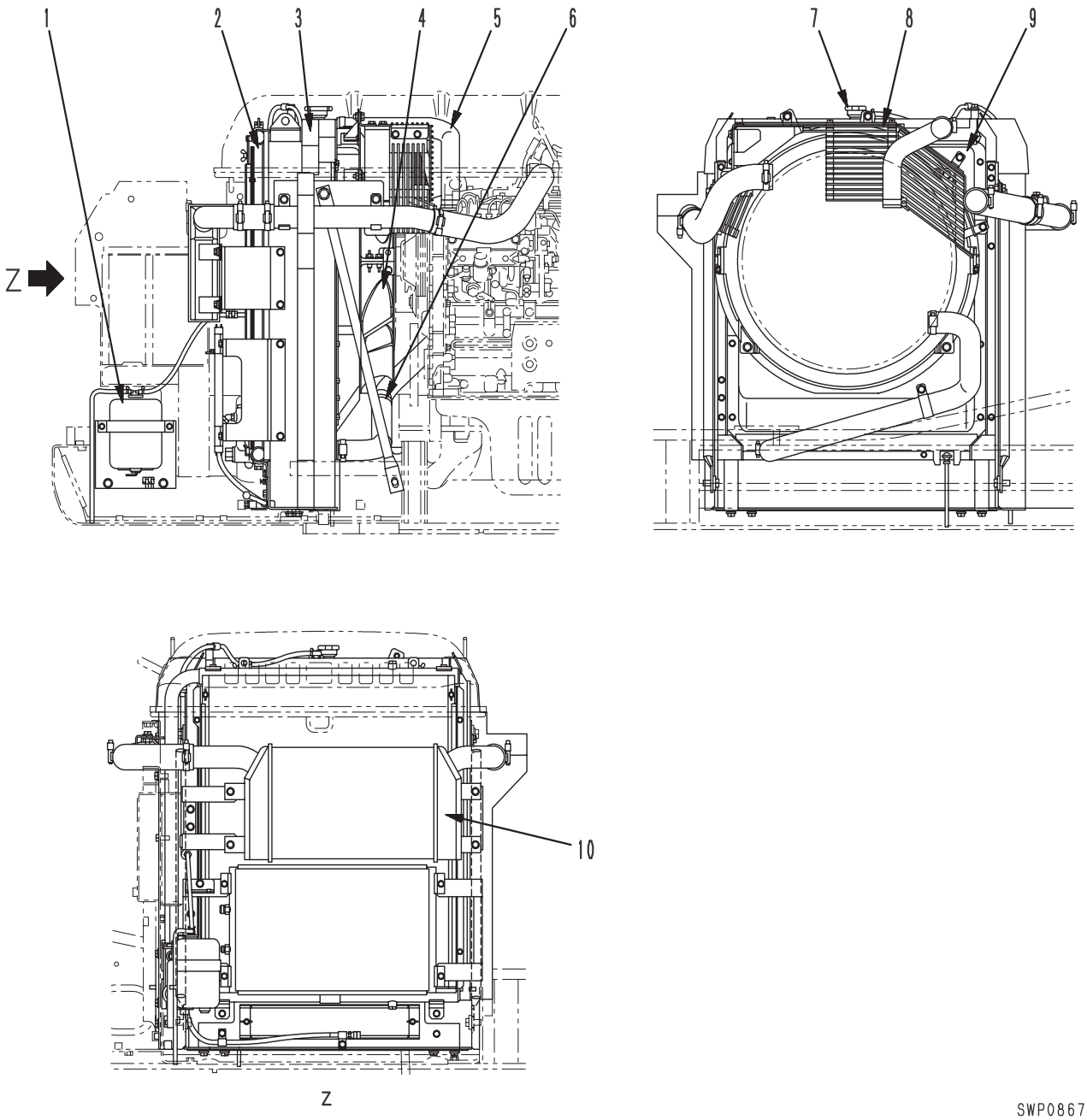


1. Drive plate
2. Torsion spring
3. Stopper pin
4. Friction plate
5. Damper assembly
6. Muffler
7. Rear engine mount
8. Front engine mount

OUTLINE

- The damper assembly is a wet type.
  Oil capacity: 0.75 **l**

RADIATOR • OIL COOLER • AFTERCOOLER

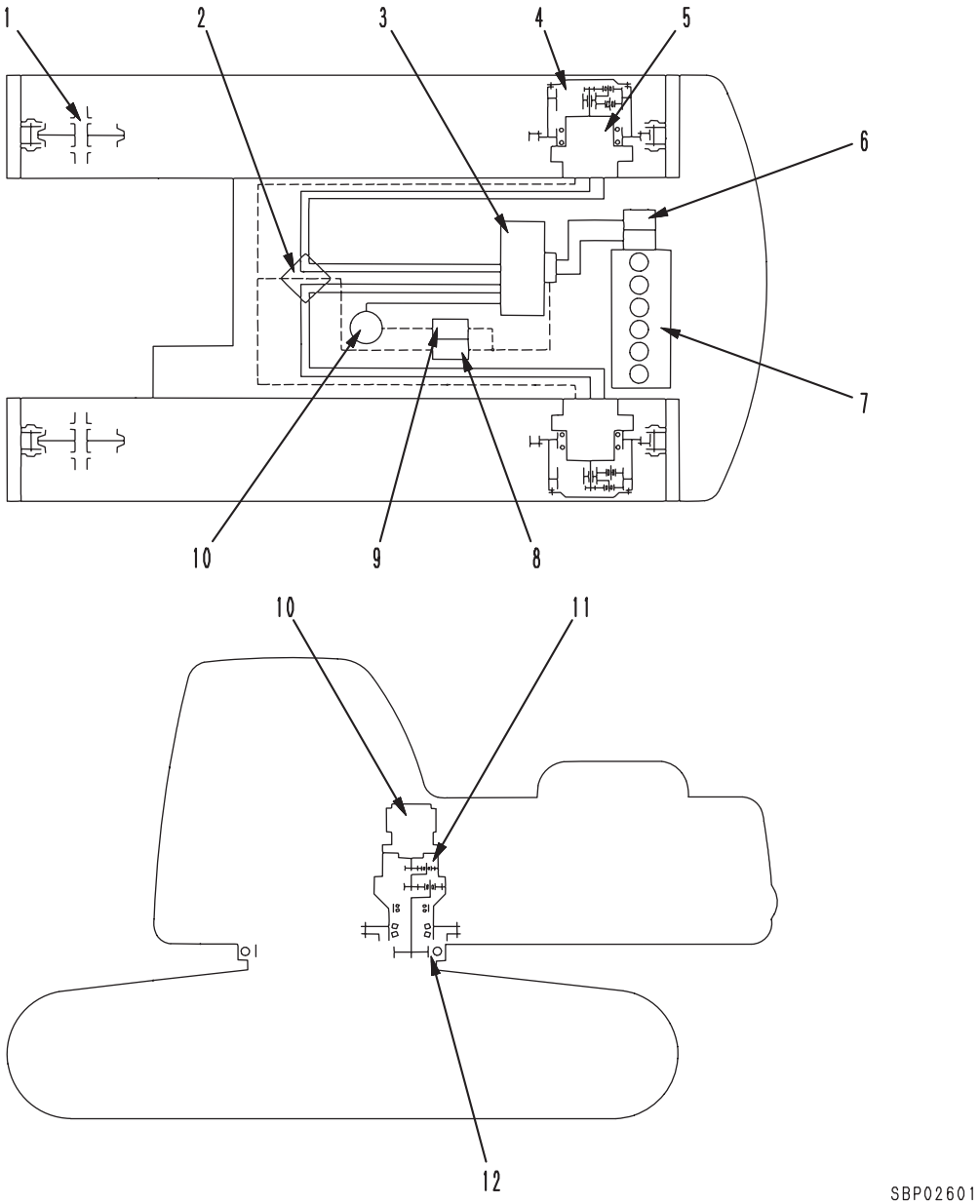


1. Reservoir tank
2. Oil cooler
3. Radiator
4. Fan
5. Radiator inlet hose
6. Radiator outlet hose
7. Radiator cap
8. Net
9. Shroud
10. Aftercooler

SPECIFICATIONS

Radiator: CWX-4 (PC210-7K, PC210LC-7K, PC210NLC-7K)
: CF19-5 (PC240LC-7K, PC240NLC-7K)
Oil cooler: CF40-1

POWER TRAIN



1. Idler
2. Center swivel joint
3. Control valve
4. Final drive
5. Travel motor (HMV 110ADT-2)
6. Hydraulic pump (HPV95+95)
7. Engine (SAA6D102E-2)
8. Travel speed solenoid valve
9. Swing brake solenoid valve
10. Swing motor (KMF125ABE-5)
11. Swing machinery
12. Swing circle

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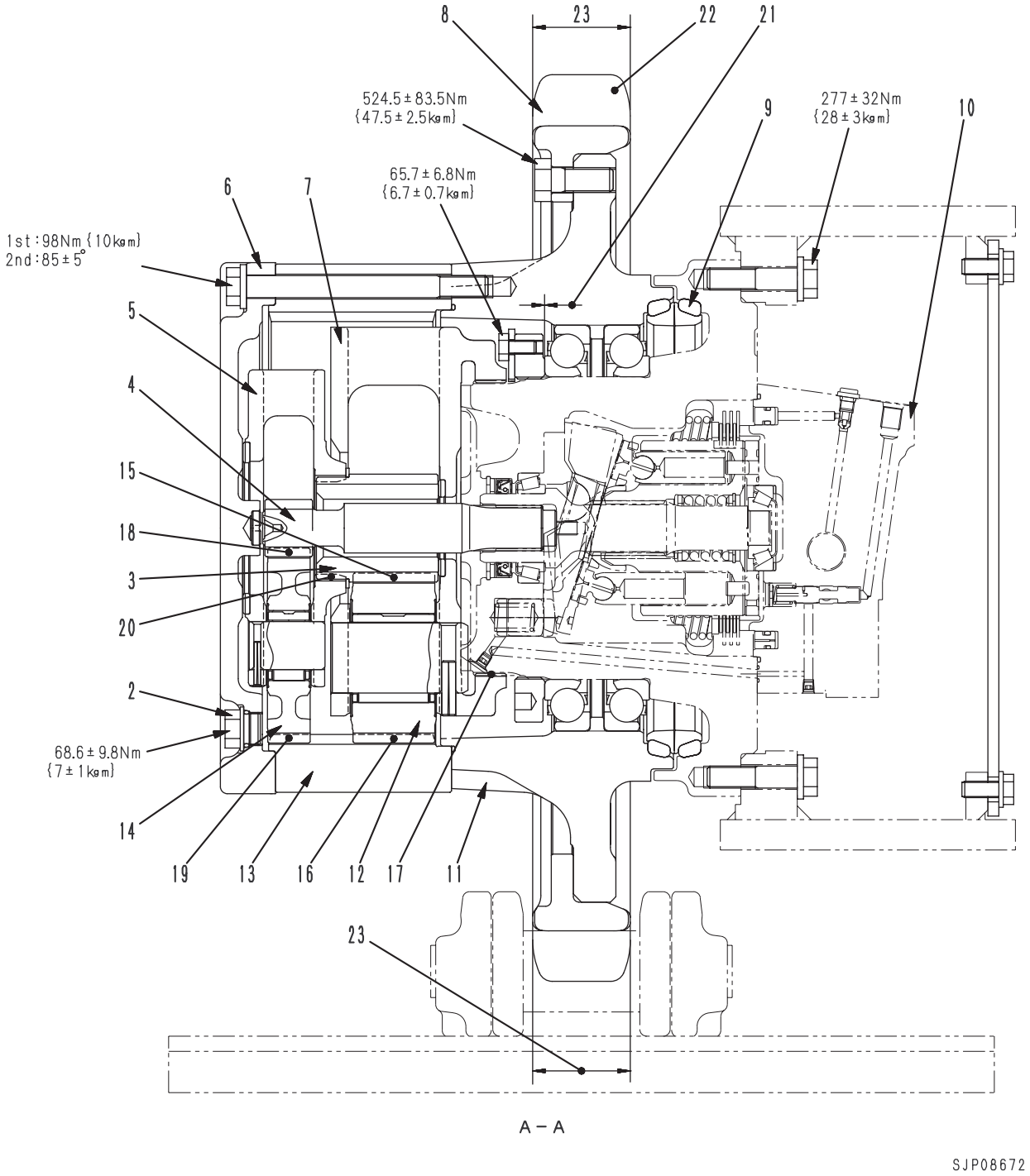
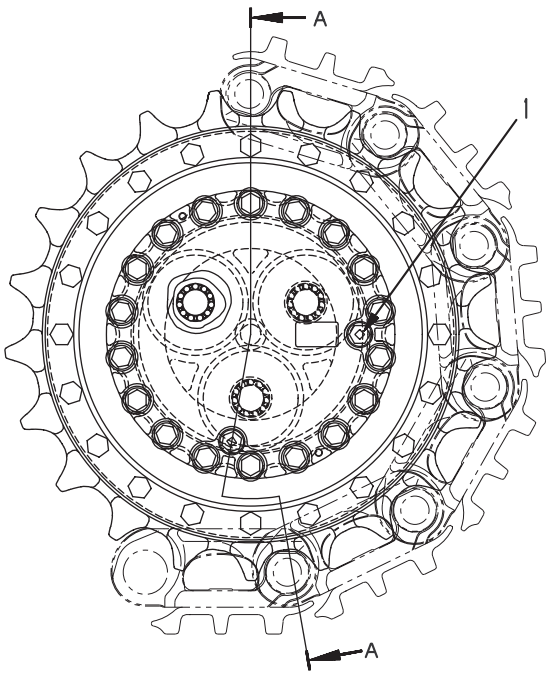
FINAL DRIVE


8
23
22
21
524.5±83.5Nm
{47.5±2.5kgm}
9
277±32Nm
{28±3kgm}
10
65.7±6.8Nm
{6.7±0.7kgm}
6
7
1st:98Nm{10kgm}
2nd:85±5°
5
4
15
18
3
20
2
68.6±9.8Nm
{7±1kgm}
14
19
13
16
12
17
11
23
A−A
SJP08672



SJP08673

1. Level plug
2. Drain plug
3. Cover
4. No. 2 sun gear (No. of teeth: 21)
5. No. 1 sun gear (No. of teeth: 10)
4. No. 1 planetary carrier
6. Cover
7. No. 2 planetary carrier
8. Sprocket
9. Floating seal
10. Travel motor
11. Hub
12. No. 2 planetary gear (No. of teeth: 36)
13. Ring gear (No. of teeth: 95)
14. No. 1 planetary gear (No. of teeth: 42)

SPECIFICATIONS

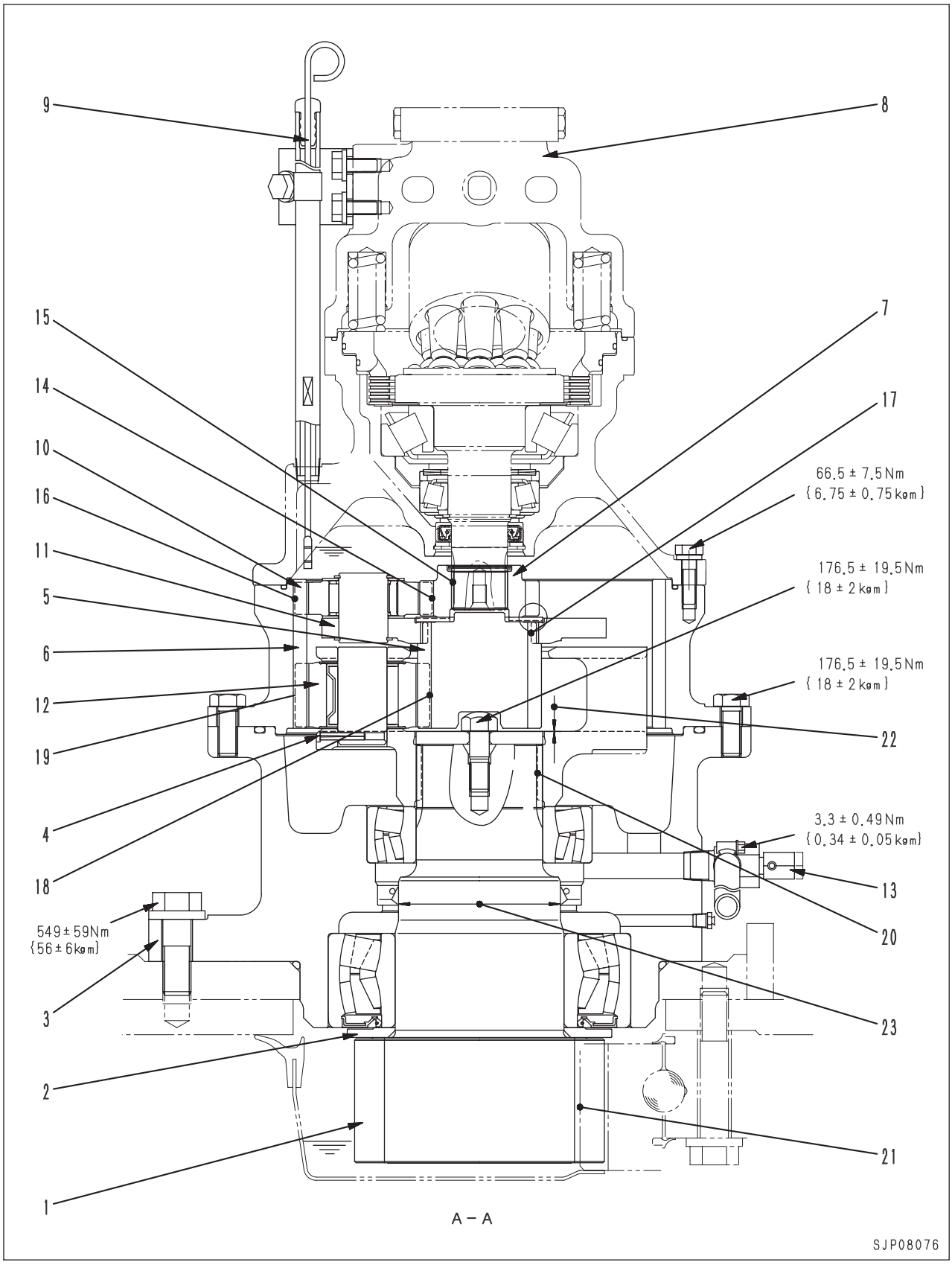
Reduction ratio:

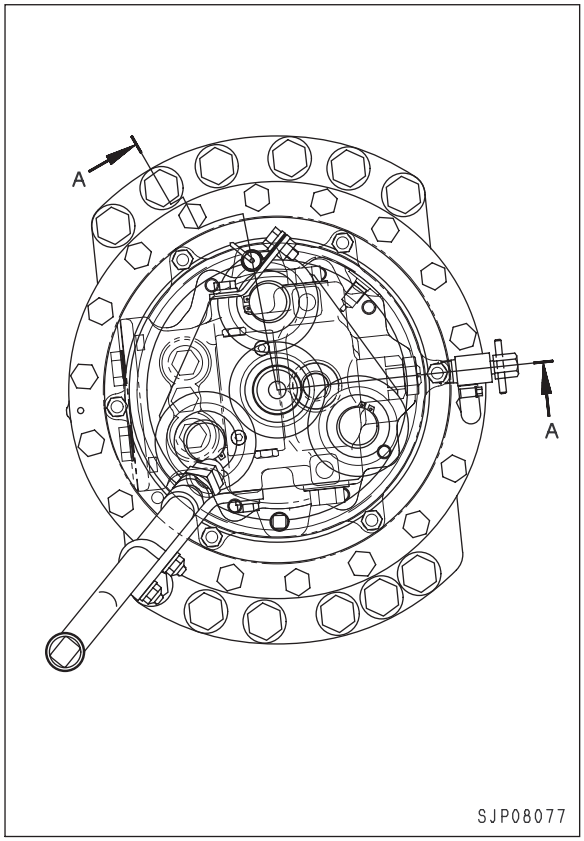
$$-\left(\frac{10+95}{10}\right)\times\left(\frac{21+95}{21}\right)+1=-57.00$$

Unit: mm

No.	Check item	Criteria		Remedy
15	Backlash between No. 1 sun gear and No. 1 planetary gear	Standard clearance	Clearance limit	Replace
		0.15 - 0.49	1.00	
16	Backlash between No. 1 planetary gear and ring gear	0.17 - 0.57	1.10	
17	Backlash between No. 1 planetary carrier and motor	0.06 - 0.25	—	
18	Backlash between No. 2 sun gear and No. 2 planetary gear	0.14 - 0.46	1.00	
19	Backlash between No. 2 planetary gear and ring gear	0.17 - 0.57	1.10	
20	Backlash between No. 2 planetary carrier and No. 1 sun gear	0.38 - 0.66	1.00	
21	End play of sprocket shaft	0.00 - 0.10	—	
22	Amount of wear on sprocket tooth	Repair limit: 6		Rebuild or replace
23	Width of sprocket tooth	Standard size	Repair limit	
		71	68	

SWING MACHINERY
PC210-7K, PC210LC-7K, PC210NLC-7K





1. Swing pinion (No. of teeth: 15)
2. Spacer
3. Case
4. No. 2 planetary carrier
5. No. 2 sun gear
6. Ring gear
7. No. 1 sun gear
8. Swing motor
9. Oil level gauge
10. No. 1 planetary gear
11. No. 1 planetary carrier
12. No. 2 planetary gear
13. Drain plug

SPECIFICATIONS

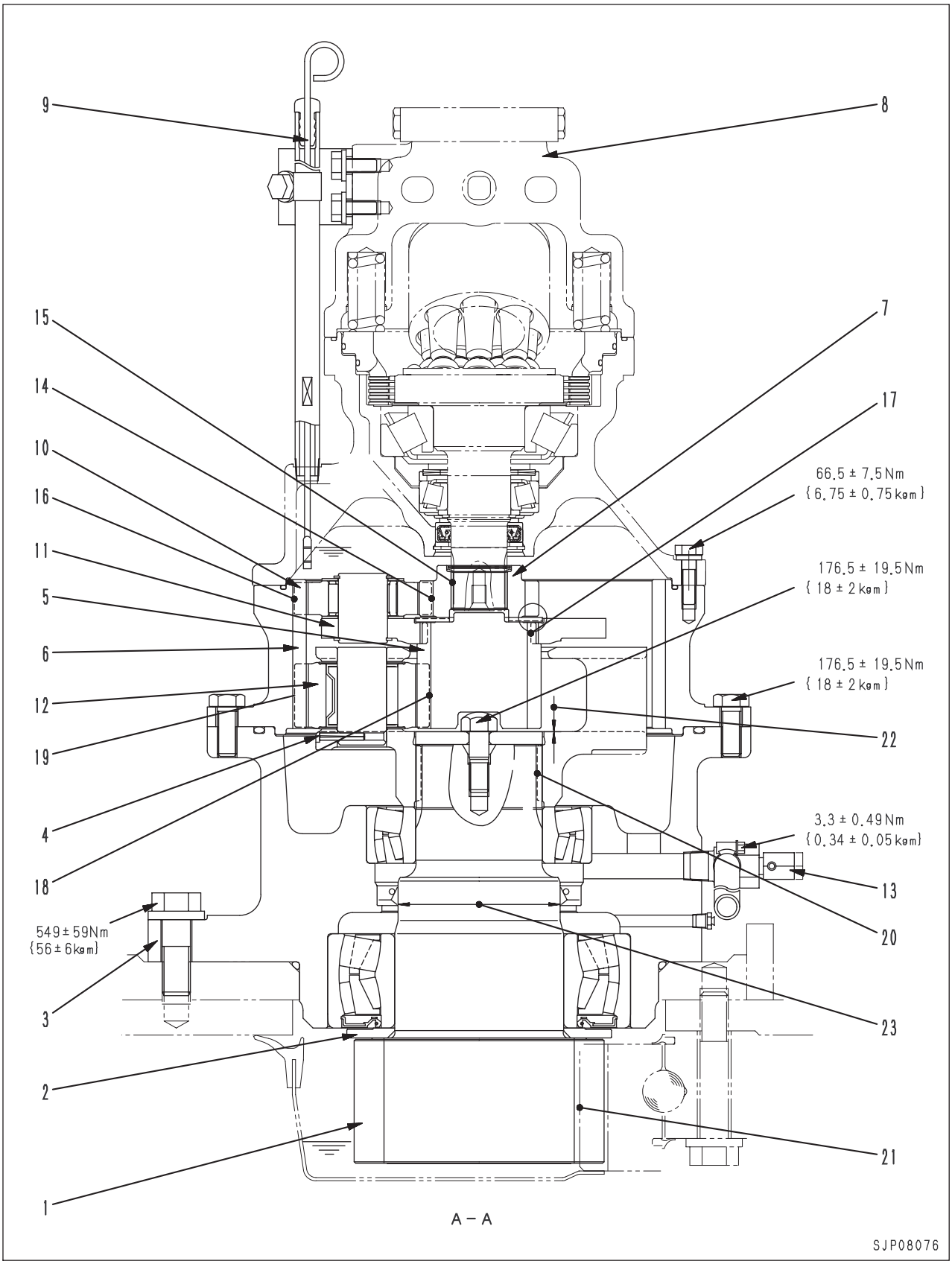
Reduction ratio:

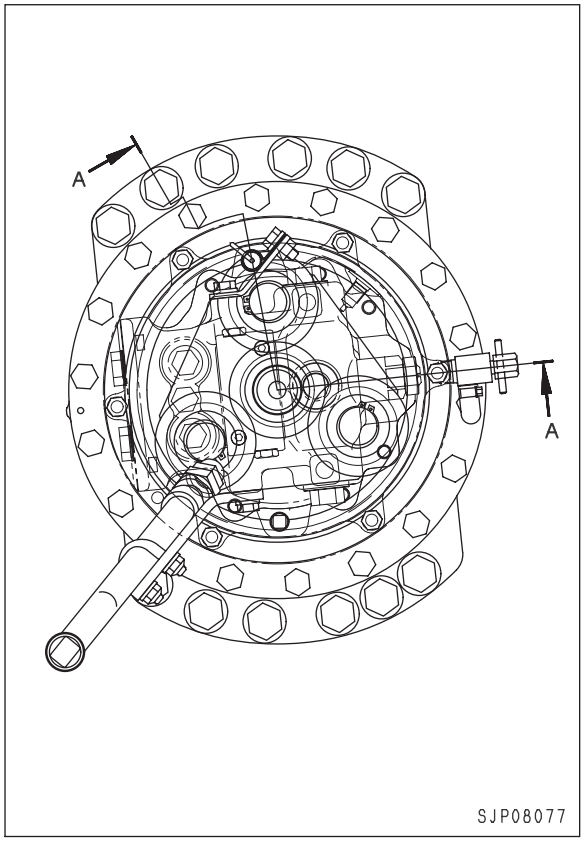
$$\left(\frac{17+58}{17}\right)\times\left(\frac{18+58}{18}\right)=18.627$$

Unit: mm

No.	Check item	Criteria		Remedy
14	Backlash between swing motor shaft and No. 1 sun gear	Standard clearance	Clearance limit	Replace
		0.18 - 0.28	—	
15	Backlash between No. 1 sun gear and No. 1 planetary gear	0.16 - 0.50	1.00	
16	Backlash between No. 1 planetary gear and ring gear	0.18 - 0.59	1.10	
17	Backlash between No. 1 planetary carrier and No. 2 sun gear	0.39 - 0.71	1.20	
18	Backlash between No. 2 sun gear and No. 2 planetary gear	0.16 - 0.50	0.90	
19	Backlash between No. 2 planetary gear and ring gear	0.18 - 0.59	1.00	
20	Backlash between No. 2 planetary carrier and swing pinion	0.07 - 0.23	—	
21	Backlash between swing pinion and swing circle	0.22 - 1.32	2.00	
22	Clearance between plate and planetary carrier	0.66 - 1.14	—	
23	Wear of swing pinion surface contacting with oil seal	Standard size	Repair limit	Apply hard chrome plating, recondition, or replace
		$115^{\ 0}_{-0.100}$	—	

PC240LC-7K, PC240NLC-7K





1. Swing pinion (No. of teeth: 13)
2. Spacer
3. Case
4. No. 2 planetary carrier
5. No. 2 sun gear
6. Ring gear
7. No. 1 sun gear
8. Swing motor
9. Oil level gauge
10. No. 1 planetary gear
11. No. 1 planetary carrier
12. No. 2 planetary gear
13. Drain plug

SPECIFICATIONS

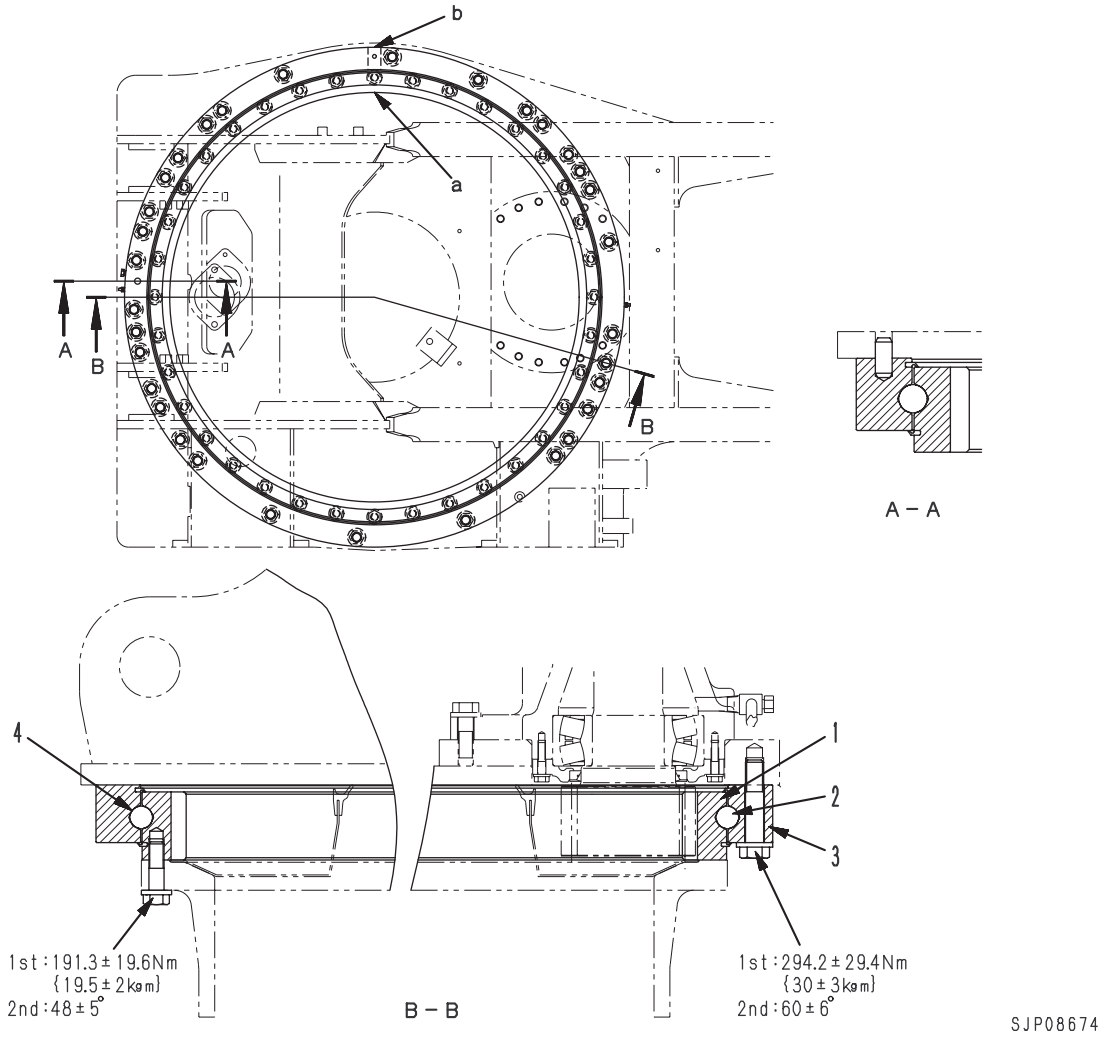
Reduction ratio:

$$\left(\frac{17+58}{17}\right)\times\left(\frac{14+58}{14}\right)=22.689$$

Unit: mm

No.	Check item	Criteria		Remedy
14	Backlash between swing motor shaft and No. 1 sun gear	Standard clearance	Clearance limit	Replace
		0.18 - 0.28	—	
15	Backlash between No. 1 sun gear and No. 1 planetary gear	0.16 - 0.59	1.00	
16	Backlash between No. 1 planetary gear and ring gear	0.18 - 0.50	1.10	
17	Backlash between No. 1 planetary carrier and No. 2 sun gear	0.39 - 0.64	1.20	
18	Backlash between No. 2 sun gear and No. 2 planetary gear	0.16 - 0.44	0.90	
19	Backlash between No. 2 planetary gear and ring gear	0.18 - 0.56	1.00	
20	Backlash between No. 2 planetary carrier and swing pinion	0.08 - 0.23	—	
21	Backlash between swing pinion and swing circle	0.23 - 1.37	2.00	
22	Clearance between plate and planetary carrier	0.58 - 0.62	—	
23	Wear of swing pinion surface contacting with oil seal	Standard size	Repair limit	Apply hard chrome plating, recondition, or replace
		115 $^{0}_{-0.100}$	—	

SWING CIRCLE
PC210-7K, PC210LC-7K, PC210NLC-7K



1. Swing circle inner race (No. of teeth: 110)
2. Ball
3. Swing circle outer race

a. Inner race soft zone S position
b. Outer race soft zone S position

SPECIFICATIONS

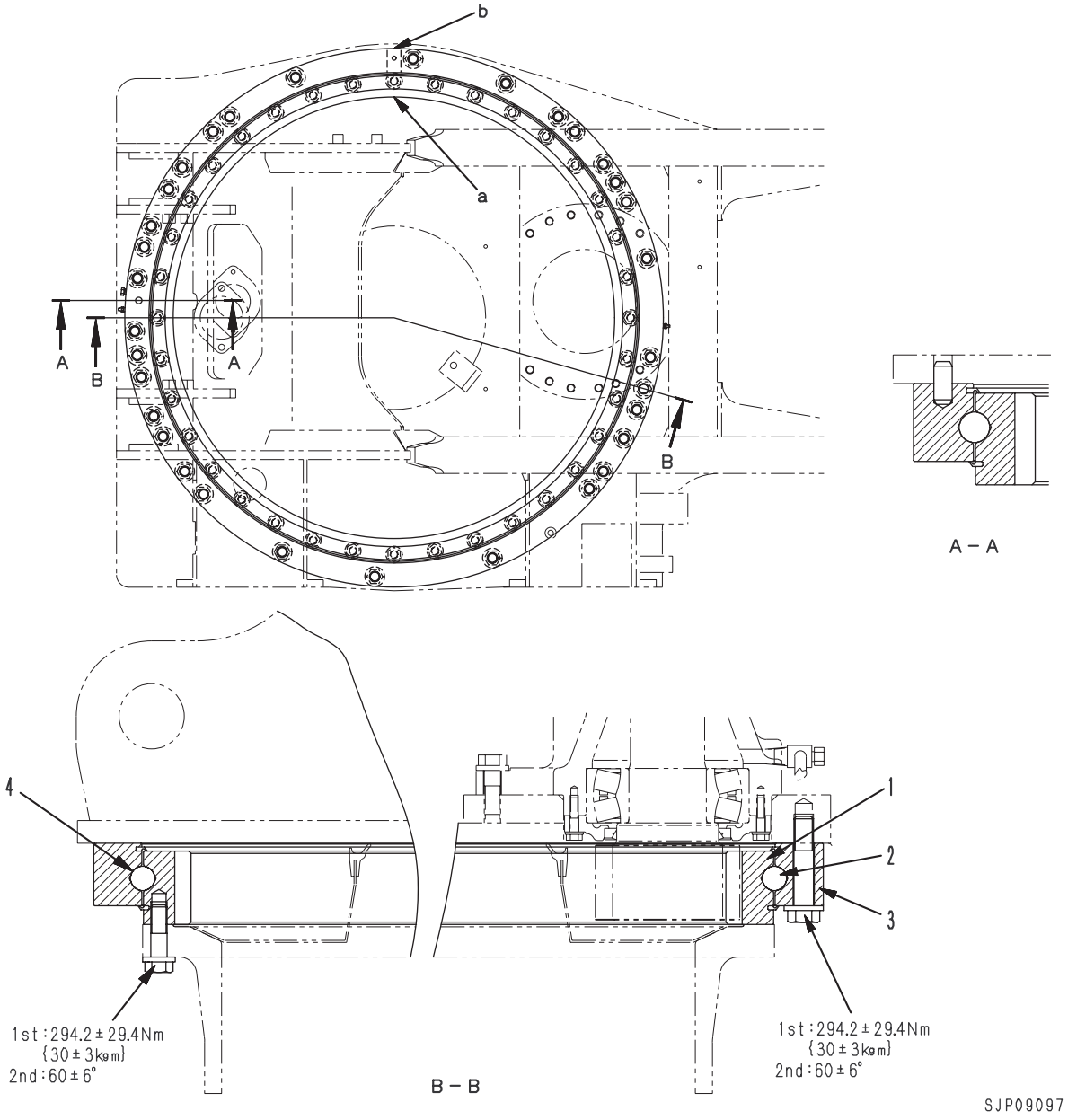
Reduction ratio: $\left(\frac{110}{15}\right) = 7.333$

Amount of grease: 14.6 **l** (G2-LI)

Unit: mm

No.	Check item	Criteria		Remedy
4	Axial clearance of bearing (when mounted on chassis)	Standard clearance	Clearance limit	Replace
		0.5 - 1.6	3.2	

PC240LC-7K, PC240NLC-7K



1. Swing circle inner race (No. of teeth: 92)
2. Ball
3. Swing circle outer race

a. Inner race soft zone S position
b. Outer race soft zone S position

SPECIFICATIONS

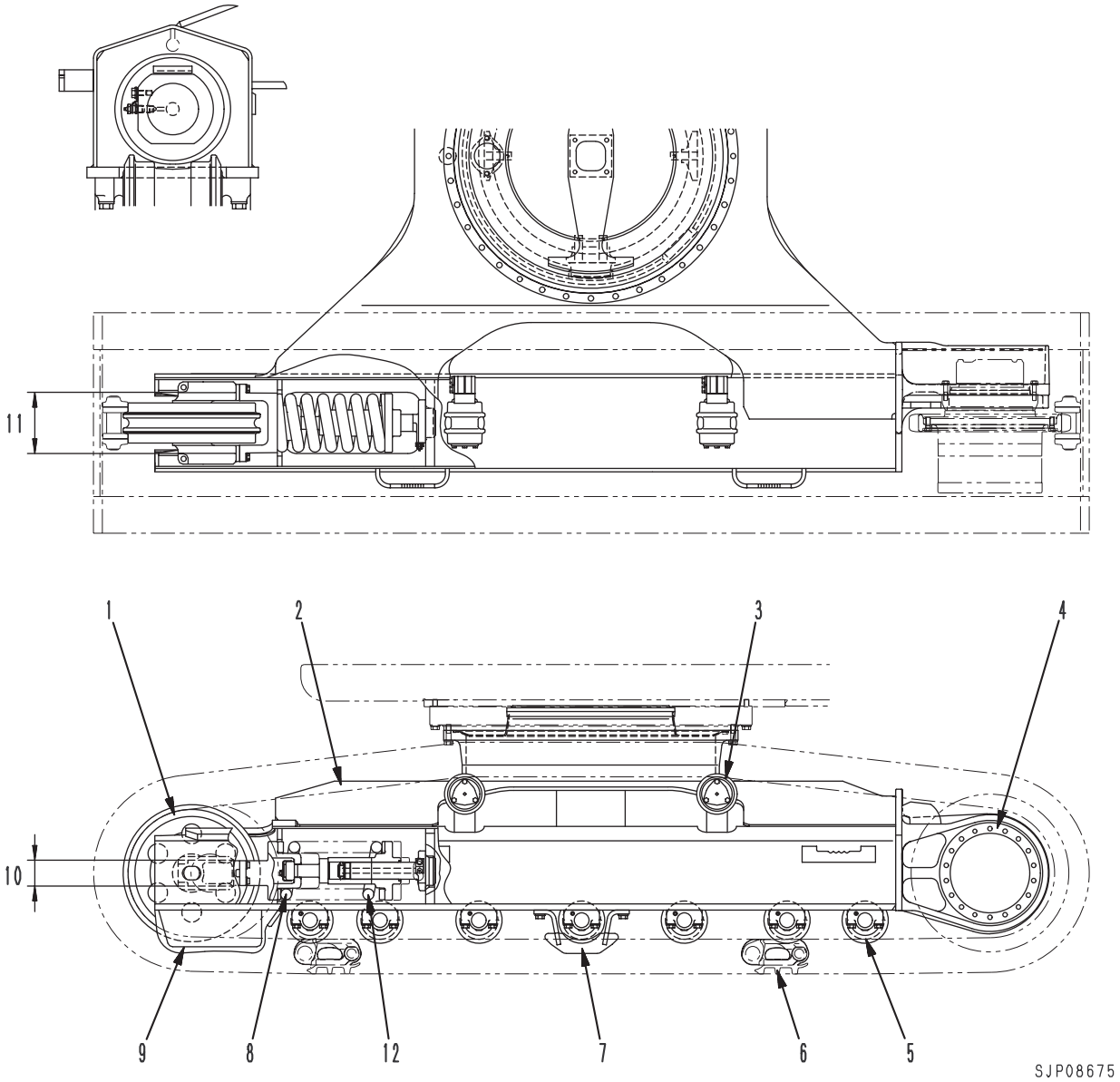
Reduction ratio: $-\left(\frac{92}{13}\right) = -7.077$

Amount of grease: 15.8 **l** (G2-LI)

Unit: mm

No.	Check item	Criteria		Remedy
4	Axial clearance of bearing (when mounted on chassis)	Standard clearance	Clearance limit	Replace
		0.5 - 1.6	3.2	

TRACK FRAME • RECOIL SPRING



1 Idler
2 Track frame
3 Carrier roller
4 Final drive
5 Track roller
6 Track shoe
7 Center guard
8 Recoil spring

- The dimensions and the number of track rollers depend on the model, but the basic structure is not different.
- Number of track rollers

Model	Q'ty
PC210-7K	7
PC210LC-7K	9
PC210NLC-7K	9
PC240LC-7K	10
PC240NLC-7K	9

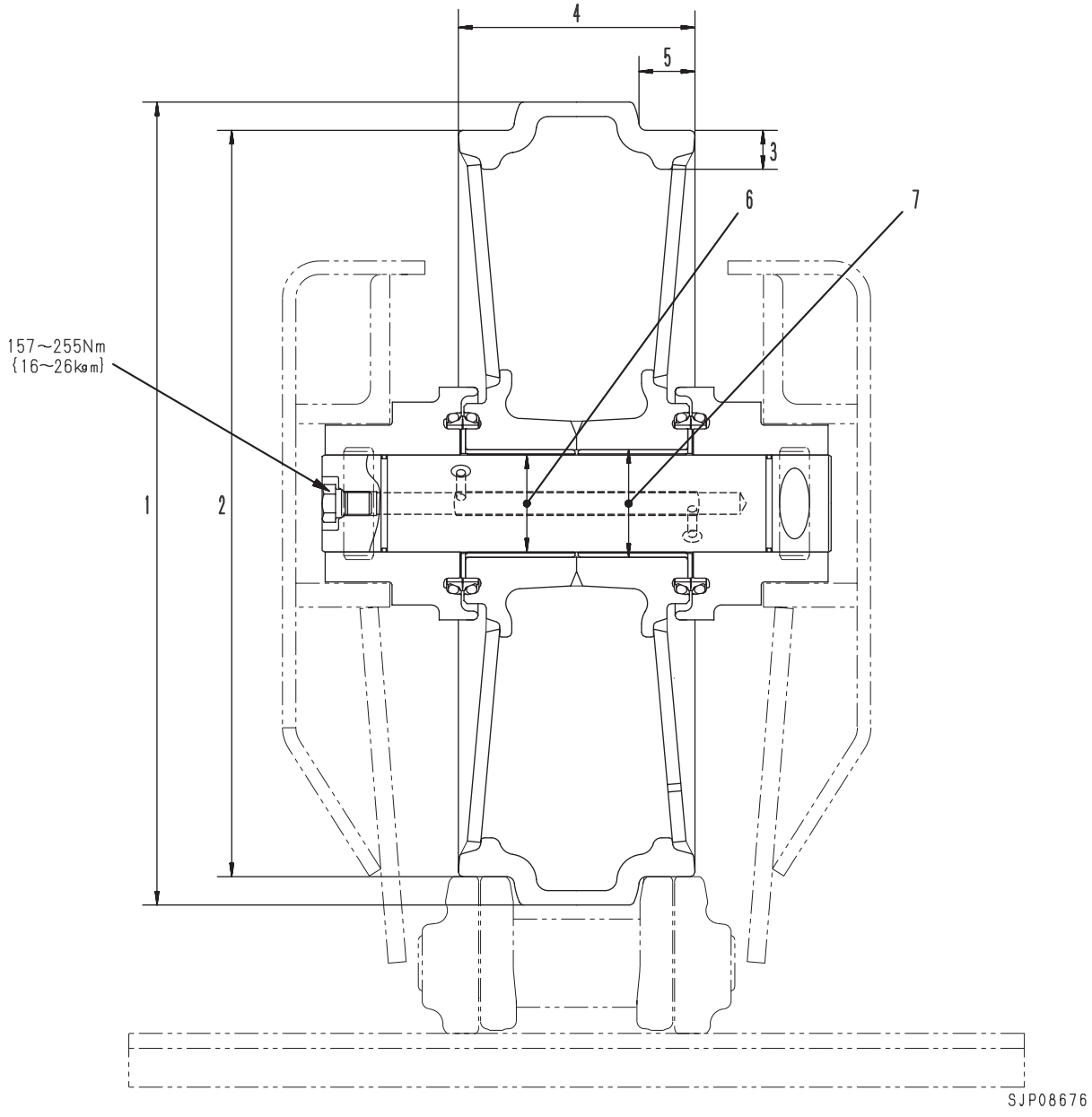
Standard shoe

Item \ Model	PC210-7K	PC210LC-7K	PC210NLC-7K	PC240LC-7K	PC240NLC-7K
Shoe width	600 mm	700 mm	500 mm	700 mm	700 mm
Link pitch	190 mm	190 mm	190 mm	190 mm	190 mm
No. on track (one side)	45 (pieces)	49 (pieces)	49 (pieces)	51 (pieces)	49 (pieces)

Unit: mm

No.	Check item		Criteria					Remedy
10	Vertical width of idler guide			Standard size	Tolerance	Repair limit		Rebuild or replace
			Track frame	107				
			Idler support	105				
11	Horizontal width of idler guide		Track frame	250				
			Idler support	247.4				
12	Recoil spring		Standard size			Repair limit		Replace
			Free length x O.D.	Installation length	Installation load	Free length	Installation load	
		PC210-7K	558 X 238	437	108.8 kN (11,100 kg)	534	87.3 kN (8,900 kg)	
		PC210LC-7K PC210NLC-7K PC240LC-7K PC240NLC-7K	603.5 X 239	466	126.5 kN (12,900 kg)	576	100.9 kN (10,300 kg)	

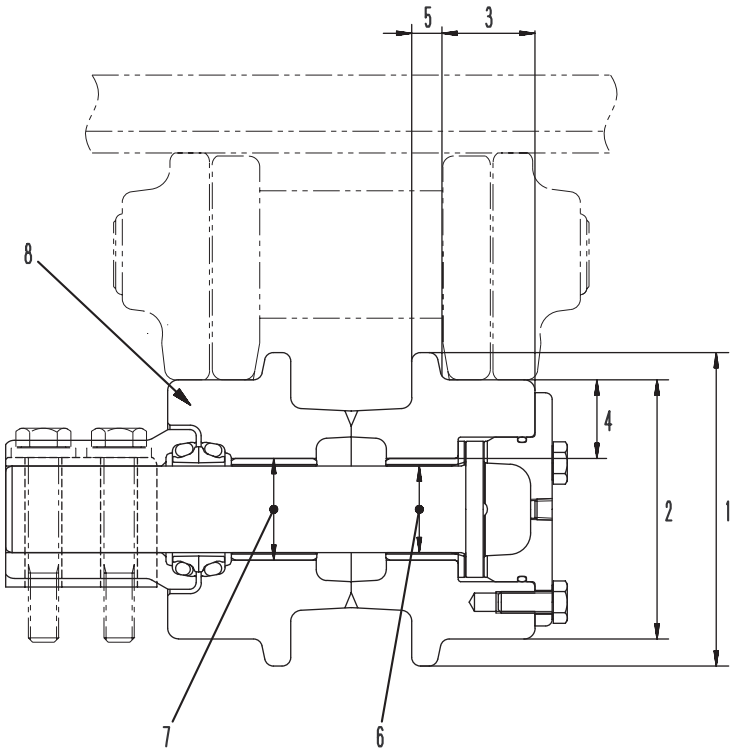
IDLER



Unit: mm

No.	Check item	Criteria					Remedy
1	Outside diameter of protruding	Standard size		Repair limit			Rebuild or replace
		538		—			
2	Outside diameter of tread	500		488			
3	Thickness of tread	26		20			
4	Total width	159		—			
5	Width of tread	37.5		43.5			
6	Clearance between shaft and bushing	Standard size	Tolerance		Standard clearance	Clearance limit	Replace bushing
			Shaft	Hole			
		65	-0.250 -0.350	+0.074 -0.036	0.214 - 0.424	1.5	
7	Interference between idler and bushing	Standard size	Tolerance		Standard inter-ference	Interference limit	
			Shaft	Hole			
		72	+0.089 +0.059	-0.006 -0.072	0.065 - 0.161	—	

CARRIER ROLLER

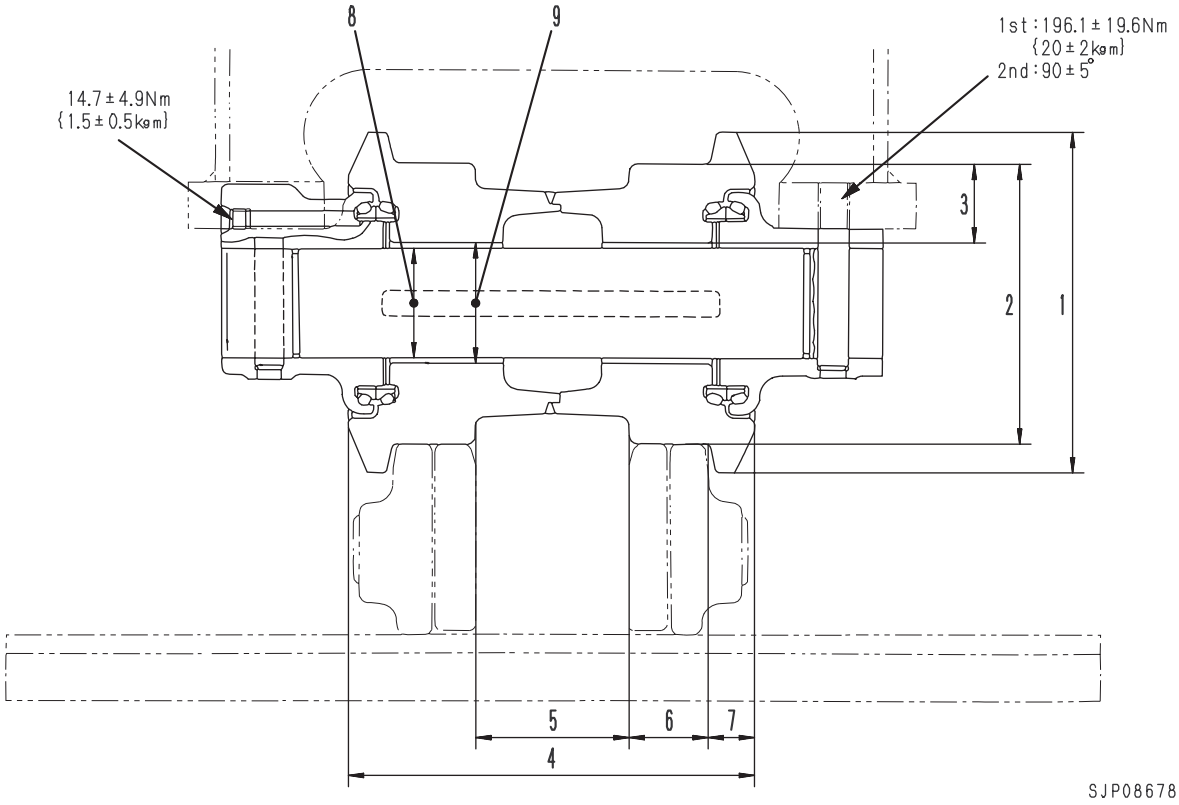


SJP08677

Unit: mm

No.	Check item	Criteria					Remedy
1	Outside diameter of flange	Standard size			Repair limit		Replace
		145			—		
2	Outside diameter of tread	120			106		
3	Width of tread	43			—		
4	Thickness of tread	36.5			29.5		
5	Width of flange	14			—		
6	Interference between shaft and bushing	Standard size	Tolerance		Standard interference	Interference limit	
			Shaft	Hole			
		40	-0.179 -0.190	+0.284 +0.169	0.339 - 0.474	—	
7	Interference between roller and bushing	47	-0.061 -0.036	0 -0.040	0.036 - 0.101	—	
8	Axial clearance of roller	Standard clearance			Clearance limit		
		0.44 - 0.76			—		

TRACK ROLLER

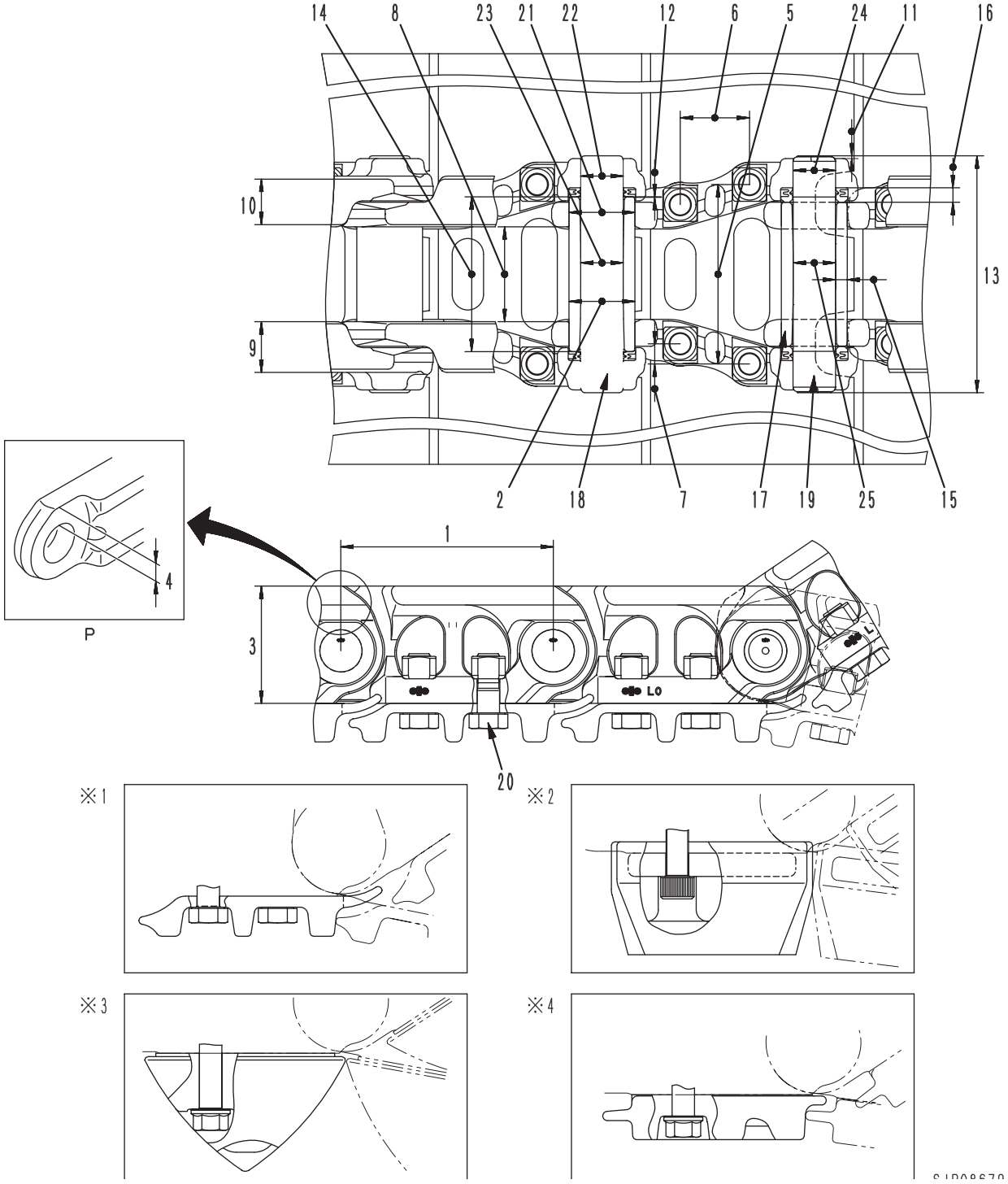


Unit: mm

No.	Check item	Criteria					Remedy
1	Outside diameter of flange	Standard size		Repair limit			Rebuild or replace
		188		—			
2	Outside diameter of tread	156		144			
3	Thickness of tread	44.5		38.5			
4	Overall width	225		—			
5	Inside width	85		—			
6	Width of tread	44.5		—			
7	Width of flange	25.5		—			
8	Clearance between shaft and bushing	Standard size	Tolerance		Standard clearance	Clearance limit	Replace bushing
			Shaft	Hole			
		60	-0.215 -0.315	+0.195 0	0.215 - 0.510	1.5	
9	Interference between roller and bushing	Standard size	Tolerance		Standard interference	Interference limit	
			Shaft	Hole			
		67	-0.153 -0.053	+0.030 0	0.023 - 0.153	—	

TRACK SHOE

TRIPLE GROUSER SHOE, ROAD LINER, SWAMP SHOE, FLAT SHOE



★ P portion shows the link of bushing press fitting end.

※1. Triple-grouser shoe
※2. Road liner
※3. Swamp shoe
※4. Flat shoe

Unit: mm

No.	Check item		Criteria			Remedy
1	Link pitch		Standard size	Repair limit		Reverse or replace
			190.25	194.25		
2	Bushing outside diameter		Standard size	When turned		
				Normal load	Impact load	
			59.3	—	54.3	
3	Link height		Standard size	Repair limit		Repair or replace
			105	97		
4	Thickness of link metal (bushing press-fitting portion)		28.5	20.5		
5	Shoe bolt pitch		160.4			Adjust or replace
6			62			
7			18			
8	Link	Inside width	84.8			
9		Overall width	45.4			
10		Tread width	39.6			
11	Protrusion of pin	Regular	2.5			
		Master	2.5			
12	Protrusion of bushing	Regular	4.85			
		Master	0.0			
13	Overall length of pin	Regular	212			
		Master	212			
14	Overall length of bushing	Regular	138.5			
		Master	128.7			
15	Thickness of bushing metal	Standard	10.4			Reverse or replace
		When turned / Impact Load	5.4			
16	Thickness of spacer		—			—
17	Press-fitting force	Bushing	88.2 - 245 kN {9 - 25 ton}			
18		Regular pin	127.4 - 274.4 kN {13 - 28 ton}			
※ 19		Master pin	78.4 - 147 kN {8 - 15 ton}			

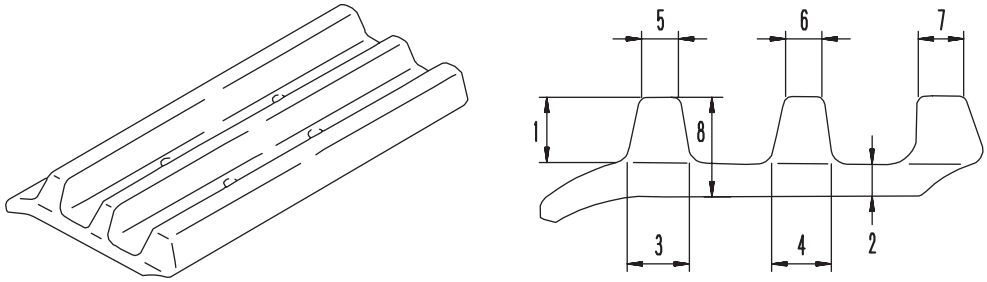
※ : Dry type track link

Unit: mm

<table>
<tr><th>No.</th><th colspan="2">Check item</th><th colspan="4">Criteria</th><th>Remedy</th></tr>
<tr><td rowspan="5">20</td><td rowspan="5">Shoe bolt</td><td rowspan="3">a. Regular link</td><td colspan="2">Tightening torque (Nm {kgm})</td><td colspan="2">Additional tightening angle (deg.)</td><td rowspan="5">Retighten</td></tr>
<tr><td>Triple shoe</td><td>490 ± 49 {50 ± 5}</td><td colspan="2">120 ± 10</td></tr>
<tr><td>Road liner (Rubber pad type)</td><td>549 ± 59 {56 ± 6}</td><td colspan="2">—</td></tr>
<tr><td rowspan="2">b. Master link</td><td>Tightening torque (Nm {kgm})</td><td>Additional tightening angle (deg.)</td><td colspan="2">Lower limit torque (Nm {kgm})</td></tr>
<tr><td>—</td><td>—</td><td colspan="2">—</td></tr>
<tr><td colspan="2">No. of shoes (each side)</td><td colspan="4">PC210-7K: 45, PC210LC-7K: 49, PC210NLC-7K: 49
PC240LC-7K: 47, PC240NLC-7K: 51</td><td>—</td></tr>
<tr><td rowspan="2">21</td><td colspan="2" rowspan="2">Interference between bushing and link</td><td rowspan="2">Standard size</td><td colspan="2">Tolerance</td><td rowspan="2">Standard interference</td><td rowspan="11">Adjust or replace</td></tr>
<tr><td>Shaft</td><td>Hole</td></tr>
<tr><td>59</td><td>+0.304
+0.394</td><td>+0.074
0</td><td>0.320 - 0.434</td></tr>
<tr><td>22</td><td colspan="2">Interference between regular pin and link</td><td>38</td><td>+0.222
+0.162</td><td>-0.138
-0.200</td><td>0.300 - 0.422</td></tr>
<tr><td rowspan="2">23</td><td colspan="2" rowspan="2">Clearance between regular pin and bushing</td><td rowspan="2">Standard size</td><td colspan="2">Tolerance</td><td rowspan="2">Standard clearance</td></tr>
<tr><td>Shaft</td><td>Hole</td></tr>
<tr><td>38</td><td>+0.222
+0.162</td><td>+0.902
+0.402</td><td>0.180 - 0.740</td></tr>
<tr><td rowspan="2">※
24</td><td colspan="2" rowspan="2">Interference between master pin and bushing</td><td rowspan="2">Standard size</td><td colspan="2">Tolerance</td><td rowspan="2">Standard interference</td></tr>
<tr><td>Shaft</td><td>Hole</td></tr>
<tr><td>37.8</td><td>+0.280
+0.250</td><td>+0.062
0</td><td>0.188 - 0.280</td></tr>
<tr><td rowspan="2">※
25</td><td colspan="2" rowspan="2">Clearance between master pin and bushing</td><td rowspan="2">Standard size</td><td colspan="2">Tolerance</td><td rowspan="2">Standard clearance</td></tr>
<tr><td>Shaft</td><td>Hole</td></tr>
<tr><td>38</td><td>-0.150
-0.350</td><td>+0.902
+0.402</td><td>0.552 - 1.252</td></tr>
<tr><td rowspan="3"></td><td rowspan="3">Height of grouser</td><td rowspan="2">Triple-grouser</td><td colspan="2">Standard size</td><td colspan="2">Repair limit</td><td rowspan="2">Lug welding, rebuild or replace</td></tr>
<tr><td colspan="2">26</td><td colspan="2">16</td></tr>
<tr><td>Road liner</td><td colspan="2">70</td><td colspan="2">25</td><td>Replace</td></tr>
</table>

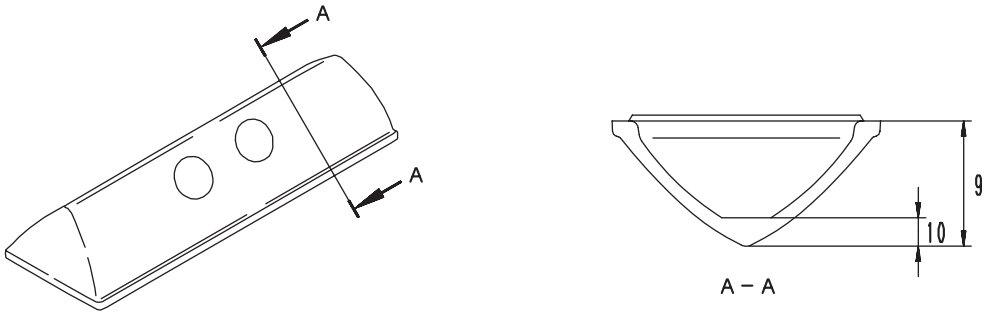
※ : Dry type track link

TRIPLE GROUSER SHOE



SJP08680

SWAMP SHOE



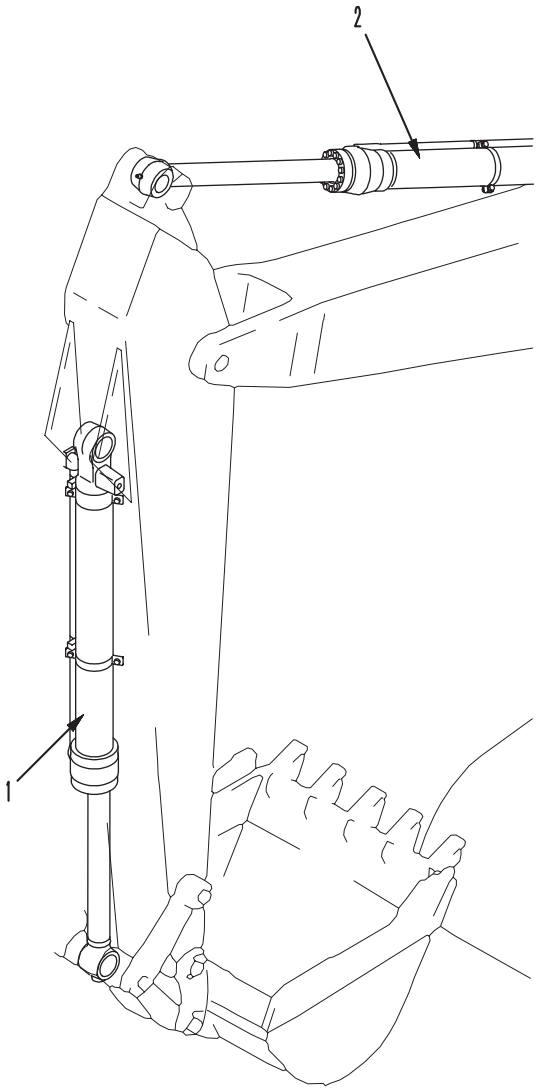
SJP08681

Unit: mm

No.	Check item	Criteria		Remedy
1	Height	Standard size	Repair limit	Rebuild or replace
		26	16	
2	Thickness	8.5		
3	Length of base	26		
4		19		
5	Length at tip	20		
6		14		
7		19		
8	Thickness	Standard size	Repair limit	
		34.5	24.5	
9	Height	102.5	90.5	
10	Thickness	17	5	

HYDRAULIC EQUIPMENT LAYOUT DRAWING

1. Bucket cylinder
2. Arm cylinder
3. Boom cylinder
4. Hydraulic tank
5. Hydraulic filter
6. R.H. travel motor
7. Swing motor
8. Hydraulic pump
9. Control valve
10. Oil cooler
11. L.H. travel motor
12. L.H. PPC valve
13. Safety lever (electric type)
14. Center swivel joint
15. R.H. PPC valve
16. Travel PPC valve
17. Attachment circuit selector valve
18. Holding valve
19. Accumulator
20. Solenoid valve assembly
    - 20A PPC lock solenoid
    - 20B Travel junction solenoid
    - 20C Pump merge/divider solenoid
    - 20D Travel speed solenoid
    - 20E Swing brake solenoid
    - 20F 2-stage relief solenoid



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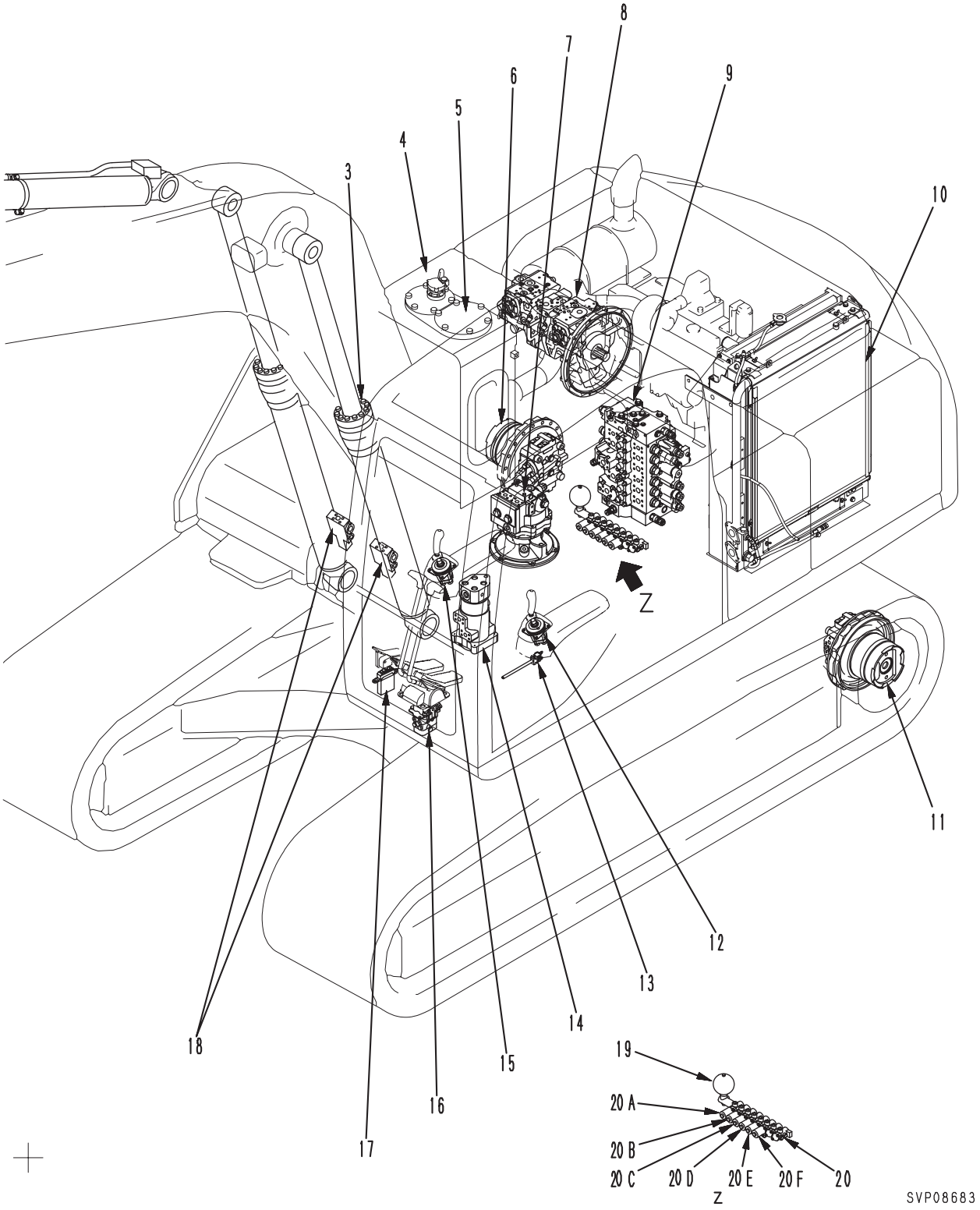
8
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20 A
17
20 B
20 C
20 D
20 E
20 F
20
Z
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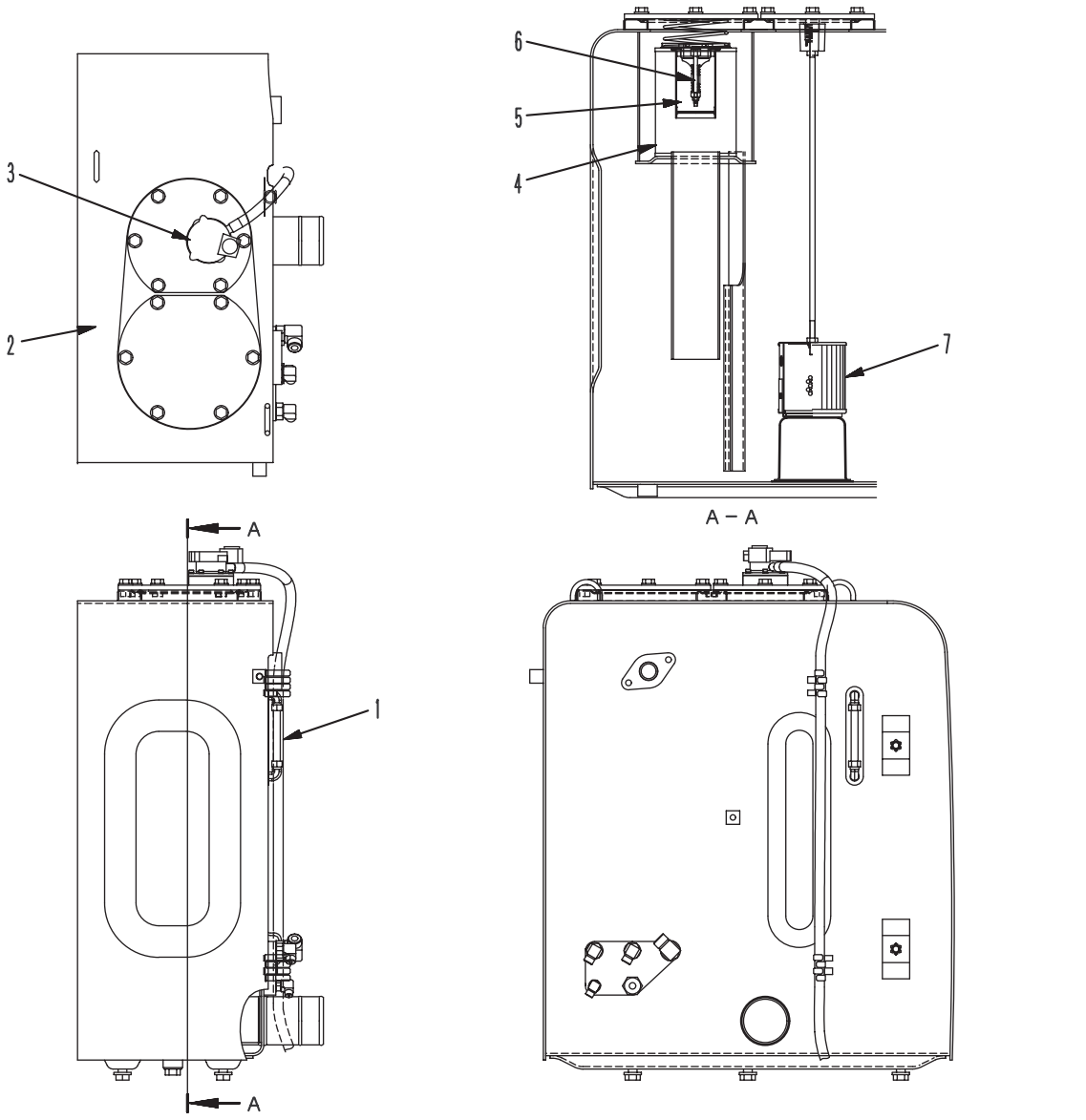
HYDRAULIC TANK



1. Sight gauge
2. Hydraulic tank
3. Oil filler cap
4. Filter element
5. Strainer
6. Bypass valve
7. Suction strainer

SPECIFICATIONS

Tank capacity: 200 **l**

Amount of oil inside tank: 143 **l**

Pressure valve

Relief cracking pressure:
16.7 ± 6.9 kPa
{0.17 ± 0.07 kg/cm²}

Suction cracking pressure:
0 - 0.49 kPa
{0 - 0.005 kg/cm²}

Bypass Valve set pressure:
150 ± 30 kPa
{1.5 ± 0.3 kg/cm²}

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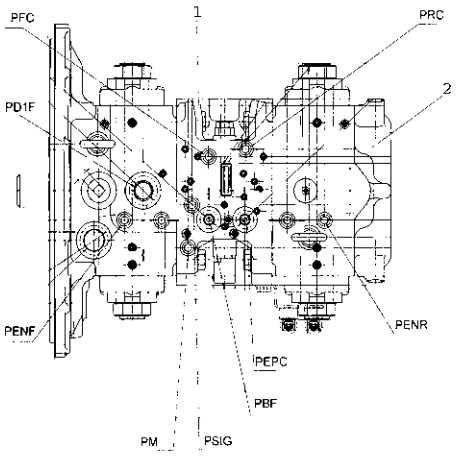
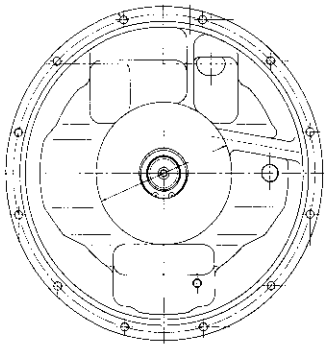
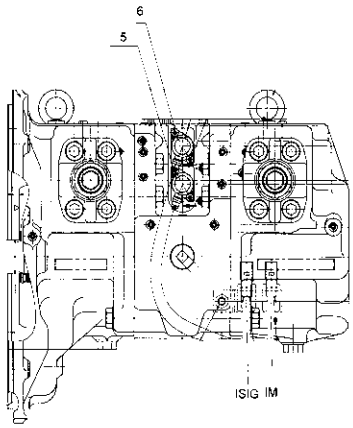
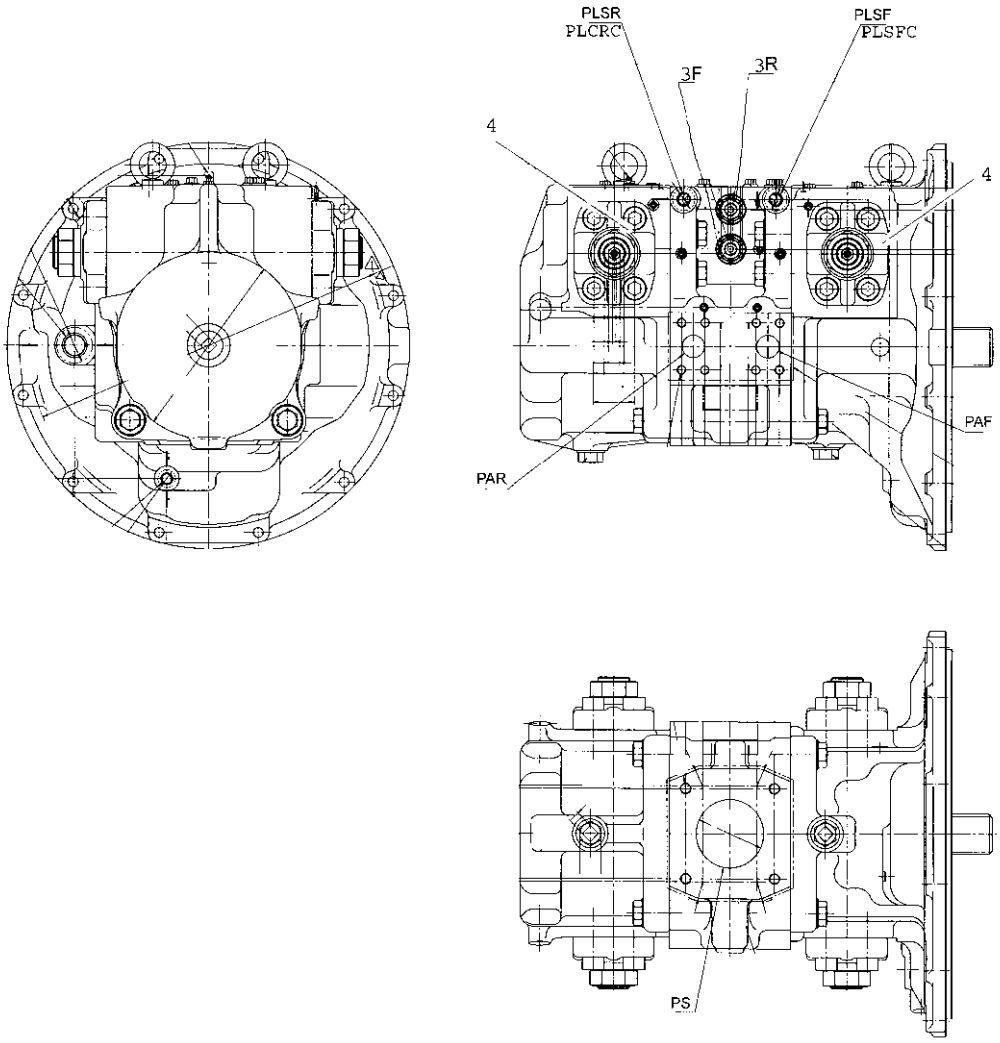
HYDRAULIC PUMP

HPV95 + 95(PC210/LC/NLC-7K)









1. Front main pump
2. Rear main pump

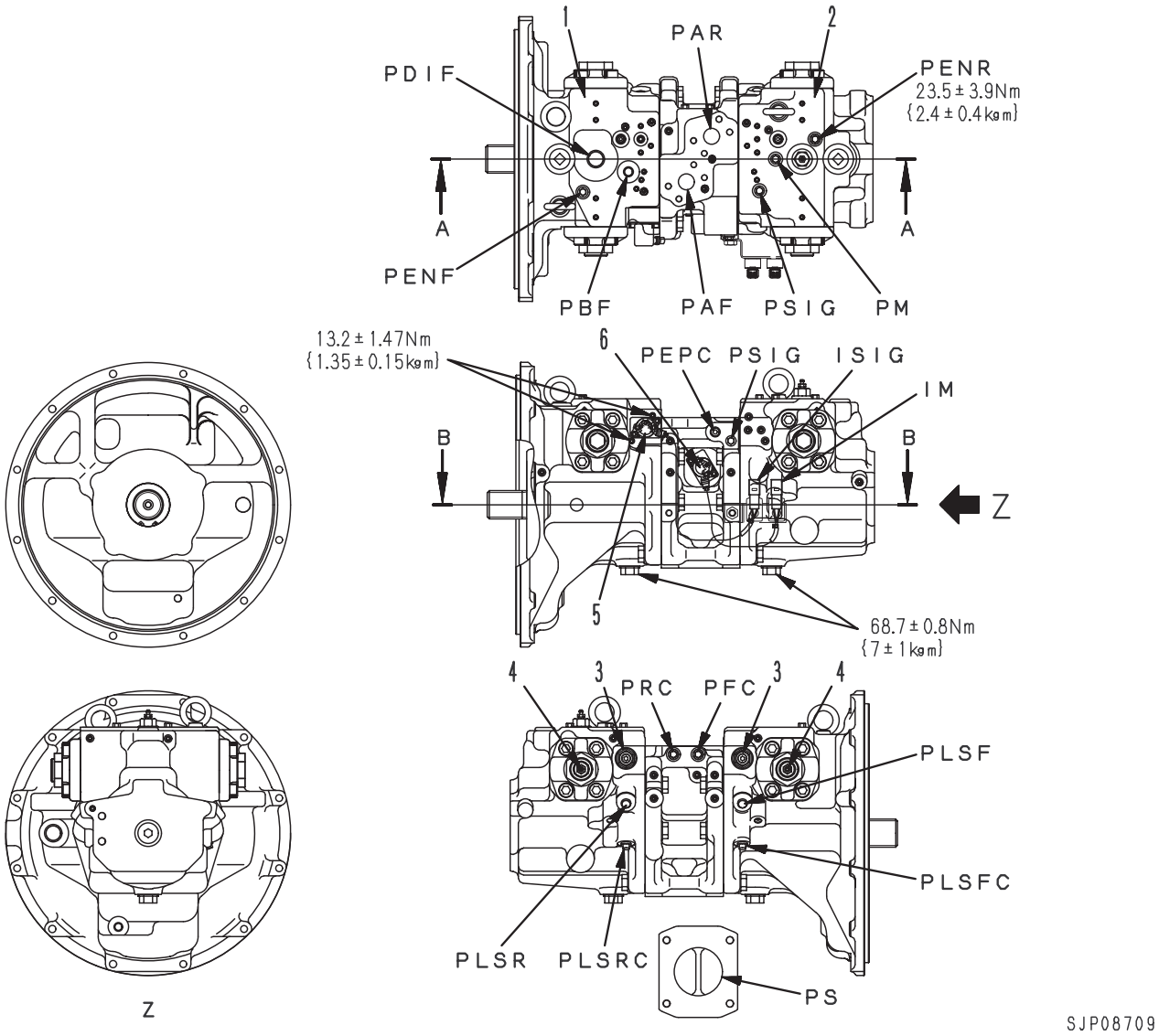
3F. LS valve front
3R. LS valve rear

4. PC valve
5. LS-EPC valve
6. PC-EPC valve

IM : PC mode selector current
ISIG : LS set selector current
PAF : Front pump delivery port
PFC : Front pump delivery pressure detection port
PAR : Rear pump delivery port
PRC : Rear pump delivery pressure detection port
PBF : Pump pressure input port
PD1F: Case drain port
PENF: Front pump control pressure detection port

PENR : Rear pump control pressure detection port
PLSF : Front load pressure input port
PLSFC: Front load pressure detection port
PLSR : Rear load pressure input port
PLSRC: Rear load pressure detection port
PS : Pump suction port
PSIG : LS set selector pressure detection port
PM : PC set selector pressure detection port
PEPC : EPC basic pressure input port

HPV95 + 95(PC240LC/NLC-7K)



1. Front main pump
2. Rear main pump
3. LS valve
4. PC valve
5. LS-EPC valve
6. PC-EPC valve

IM : PC mode selector current
ISIG : LS set selector current
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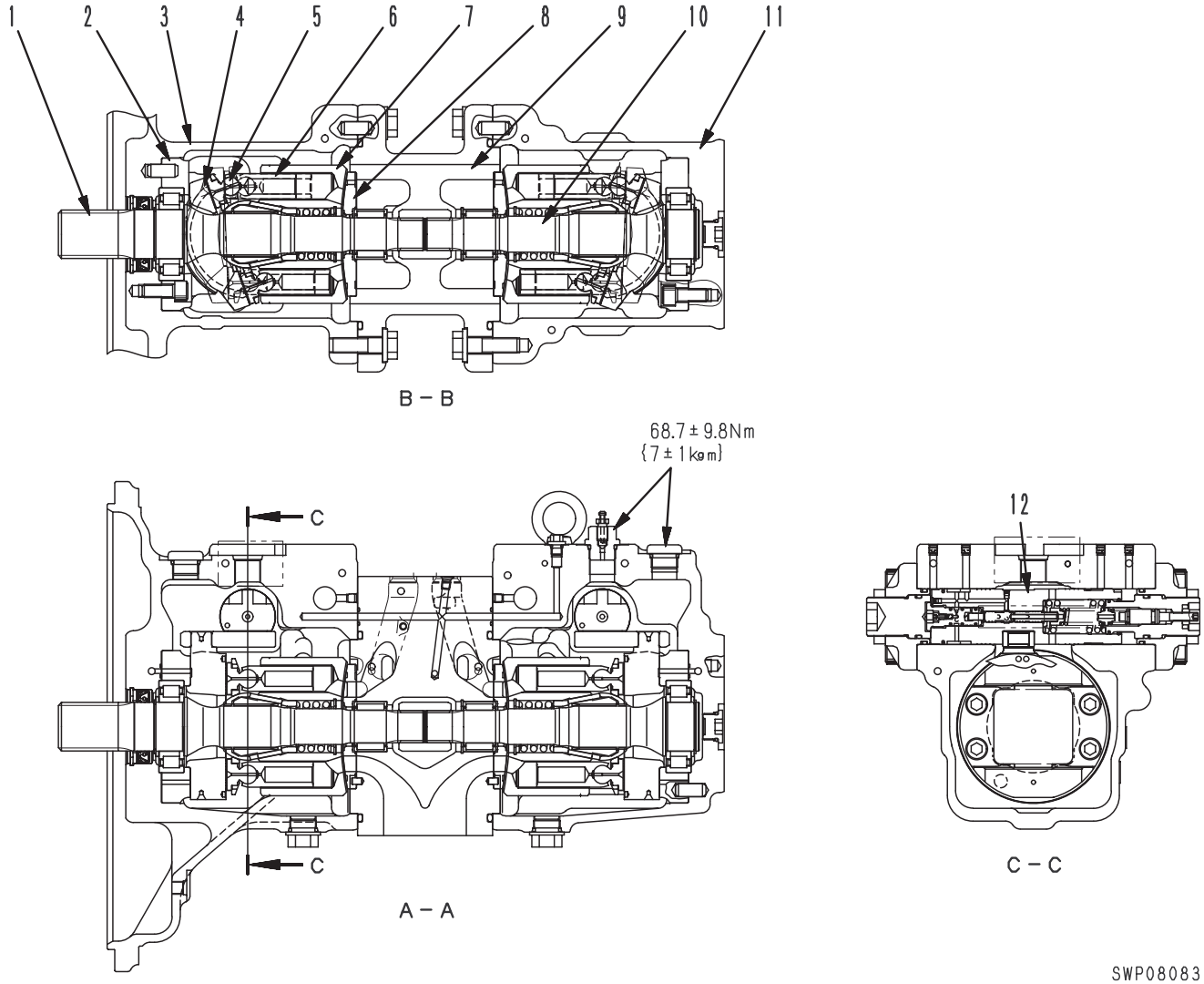
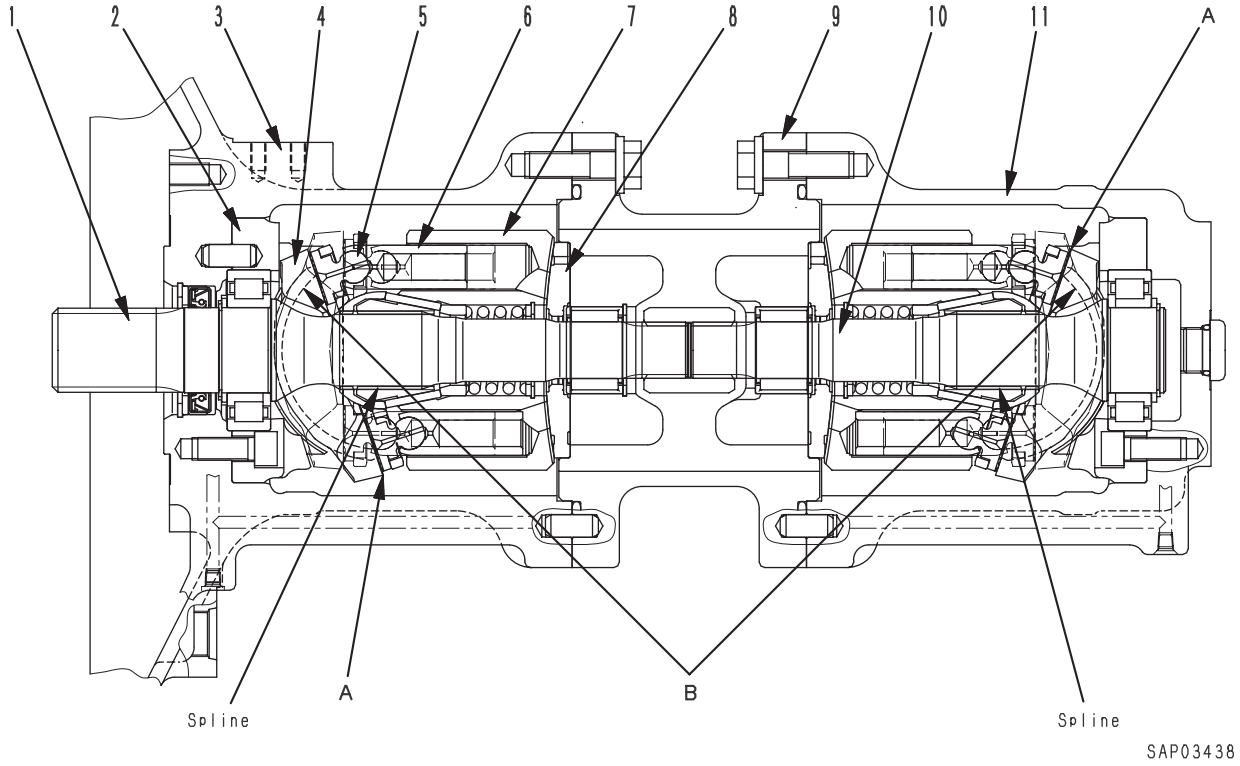
Outline

- This pump consists of 2 variable capacity swash plate piston pumps, PC valve, LS valve, and EPC valve.



1. Shaft (Front)
2. Cradle
3. Case (Front)
4. Rocker cam
5. Shoe
6. Piston
7. Cylinder block
8. Valve plate
9. End cap
10. Shaft (Rear)
11. Case (Rear)
12. Servo piston



Function

- The rotation and torque transmitted to the pump shaft are converted into hydraulic energy, and pressurized oil is discharged according to the load.
- It is possible to change the discharge amount by changing the swash plate angle.

Structure

- Cylinder block (7) is supported to shaft (1) by a spline, and shaft (1) is supported by the front and rear bearings.
- The tip of piston (6) is a concave ball, and shoe (5) is caulked to it to form one unit. Piston (6) and shoe (5) form a spherical bearing.
- Rocker cam (4) has flat surface **A**, and shoe (5) is always pressed against this surface while sliding in a circular movement.

  Rocker cam (4) brings high pressure oil at cylinder surface **B** with cradle (2), which is secured to the case, and forms a static pressure bearing when it slides.
- Piston (6) carries out relative movement in the axial direction inside each cylinder chamber of cylinder block (7).
- The cylinder block seals the pressure oil to valve plate (8) and carries out relative rotation. This surface is designed so that the oil pressure balance is maintained at a suitable level. The oil inside each cylinder chamber of cylinder block (7) is sucked in and discharged through valve plate (8).

Operation

1) Operation of pump

i Cylinder block (7) rotates together with shaft (1), and shoe (5) slides on flat surface **A**.

When this happens, rocker cam (4) moves along cylindrical surface **B**, so angle α between center line **X** of rocker cam (4) and the axial direction of cylinder block (7) changes. (Angle α is called the swash plate angle.)

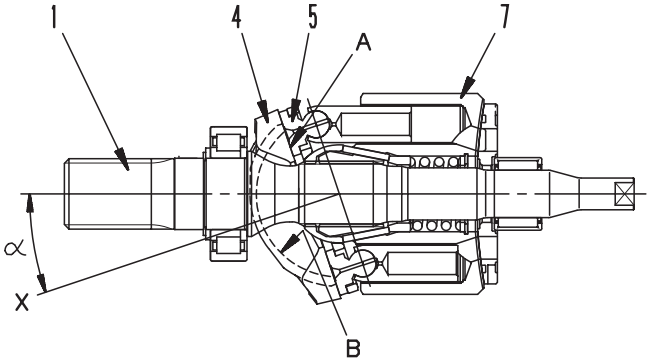
ii Center line **X** of rocker cam (4) maintains swash plate angle α in relation to the axial direction of cylinder block (7), and flat surface **A** moves as a cam in relation to shoe (5).

In this way, piston (6) slides on the inside of cylinder block (7), so a difference between volumes **E** and **F** is created inside cylinder block (7). The suction and discharge is carried out by this difference **F - E**.

In other words, when cylinder block (7) rotates and the volume of chamber **E** becomes smaller, the oil is discharged during that stroke. On the other hand, the volume of chamber **F** becomes larger, and as the volume becomes bigger, the oil is sucked in.

iii If center line **X** of rocker cam (4) is in line with the axial direction of cylinder block (7) (swash plate angle = 0), the difference between volumes **E** and **F** inside cylinder block (7) becomes 0, so the pump does not carry out any suction or discharge of oil.

(In actual fact, the swash plate angle never becomes 0.)



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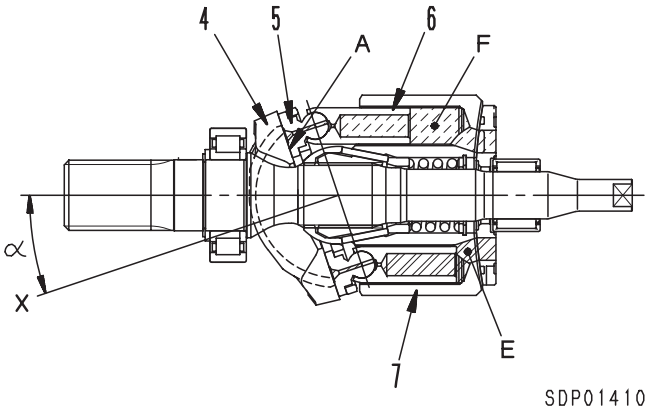

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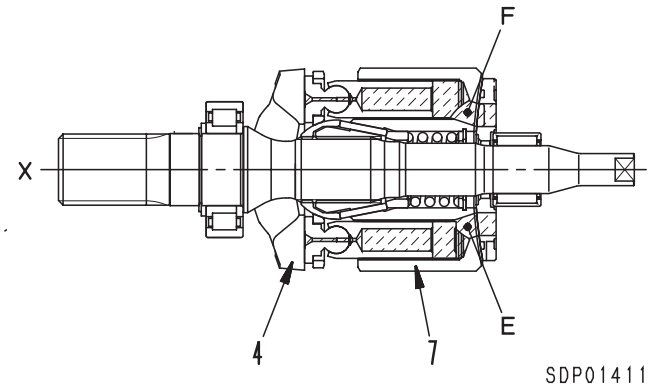
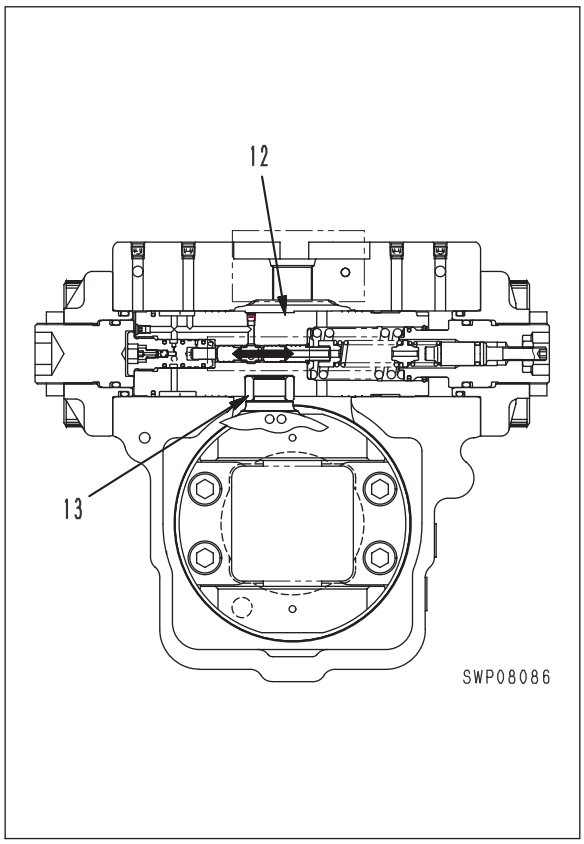
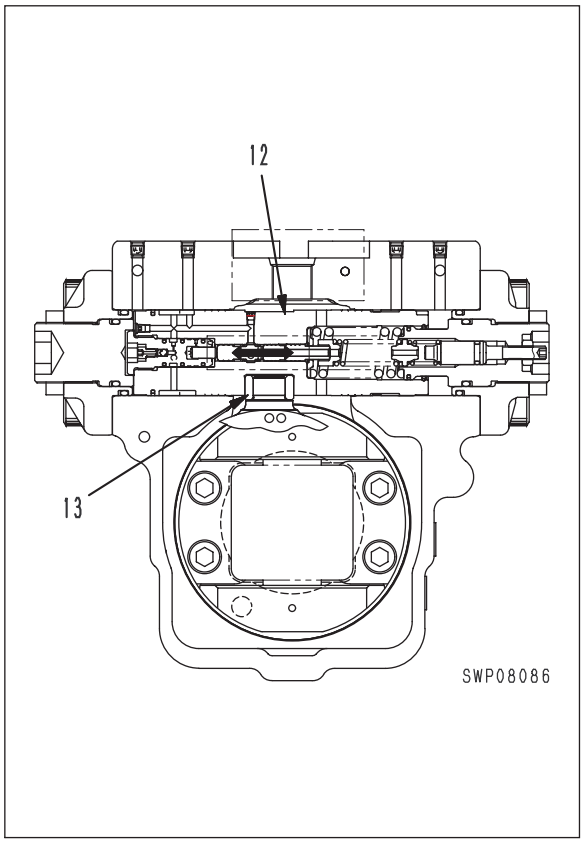


SDP01411

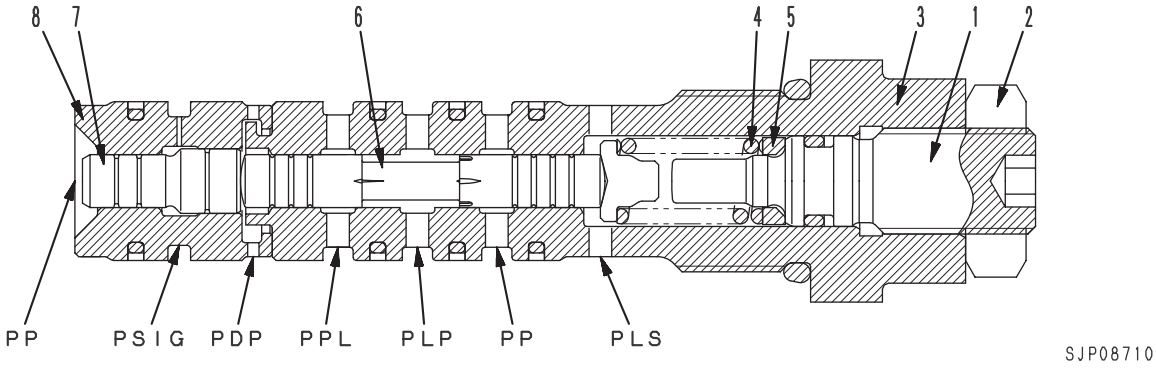
2) Control of discharge amount

- If the swash plate angle α becomes larger, the difference between volumes **E** and **F** becomes larger and discharge amount **Q** increases.
- Swash plate angle α is changed by servo piston (12).
- Servo piston (12) moves in a reciprocal movement (↔) according to the signal pressure from the PC and LS valves. This straight line movement is transmitted through rod (13) to rocker cam (4), and rocker cam (4), which is supported by the cylindrical surface to cradle (2), slides in a rotating movement in direction of arrow.
- With servo piston (12), the area receiving the pressure is different on the left and the right, so main pump discharge pressure (self pressure) **PP** is always brought to the chamber receiving the pressure at the small diameter piston end.
- Output pressure **Pen** of the LS valve is brought to the chamber receiving the pressure at the large diameter end. The relationship in the size of pressure **PP** at the small diameter piston end and pressure **Pen** at the large diameter end, and the ratio between the area receiving the pressure of the small diameter piston and the large diameter piston controls the movement of servo piston (12).





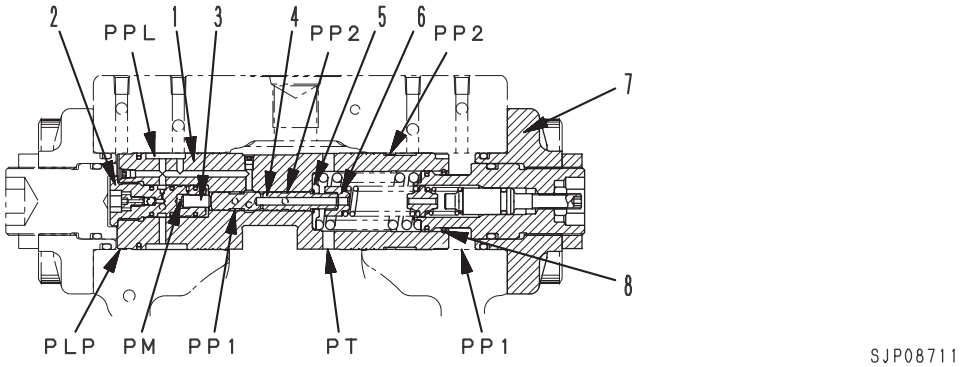
LS VALVE



1. Plug
2. Locknut
3. Sleeve
4. Spring
5. Seat
6. Spool
7. Piston
8. Sleeve

PP : Pump port
PDP : Drain port
PLP : LS control pressure output port
PLS : LS pressure input port
PPL : PC control pressure input port
PSIG : LS mode selection pilot port

PC VALVE



1. Servo piston assembly
2. Plug
3. Pin
4. Spool
5. Retainer
6. Seat
7. Cover
8. Wiring

PP1 : Pump port
PP2 : Pump pressure pilot port
PT : Drain port
PM : PC mode selector pressure pilot port
PPL : PC control pressure output port
PLP : LS control pressure output port

Function

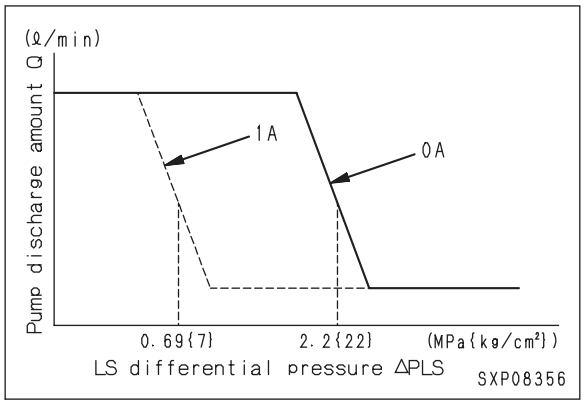
(1) LS valve

The LS valve detects the load and controls the discharge amount.

This valve controls main pump discharge amount **Q** according to differential pressure Δ**PLS** (=**PP - PLS**) [called the LS differential pressure] (the difference between main pump pressure **PP** and control valve outlet port pressure **PLS**).

Main pump pressure **PP**, pressure **PLS** {called the LS pressure} coming from the control valve output, and pressure **Psig** {called the LS selector pressure} from the proportional solenoid valve enter this valve. The relationship between discharge amount **Q** and differential pressure Δ**PLS**, (the difference between main pump pressure **PP** and LS pressure **PLS**) (= **PP - PLS**) changes as shown in the diagram at the right according to LS pressure selector current **isig** of the LS-EPC valve.

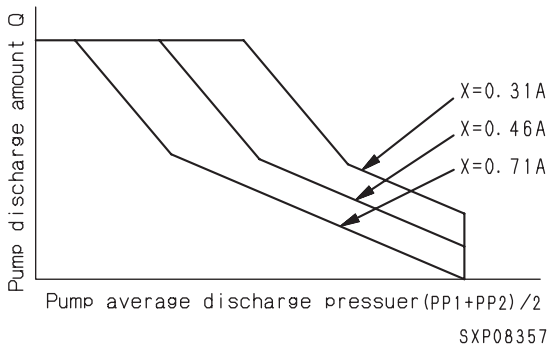
When isig changes between 0 and 1A, the set pressure of the spring changes according to this, and the selector point for the pump discharge amount changes at the rated central valve between 0.69 ↔ 2.2 MPa {7 ↔ 22 kg/cm²}.



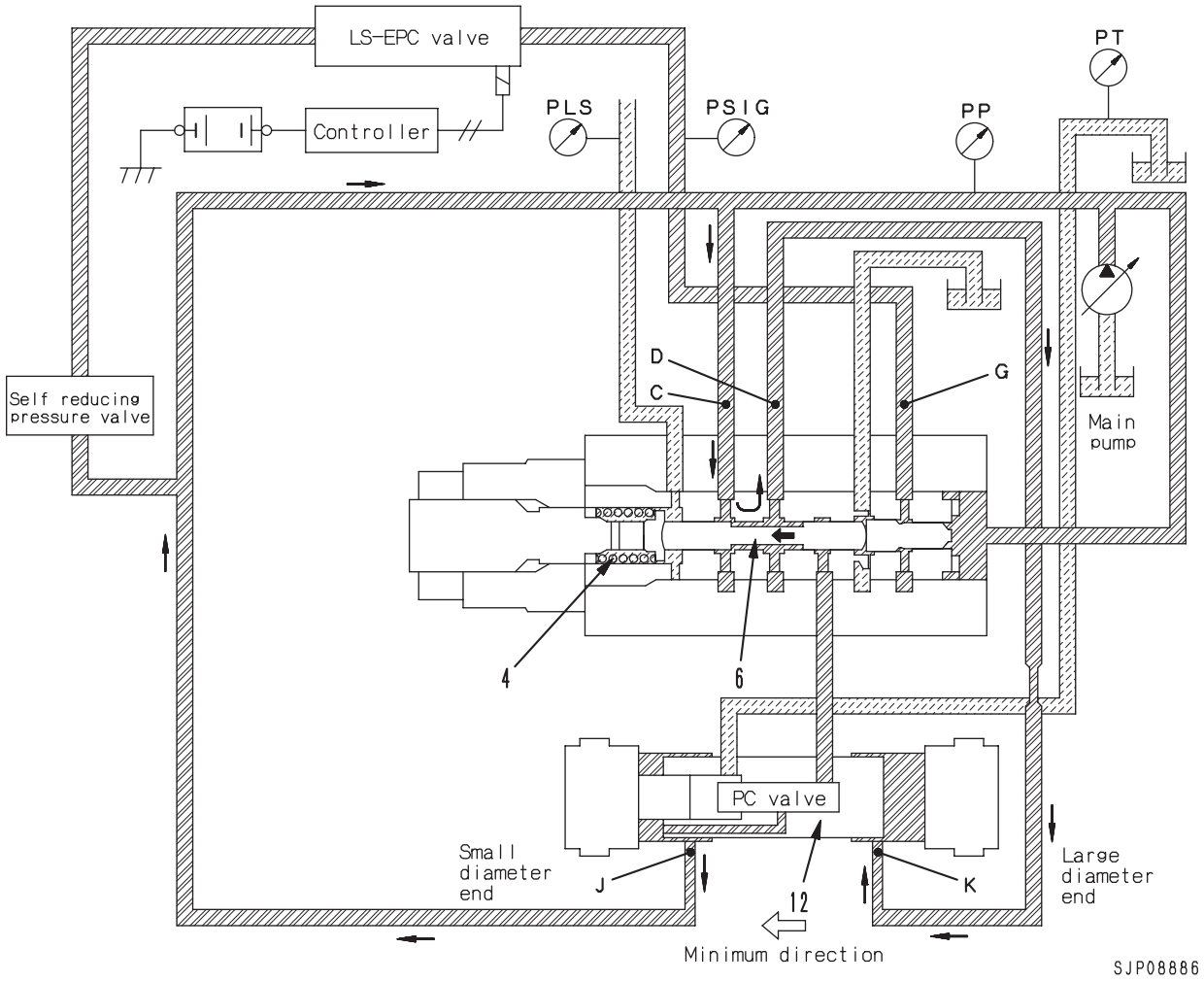
(2) PC valve

When the pump discharge pressure **PP1** (self-pressure) and **PP2** (other pump pressure) are high, the PC valve controls the pump so that no more oil than the constant flow (in accordance with the discharge pressure) flows even if the stroke of the control valve becomes larger. In this way, it carries out equal horsepower control so that the horsepower absorbed by the pump does not exceed the engine horsepower.

In other words, If the load during the operation becomes larger and the pump discharge pressure rises, it reduces the discharge amount from the pump; and if the pump discharge pressure drops, it increases the discharge amount from the pump. The relationship between the average of the front and rear pump discharge pressures (average discharge amount of F, R pumps (**PP1 + PP2)/2)** and pump discharge amount **Q** is shown on the right, with the current given to the PC-EPC valve solenoid shown as a parameter. The controller senses the actual speed of the engine, and if the speed drops because of an increase in the load, it reduces the pump discharge amount to allow the speed to recover. In other words, when the load increases and the engine speed drops below the set value, the command current to the PC-EPC valve solenoid from the controller increases according to the drop in the engine speed to reduce the pump swash plate angle.



OPERATION

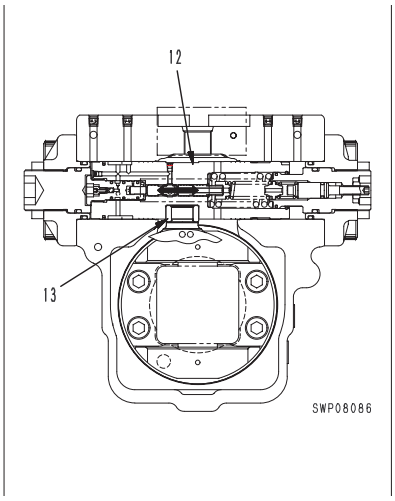


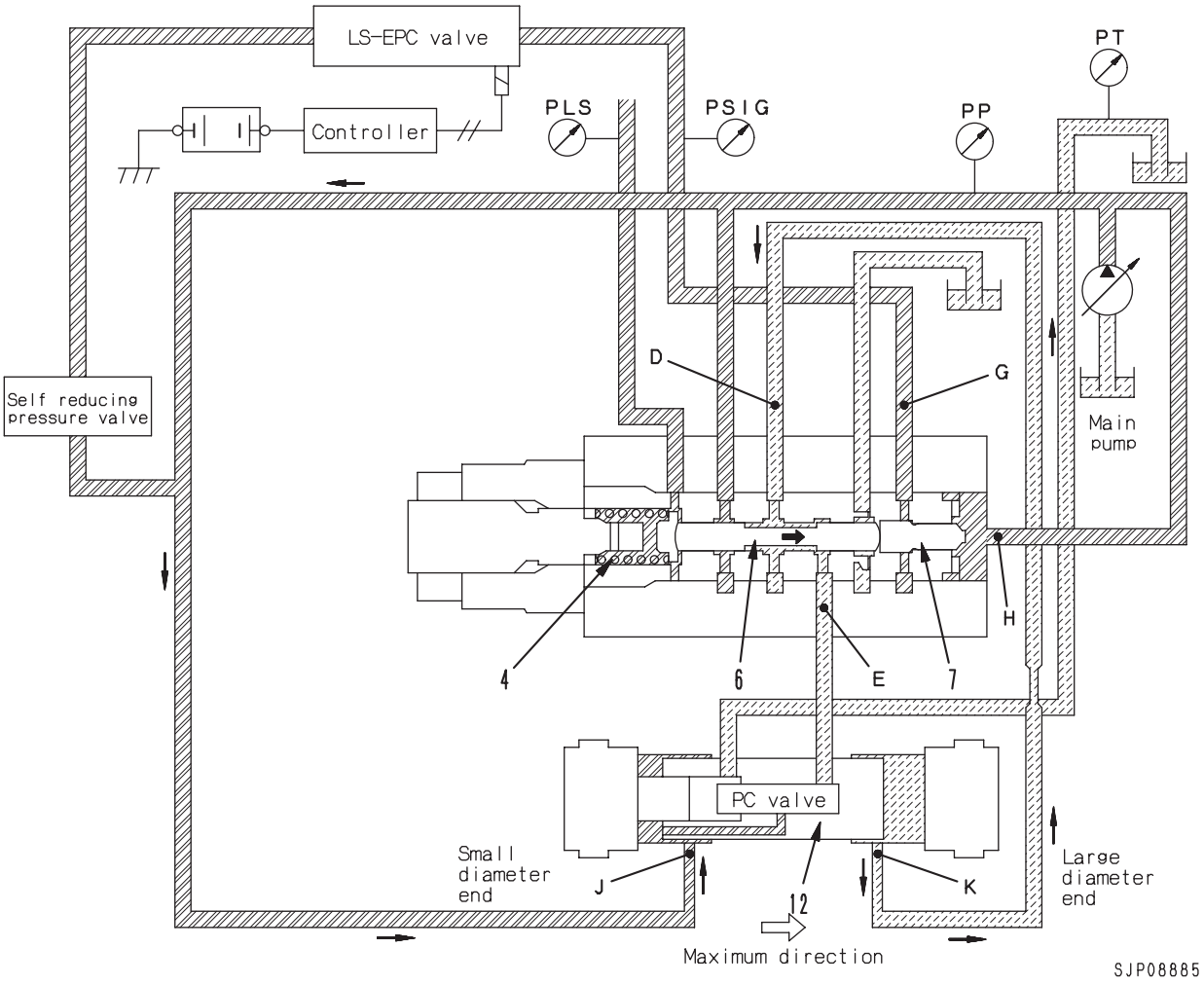
(1) LS valve

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 (11) 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.)

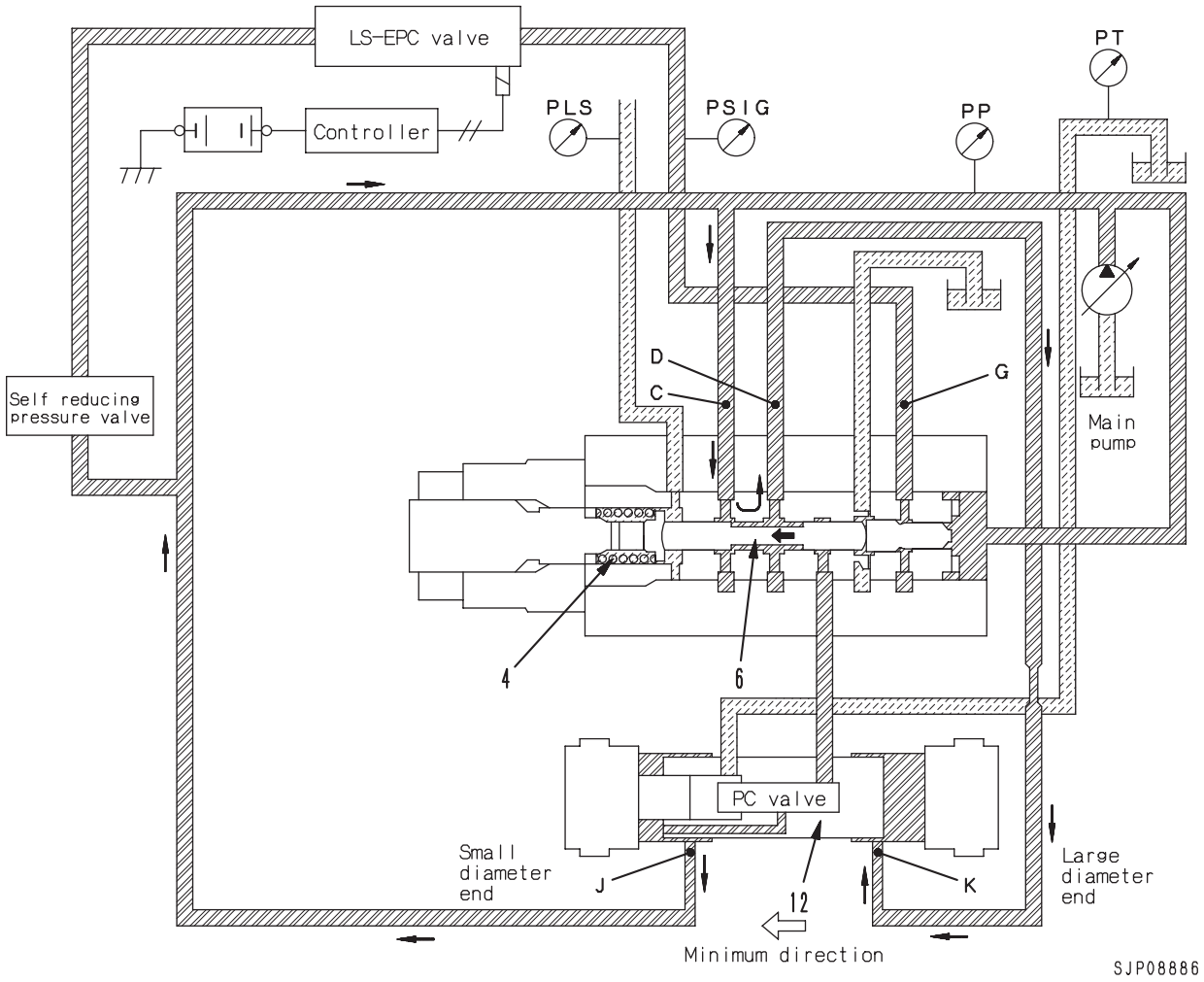
  At this point, spool (6) is pushed to the left,and port **C** and port **D** are connected. Pump pressure **PP** enters the large diameter end of the piston from port **K** and the same pump pressure **PP** also enters port **J** at the small diameter end of the piston, so the swash plate is moved to the minimum angle by the difference in the area of the piston (11).





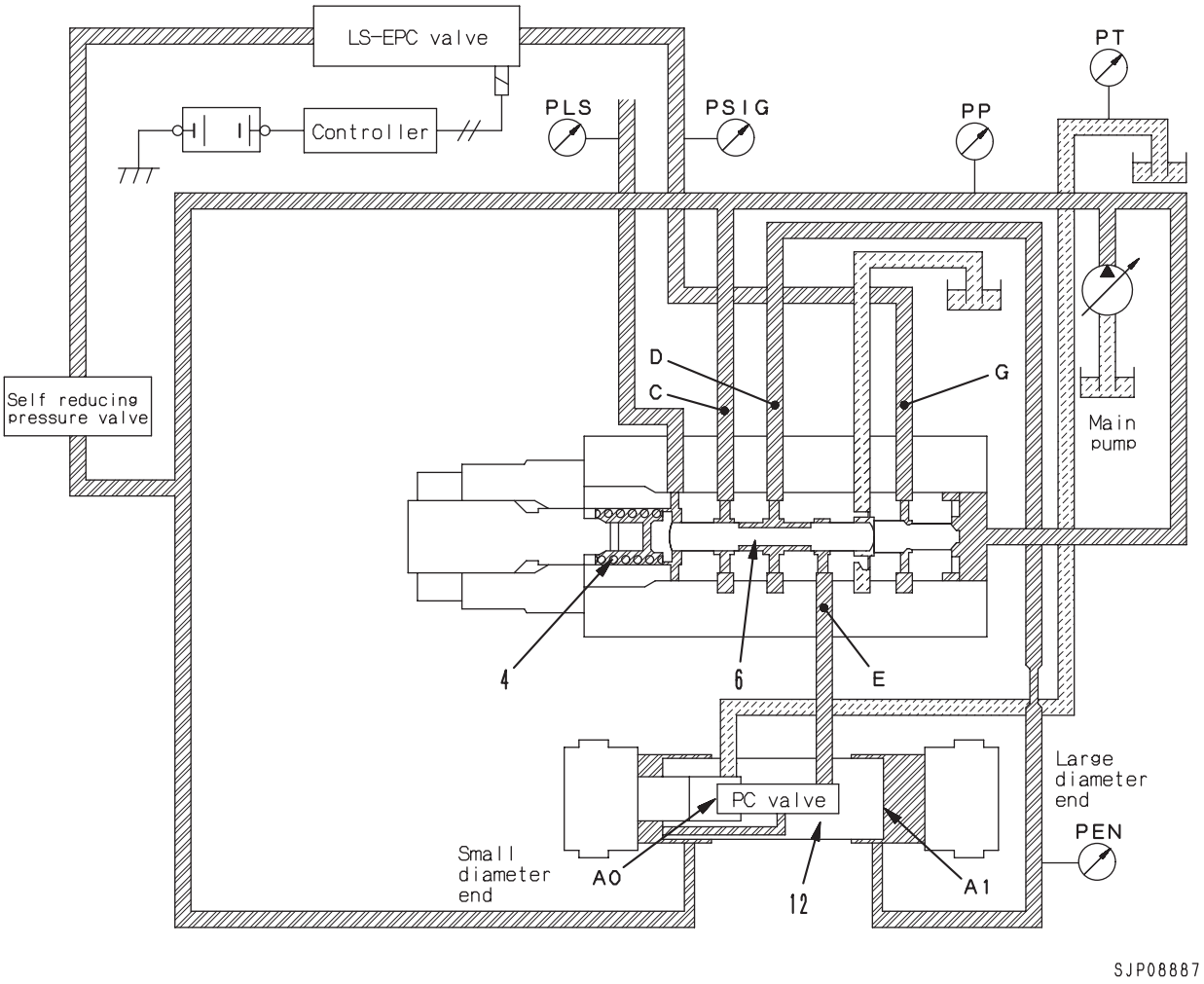
2) Operation in increase direction for pump discharge amount

- When the difference between the main pump pressure **PP** and LS pressure **PLS**, in other words, LS differential pressure Δ**PLS,** becomes smaller (for example, when the area of opening of the control valve becomes larger and pump **PP** drops), spool (6) is pushed to the right by the combined force of LS pressure **PLS** and the force of spring (4).
- When spool (6) moves, port **D** and port **E** are joined and connected to the PC valve. When this happens, the PC valve is connected to the drain port, so circuit **D - K** becomes drain pressure **PT**. (The operation of the PC valve is explained later).
- For this reason, the pressure at the large diameter end of servo piston (12) becomes drain pressure **PT**, and pump pressure **PP** enters port **J** at the small diameter end, so servo piston (12) is pushed to the right. Therefore, the swash plate moves in the direction to make the discharge amount larger. If the output pressure of the EPC valve for the LS valve enters port **G**, this pressure creates a force to move piston (7) to the left. If piston (7) is pushed to the left, it acts to make the set pressure of spring (4) weaker, and the difference between **PLS** and **PP** changes when ports **D** and **E** of spool (6) are connected.



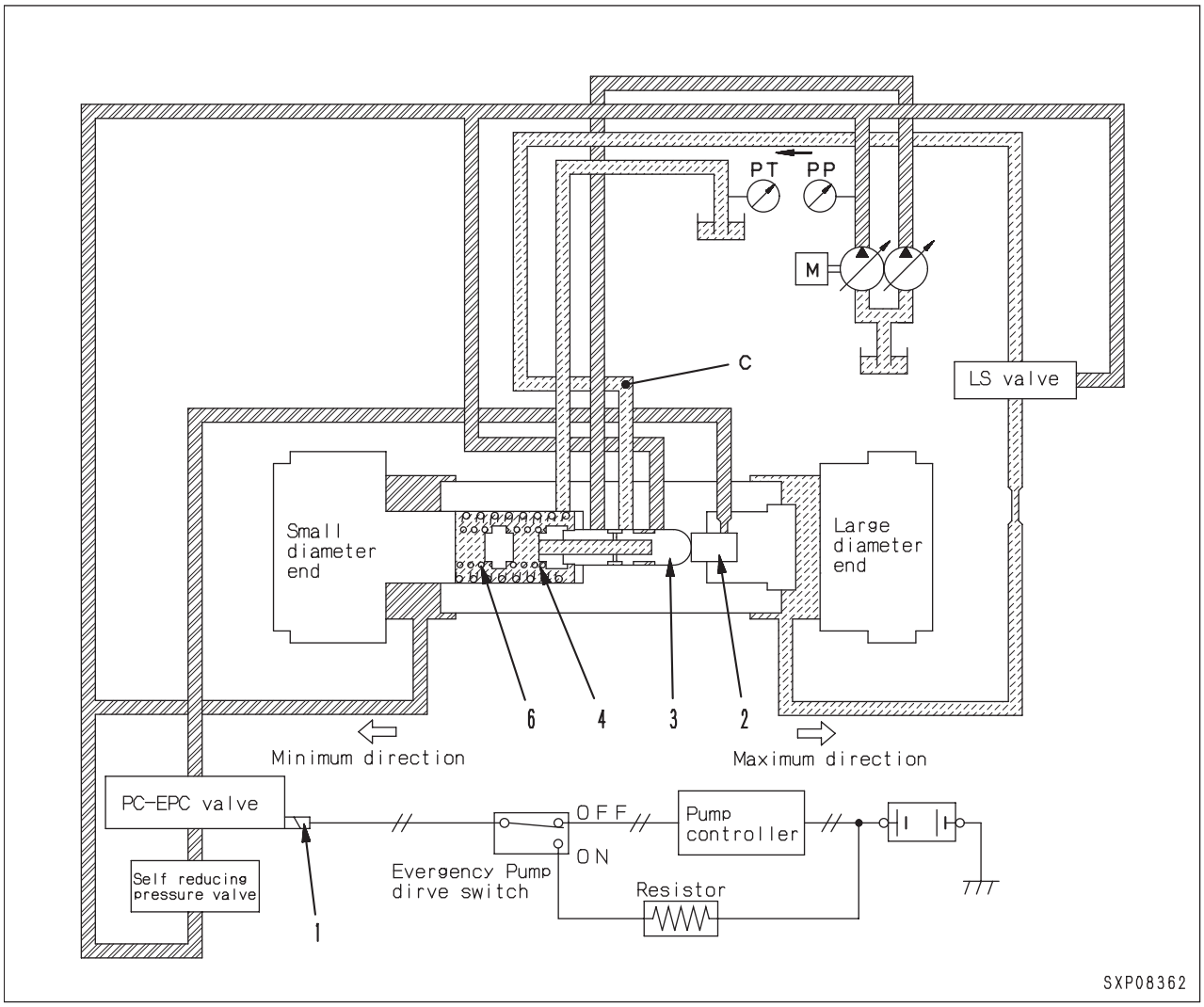
3) Operation in decrease direction for pump discharge amount

- The following explains the situation if the servo piston (12) moves to the left (the discharge amount becomes smaller). When LS differential pressure **ΔPLS** becomes larger (for example, when the area of opening of the control valve becomes smaller and pump pressure **PP** rises), pump pressure **PP** pushes spool (6) to the left.
- When spool (6) moves, main port pressure **PP** flows from port **C** and port **D** and from port **K**, it enters the large diameter end of the piston.
- Main pump pressure **PP** also enters port **J** at the small diameter end of the piston, but because of the difference in area between the large diameter end and the small diameter end of servo piston (12), servo piston (12) is pushed to the left.
- As a result, the swash plate moves in the direction to make angle smaller.
- If LS selection pressure **PSIG** enters port **G**, it acts to make the set pressure of spring (4) weaker.



4) When servo piston is balanced

- Let us take the area receiving the pressure at the large diameter end of the piston as **A1**, the area receiving the pressure at the small diameter end as **A0**, and the pressure flowing into the large diameter end of the piston as **Pen**. If the main pump pressure **PP** of the LS valve and the combined force of force **Z** of spring (4) and LS pressure **PLS** are balanced, and the relationship is **A0** x **PP** = **A1** x **Pen**, servo piston (11) will stop in that position, and the swash plate will be kept at an intermediate position. (It will stop at a position where the opening of the throttle from port **D** to port **E** and from port **C** to port **D** of spool (6) is approximately the same.)
- At this point, the relationship between the area receiving the pressure at both ends of piston (12) is **A0 : A1** = 1:2, so the pressure applied to both ends of the piston when it is balanced becomes **PP : Pen** = 2:1.
- The position where spool (6) is balanced and stopped is the standard center, and the force of spring (4) is adjusted so that it is determined when **PP - PLS** = 2.2 MPa {22 kg/cm²}. However, if **PSIG** (the output pressure of 0 ↔ 2.9 MPa {0 ↔ 30 kg/cm²} of the EPC valve of the LS valve) is applied to port **G**, the balance stop position will change in proportion to pressure **PSIG** between **PP - PLS** = 2.2 ↔ 0.69 MPa {22 ↔ 7 kg/cm²}.



(2) PC Valve

1) When pump controller is normal

a. When the load on the actuator is small and pump pressures PP1 and PP2 are low

① Movement of PC-EPC solenoid (1)

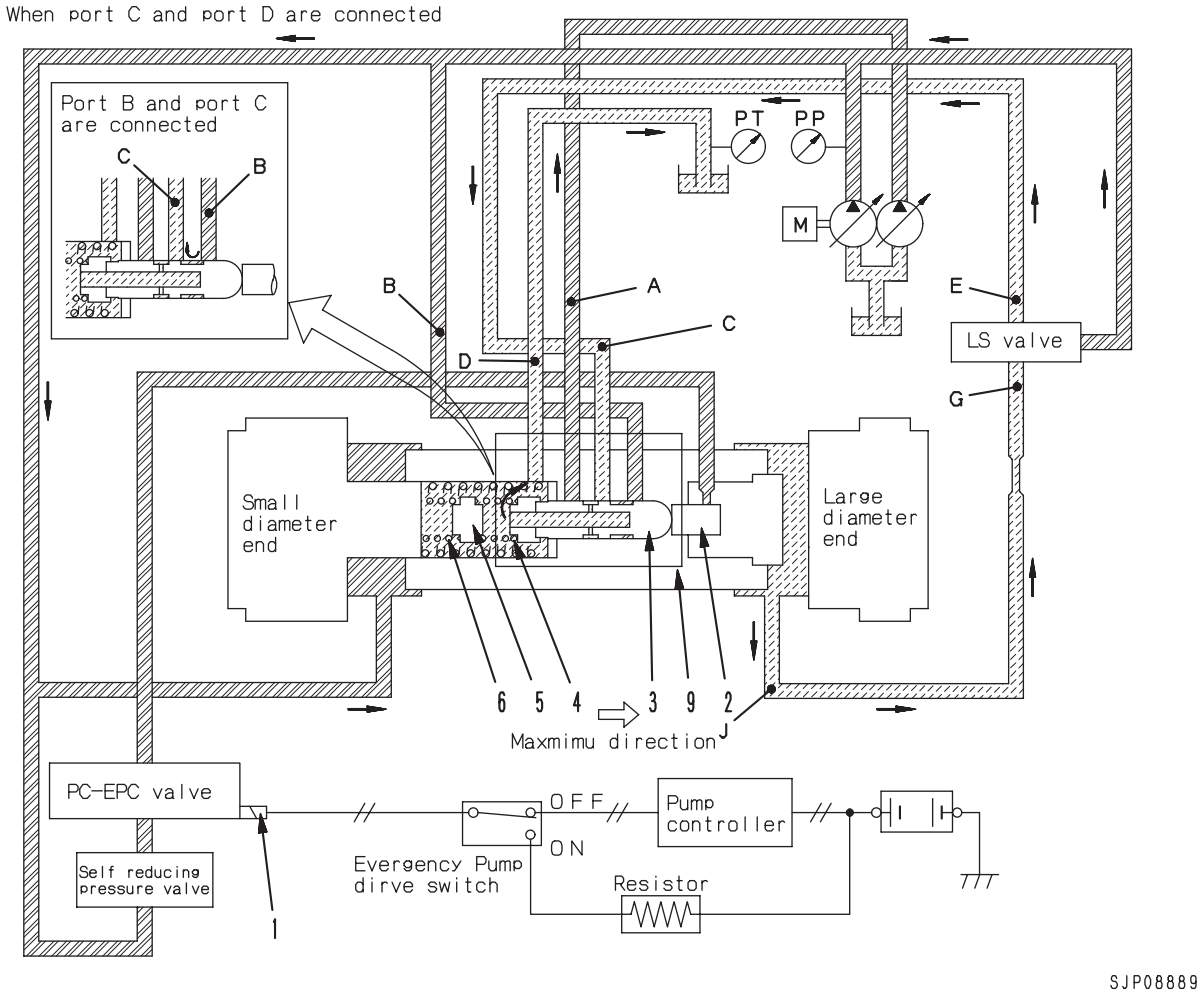
- The command current from the pump controller flows to PC-EPC solenoid (1).This command current acts on the PC-EPC valve and outputs the signal pressure. When this signal pressure is received, the force pushing piston (2) is changed.
- On the opposite side to the force pushing this piston (2) is the spring set pressure of springs (4) and (6) and pump pressure **PP1** (self pressure) and **PP2** (other pump pressure) pushing spool (3). Piston (2) stops at a position where the combined force pushing spool (3) is balanced, and
- the pressure (pressure of port **C**) output from the PC valve changes according to this position.
- The size of command current **X** is determined by the nature of the operation (lever operation), the selection of the working mode, and the set value and actual value for the engine speed.

★ Other pump pressure

This is the pressure of the pump at the opposite end.

For the F pump, it is the R pump pressure

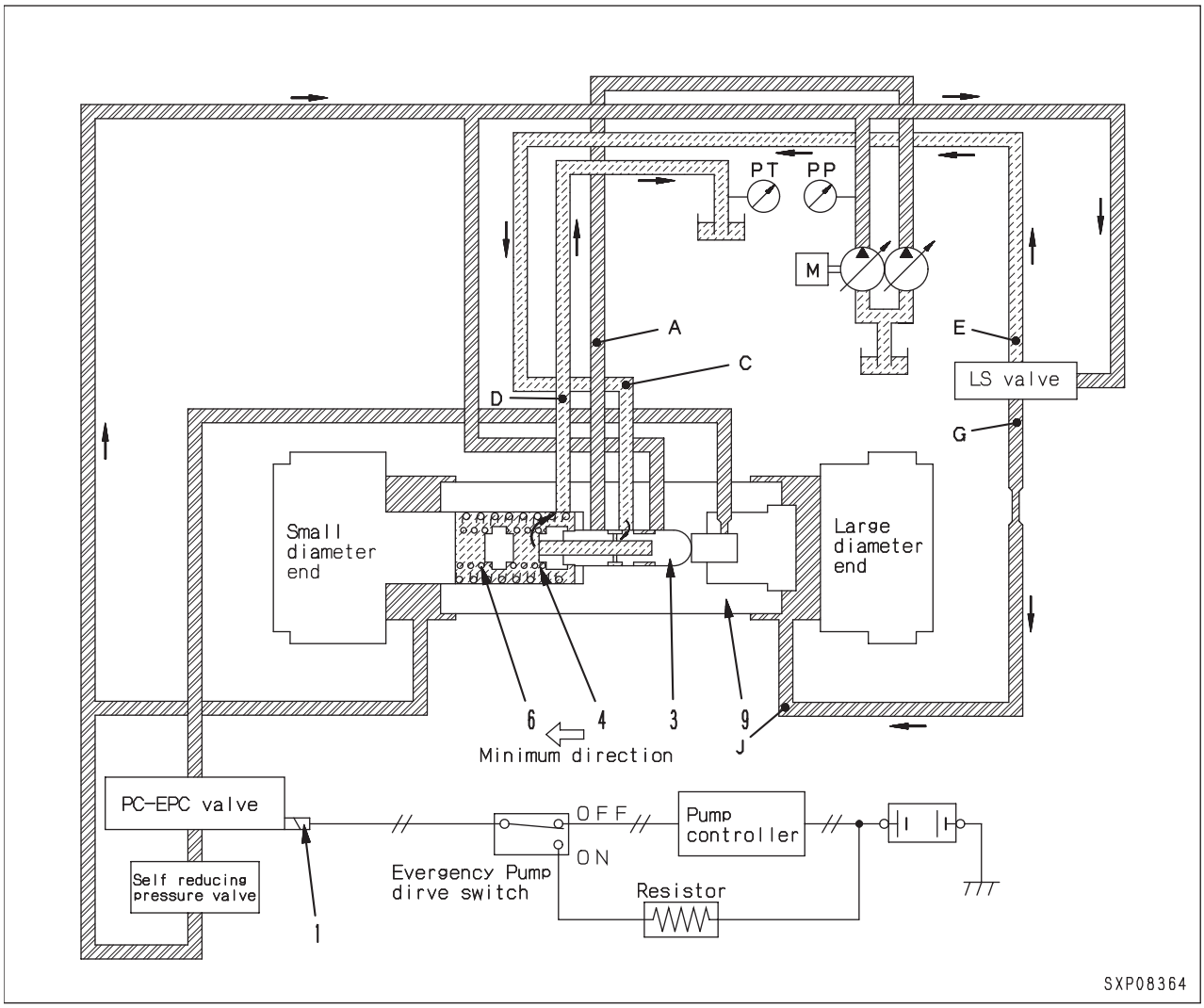
For the R pump, it is the F pump pressure



② **Action of spring**

- The spring load of springs (4) and (6) in the PC valve is determined by the swash plate position.
- If piston (9) moves to the left, spring (6) is compressed, and if it moves further to the left, spring (6) contacts seat (5) and is fixed in position. In other words, the spring load is changed by piston (9) extending or compressing springs (4) and (6).
- If the command circuit input to PC-EPC valve solenoid (1) changes further, the force pushing piston (2) changes, and the spring load of springs (4) and (6) also changes according to the valve of the PC-EPC valve solenoid command current.

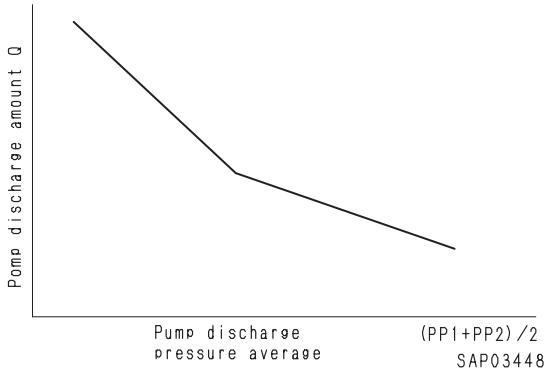
- Port **C** of the PC valve is connected to port **E** of the LS valve (see (1) LS valve). Self pressure **PP1** enters port **B** and the small diameter end of servo piston (9), and other pump pressure **PP2** enters port **A**.
- When pump pressures **PP1** and **PP2** are small, spool (3) is on the right. At this point, port **C** and **D** are connected, and the pressure entering the LS valve becomes drain pressure **PT**. If port **E** and port **G** of the LS valve are connected (see (1) LS valve), the pressure entering the large diameter end of the piston from port **J** becomes drain pressure **PT**, and servo piston (9) moves to the right. In this way, the pump discharge amount moves in the direction of increase.
- As servo piston (9) moves further, springs (4) and (6) expand and the spring force becomes weaker. When the spring force becomes weaker, spool (3) moves to the left, so the connection between port **C** and port **D** is cut, and the pump discharge pressure ports **B** and **C** are connected. As a result, the pressure at port **C** rises, and the pressure at the large diameter end of the piston also rises, so the movement of piston (9) to the right is stopped.
- In other words, the stop position for piston (9) (= pump discharge amount) is decided at the point where the force of springs (4) and (6) and the pushing force from the PC-EPC valve solenoid and the pushing force created by the pressures **PP1** and **PP2** acting on the spool (3) are in balance.



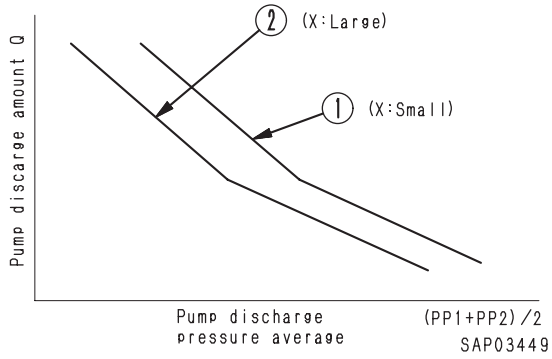
b. When load on actuator is large and pump discharge pressure is high

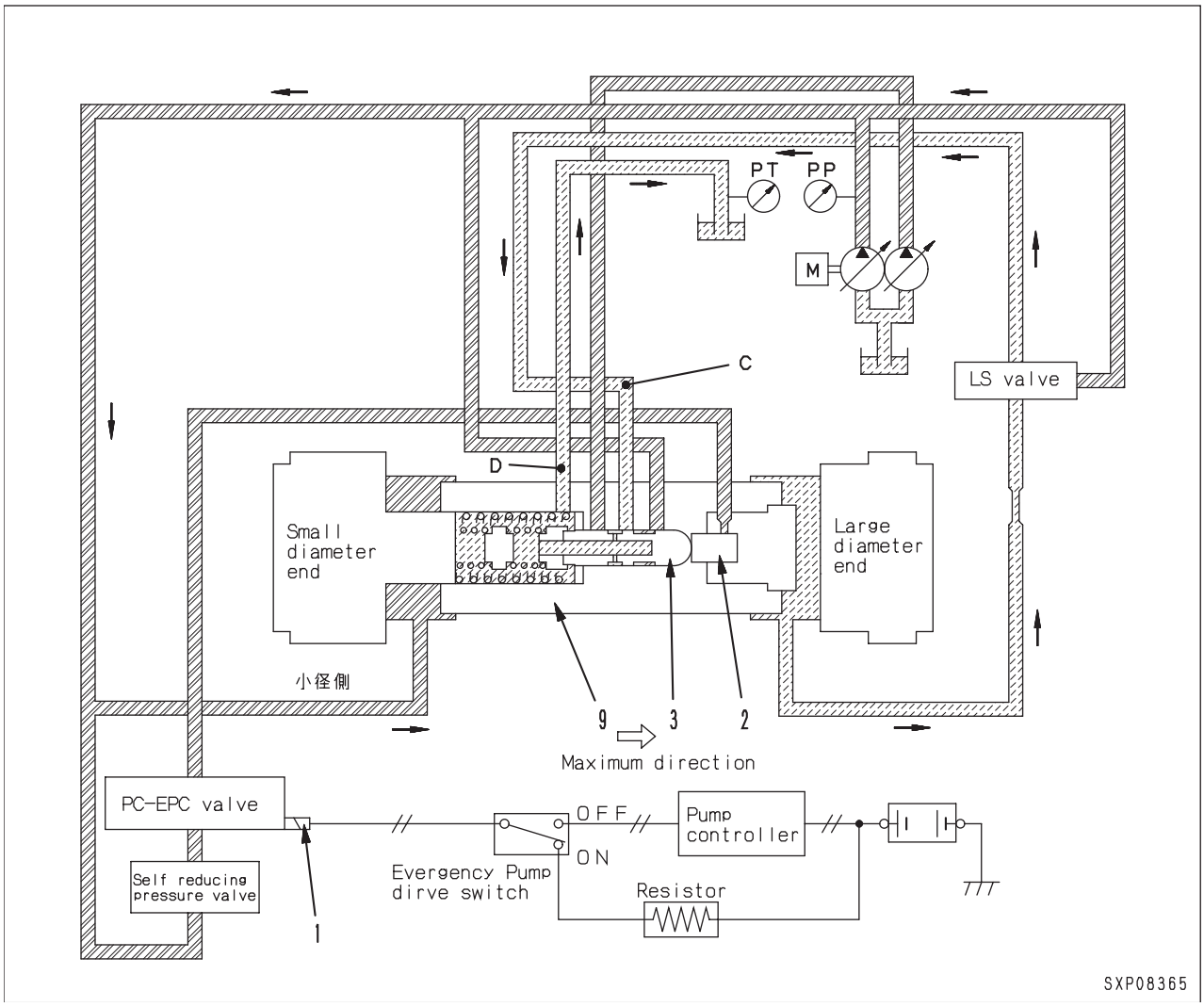
- When the load is large and pump discharge pressures **PP1** and **PP2** (see page 10-33) are high, the force pushing spool (3) to the left becomes larger and spool (3) moves to the position in the diagram above. When this happens, as shown in the diagram above, part of the pressurized oil from port **B** flows out through port **C** where the LS valve is actuated to port **D**, and the pressurized oil flowing from port **C** to the LS valve becomes approximately half of main pump pressure **PP.**
- When port **E** and port **G** of the LS valve are connected (see (1) LS valve), the pressure from port **J** enters the large diameter end of servo piston (9), and servo piston (9) stops.
- If main pump pressure **PP** increases further and spool (3) moves further to the left, main pump pressure **PP1** flows to port **C** and acts to make the discharge amount the minimum. When piston (9) moves to the left, springs (4) and (6) are compressed and push back spool (3). When spool (3) moves to the left, the opening of port **C** and port **D** becomes larger. As a result, the pressure at port **C** (= **J**) drops, and piston (9) stops moving to the left.
- The position in which piston (9) stops when this happens is further to the left than the position when pump pressures **PP1** and **PP2** are low.

- The relation of average pump pressure **(PP1 + PP2)/2** and the position of servo piston (9) forms a bent line because of the double-spring effect of springs (4) and (6). The relationship between average pump pressure **(PP1 + PP2)/2** and pump discharge amount **Q** is shown in the figure at the right.



- If command voltage **X** sent to PC-EPC valve solenoid (1) increases further, the relationship between average pump pressure **(PP1 + PP2)/2**, and pump discharge amount **Q** is proportional to the pushing force of the PC-EPC valve solenoid and moves in parallel. In other words, the pushing force of PC-EPC solenoid (1) is added to the force pushing to the left because of the pump pressure applied to the spool (3), so the relationship between the average pump pressure **(PP1 + PP2)/2** and **Q** moves from ① to ② in accordance with the increase in **X**.

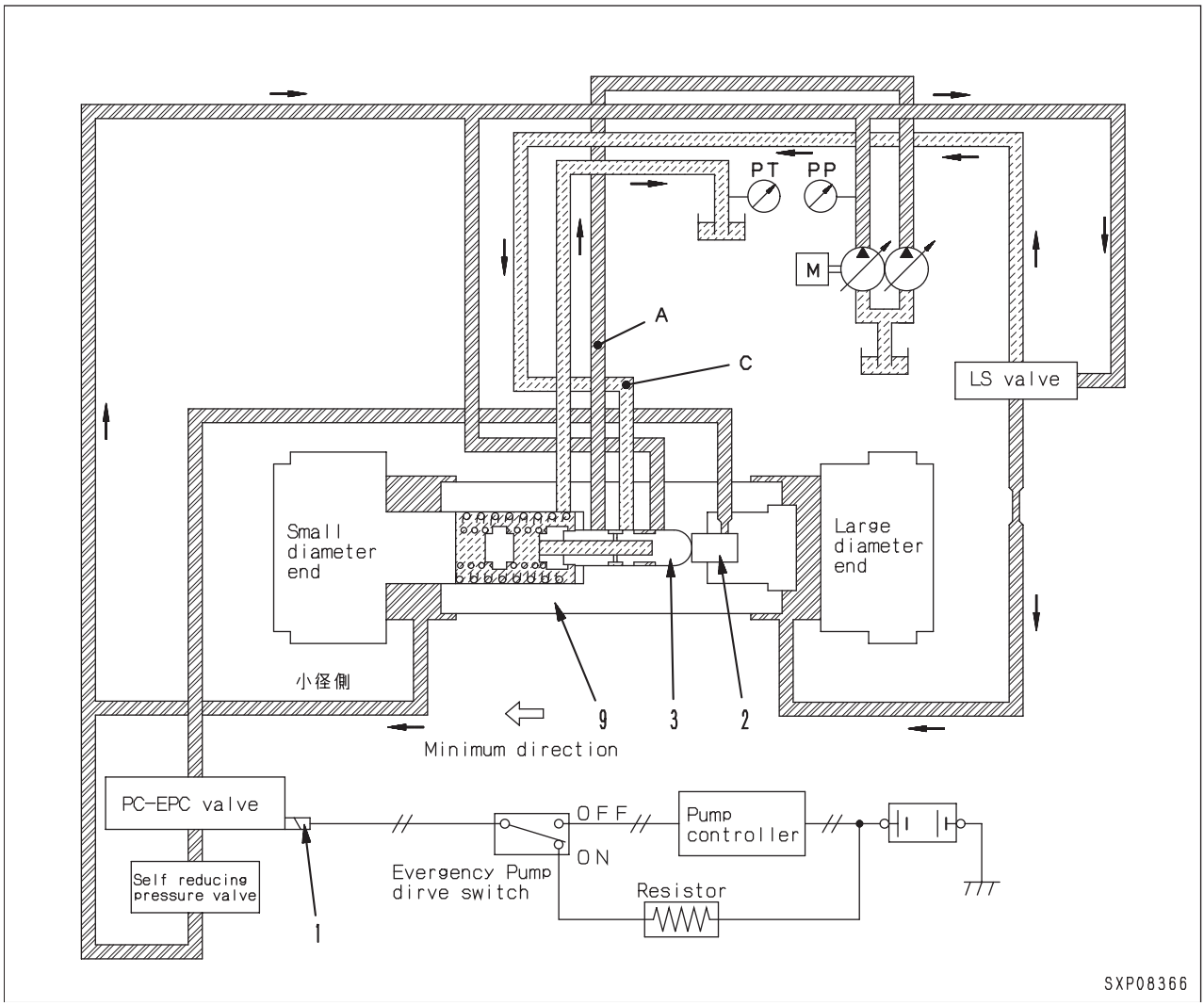




2) When pump controller is abnormal and PC prolix switch is ON

a. When load on main pump is light

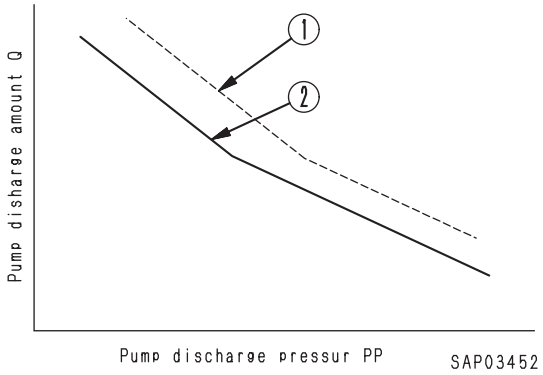
- If there is a failure in the pump controller, turn emergency pump drive switch **ON** to switch to the resistor side. In this case, the power source is taken directly from the battery. But if the current is used as it is, it is too large, so use the resistor to control the current flowing to PC-EPC valve solenoid (1).
- When this is done, the current becomes constant, so the force pushing piston (2) is also constant.
- If the main pump pressure **PP1** and **PP2** are low, the combined force of the pump pressure and the force of PC-EPC valve solenoid (1) is weaker than the spring set force, so spool (3) is balanced at a position to the left.
- At this point, port **C** is connected to the drain pressure of port **D**, and the large diameter end of the piston of servo piston (9) also becomes the drain pressure **PT** through the LS valve. When this happens, the pressure at the small diameter end of the piston is large, so servo piston (9) moves in the direction to make the discharge amount larger.



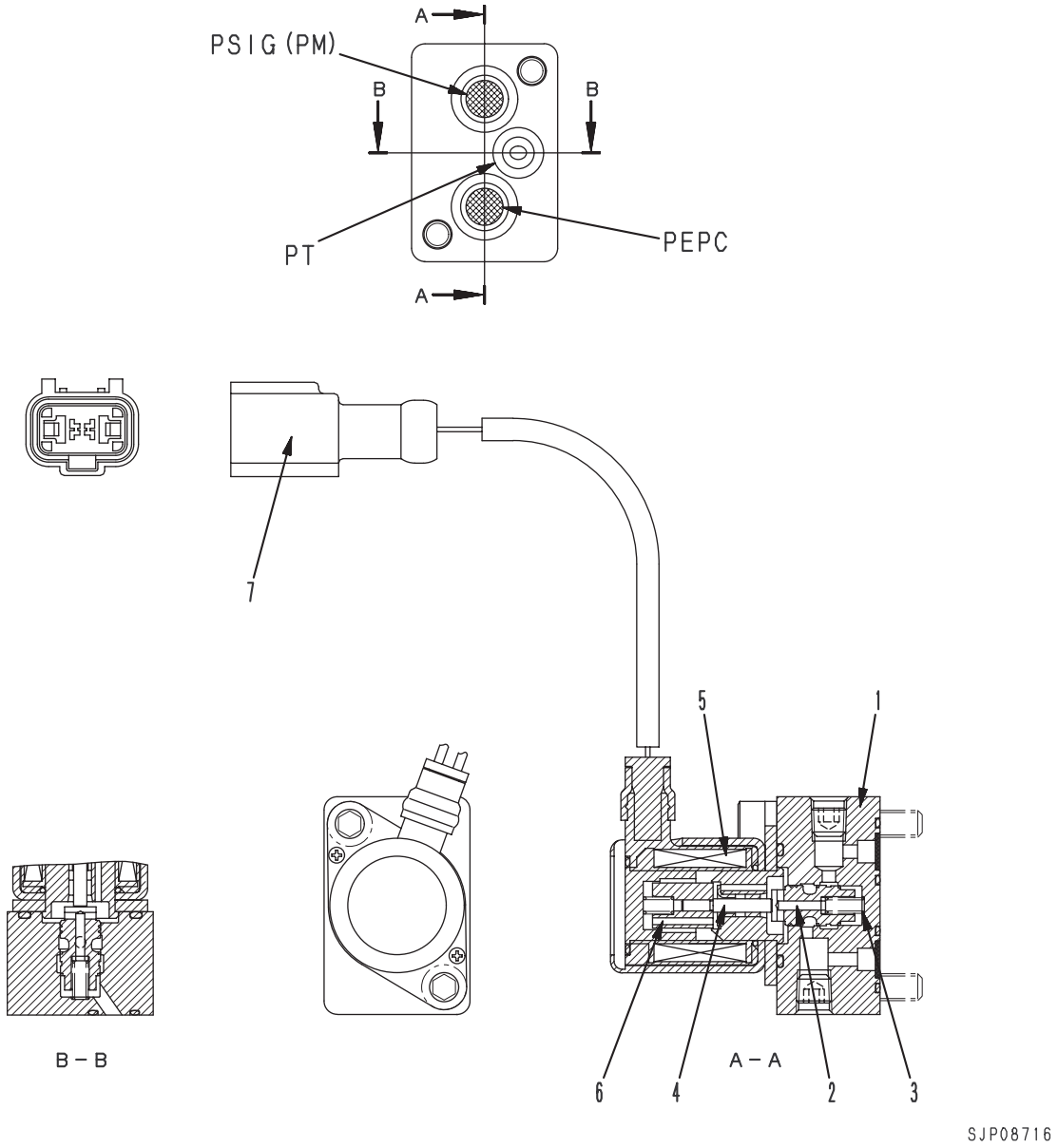
b. When main pump load is heavy

- In the same way as in the previous item, when the emergency pump drive switch is **ON**, the command current sent to PC-EPC valve solenoid (1) becomes constant. For this reason, the force of piston (2) pushing spool (3) is constant.
- If main pump pressures **PP1** and **PP2** increase, spool (3) moves further to the left than when the main pump load is light, and is balanced at the position in the diagram above.
- In this case, the pressure from port **B** flows to port **C**, so servo piston (9) moves to the left (to make the discharge amount smaller) by the same mechanism as explained in item 2)-b, and stops at a position to the left of the position when the load on the pump is light. In other words, even when the emergency pump drive switch is **ON**, the curve for the pump pressure **PP** and discharge amount **Q** is determined as shown in the diagram for the valve of the current sent to the PC-EPC valve solenoid through the resistor.

The curve when the PC prolix switch is **ON** is curve ②, which is to the left of curve ① for when the pump controller is normal.



LS(PC)-EPC VALVE

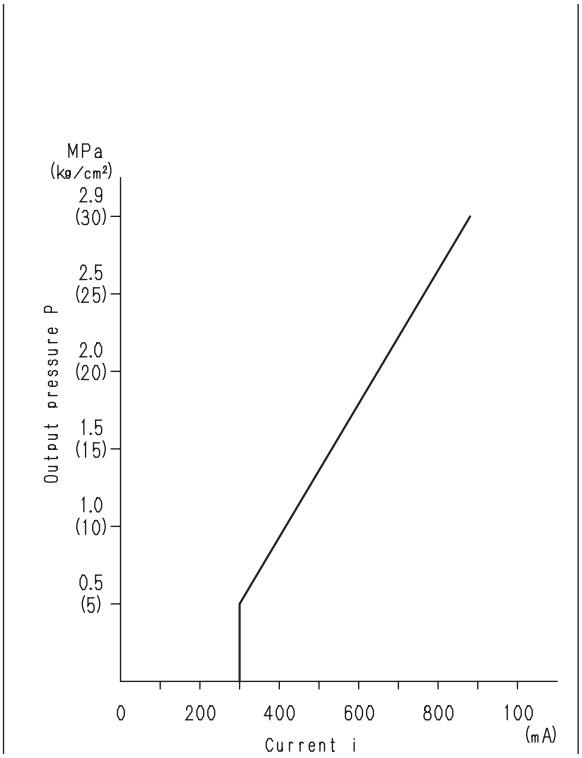


1. Body
2. Spool
3. Spring
4. Rod
5. Coil
6. Plunger
7. Connector

PSIG(PM) : To LS(PC) valve
PT : To tank
PEPC : From self-reducing pressure valve

FUNCTION

- The EPC valve consists of the proportional solenoid portion and the hydraulic valve portion.
- When it receives signal current **i** from the pump controller, it generates the EPC output pressure in proportion to the size of the signal, and outputs it to the LS valve.

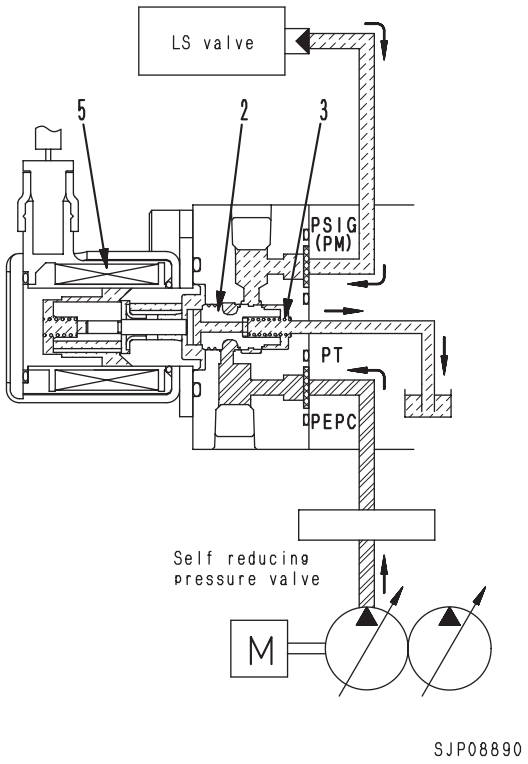


OPERATION

1. When signal current is 0 (coil deenergized)

- When there is no signal current flowing from the controller to coil (5), coil (5) is generalized.
- For this reason, spool (2) is pushed to the right in the direction of the arrow by spring (3).
- As a result, port **PEPC** closes and the pressurized oil from the main pump does not flow to the LS valve.

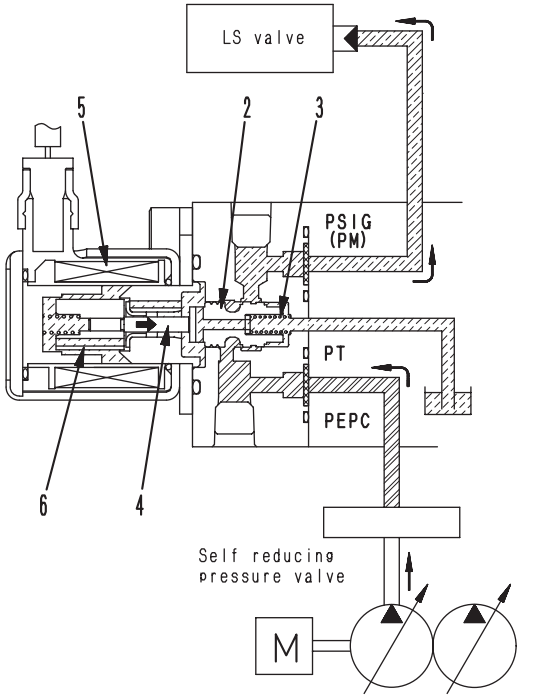
  At the same time, the pressurized oil from the LS valve passes from port **PSIG(PM)** through port **PT** and is drained to the tank.



SJP08890

2. When signal current is very small (coil energized)

- When a very small signal current flows to coil (5), coil (5) is energized, and a propulsion force is generated which pushes plunger (6) to the left.
- Push pin (4) pushes spool (2) to the left, and pressurized oil flows from port **PEPC** to port **PSIG(PM)**.
- When the pressure at port **PSIG(PM)** rises and the load of spring (3) + the force acting on surface **a** of spool (2) becomes greater than the propulsion force of plunger (6), spool (2) is pushed to the right. The circuit between port **PEPC** and port **PSIG(PM)** is shut off, and at the same time, port **PSIG(PM)** and port **PT** are connected.
- As a result, spool (2) is moved up or down until the propulsion force of plunger (6) is balanced with the load of spring (3) + pressure of port **PSIG(PM)**.
- Therefore, the circuit pressure between the EPC valve and the LS valve is controlled in proportion to the size of the signal current.

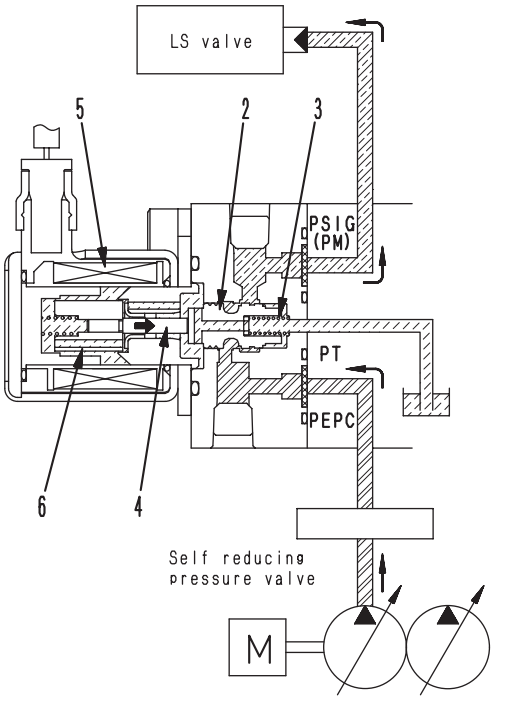


SJP08891

3. When signal current is maximum (coil energized)

- When the signal current flows to coil (5), coil (5) is energized.
- When this happens, the signal current is at its maximum, so the propulsion force of plunger (6) is also at its maximum.
- For this reason, spool (2) is pushed fully to the left by push pin (4).
- As a result, the maximum flow of pressurized oil from port **PEPC** flows to port **PSIG(PM)**, and the circuit pressure between the EPC valve and LS valve becomes the maximum.

  At the same time, port **PT** closes and stops the oil from flowing to the tank.



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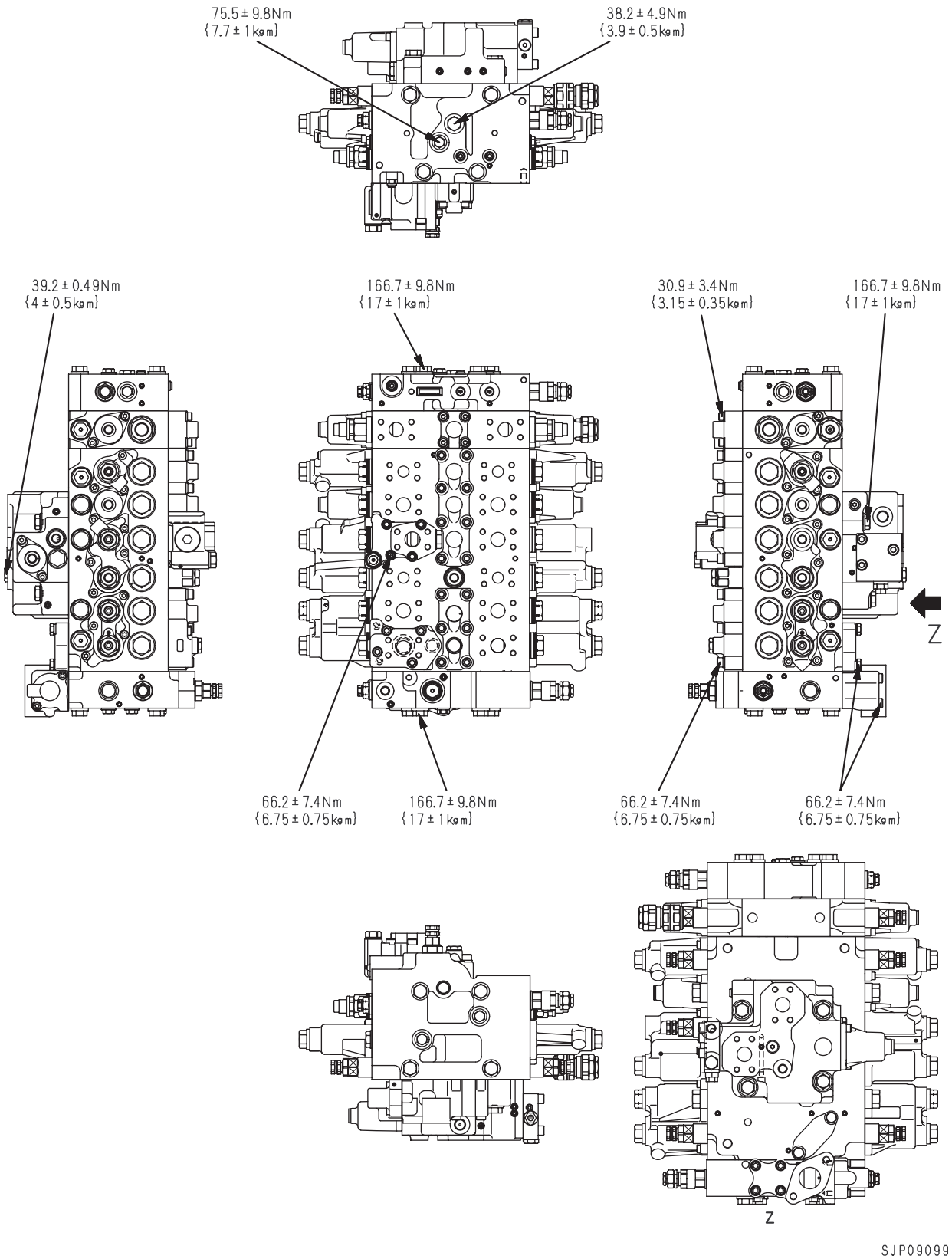
CONTROL VALVE



PC210-7K, PC210LC-7K, PC210NLC-7K

1. 6-spool valve
2. Cover 1
3. Cover 2
4. Pump merge-divider valve
5. Back pressure valve
6. Boom lock valve
7. Service valve

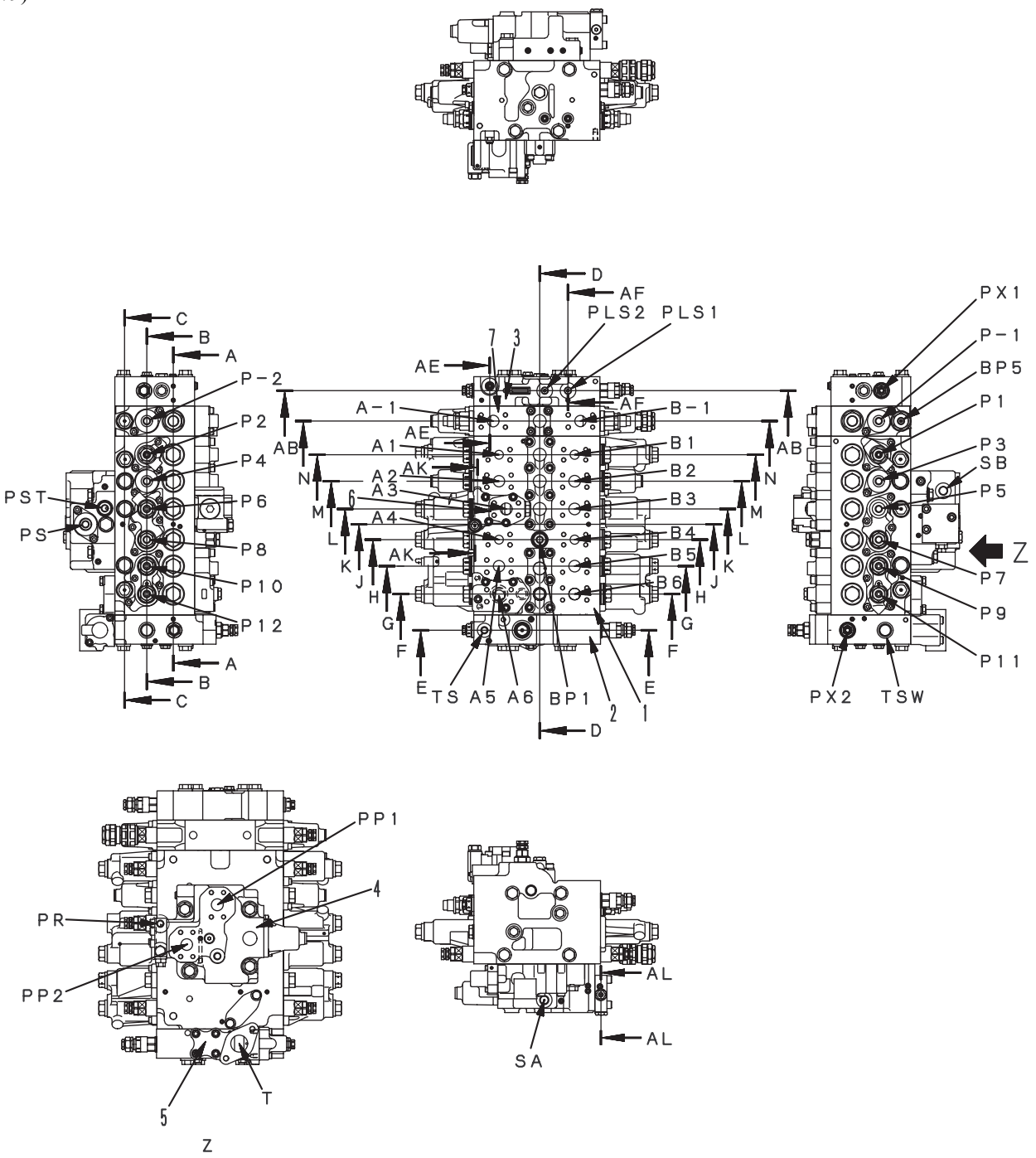
OUTLINE

- This control valve consists of a 6-spool valve (unit type), 1 service valves, a pump merge-divider valve, a back pressure valve, and a boom hydraulic drift prevention valve.
- Since all the valves are assembled together with connecting bolts and their passes are connected to each other inside the assembly, the assembly is small in size and easy to maintain.
- Since one spool of this control valve is used for one work equipment unit, its structure is simple.

A1 :To bucket cylinder head
A2 :To left travel motor
A3 :To boom cylinder bottom
A4 :To swing motor
A5 :To right travel motor
A6 :To arm cylinder head
A-1 :To attachment
B1 :To bucket cylinder bottom
B2 :To left travel motor
B3 :To bottom cylinder head
B4 :To swing motor
B5 :To right travel motor
B6 :To arm cylinder bottom
B-1 :To attachment
P1 :From bucket PPC valve
P2 :From bucket PPC valve
P3 :From left travel PPC valve
P4 :From left travel PPC valve
P5 :From boom PPC valve
P6 :From boom PPC valve
P7 :From swing PPC valve
P8 :From swing PPC valve
P9 : From right travel PPC valve
P10 : From right travel PPC valve
P11 : From arm PPC valve
P12 : From arm PPC valve
P-1 : From service PPC valve
P-2 : From service PPC valve
BP1: Boom RAISE PPC output pressure
BP5: From attachment circuit selector solenoid valve
PLS1:To rear pump control
PLS2:To front pump control
PP1 : From rear main pump
PP2 : From front main pump
PR : To solenoid valve, PPC valve, EPC valve
PS : From pump merge-divider solenoid valve
PST: From travel junction valve
PX1: From 2-stage solenoid valve
PX2: From 2-stage solenoid valve
SA : Pressure sensor fitting port
SB : Pressure sensor fitting port
T : To tank
TS : To tank
TSW: To swing motor

7-spool valve
(6-spool valve + 1 service valves)

(1/9)



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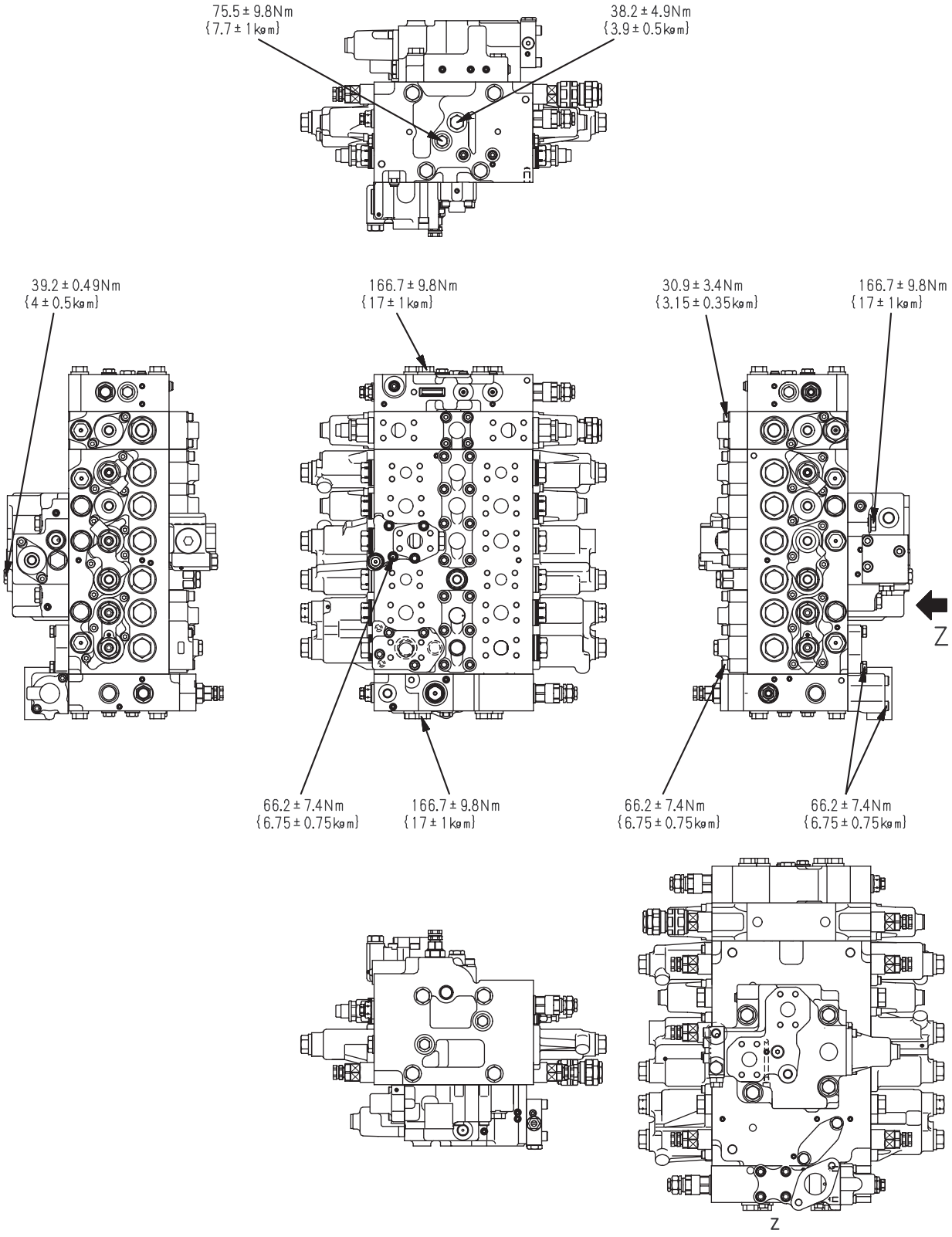
75.5 ± 9.8Nm
{7.7 ± 1kgm}
38.2 ± 4.9Nm
{3.9 ± 0.5kgm}
39.2 ± 0.49Nm
{4 ± 0.5kgm}
166.7 ± 9.8Nm
{17 ± 1kgm}
30.9 ± 3.4Nm
{3.15 ± 0.35kgm}
166.7 ± 9.8Nm
{17 ± 1kgm}
Z
66.2 ± 7.4Nm
{6.75 ± 0.75kgm}
166.7 ± 9.8Nm
{17 ± 1kgm}
66.2 ± 7.4Nm
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66.2 ± 7.4Nm
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Z
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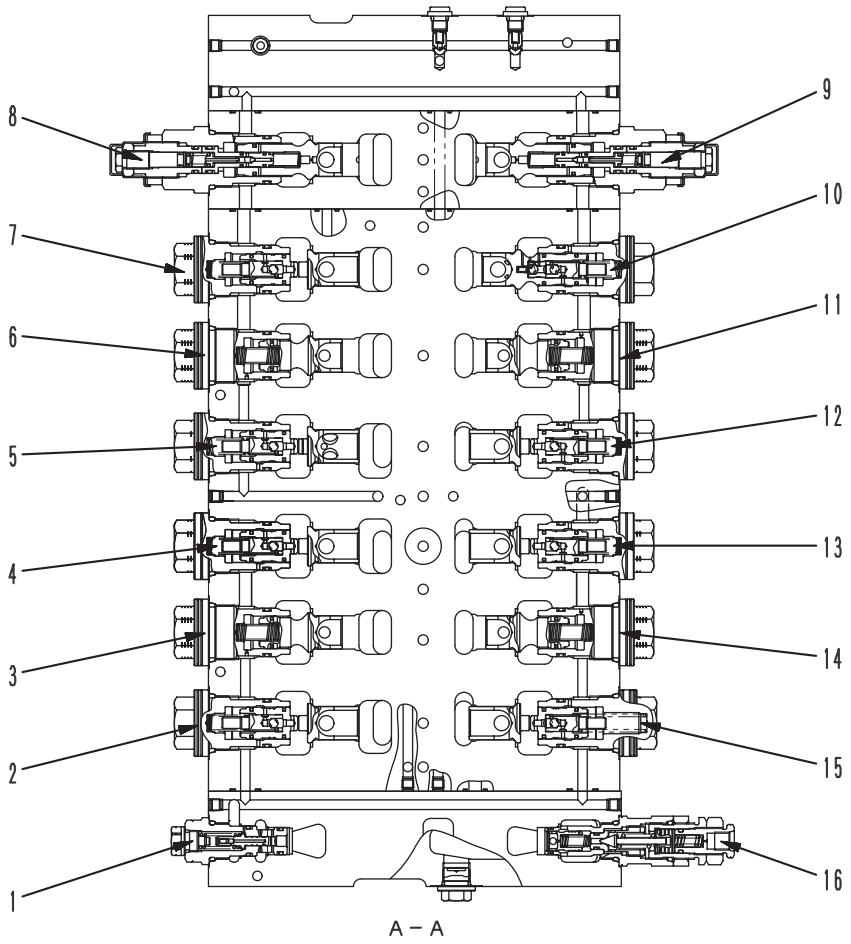
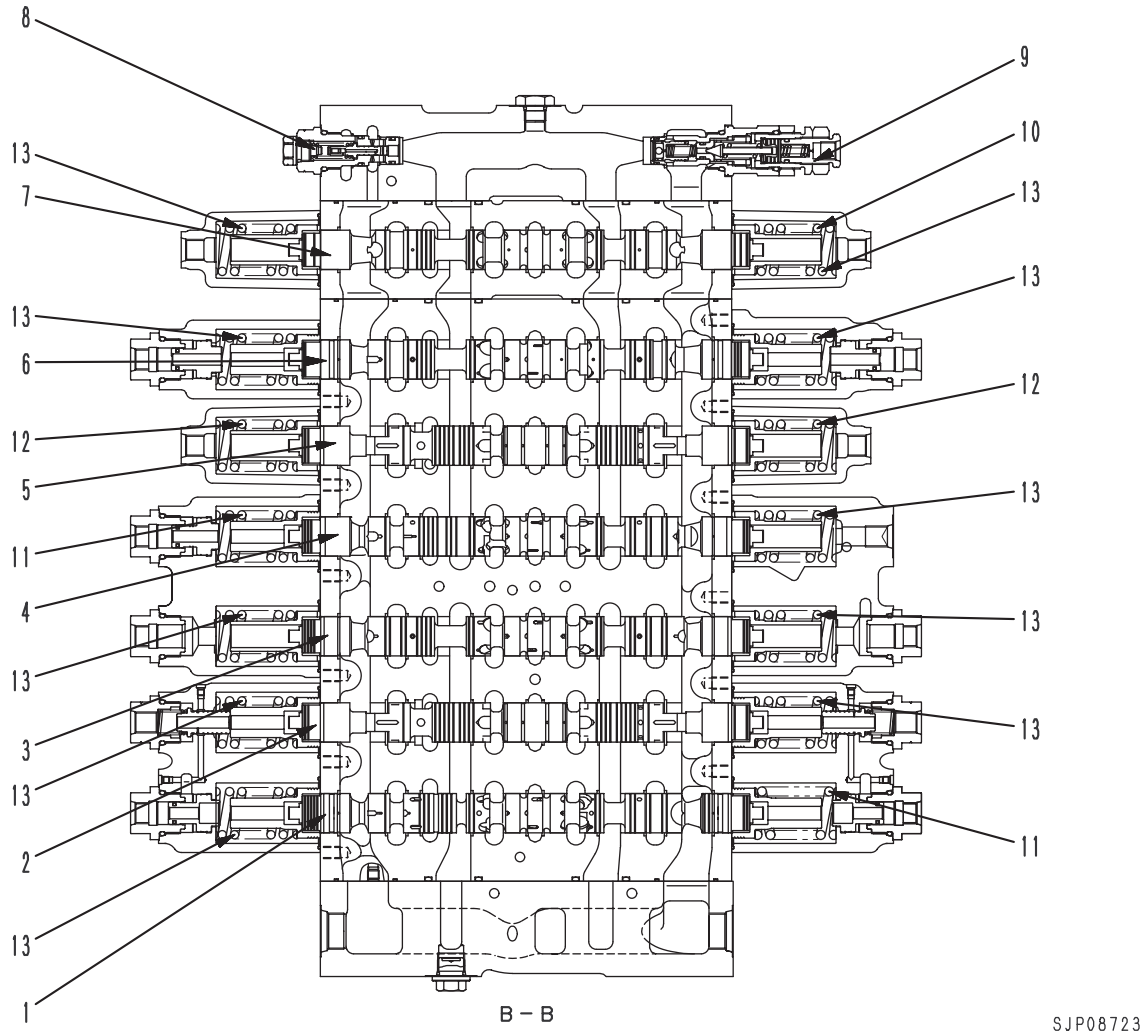


1. Unload valve
2. Pressure compensation valve (Arm OUT)
3. Pressure compensation valve (Right travel Reverse)
4. Pressure compensation valve (Left swing)
5. Pressure compensation valve (Boom RAISE)
6. Pressure compensation valve (Left travel reverse)
7. Pressure compensation valve (Bucket DUMP)
8. Pressure compensation valve (Service)
9. Pressure compensation valve (Service)
10. Pressure compensation valve (Bucket CURL)
11. Pressure compensation valve (Left travel forward)
12. Pressure compensation valve (Boom LOWER)
13. Pressure compensation valve (Right swing)
14. Pressure compensation valve (Right travel forward)
15. Pressure compensation valve (Arm IN)
16. Main relief valve

(4/9)

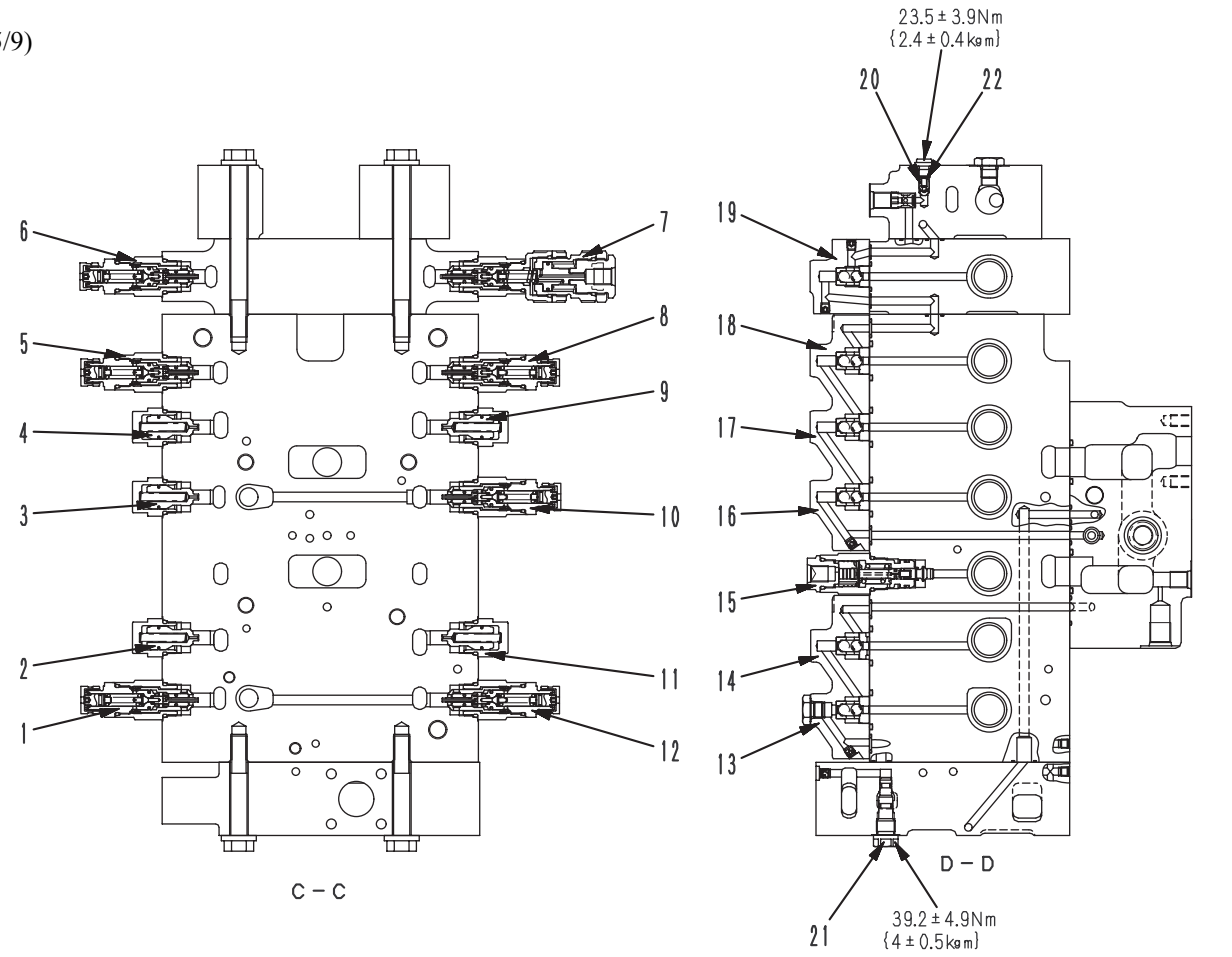


1. Spool (Arm)
2. Spool (Right travel)
3. Spool (Swing)
4. Spool (Boom)
5. Spool (Left travel)
6. Spool (Bucket)
7. Spool (Service)
8. Unload valve
9. Main relief valve
10. Spool return spring

Unit: mm

No.	Check item	Criteria					Remedy
		Standard size			Repair limit		
11	Spool return spring	Free length x Outside diameter	Installed length	Installed load	Free length	Installed load	If damaged or deformed, replace spring
		54.2 x 34.8	51.2	416.5 N {42.5 kg}	—	333.2 N {34 kg}	
12	Spool return spring	54.6 x 34.8	51.2	429.9 N {43.9 kg}	—	336.1 N {34.3 kg}	
13	Spool return spring	54.5 x 34.8	51.2	393 N {40.1 kg}	—	314.6 N {32.1 kg}	

(5/9)



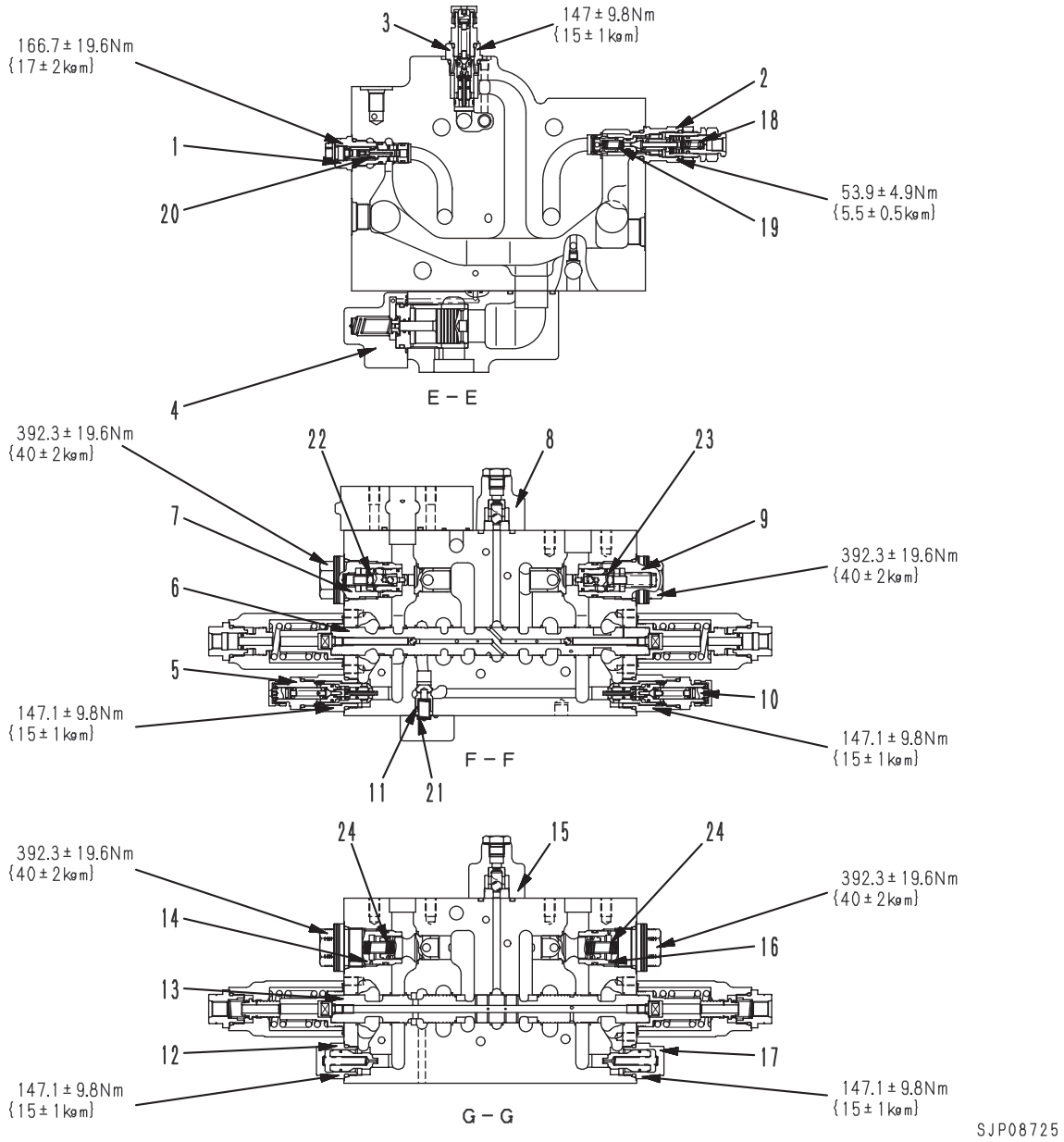
SJP08724

1. Safety-suction valve (Arm OUT)
2. Suction valve (Right travel reverse)
3. Suction valve (Boom RAISE)
4. Suction valve (Left travel reverse)
5. Safety-suction valve (Bucket DUMP)
6. Safety-suction valve (Service)
7. Safety-suction valve (2-stage) (Service)
8. Safety-suction valve (Bucket CURL)
9. Suction valve (Left travel forward)
10. Safety-suction valve (Boom LOWER)
11. Suction valve (Right travel forward)
12. Safety-suction valve (Arm IN)
13. LS shuttle valve (Arm)
14. LS shuttle valve (Right travel)
15. LS select valve
16. LS shuttle valve (Boom)
17. LS shuttle valve (Left travel)
18. LS shuttle valve (Bucket)
19. LS shuttle valve (Service)
20. LS check valve
21. Pressure relief plug

Unit: mm

No.	Check item	Criteria					Remedy
		Standard size			Repair limit		
22	Check valve spring	Free length x Outside diameter	Installed length	Installed load	Free length	Installed load	If damaged or deformed, replace spring
		11.5 x 4.6	8.5	1.5 N {0.15 kg}	—	1.2 N {0.12 kg}	

(6/9)



ARM CONTROL VALVE

1. Unload valve
2. Main relief valve
3. Safety valve (Boom RAISE)
4. Lift check valve
5. Safety-suction valve
6. Spool
7. Pressure compensation valve (OUT)
8. LS shuttle valve
9. Pressure compensation valve (IN)
10. Safety-suction valve
11. Check valve for regeneration circuit

R. H. TRAVEL CONTROL VALVE

12. Suction valve
13. Spool
14. Pressure compensation valve (Reverse)
15. LS shuttle valve
16. Pressure compensation valve (Forward)
17. Suction valve

Unit: mm

No.	Check item	Criteria					Remedy
		Standard size			Repair limit		
18	Relief spring	Free length x Outside diameter	Installed length	Installed load	Free length	Installed load	If damaged or deformed, replace spring
		30.7 x 9.6	25.9	406.7 N {41.5 kg}	—	325.6 N {33.2 kg}	
19	Valve spring	24.3 x 8	19.5	69.6 N {7.1 kg}	—	55.7 N {5.7 kg}	
20	Unload spring	31.5 x 10.2	26.9	70.6 N {7.2 kg}	—	56.4 N {5.8 kg}	
21	Regeneration valve spring	31.5 x 10.3	19	6.2 N {0.6 kg}	—	4.9 N {0.5 kg}	
22	Piston return spring	48.1 x 10.8	28	17.5 N {1.8 kg}	—	14.0 N {1.4 kg}	
23	Piston return spring	56.4 x 11.9	45	79.4 N {8.1 kg}	—	63.5 N {6.5 kg}	
24	Piston return spring	36.9 x 11.1	28	29.4 N {3 kg}	—	23.5 N {2.4 kg}	

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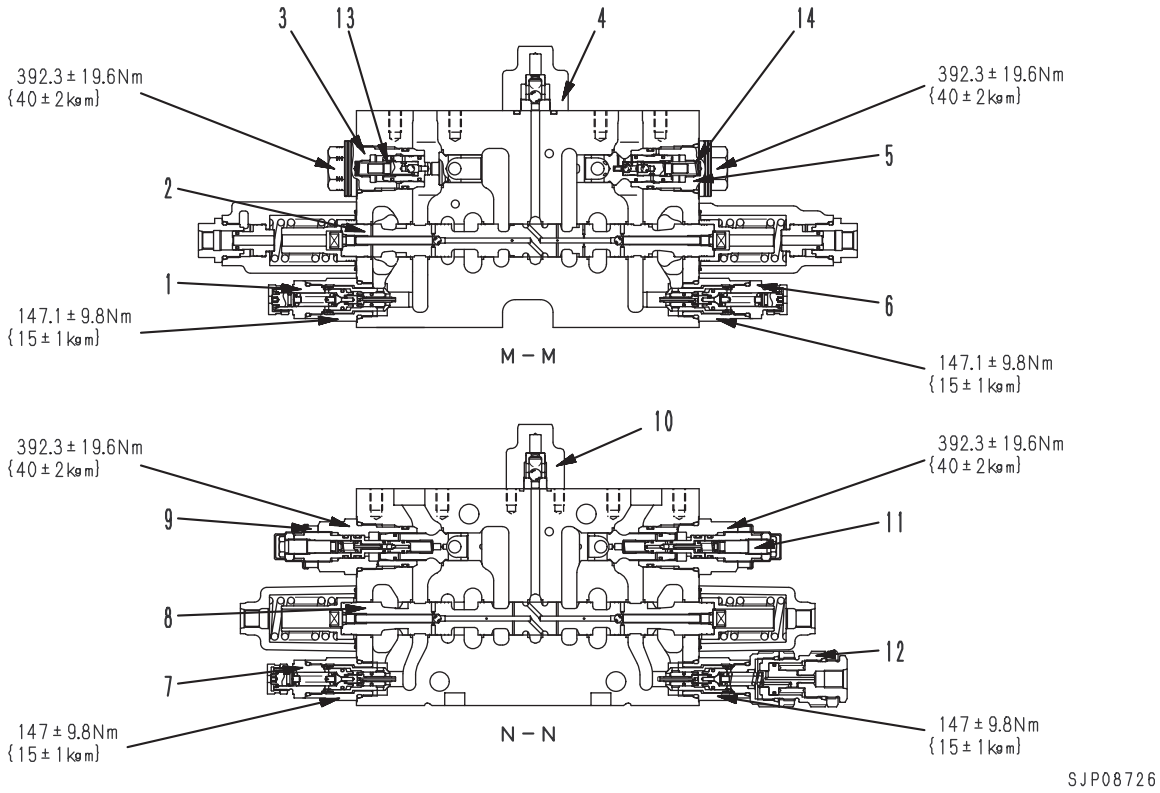

BUCKET CONTROL VALVE

1. Safety-suction valve
2. Spool
3. Pressure compensation valve (DUMP)
4. LS shuttle valve
5. Pressure compensation valve (CURL)
6. Safety-suction valve

SERVICE VALVE

7. Safety-suction valve
8. Spool
9. Pressure compensation valve
10. LS shuttle valve
11. Pressure compensation valve
12. Safety-suction valve

Unit: mm

No.	Check item	Criteria					Remedy
		Standard size			Repair limit		
13	Piston return spring	Free length x Outside diameter	Installed length	Installed load	Free length	Installed load	If damaged or deformed, replace spring
		48.1 x 10.8	28	17.5 N {1.8 kg}	—	14.0 N {1.4 kg}	
14	Piston return spring	36.9 x 11.1	28	29.4 N {3 kg}	—	23.5 N {2.4 kg}	

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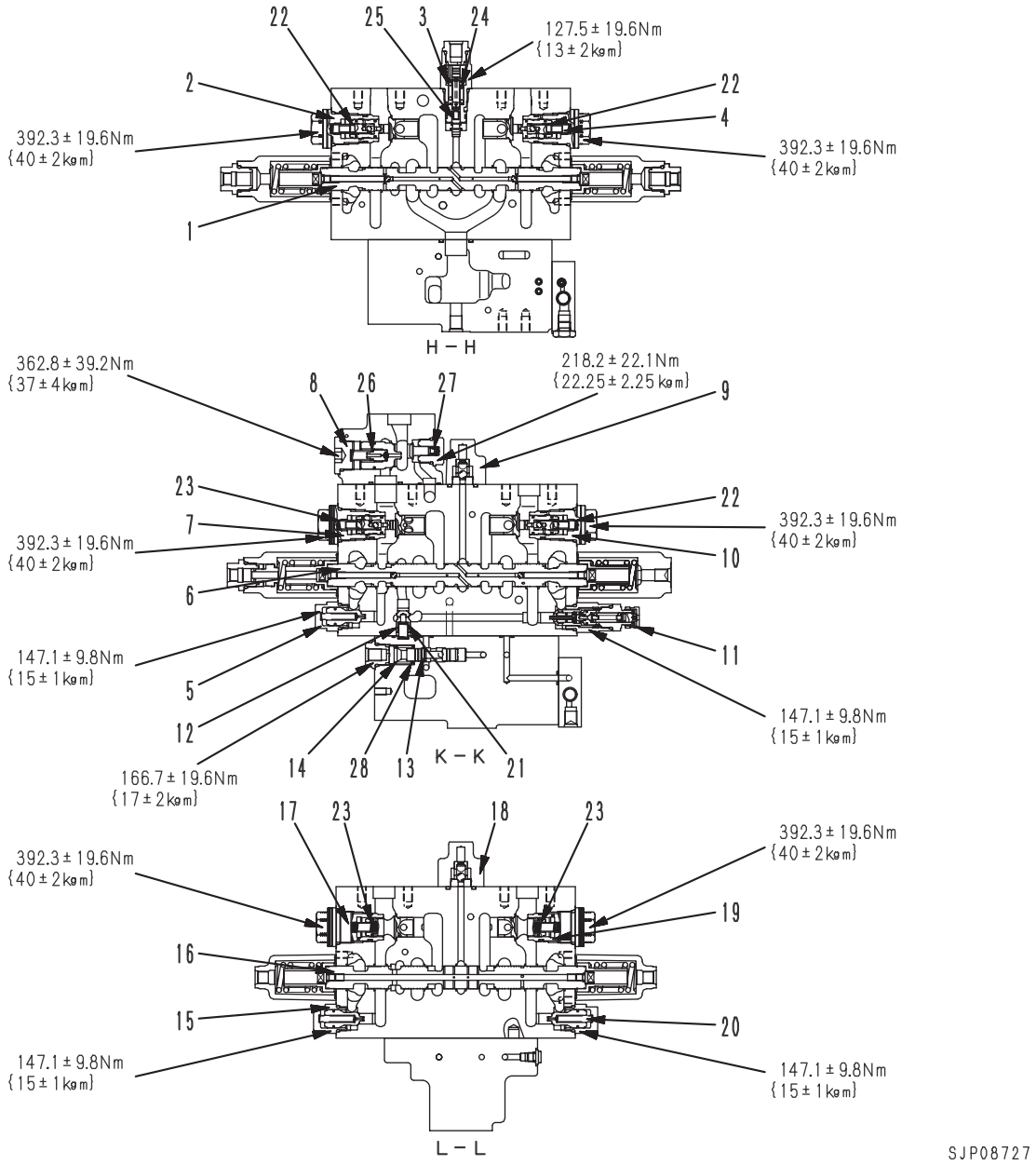


SWING CONTROL VALVE

1. Spool
2. Pressure compensation valve (Left)
3. LS select valve
4. Pressure compensation valve (Right)

BOOM CONTROL VALVE

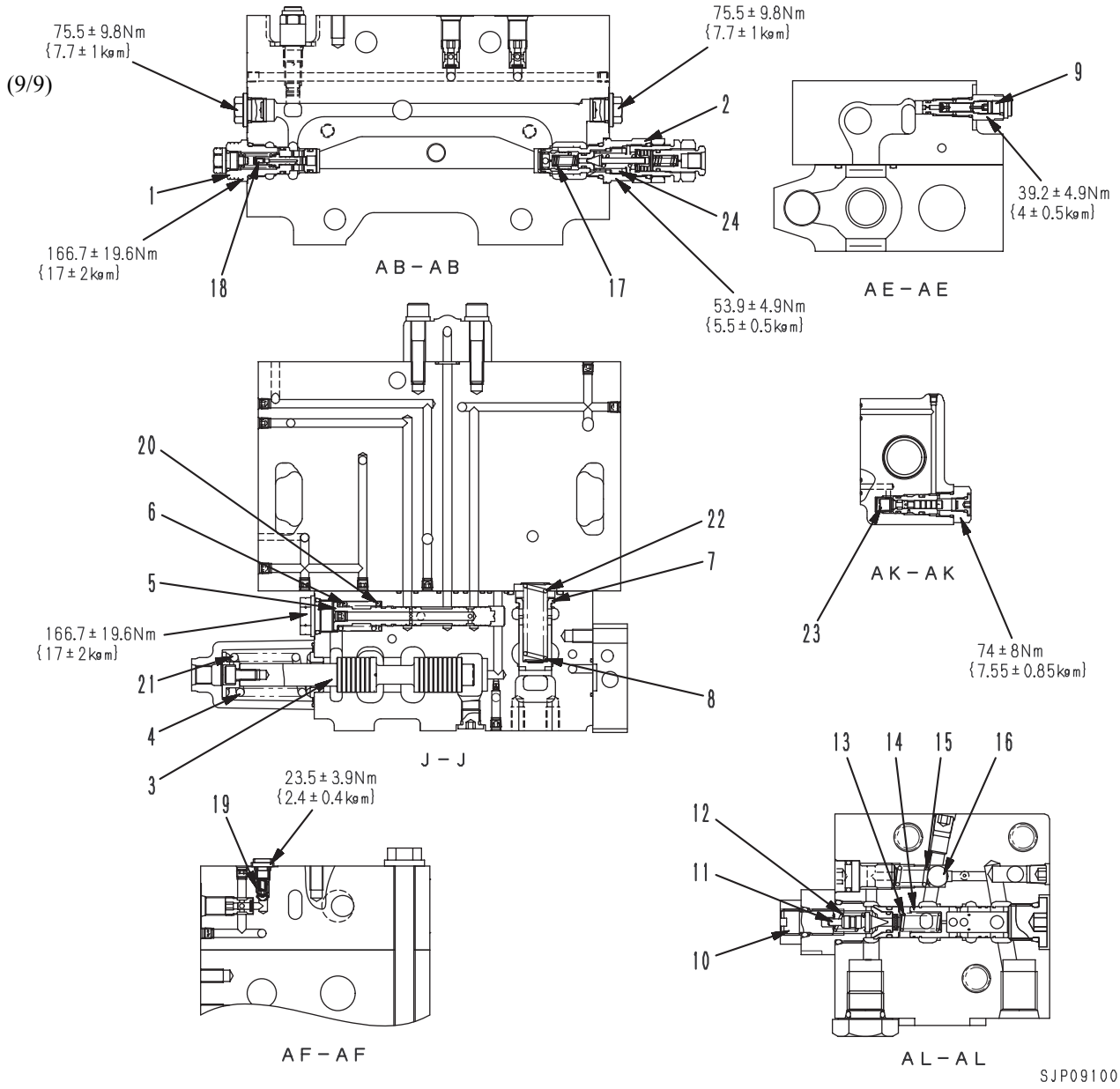
5. Suction valve
6. Spool
7. Pressure compensation valve (RAISE)
8. Hydraulic drift prevention valve
9. LS shuttle valve
10. Pressure compensation valve (Lower)
11. Safety-suction valve
12. Check valve for regeneration circuit

L. H. TRAVEL CONTROL VALVE

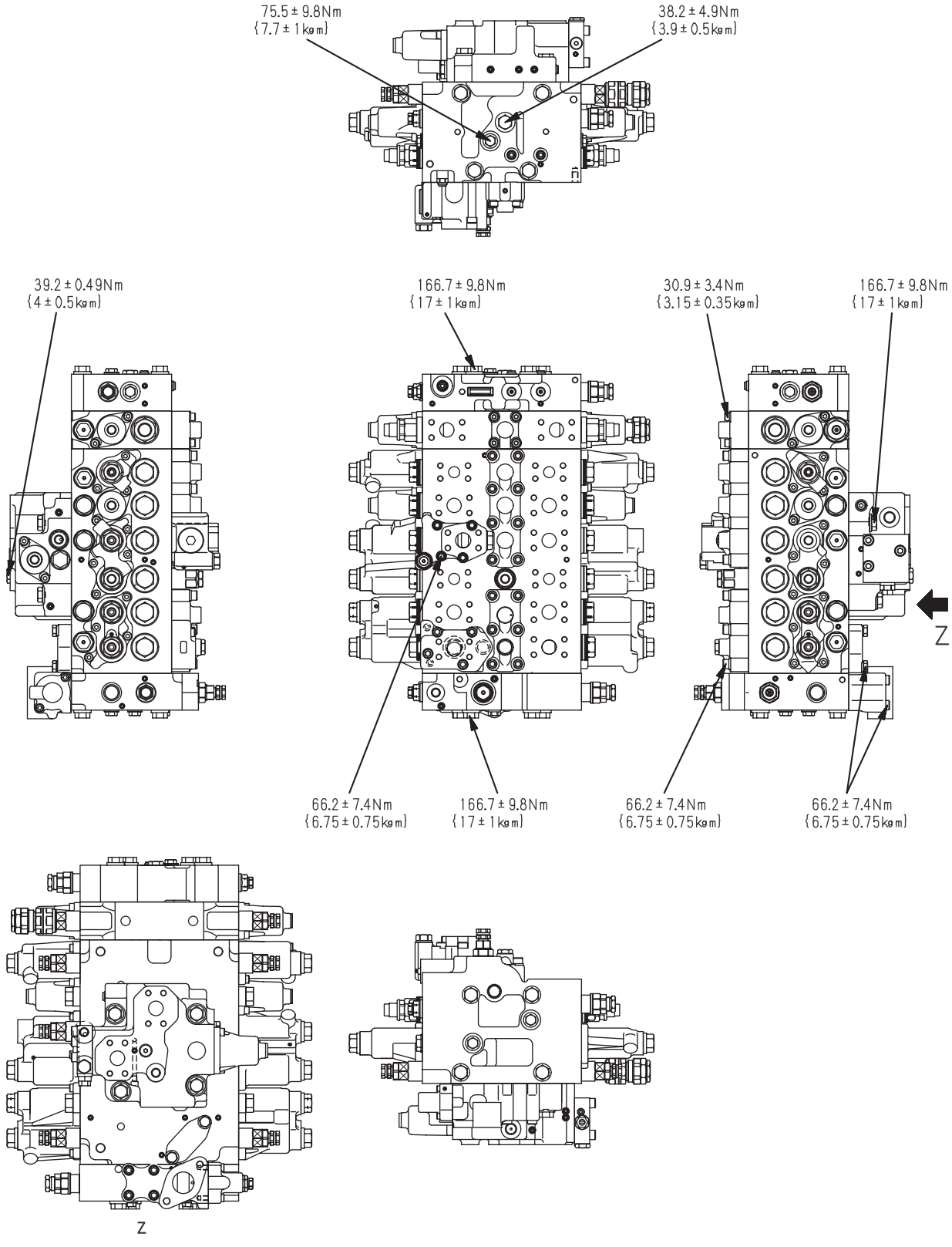
13. Pump merge-divider valve (Travel junction valve)
14. Return spring
15. Suction valve
16. Spool
17. Pressure compensation valve (Reverse)
18. LS shuttle valve
19. Pressure compensation valve (Forward)
20. Suction valve

Unit: mm

No.	Check item	Criteria					Remedy
		Standard size			Repair limit		
21	Regeneration valve spring	Free length x Outside diameter	Installed length	Installed load	Free length	Installed load	If damaged or deformed, replace spring
		31.5 x 10.3	19	6.2 N {0.6 kg}	—	4.9 N {0.5 kg}	
22	Piston return spring	48.1 x 10.8	28	17.5 N {1.8 kg}	—	14.0 N {1.4 kg}	
23	Piston return spring	36.9 x 11.1	28	29.4 N {3 kg}	—	23.5 N {2.4 kg}	
24	Load spring	30.4 x 16.7	27	428.3 N {43.7 kg}	—	343 N {35.0 kg}	
25	Check valve spring	13.6 x 5.5	10	3.0 N {0.3 kg}	—	2.4 N {0.25 kg}	
26	Check valve spring	33.0 x 12.0	26	35.3 N {3.6 kg}	—	28.2 N {2.9 kg}	
27	Check valve spring	16.4 x 8.9	11.5	13.7 N {1.4 kg}	—	11.0 N {1.1 kg}	
28	Spool return spring	30.7 x 20.5	23	50.0 N {5.1 kg}	—	40.0 N {4.1 kg}	



1. Unload valve
2. Main relief valve
3. Pump merge-divider valve (Main)
4. Return spring
5. Pump merge-divider valve (For LS)
6. Return spring
7. Valve (Sequence valve)
8. Spring (Sequence valve)
9. LS bypass plug
10. Screw
11. Poppet
12. Spring (Pressure reducing valve pilot)
13. Spring (Pressure reducing valve main)
14. Valve (Pressure reducing valve)
15. Spring (Safety valve)
16. Ball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Z
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{6.75 ± 0.75kgm}
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66.2 ± 7.4Nm
{6.75 ± 0.75kgm}
66.2 ± 7.4Nm
{6.75 ± 0.75kgm}
Z
SJP09102

Unit: mm

No.	Check item	Criteria					Remedy
		Standard size			Repair limit		
17	Valve spring	Free length x Outside diameter	Installed length	Installed load	Free length	Installed load	If damaged or deformed, replace spring
		24.3 x 8	19.5	69.6 N {7.1 kg}	—	55.7 N {5.7 kg}	
18	Unload spring	31.5 x 10.2	26	83.4 N {8.5 kg}	—	66.7 N {6.8 kg}	
19	Check valve spring	11.5 x 4.6	8.5	1.5 N {0.15 kg}	—	1.2 N {0.12 kg}	
20	Spool return spring	46.6 x 21.8	3.3	156.8 N {16.0 kg}	—	125.5 N {12.8 kg}	
21	Spool return spring	64.5 x 32.3	63	177.5 N {18.1 kg}	—	142.0 N {14.5 kg}	
22	Sequence valve spring	70.9 x 18.0	59	199.8 N {20.4 kg}	—	160.0 N {16.3 kg}	
23	Spool return spring	29.9 x 11.0	10.7	10.4 N {1.1 kg}	—	8.3 N {0.8 kg}	
24	Relief spring	34.7 x 10.4	32.3	430.2 N {43.9 kg)	—	344.2 N {35.1 kg}	

CONTROL VALVE
PC240LC-7K, PC240NLC-7K

1. 6-spool valve
2. Cover 1
3. Cover 2
4. Pump merge-divider valve
5. Back pressure valve
6. Boom lock valve
7. Service valve

OUTLINE

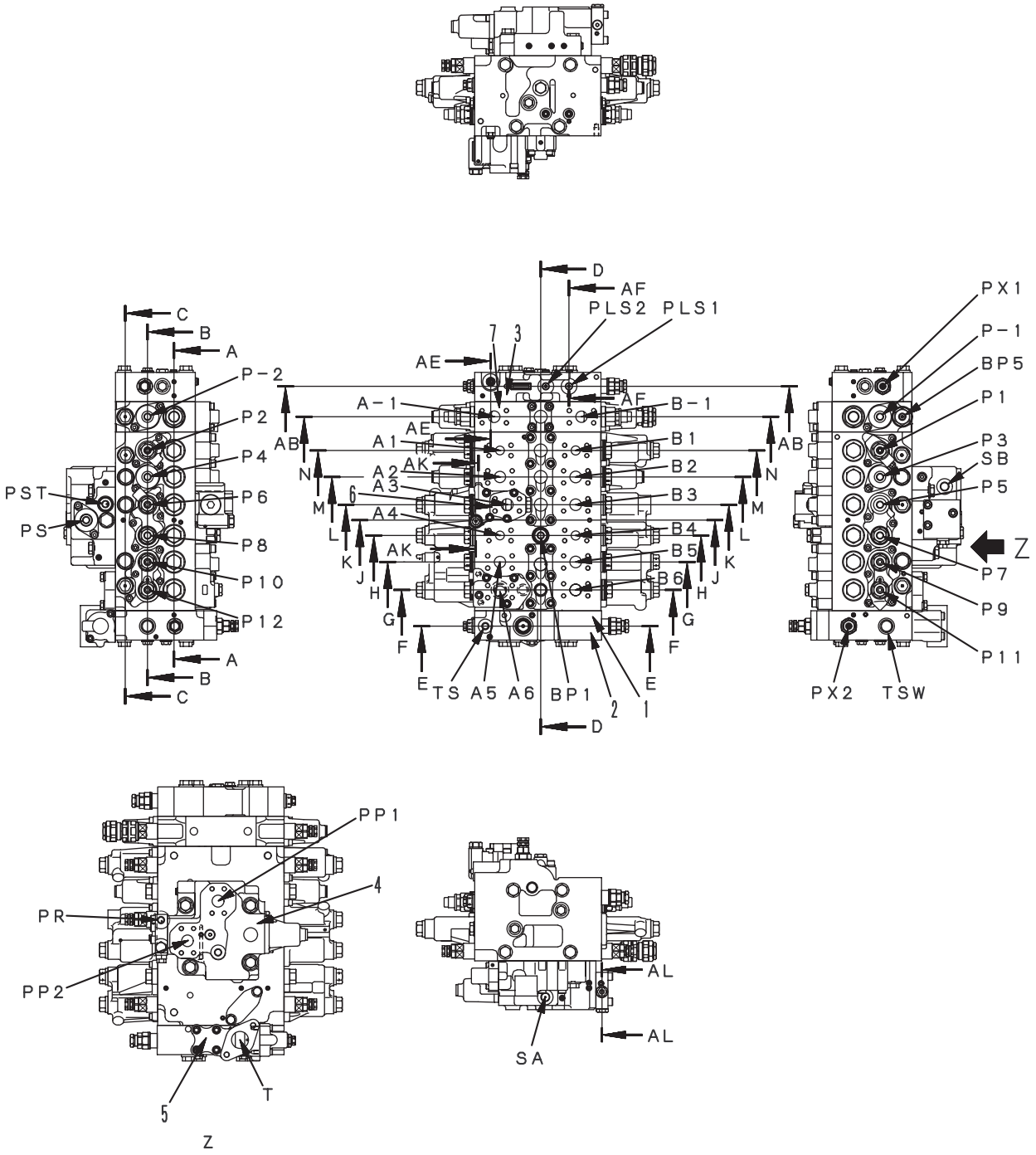
- This control valve consists of a 6-spool valve (unit type), 1 service valves, a pump merge-divider valve, a back pressure valve, and a boom hydraulic drift prevention valve.
- Since all the valves are assembled together with connecting bolts and their passes are connected to each other inside the assembly, the assembly is small in size and easy to maintain.
- Since one spool of this control valve is used for one work equipment unit, its structure is simple.

A1 :To bucket cylinder head
A2 :To left travel motor
A3 :To boom cylinder bottom
A4 :To swing motor
A5 :To right travel motor
A6 :To arm cylinder head
A-1 :To attachment
B1 :To bucket cylinder bottom
B2 :To left travel motor
B3 :To bottom cylinder head
B4 :To swing motor
B5 :To right travel motor
B6 :To arm cylinder bottom
B-1 :To attachment
P1 :From bucket PPC valve
P2 :From bucket PPC valve
P3 :From left travel PPC valve
P4 :From left travel PPC valve
P5 :From boom PPC valve
P6 :From boom PPC valve
P7 :From swing PPC valve
P8 :From swing PPC valve
P9 : From right travel PPC valve
P10 : From right travel PPC valve
P11 : From arm PPC valve

P-1 :From service PPC valve
P-2 : From service PPC valve
BP1: Boom RAISE PPC output pressure
BP5: From attachment circuit selector solenoid valve
PLS1:To rear pump control
PLS2:To front pump control
PP1 : From rear main pump
PP2 : From front main pump
PR : To solenoid valve, PPC valve, EPC valve
PS : From pump merge-divider solenoid valve
PST: From travel junction valve
PX1: From 2-stage solenoid valve
PX2: From 2-stage solenoid valve
SA : Pressure sensor fitting port
SB : Pressure sensor fitting port
T : To tank
TS : To tank
TSW: To swing motor

7-spool valve
(6-spool valve + 1 service valves)

(1/9)



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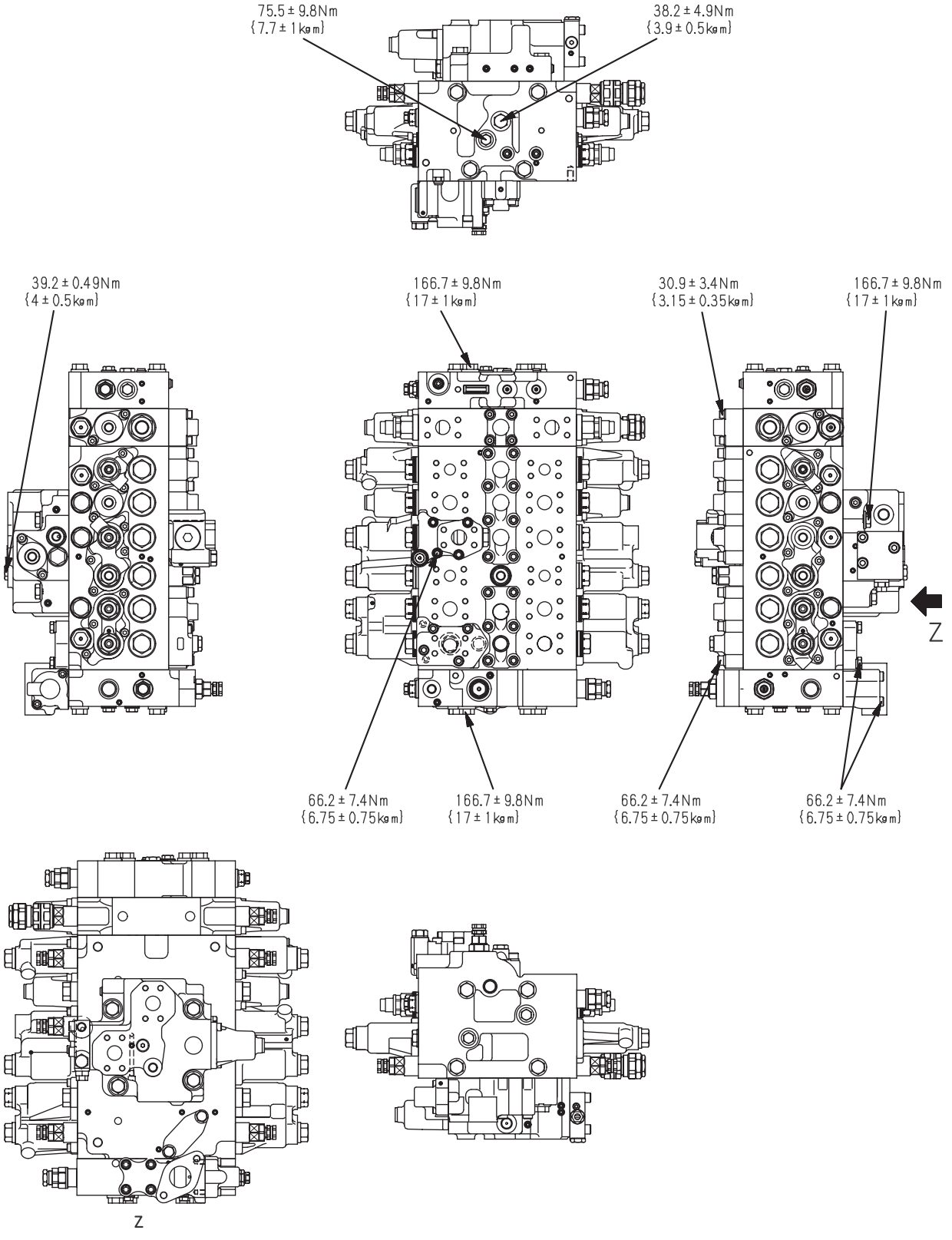
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166.7 ± 9.8Nm
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Z
66.2 ± 7.4Nm
{6.75 ± 0.75kgm}
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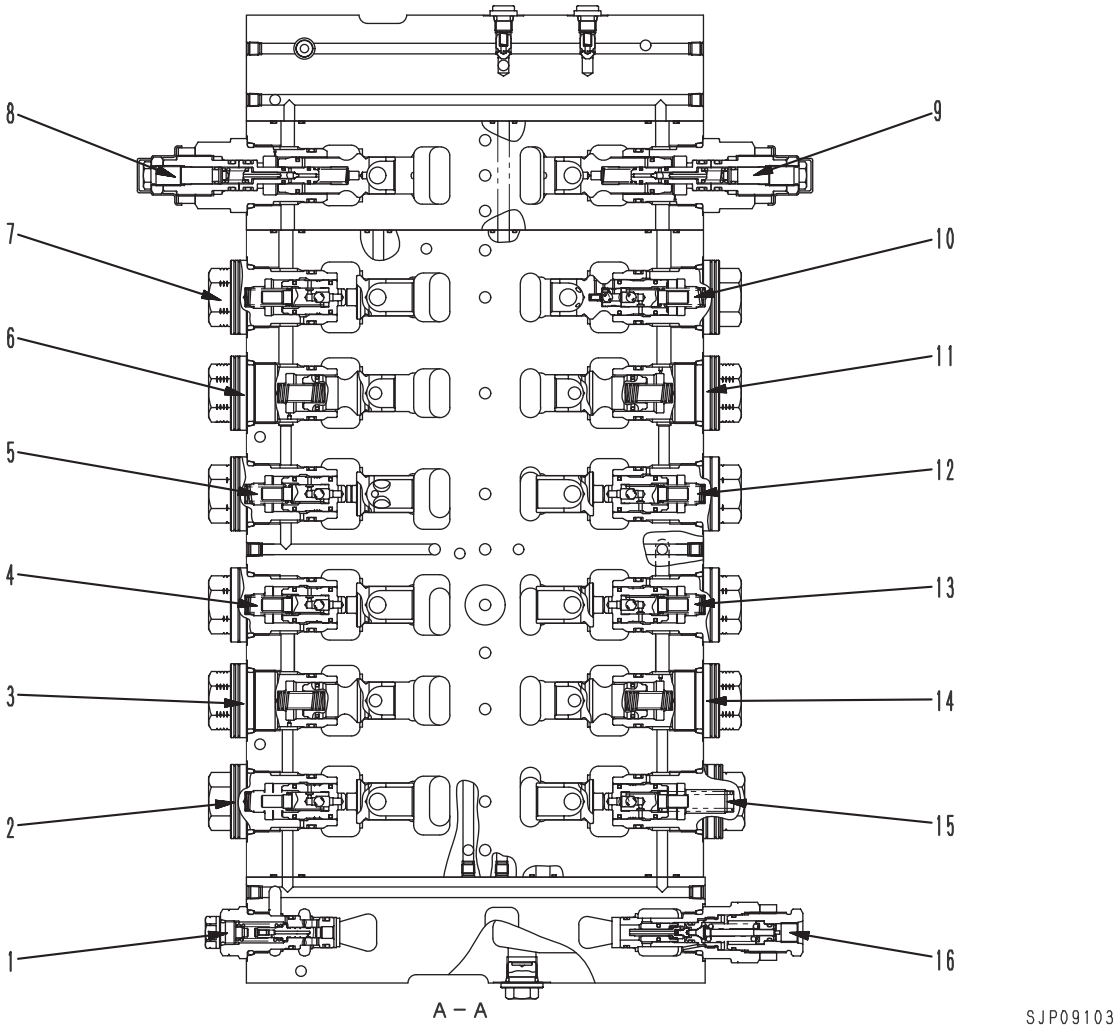
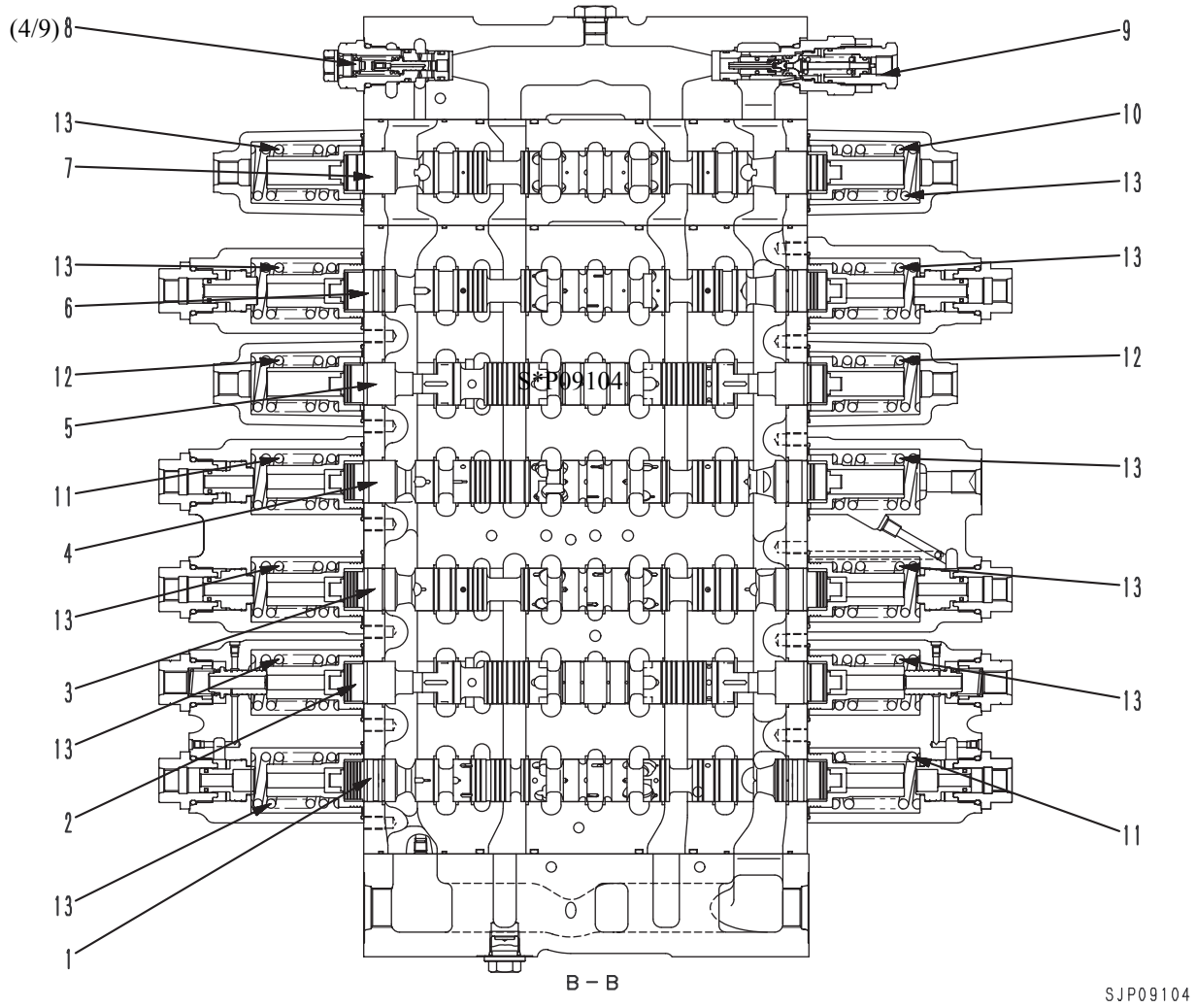


1. Unload valve
2. Pressure compensation valve (Arm OUT)
3. Pressure compensation valve (Right travel Reverse)
4. Pressure compensation valve (Left swing)
5. Pressure compensation valve (Boom RAISE)
6. Pressure compensation valve (Left travel reverse)
7. Pressure compensation valve (Bucket DUMP)
8. Pressure compensation valve (Service)
9. Pressure compensation valve (Service)
10. Pressure compensation valve (Bucket CURL)
11. Pressure compensation valve (Left travel forward)
12. Pressure compensation valve (Boom LOWER)
13. Pressure compensation valve (Right swing)
14. Pressure compensation valve (Right travel forward)
15. Pressure compensation valve (Arm IN)
16. Main relief valve

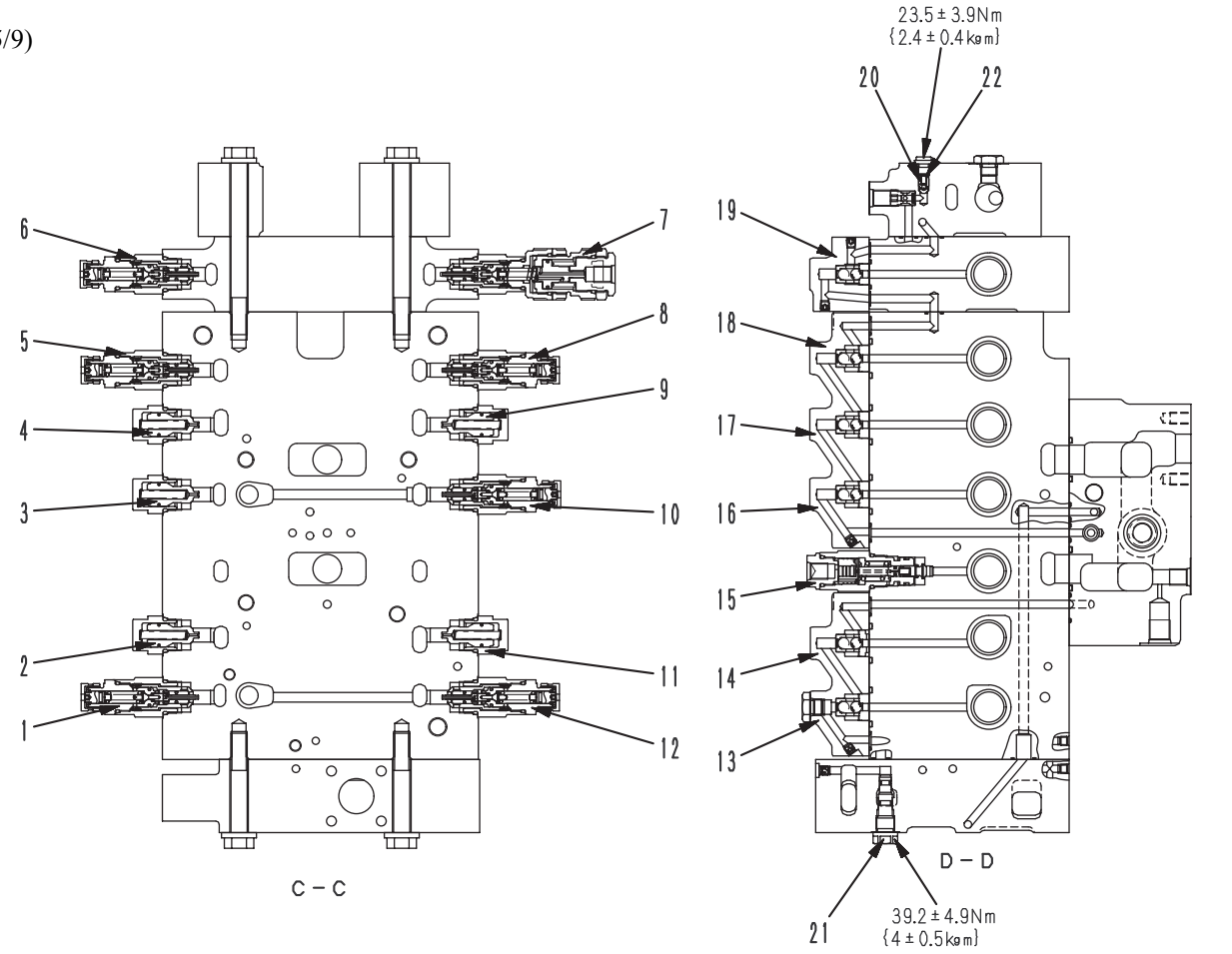


1. Spool (Arm)
2. Spool (Right travel)
3. Spool (Swing)
4. Spool (Boom)
5. Spool (Left travel)
6. Spool (Bucket)
7. Spool (Service)
8. Unload valve
9. Main relief valve
10. Spool return spring

Unit: mm

No.	Check item	Criteria					Remedy
		Standard size			Repair limit		
11	Spool return spring	Free length x Outside diameter	Installed length	Installed load	Free length	Installed load	If damaged or deformed, replace spring
		54.2 x 34.8	51.2	416.5 N {42.5 kg}	—	333.2 N {34 kg}	
12	Spool return spring	54.6 x 34.8	51.2	429.9 N {43.9 kg}	—	336.1 N {34.3 kg}	
13	Spool return spring	54.5 x 34.8	51.2	393 N {40.1 kg}	—	314.6 N {32.1 kg}	

(5/9)

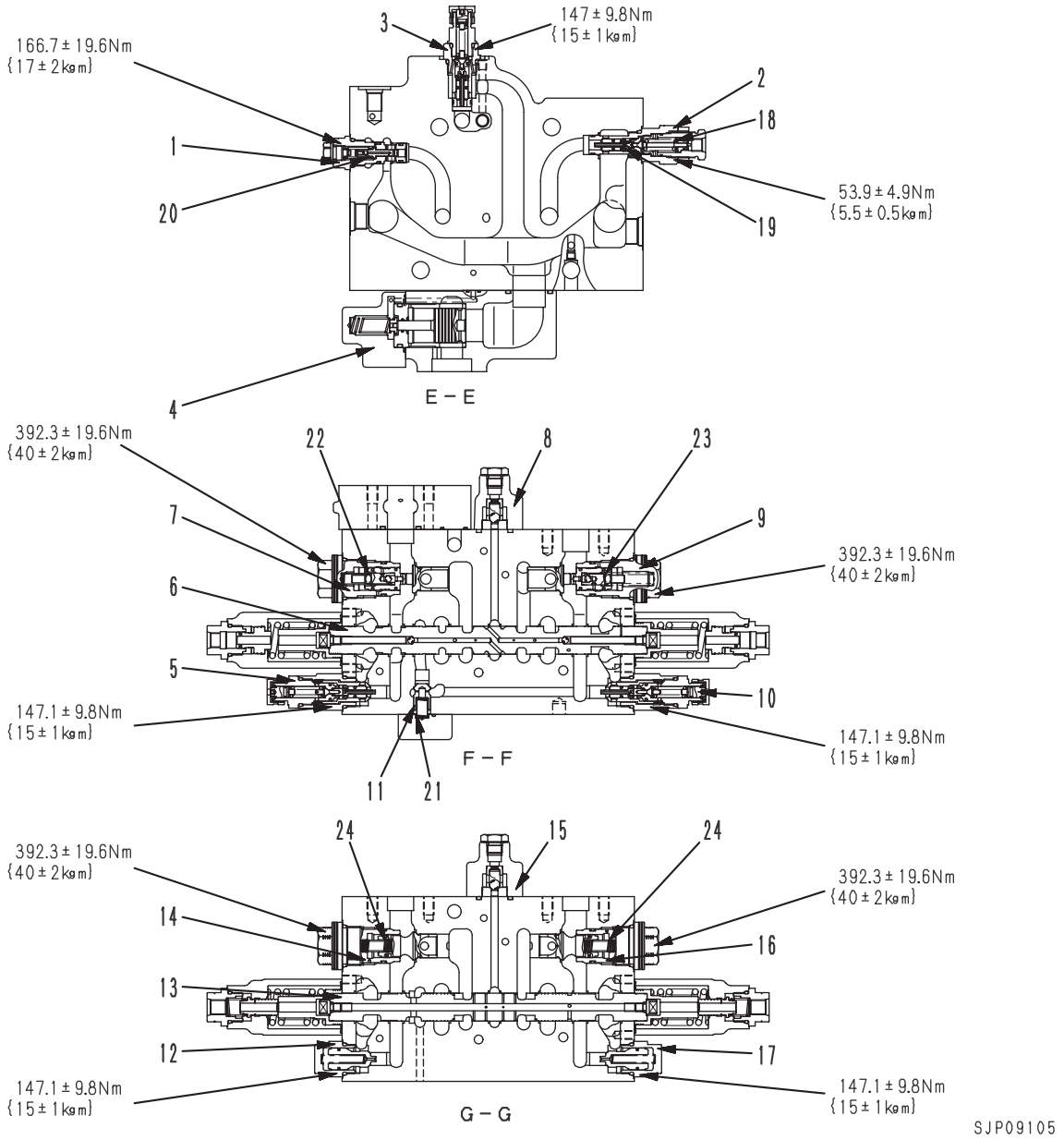


1. Safety-suction valve (Arm OUT)
2. Suction valve (Right travel reverse)
3. Suction valve (Boom RAISE)
4. Suction valve (Left travel reverse)
5. Safety-suction valve (Bucket DUMP)
6. Safety-suction valve (Service)
7. Safety-suction valve (2-stage) (Service)
8. Safety-suction valve (Bucket CURL)
9. Suction valve (Left travel forward)
10. Safety-suction valve (Boom LOWER)
11. Suction valve (Right travel forward)
12. Safety-suction valve (Arm IN)
13. LS shuttle valve (Arm)
14. LS shuttle valve (Right travel)
15. LS select valve
16. LS shuttle valve (Boom)
17. LS shuttle valve (Left travel)
18. LS shuttle valve (Bucket)
19. LS shuttle valve (Service)
20. LS check valve
21. Pressure relief plug

Unit: mm

No.	Check item	Criteria					Remedy
		Standard size			Repair limit		
22	Check valve spring	Free length x Outside diameter	Installed length	Installed load	Free length	Installed load	If damaged or deformed, replace spring
		11.5 x 4.6	8.5	1.5 N {0.15 kg}	—	1.2 N {0.12 kg}	

(6/9)



ARM CONTROL VALVE

1. Unload valve
2. Main relief valve
3. Safety valve (Boom RAISE)
4. Lift check valve
5. Safety-suction valve
6. Spool
7. Pressure compensation valve (OUT)
8. LS shuttle valve
9. Pressure compensation valve (IN)
10. Safety-suction valve
11. Check valve for regeneration circuit

R. H. TRAVEL CONTROL VALVE

12. Suction valve
13. Spool
14. Pressure compensation valve (Reverse)
15. LS shuttle valve
16. Pressure compensation valve (Forward)
17. Suction valve

Unit: mm

No.	Check item	Criteria					Remedy
		Standard size			Repair limit		
18	Relief spring	Free length x Outside diameter	Installed length	Installed load	Free length	Installed load	
		34.7 x 10.4	32.3	430.2 N {43.9 kg}	—	344.2 N {35.1 kg}	
19	Valve spring	10.45 x 7	4.8	3.1 N {0.32 kg}	—	2.5 N {0.26 kg}	
20	Unload spring	31.5 x 10.2	26.9	70.6 N {7.2 kg}	—	56.4 N {5.8 kg}	If damaged or deformed, replace spring
21	Regeneration valve spring	31.5 x 10.3	19	6.2 N {0.6 kg}	—	4.9 N {0.5 kg}	
22	Piston return spring	48.1 x 10.8	28	17.5 N {1.8 kg}	—	14.0 N {1.4 kg}	
23	Piston return spring	56.4 x 11.9	45	79.4 N {8.1 kg}	—	63.5 N {6.5 kg}	
24	Piston return spring	36.9 x 11.1	28	29.4 N {3 kg}	—	23.5 N {2.4 kg}	

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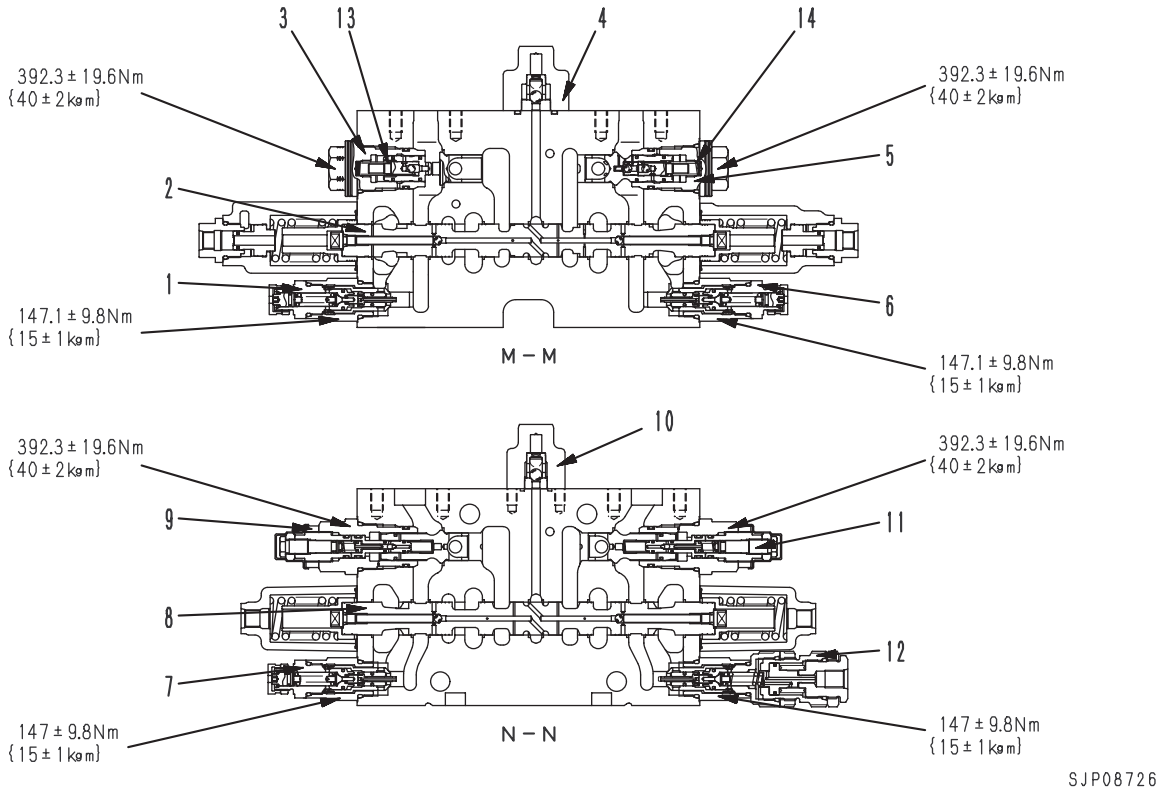

BUCKET CONTROL VALVE

1. Safety-suction valve
2. Spool
3. Pressure compensation valve (DUMP)
4. LS shuttle valve
5. Pressure compensation valve (CURL)
6. Safety-suction valve

SERVICE VALVE

7. Safety-suction valve
8. Spool
9. Pressure compensation valve
10. LS shuttle valve
11. Pressure compensation valve
12. Safety-suction valve

Unit: mm

No.	Check item	Criteria					Remedy
		Standard size			Repair limit		
13	Piston return spring	Free length x Out-side diameter	Installed length	Installed load	Free length	Installed load	If damaged or deformed, replace spring
		48.1 x 10.8	28	17.5 N {1.8 kg}	—	14.0 N {1.4 kg}	
14	Piston return spring	36.9 x 11.1	28	29.4 N {3 kg}	—	23.5 N {2.4 kg}	

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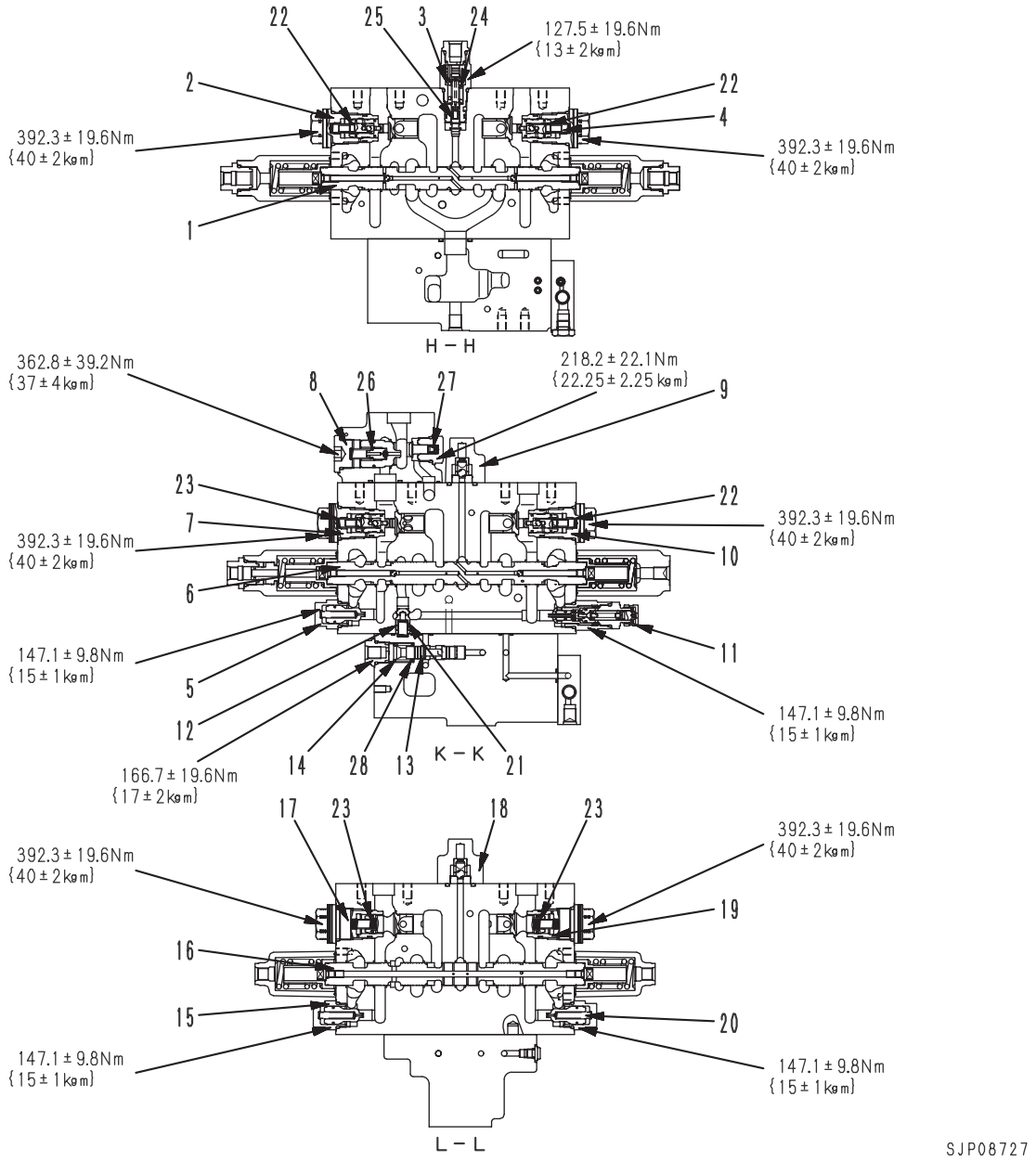

SWING CONTROL VALVE

1. Spool
2. Pressure compensation valve (Left)
3. LS select valve
4. Pressure compensation valve (Right)

BOOM CONTROL VALVE

5. Suction valve
6. Spool
7. Pressure compensation valve (RAISE)
8. Hydraulic drift prevention valve
9. LS shuttle valve
10. Pressure compensation valve (Lower)
11. Safety-suction valve
12. Check valve for regeneration circuit

L. H. TRAVEL CONTROL VALVE

13. Pump merge-divider valve (Travel junction valve)
14. Return spring
15. Suction valve
16. Spool
17. Pressure compensation valve (Reverse)
18. LS shuttle valve
19. Pressure compensation valve (Forward)
20. Suction valve

Unit: mm

No.	Check item	Criteria					Remedy
		Standard size			Repair limit		
21	Regeneration valve spring	Free length x Outside diameter	Installed length	Installed load	Free length	Installed load	If damaged or deformed, replace spring
		31.5 x 10.3	19	6.2 N {0.6 kg}	—	4.9 N {0.5 kg}	
22	Piston return spring	48.1 x 10.8	28	17.5 N {1.8 kg}	—	14.0 N {1.4 kg}	
23	Piston return spring	36.9 x 11.1	28	29.4 N {3 kg}	—	23.5 N {2.4 kg}	
24	Load spring	30.4 x 16.7	27	428.3 N {43.7 kg}	—	343 N {35.0 kg}	
25	Check valve spring	13.6 x 5.5	10	3.0 N {0.3 kg}	—	2.4 N {0.25 kg}	
26	Check valve spring	33.0 x 12.0	26	35.3 N {3.6 kg}	—	28.2 N {2.9 kg}	
27	Check valve spring	16.4 x 8.9	11.5	13.7 N {1.4 kg}	—	11.0 N {1.1 kg}	
28	Spool return spring	30.7 x 20.5	23	50.0 N {5.1 kg}	—	40.0 N {4.1 kg}	

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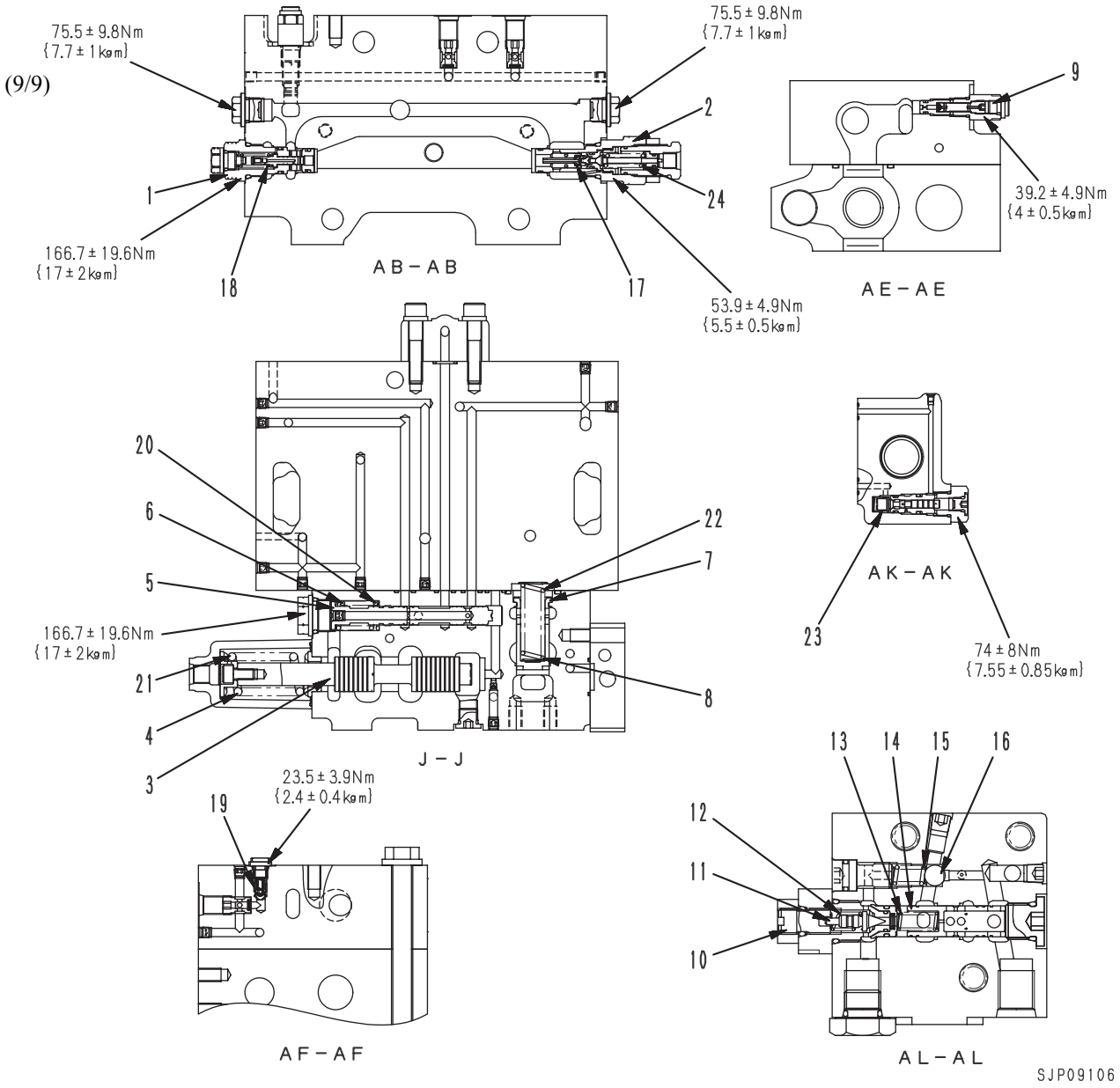


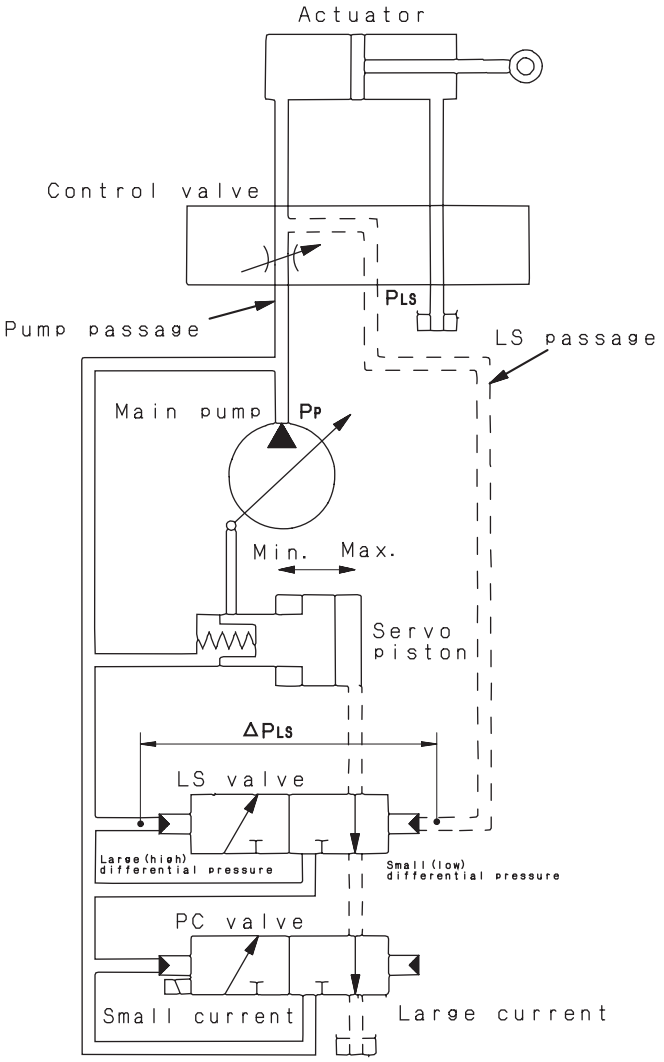
1. Unload valve
2. Main relief valve
3. Pump merge-divider valve (Main)
4. Return spring
5. Pump merge-divider valve (For LS)
6. Return spring
7. Valve (Sequence valve)
8. Spring (Sequence valve)
9. LS bypass plug
10. Screw
11. Poppet
12. Spring (Pressure reducing valve pilot)
13. Spring (Pressure reducing valve main)
14. Valve (Pressure reducing valve)
15. Spring (Safety valve)
16. Ball

Basic principle

1) Control of pump swash plate

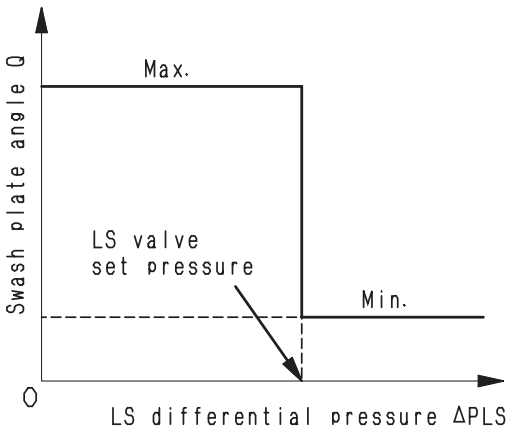
- The pump swash plate angle (pump discharge amount) is controlled so that LS differential pressure **ΔPLS** (the difference between pump pressure **PP** and control valve outlet port LS pressure **PLS**) (load pressure of actuator) is constant.

  (LS pressure **ΔPLS** = Pump discharge pressure **PP** – LS pressure **PLS**)



SBP03454

- If LS differential pressure **ΔPLS** becomes lower than the set pressure of the LS valve (when the actuator load pressure is high), the pump swash plate moves towards the maximum position; if it becomes higher than the set pressure of the LS valve (when the actuator load pressure is low), the pump swash plate moves towards the minimum position.

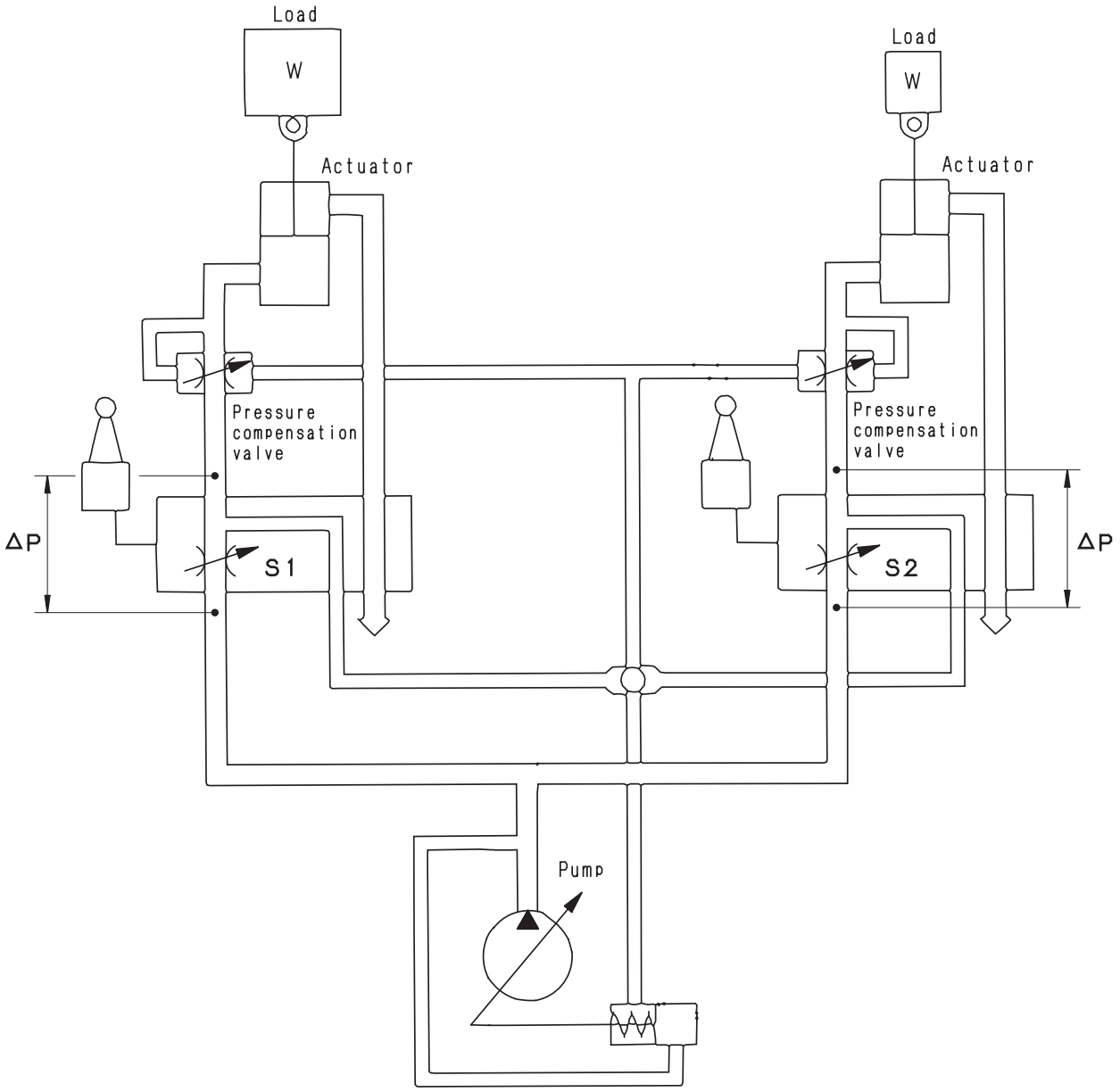


SAP03455

2) Pressure compensation

- A pressure compensation valve is installed to the outlet port side of the control valve to balance the load.
- When two actuators are operated together, this valve acts to make pressure difference ΔP between the upstream (inlet port) and downstream (outlet port) of the spool of each valve the same regardless of the size of the load (pressure).

In this way, the flow of oil from the pump is divided (compensated) in proportion to the area of opening **S1** and **S2** of each valve.



SBP03456

SELF PRESSURE REDUCING VALVE

FUNCTION

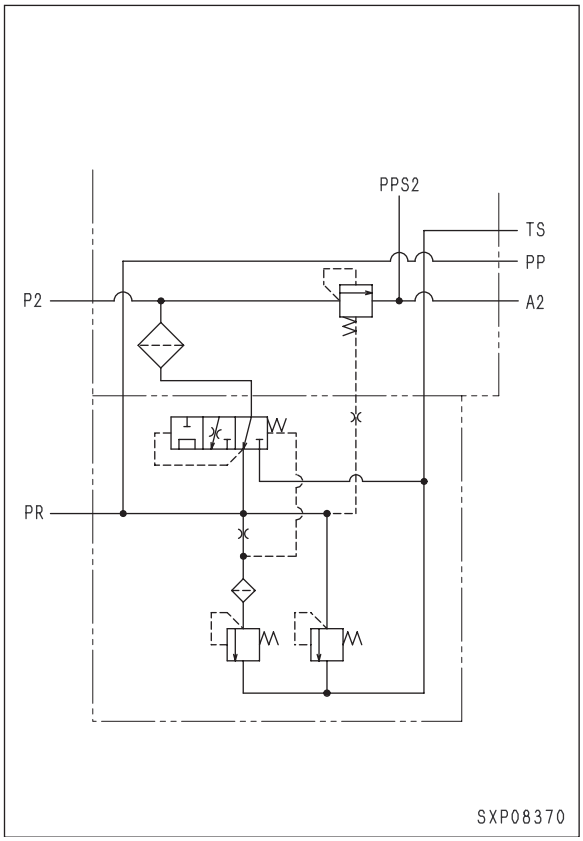
- This value reduces the discharge pressure of the main pump and supplies it as control pressure for the solenoid valves, PPC valves, etc..

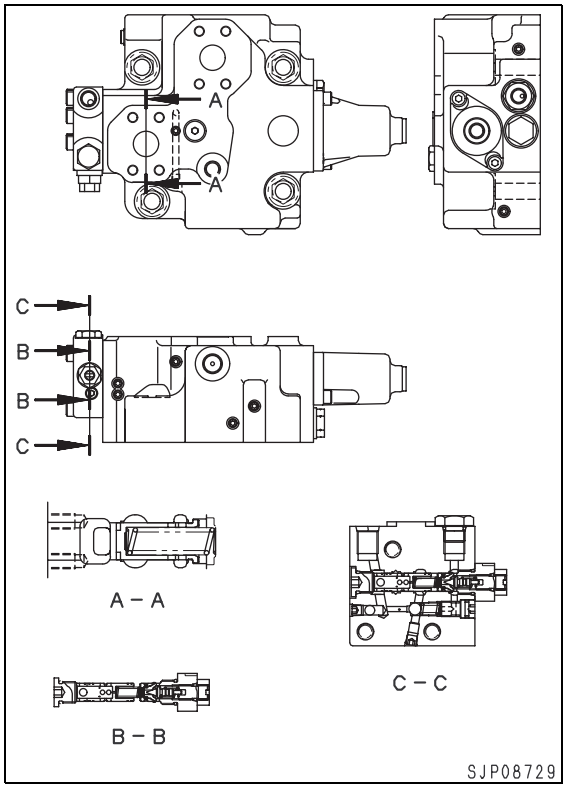
OPERATION

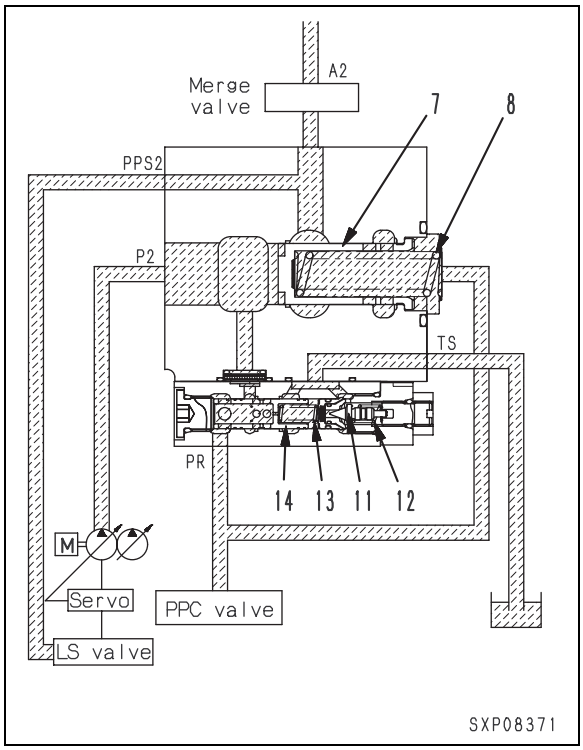
1. When engine is stopped

- Puppet (11) is pressed by spring (12) against the seat and port PR is not connected to TS.
- Valve (14) is pressed by spring (13) against the left side and port P2 is connected to PR.
- Valve (7) is pressed by spring (8) against the left side and port P2 is not connected to A2.

  (See Fig. 1.)





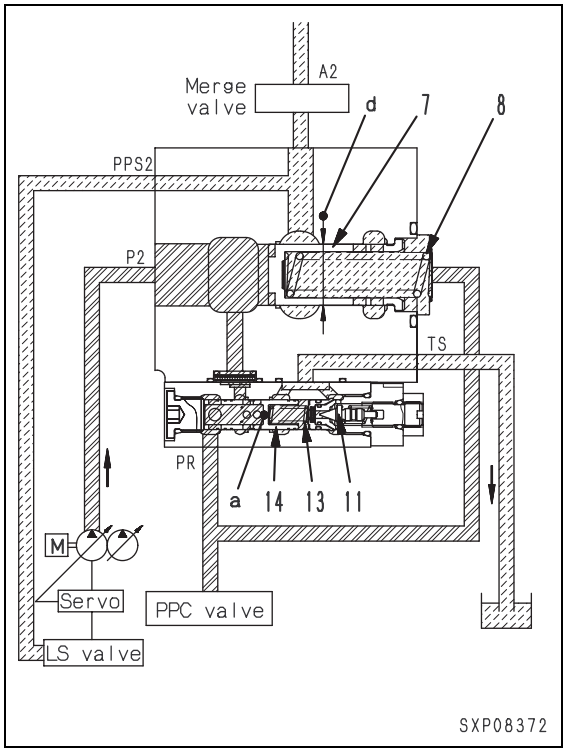


2. When in neutral or load pressure P2 is low (When boom is lowered and arm is in IN position and they are moving down under own weight)

Note: When load pressure A2 is lower than self-pressure reducing valve output pressure PR.

- Valve (7) receives the force of spring (8) and PR pressure (which is 0 MPa {0 kg/cm²} when the engine is stopped) in the direction to close the circuit between ports P2 and A2. If the hydraulic oil flows in port P2, the ϕdx P2 pressure becomes equal to the total of the force of spring (8) and the value of area of ∅d x PR pressure, then the area of the pass between ports P2 and A2 is so adjusted that the P2 pressure will be kept constant above the PR pressure.
- If the PR pressure rises above the set level, puppet (11) opens and the hydraulic oil flows from the PR port through orifice "a" in spool (14) and open part of puppet (11) to seal drain port TS.

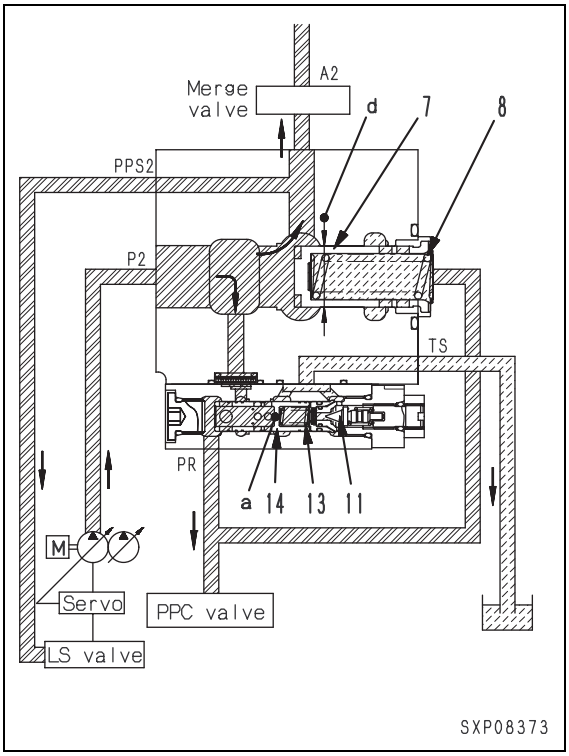
  Accordingly, differential pressure is generated between before and after orifice "a" in spool (14) and then spool (14) moves to close the pass between port P2 and PR. The P2 pressure is controlled constant (at the set pressure) by the area of the oil pass at this time and supplied as the PR pressure. (See Fig. 2.)



3. When load pressure P2 is high

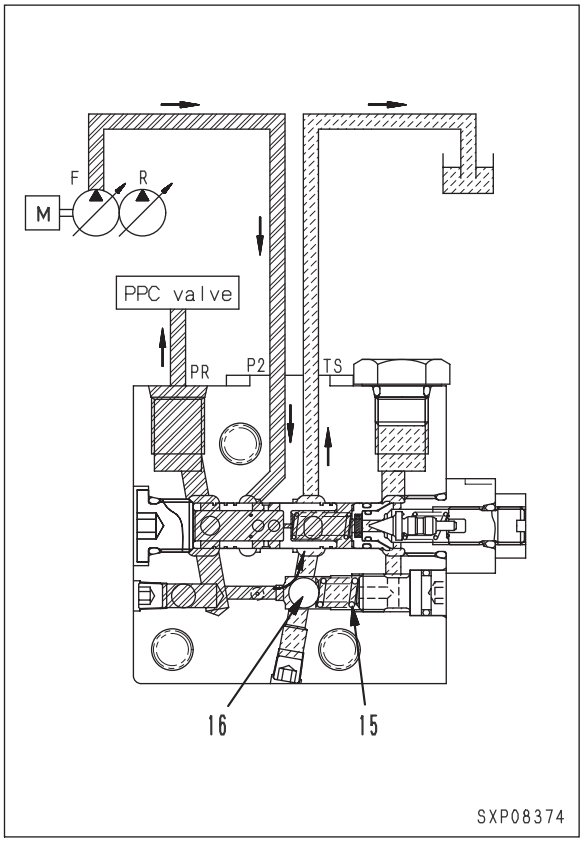
- If load pressure A2 rises and the pump discharge increases because of operation of the work equipment, the ϕdx P2 pressure rises higher than the total of the force of spring (8) and the value of ∅d x PR pressure, and then valve (7) moves to the right stroke end.
- As a result, the area of the pass between ports P2 and A2 increases and the pass resistance lowers and the loss of the engine power is reduced.
- If the PR pressure rises above the set pressure, puppet (11) opens and the hydraulic oil flows from the PR port through orifice "a" in spool (14) and open part of puppet (11) to seal drain port TS.

  Accordingly, differential pressure is generated between before and after orifice "a" in spool (14) and then spool (14) moves to close the pass between port P2 and PR. The P2 pressure is controlled constant (at the set pressure) by the area of the oil pass at this time and supplied as the PR pressure. (See Fig. 3.)



4. When abnormally high pressure is generated

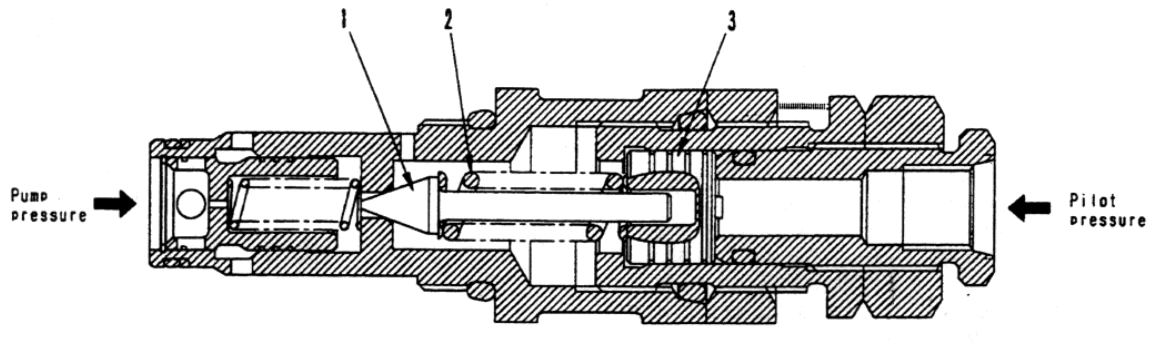
- If the PR pressure on the self-pressure reducing valve rises high abnormally, ball (16) separates from the seat against the force of spring (15) and the hydraulic oil flows from output port PR to TS. Accordingly, the PR pressure lowers. By this operation, the hydraulic devices (PPC valves, solenoid valves, etc.) are protected from abnormal pressure. (See Fig. 4.)



Unit: mm

No.	Check item	Criteria					Remedy
		Standard size			Repair limit		
17	Valve spring	Free length x Outside diameter	Installed length	Installed load	Free length	Installed load	
		10.45 x 7	4.8	3.1 N {0.32 kg}	—	2.5 N {0.26 kg}	
18	Unload spring	31.5 x 10.2	26.8	70.6 N {7.2 kg}	—	56.4 N {5.8 kg}	
19	Check valve spring	11.5 x 4.6	8.5	1.5 N {0.15 kg}	—	1.2 N {0.12 kg}	
20	Spool return spring	46.6 x 21.8	3.3	156.8 N {16.0 kg}	—	125.5 N {12.8 kg}	If damaged or deformed, replace spring
21	Spool return spring	64.5 x 32.3	63	177.5 N {18.1 kg}	—	142.0 N {14.5 kg}	
22	Sequence valve spring	70.9 x 18.0	59	199.8 N {20.4 kg}	—	160.0 N {16.3 kg}	
23	Spool return spring	29.9 x 11.0	10.7	10.4 N {1.1 kg}	—	8.3 N {0.8 kg}	
24	Relief spring	34.7 x 10.4	32.3	430.2 N {43.9 kg)	—	344.2 N {35.1 kg}	

MAIN RELIEF VALVE (PC210/LC/NLC-7K)

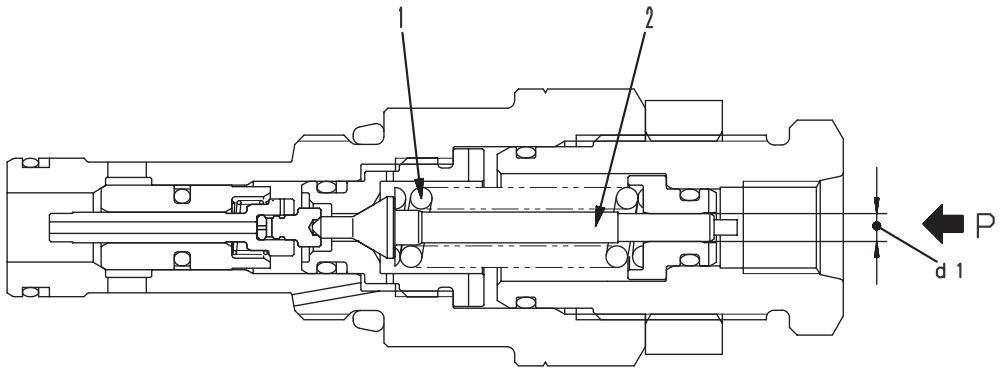


1. Poppet
2. Spring
3. Piston

Function

- The low set pressure and high set pressure can be changed by external pilot pressure.
- The relief pressure is determined by the pump pressure acting on poppet (1) and the set load of spring (2).
- When the pilot pressure is OFF, the system is set to low pressure. When the pilot pressure is ON, piston (3) is pushed fully to the left, so the force of the spring (2) increases and the relief pressure becomes the high set pressure.

MAIN RELIEF VALVE (PC240LC/NLC-7K)



SJP09020

1. Spring
2. Poppet

FUNCTION

- The relief valve set pressure is set to 2 stages.
  When power is needed, pilot pressure P is turned ON and the pressure is set to high pressure.

OPERATION

- The relief valve set pressure is determined by the installed load of spring (1). (First stage)
- It is unnecessary to set the first and second stage individually.
  The second stage is set when the first stage is set.

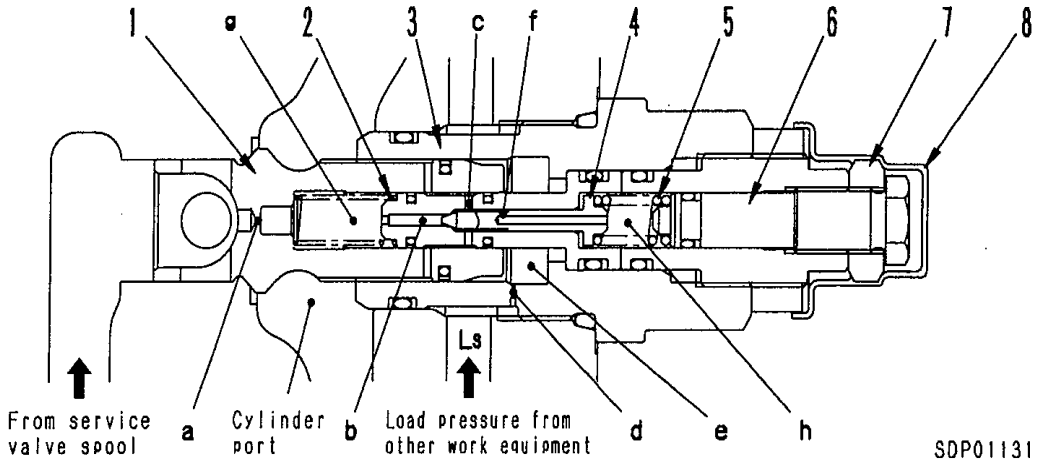
1. When pilot pressure P is OFF: Low-pressure setting

   The set pressure is determined by the installed load of spring (1).

2. When pilot pressure P is ON: High-pressure setting

   In addition to the installed load of spring (1), pilot pressure P is applied to poppet diameter d1, so the set pressure becomes higher.

VARIABLE PRESSURE COMPENSATION VALVE



1. Valve
2. Spring
3. Sleeve
4. Poppet
5. Spring
6. Screw
7. locknut
8. Plastic cap

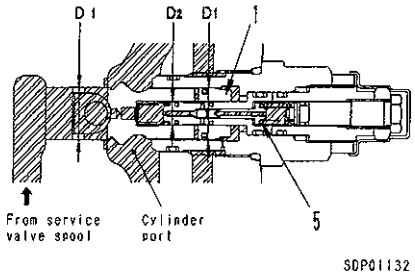
Function

- It is possible to adjust the division of the oil flow to the service valve when the service valve (for attachment) is operated together with the main control valve (boom RAISE etc.).
  (Variable in proportion to surface area)
- The pump pressure leaving the service valve spool acts on the left end of valve(1), and at the same time passes through throttle **A** and enters chamber **G.**
  The maxium **LS** pressure passes through throttle **D** and enters chamber **E.** At the same time, the cylinder port pressure passes through passage **C** and throttle **F,** and goes to chamber **H.**
  In addition, the force of spring (2) acts on valve (1), and the force of spring (5) acts on poppet (4). The force of spring (5) can be adjusted with screw(6).

Operation

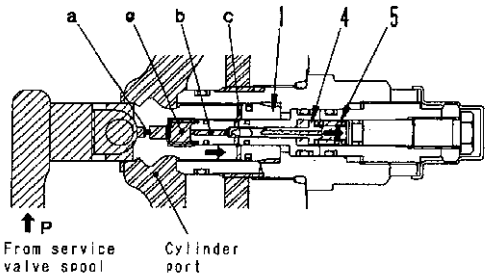
Simultaneous operation with work equipment under heavy load (boom RAISE, etc.)

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 presure 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-sectonal area of diameter D1
   A2: Cross-sectional area of diameter D2
   F: Force of spring



SDP01132

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.



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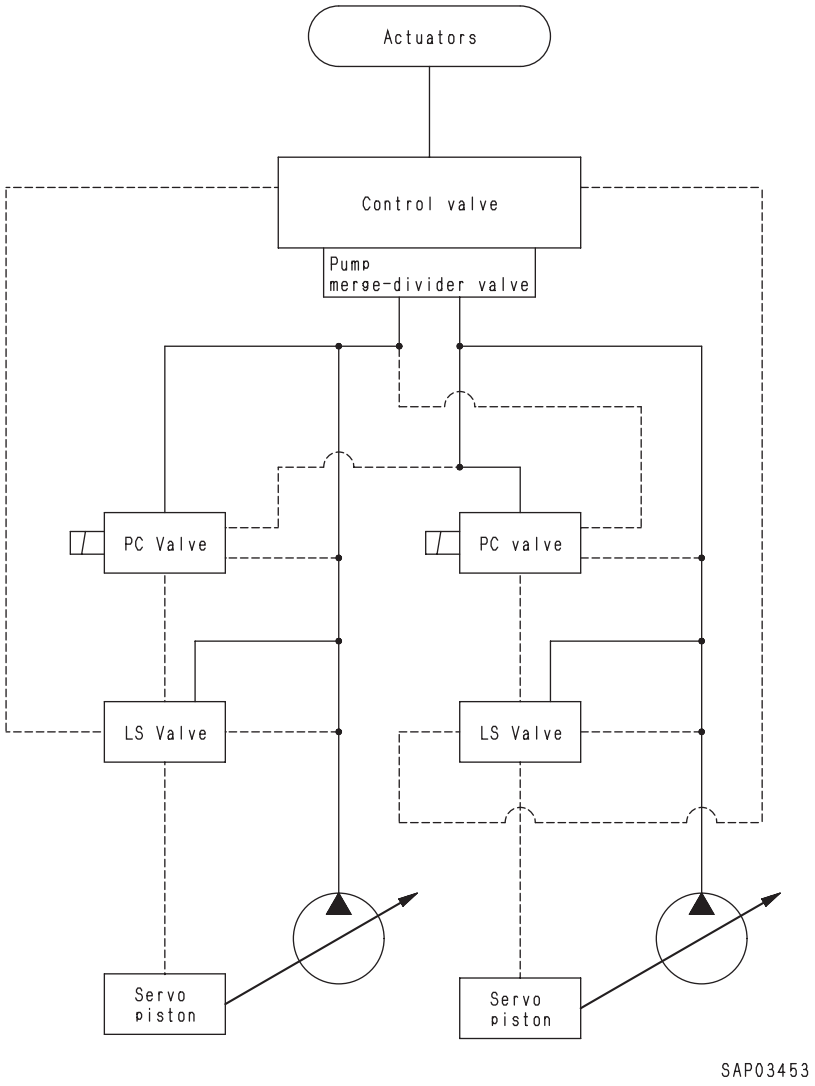
CLSS

OUTLINE OF CLSS



FEATURES

- CLSS stands for Closed center Load Sensing System, and has the following features.

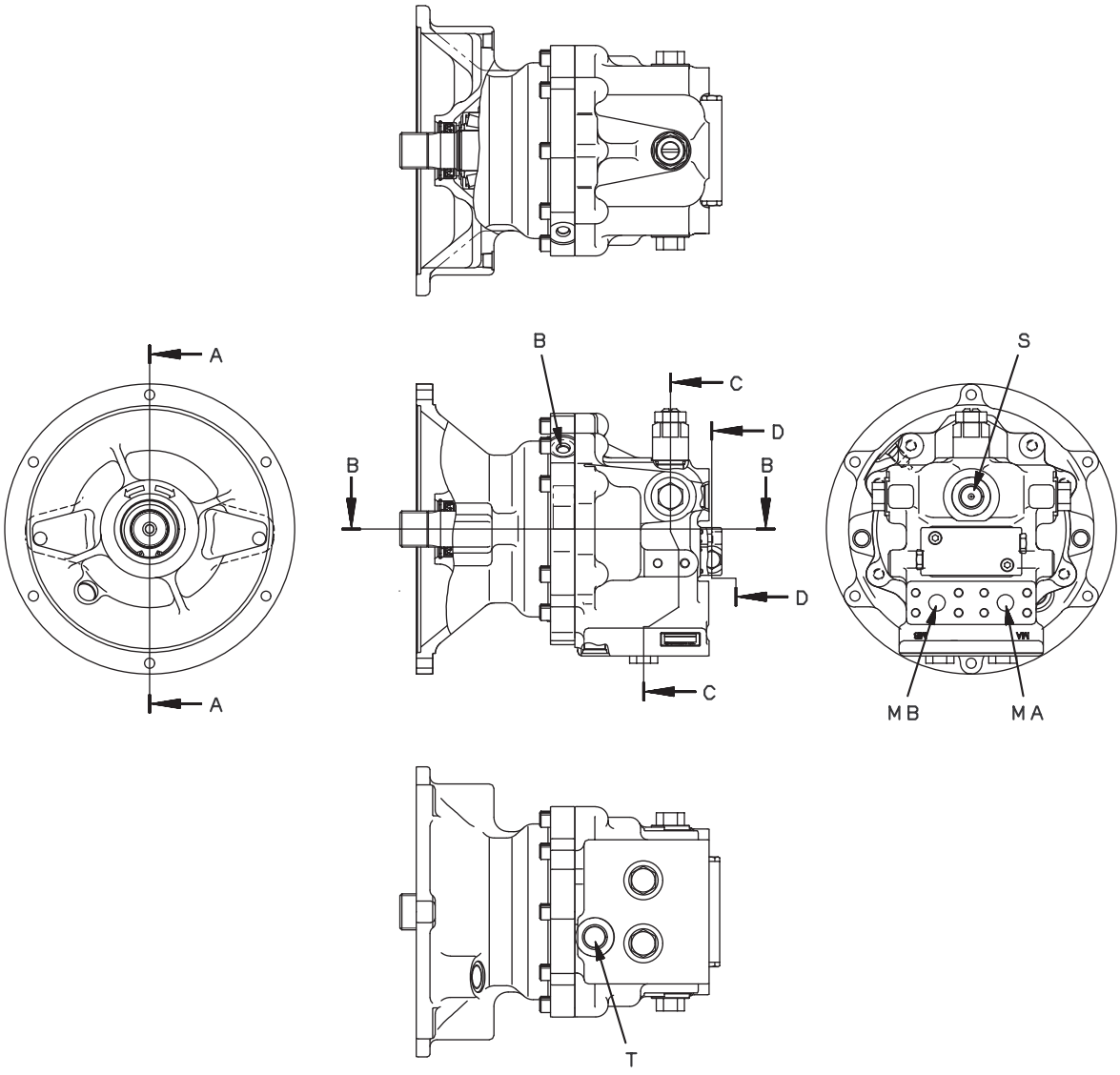
1) Fine control not influenced by load
2) Control enabling digging even with fine control
3) Ease of compound operation ensured by flow divider function using area of opening of spool during compound operations
4) Energy saving using variable pump control

STRUCTURE

- The CLSS consists of a main pump (2 pumps), control valve, and actuators for the work equipment.
- The main pump body consists of the pump itself, the PC valve and LS valve.

SWING MOTOR

KMF125ABE-5

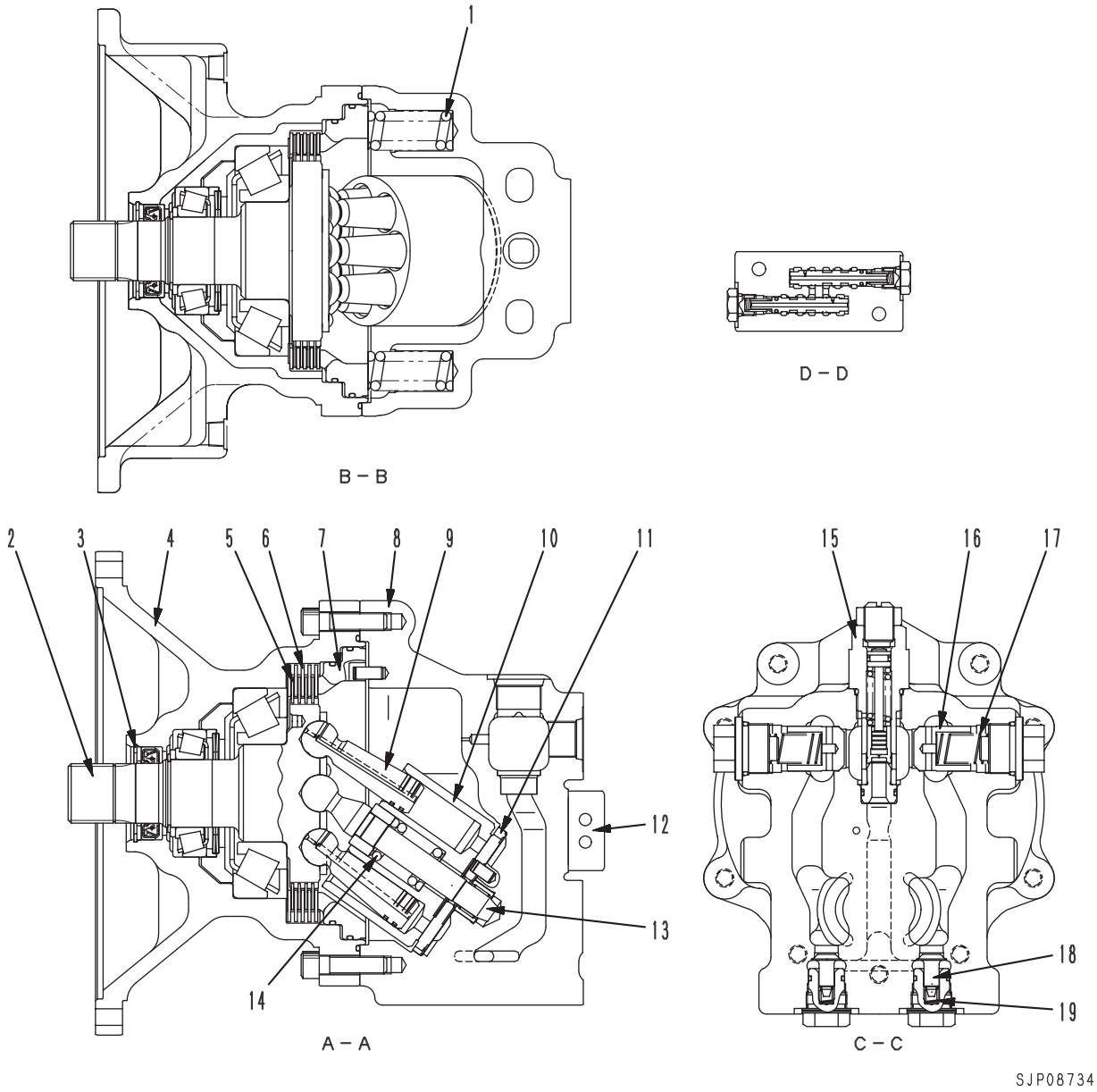


SJP08733

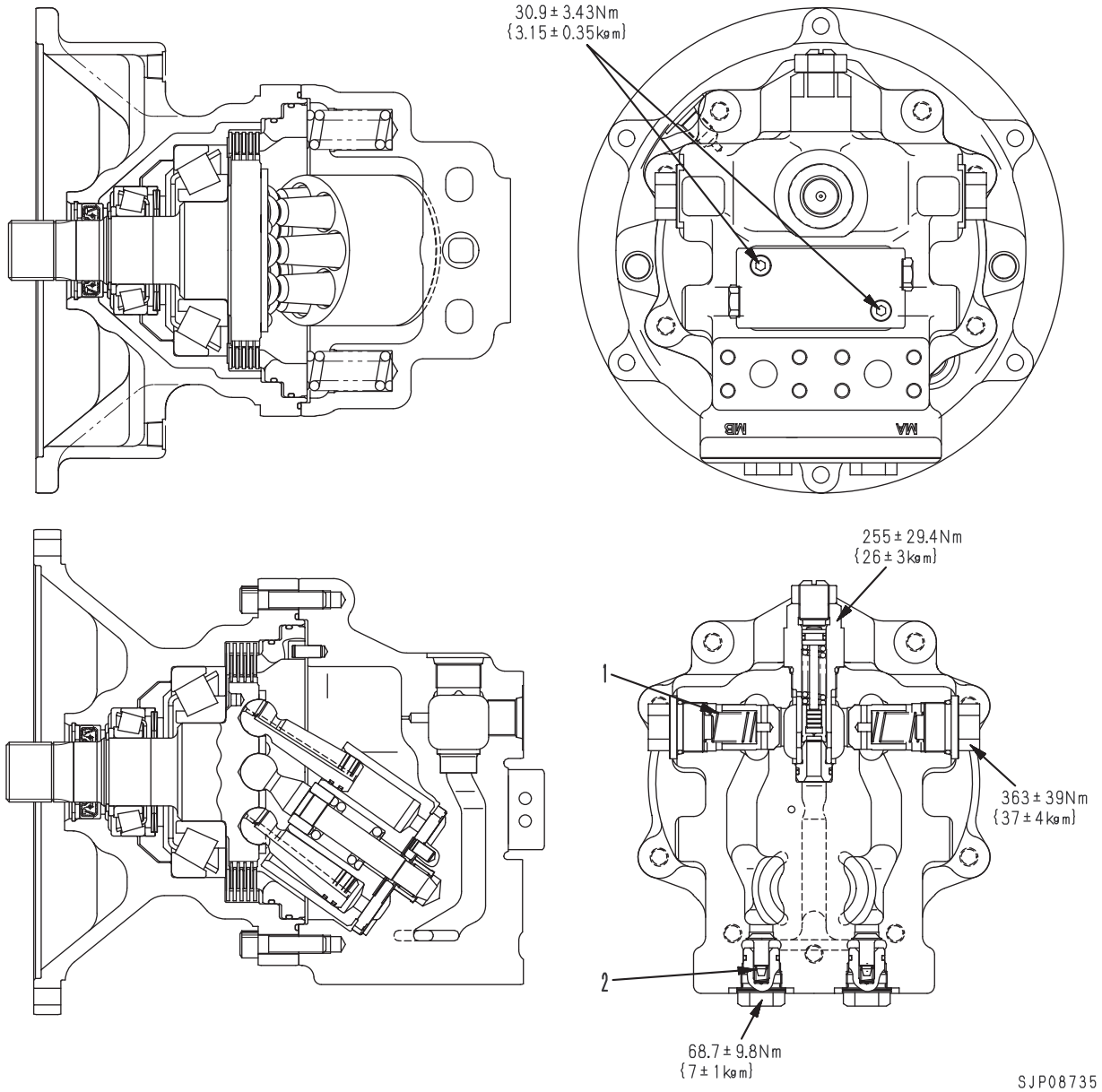
B : From swing lock solenoid valve
S : From control valve
T : To tank
MA : From control valve
MB : From control valve

SPECIFICATIONS

	PC210-7K	PC240-7K
Model	KMF125ABE-5	
Theoretical displacement	125.0 cm³/rev	
Safety valve set pressure	28.4 MPa {290 kg/cm²}	
Rated revolving speed	1,694 rpm	1,879 rpm
Brake release pressure	1.9 MPa {19 kg/cm²}	



1. Brake spring
2. Drive shaft
3. Spacer
4. Case
5. Disc
6. Plate
7. Brake piston
8. Housing
9. Piston
10. Cylinder block
11. Valve plate
12. Reverse prevention valve
13. Center shaft
14. Center spring
15. Safety valve
16. Check valve
17. Check valve spring
18. Shuttle valve
19. Shuttle valve spring



Unit: mm

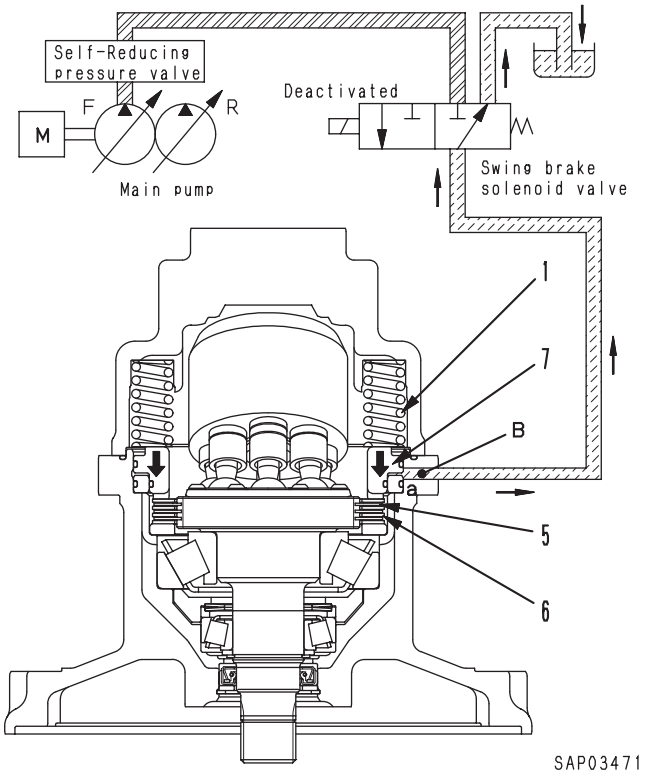
No.	Check item	Criteria					Remedy
		Standard size			Repair limit		
1	Check valve spring	Free length x Outside diameter	Installed length	Installed load	Free length	Installed load	If damaged or deformed, replace spring
		62.5 x 20.0	35	3.5 N {0.36 kg}	—	2.8 N {0.29 kg}	
2	Shuttle valve spring	16.4 x 8.9	11.5	13.7 N {1.4 kg}	—	10.8 N {1.1 kg}	

Operation of swing lock

1. When swing lock solenoid valve is deactivated

When the swing lock solenoid valve is deactivated, the pressurized oil from the main pump is shut off and port **B** is connected to the tank circuit.

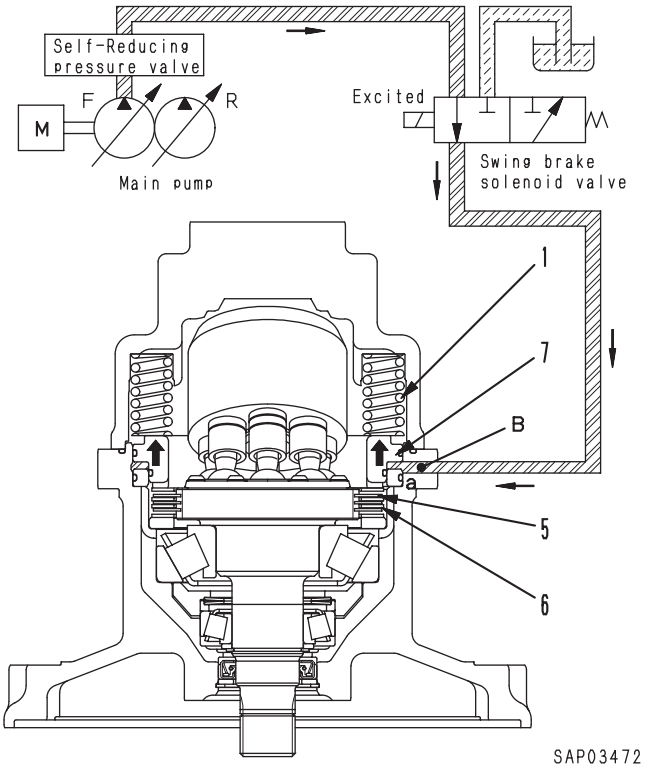
As a result, brake piston (7) is pushed down by brake spring (1), discs (5) and plates (6) are pushed together, and the brake is applied.



2. When swing lock solenoid valve is excited

When the swing lock solenoid valve is excited, the valve is switched and the pressure oil from the main pump enters port **B** and flows to brake chamber **a**.

The pressure oil entering chamber **a** overcomes brake spring (1) and pushes brake piston (7) up. As a result, discs (5) and plates (6) are separated and the brake is released.



RELIEF VALVE PORTION

1) Outline

The relief portion consists of check valves (2) and (3), shuttle valves (4) and (5), and relief valve (1).

2. Function

When the swing is stopped, the outlet port circuit of the motor from the control valve is closed, but the motor continues to rotate under inertia, so the pressure at the output side of the motor becomes abnormally high, and this may damage the motor.

To prevent this, the abnormally high pressure oil is relieved to port **S** from the outlet port of the motor (high-pressure side) to prevent any damage.

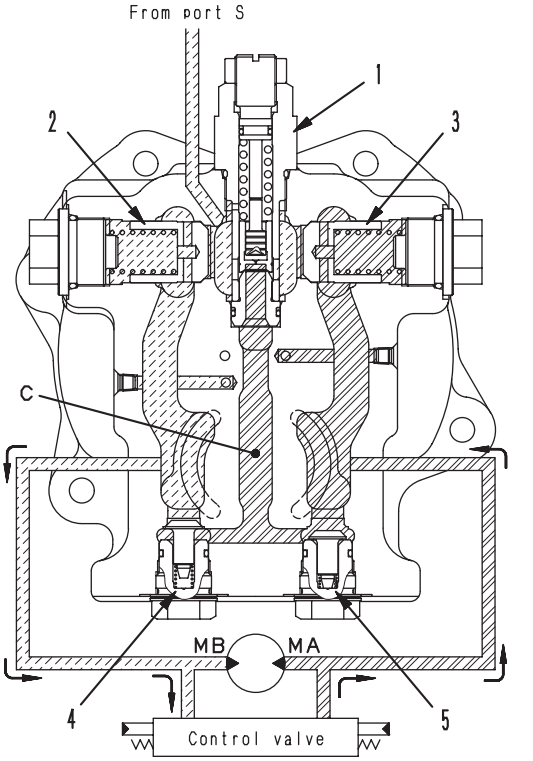
3. Operation

1) When starting swing

- When the swing control lever is operated to swing right, the pressure oil from the pump passes through the control valve and is supplied to port **MA**. As a result, the pressure at port **MA** rises, the starting torque is generated in the motor, and the motor starts to rotate. The oil from the outlet port of the motor passes from port **MA** through the control valve and returns to the tank. (Fig. 1)

2) When stopping swing

- When the swing control lever is returned to neutral, the supply of pressure oil from the pump to port **MA** is stopped. With the oil from the outlet port of the motor, the return circuit to the tank is closed by the control valve , so the pressure at port **MB** rises. As a result, rotation resistance is generated in the motor, so the braking effect starts.
- If the pressure at port **MB** becomes higher than the pressure at port **MA**, it pushes shuttle valve **A** (4) and chamber **C** becomes the same pressure as port **MB**. The oil pressure rises further until it reaches the set pressure of relief valve (1). As a result, a high braking torque acts on the motor and stops the motor. (Fig.2)
- When relief valve (1) is being actuated, the relief oil and oil from port **S** passes through check valve **B** (3) and is supplied to port **MA**. This prevents cavitation at port **MA**.



(Fig. 1)

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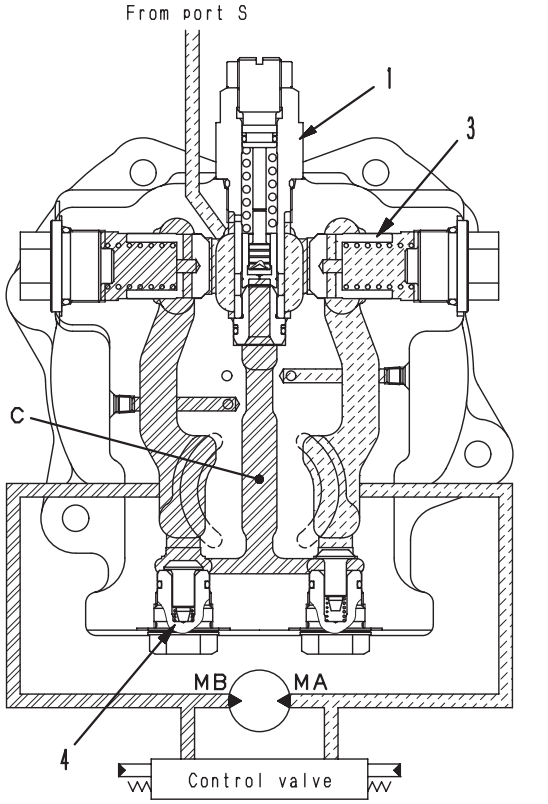
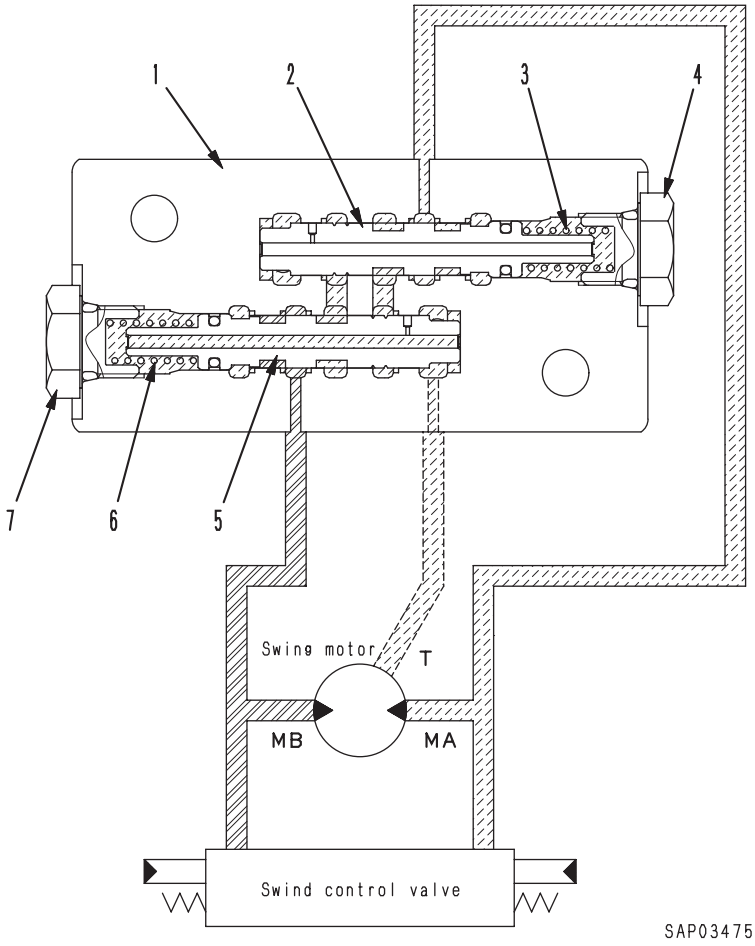


(Fig. 2)

SAP03474

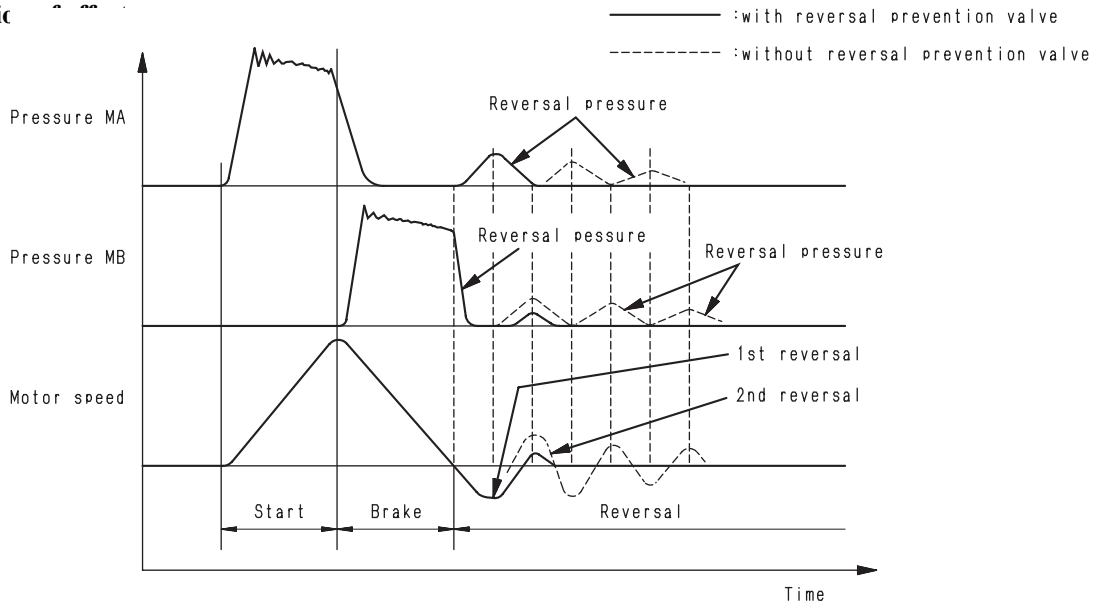
REVERSE PREVENTION VALVE

Operation diagram



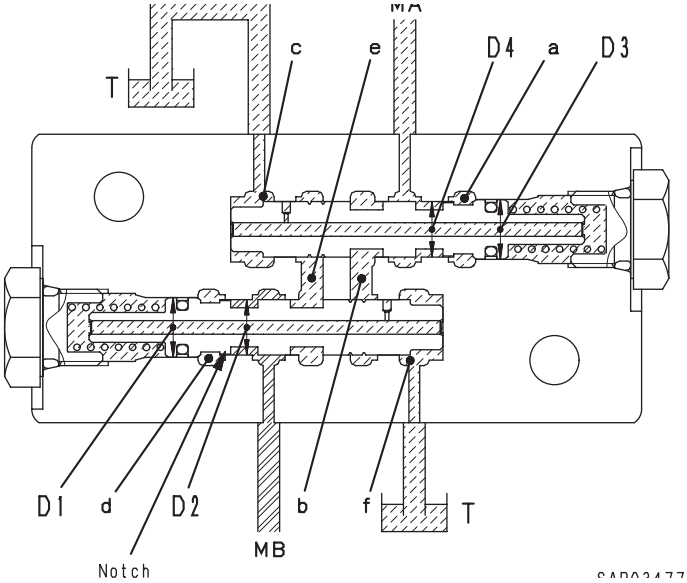
1. Valve body
2. Spool (**MA** side)
3. Spring (**MA** side)
4. Plug
5. Spool (**MB** side)
6. Spring (**MB** side)
7. Plug

Explanatic



Outline

This valve reduces the swing back generation in the swing body by the inertia of the swing body, the backlash and rigidity of the machinery system, and the compression of the hydraulic oil when the swing is stopped. This is effective in preventing spillage of the load and reducing the cycle time when stopping the swing (the positioning ability is good and it is possible to move swiftly to the next job.

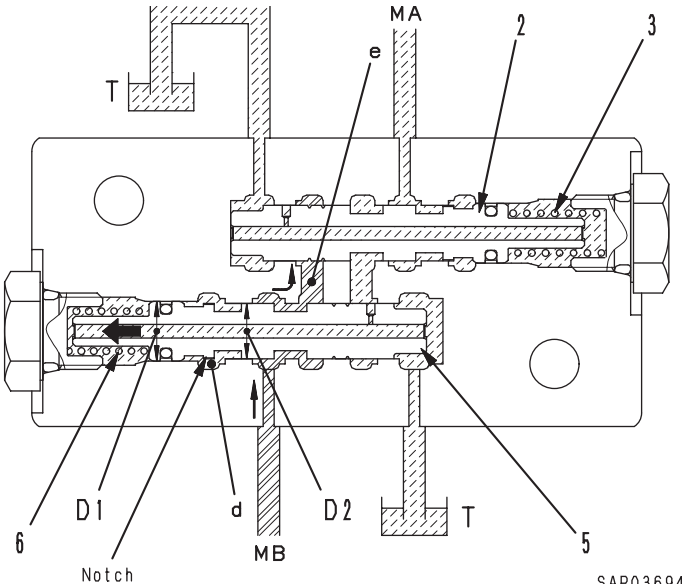


Operation

1) When brake pressure is being generated at port MB

- Pressure **MB** passes through the notch and goes to chamber **d**, spool (5) pushes spring (6) according to the difference in area **D1** > **D2**, moves to the left, and **MB** is connected to **e**.

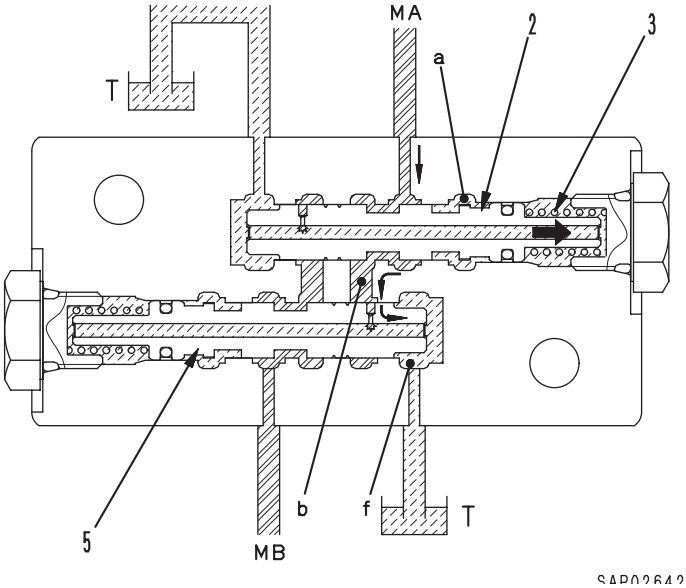
  When this happens, pressure **MA** is below the set pressure of spring (3), so spool (2) does not move. For this reason, the pressure oil is closed by spool (2), and the braking force is ensured.



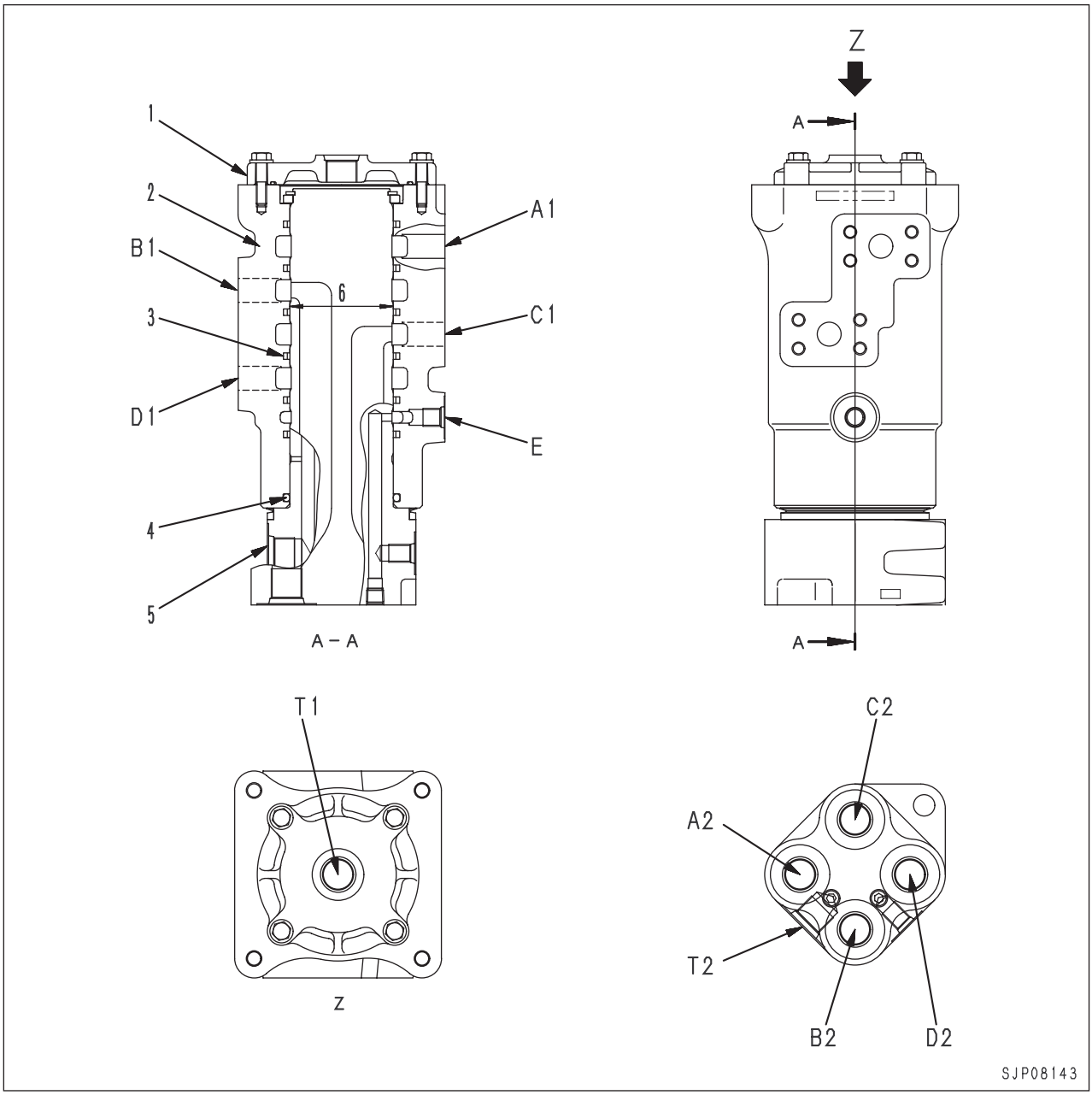
2) After motor stops

- The motor is reversed by the closing pressure generated at port **MB**. (1st reversal)

  When this happens, reversal pressure is generated at port **MA**. Pressure **MA** goes to chamber **a**, so spool (2) pushes spring (3) and moves to the right, and **MA** is connected to **B**. At the same time, **b** is connected to **f** through the drill hole in spool (5), so the reversal pressure at port **MA** is bypassed to port **T** to prevent the 2nd reversal.



CENTER SWIVEL JOINT



1. Cover
2. Body
3. Slipper seal
4. O-ring
5. Shaft

A1. To L.H. travel motor port PB
A2. From control valve port A5
C1. To R.H. travel motor port PA
B2. From control valve port B5
D1. To R.H. travel motor port PB
E. To L.H. and R.H. travel motors port P

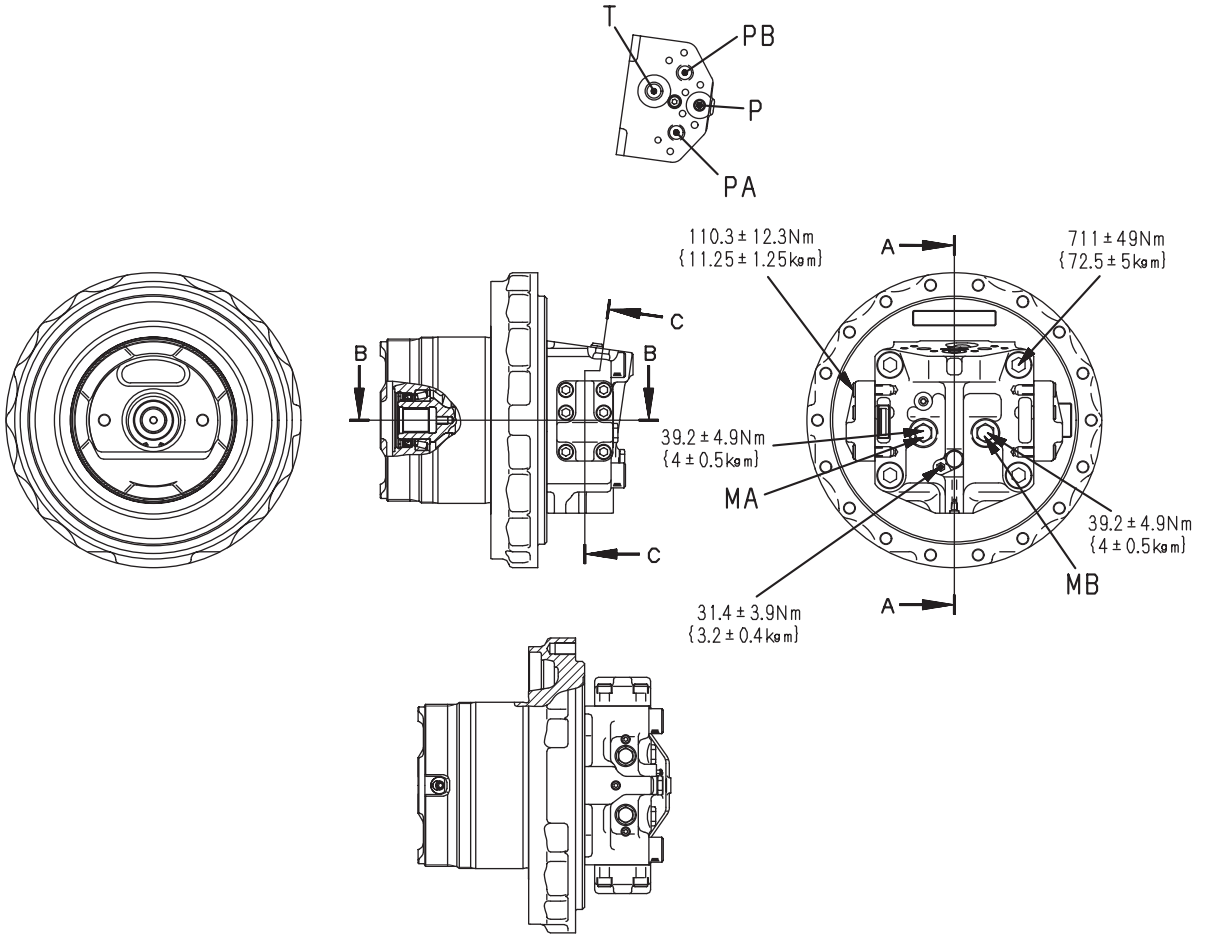
T2. To tank
T1. From L.H. and R.H. travel motors port T
D2. From control valve port B2
B1. To L.H. travel motor port PA
C2. From control valve port A2

Unit: mm

No.	Check Item	Criteria			Remedy
6	Clearance between rotor and shaft	Standard Size	Standard clearance	Repair limit	Replace
		80	—	—	

TRAVEL MOTOR

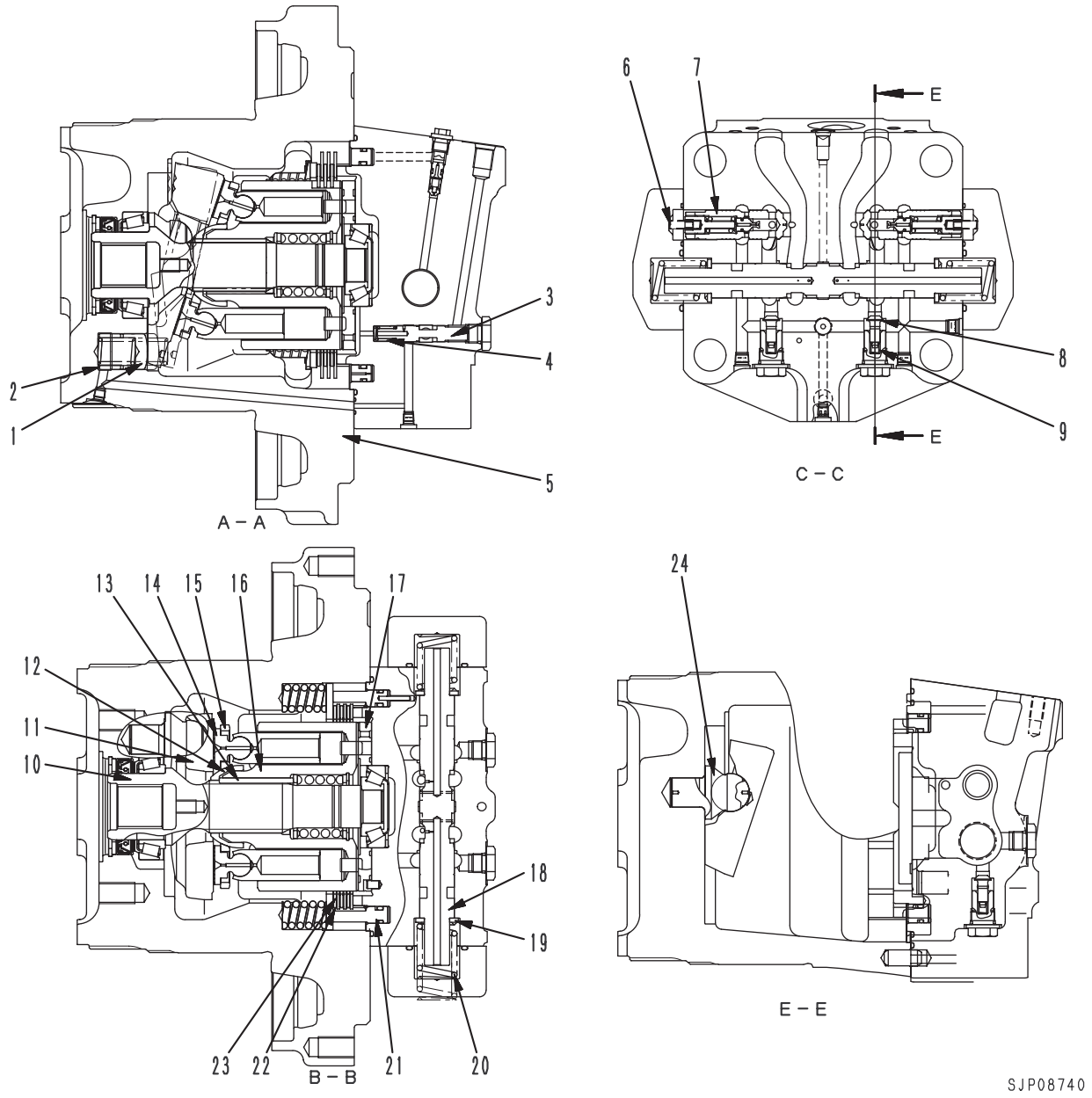
HMV110-2



P : From travel speed solenoid valve
T : To tank
PA : From control valve
PB : From control valve
MA: MA pressure pickup port
MB: MB pressure pickup port

SPECIFICATIONS

Item \ Model		PC210-7K	PC240-7K
Type		HMV110-2	
Theoretical Delivery	Min.	78.6 cm³/rev	74 cm³/rev
	Max.	106.2 cm³/rev	110.7 cm³/rev
Set pressure		37.3 MPa {380 kg/cm²}	
Rated speed	Min. Capacity	2,805 rpm	3,046 rpm
	Max. capacity	1,842 rpm	1,588 rpm
Brake releasing pressure		1.2 MPa {12 kg/cm²}	
Travel speed switching pressure	Differential pressure	0.8 MPa {8 kg/cm²}	



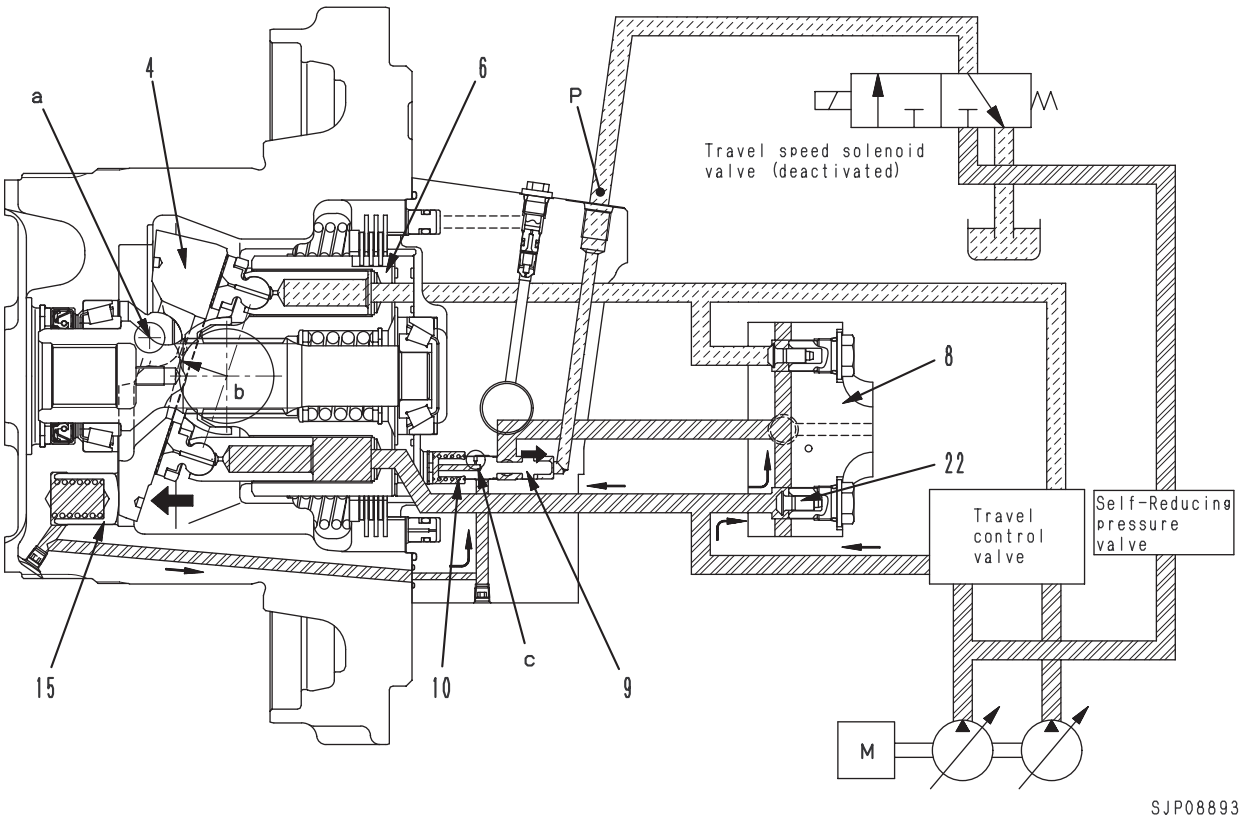
1. Regulator piston
2. Spring
3. Regulator valve
4. Spring
5. Motor case
6. Suction safety valve spring
7. Suction safety valve
8. Check valve
9. Check valve spring
10. Output shaft
11. Rocker cam
12. Retainer guide
13. Pin
14. Piston
15. Retainer
16. Cylinder
17. Valve plate
18. Counterbalance valve
19. Ring
20. Spool return spring
21. Brake piston
22. Plate
23. Disc
24. Ball

Unit: mm

No.	Check item		Criteria					Remedy
			Standard size			Repair limit		
			Free length x Outside diameter	Installed length	Installed load	Free length	Installed load	
1	Check valve spring	PC210-7K	31.6 x 6.5	24.2	2.55 N {0.26 kg}	—	1.96 N {0.2 kg}	If damaged or deformed, replace spring
		PC240-7K	31.6 x 6.5	24.2	7.16 N {0.73 kg}	—	5.73 N {0.58 kg}	
2	Check valve spring		13.0 x 6.5	9.5	1.96 N {0.2 kg}	—	1.57 N {0.16 kg}	
3	Return spring		58.43 x 30	42.6	411 N {41.9 kg}	—	329 N {33.5 kg}	
4	Regulator valve spring		21.5 x 11.1	17.1	55 N {5.6 kg}	—	44 N {4.5 kg}	

OPERATION OF MOTOR

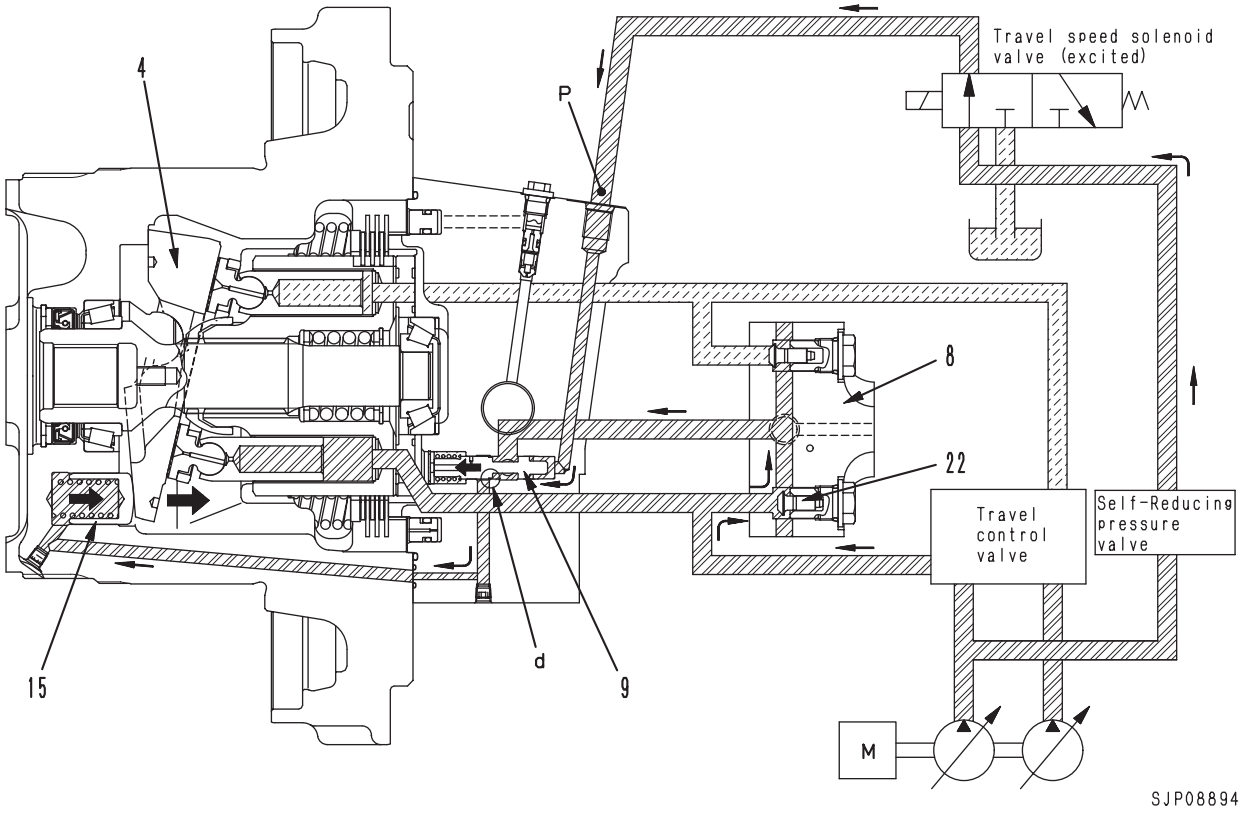
1) Motor swash plate angle at maximum



- The solenoid valve is deactivated, so the pilot pressure oil from the main pump does not flow to port **P**.

  For this reason, regulator valve (9) is pushed to the right in the direction of the arrow by spring (10).
- Because of this, it pushes check valve (22), and the main pressure oil from the control valve going to end cover (8) is shut off by regulator valve (9).
- Fulcrum **a** of rocker cam (4) is eccentric to point of force **b** of the combined force of the propulsion force of cylinder (6), so the combined force of the piston propulsion force acts as a moment to angle rocker cam (4) in the direction of the maximum swash plate angle.
- At the same time, the pressurized oil at regulator piston (15) passes through orifice **c** in regulator valve (9) and is drained to the motor case.
- As a result, rocker cam (4) moves in the maximum swash plate angle direction, the motor capacity becomes maximum.

2) Motor swash plate angle at minimum

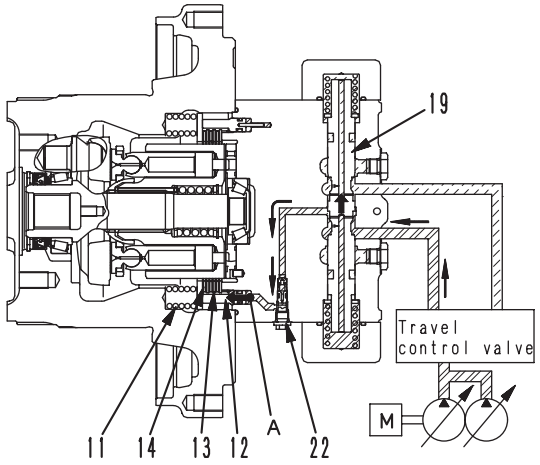


- When the solenoid valve is excited, the pilot pressure oil from the main pump flows to port **P**, and pushes regulator valve (9) to the left direction of the arrow.
- Because of this, the main pressure oil from the control valve passes through passage **d** in regulator valve (9), enters regulator piston (15) at the bottom, and pushes regulator piston (15) to the right in the direction of the arrow.
- As a result, rocker cam (4) moves in the minimum swash plate angle direction, the motor capacity becomes minimum.

OPERATION OF PARKING BRAKE

1) When starting to travel

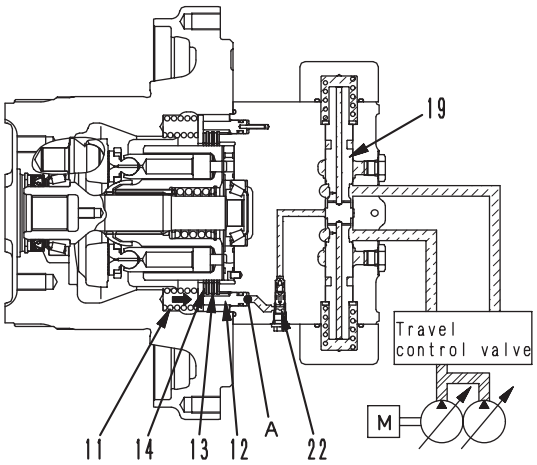
When the travel lever is operated, the pressurized oil from the pump actuates counterbalance valve spool (19), opens the circuit to the parking brake, and flows into chamber **A** of the brake piston (12). It overcomes the force of spring (11), and pushes piston (12) to the left in the direction of the arrow. When this happens, the force pushing plate (13) and disc (14) together is lost, so plate (13) and disc (14) separate and the brake is released.



SJP08895

1. When stopping travel

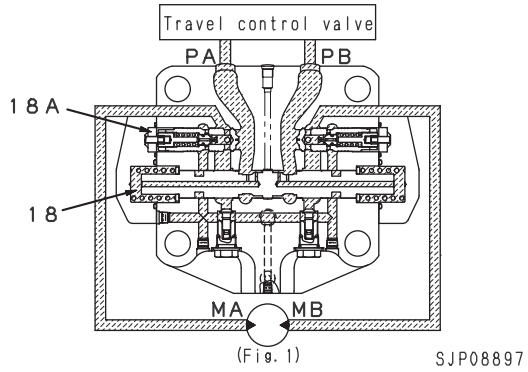
When the travel lever is placed in neutral, counterbalance valve spool (19) returns to the neutral position and the circuit to the parking brake is closed. The pressurized oil in chamber **A** of brake piston (12) is drained to the case from the orifice in the brake piston, and brake piston (12) is pushed to the right in the direction of the arrow by spring (11). As a result, plate (13) and disc (14) are pushed together, and the brake is applied. A time delay is provided by having the pressurized oil pass through a throttle in slow return valve (22) when the brake piston returns, and this ensures that the brake is still effective after the machine stops.



SJP08896

OPERATION OF BRAKE VALVE

- The brake valve consists of a suction safety valve (18A), counterbalance valve (18) in a circuit as shown in the diagram on the right. (Fig. 1)
- The function and operation of each component is as given below.



(Fig. 1) SJP08897

1) Counterbalance valve, check valve

Function

- When traveling downhill, the weight of the machine makes it try to travel faster than the speed of the motor.

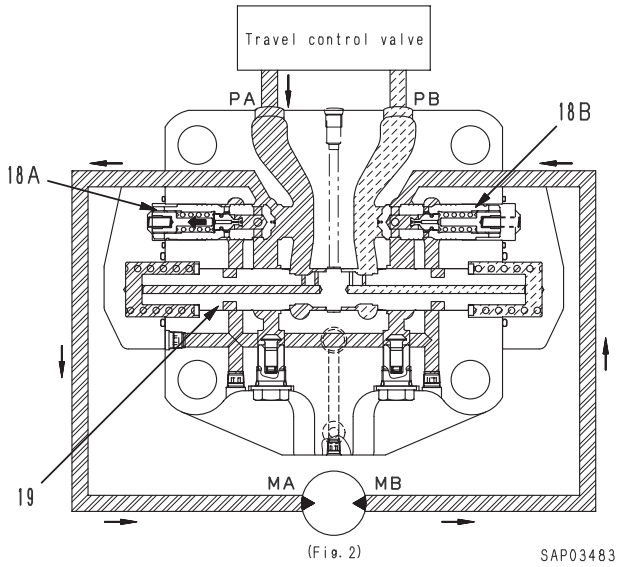
  As a result, if the machine travels with the engine at low speed, the motor will rotate without load and the machine will run away, which is extremely dangerous.

  To prevent this these valves act to make the machine travel according to the engine speed (pump discharge amount).

Operation when pressure oil is supplied

- When the travel lever is operated, the pressurized oil from the control valve is supplied to port **PA**. It pushes open suction safety valve (18A) and flows from motor inlet port **MA** to motor outlet port **MB**.

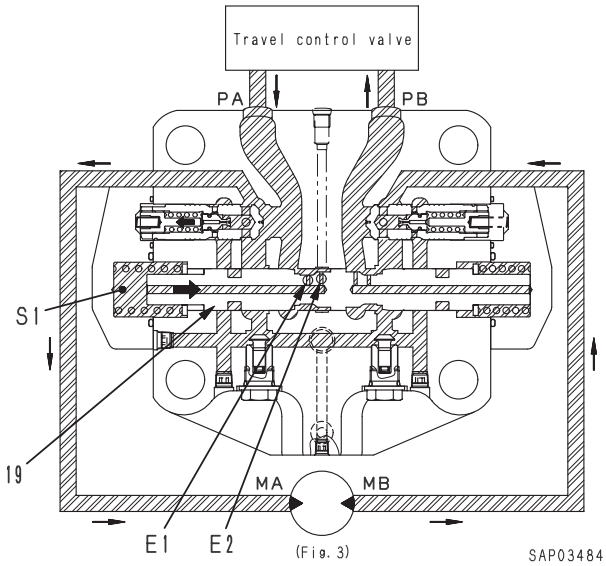
  However, the motor outlet port is closed by suction safety valve (18B) and spool (19), so the pressure at the supply side rises. (Fig. 2)



(Fig. 2) SAP03483

- The pressurized oil at the supply side flows from orifice **E1** and **E2** in spool (19) to chamber **S1**. When the pressure in chamber **S1** goes above the spool switching pressure, spool (19) is pushed to the right in the direction of the arrow.

  As a result, port **MB** and port **PB** are connected, the outlet port side of the motor is opened, and the motor starts to rotate. (Fig. 3)



(Fig. 3) SAP03484

Operation of brake when traveling downhill

- If the machine tries to run away when traveling downhill, the motor will turn under no load, so the pressure at the motor inlet port will drop, and the pressure in chamber **S1** through orifices **E1** and **E2** will also drop. When the pressure in chamber **S1** drops below the spool switching pressure, spool (19) is returned to the left, in the direction of the arrow by spring (20), and outlet port **MB** is throttled.

  As a result, the pressure at the outlet port side rises, resistance is generated to the rotation of the motor, and this prevents the machine from running away.

  In other words, the spool moves to a position where the pressure at the outlet port **MB** balances the pressure at the inlet port and the force generated by the weight of the machine. It throttles the outlet port circuit and controls the travel speed according to the amount of oil discharged from the pump. (Fig. 4)

2) Safety valve

Function

- When travel is stopped (or when traveling downhill), the circuits at the inlet and outlet ports of the motor are closed by the counterbalance valve, but the motor is rotated by inertia, so the pressure at the outlet port of the motor will become abnormally high and damage the motor or piping. The safety valve acts to release this abnormal pressure and send it to the inlet port side of the motor to prevent damage to the equipment.

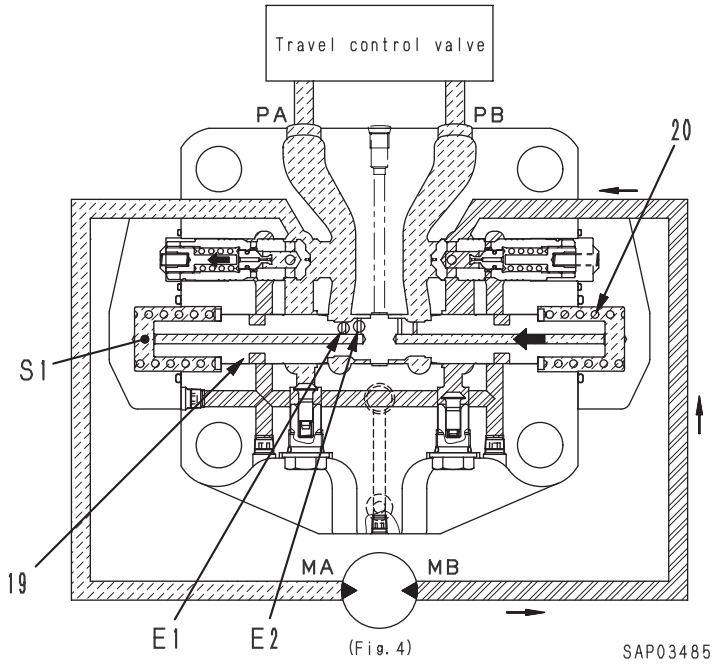
Operation

1. When travel is stopped (or when traveling downhill, rotating to right)

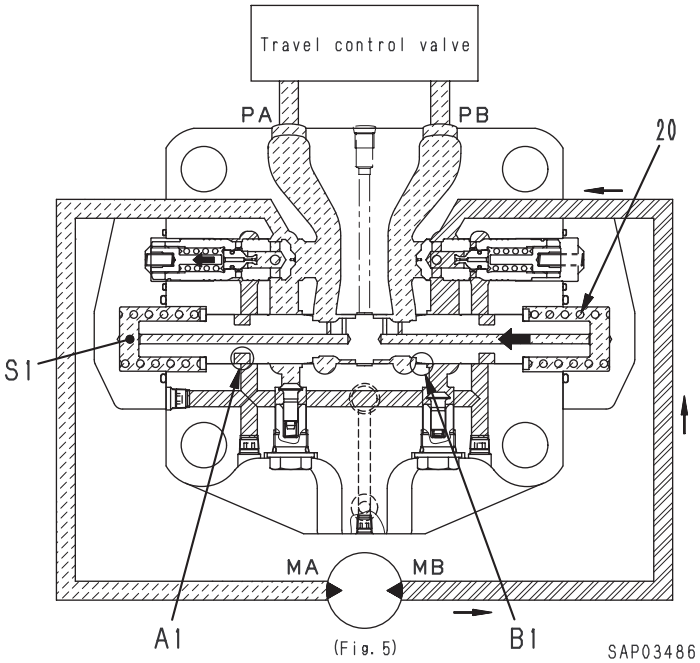
- When the motor inlet port pressure (pressure **PA**) goes down, the pressure in chamber **S1** also goes down. When it goes below the switching pressure of the spool, spool is returned to the left by spring (20), and outlet port passage **B1** is throttled. When this happens, the motor continues to rotate under inertia, so the outlet pressure (pressure **MB**) rises. (Fig. 5)
- If the pressure goes above the set pressure of suction-safety valve (18A), the poppet opens. The oil then passes through large notch **A1** in counterbalance valve spool (19) and flows to chamber **MA** in the circuit on the opposite side. (Fig. 6)

2. When rotating to left

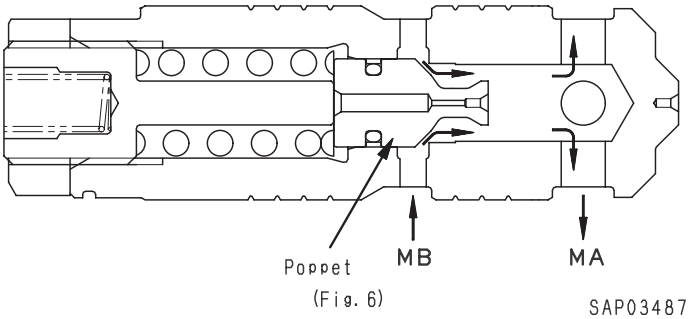
The operation is the reverse of when rotating to the right.



(Fig. 4) SAP03485



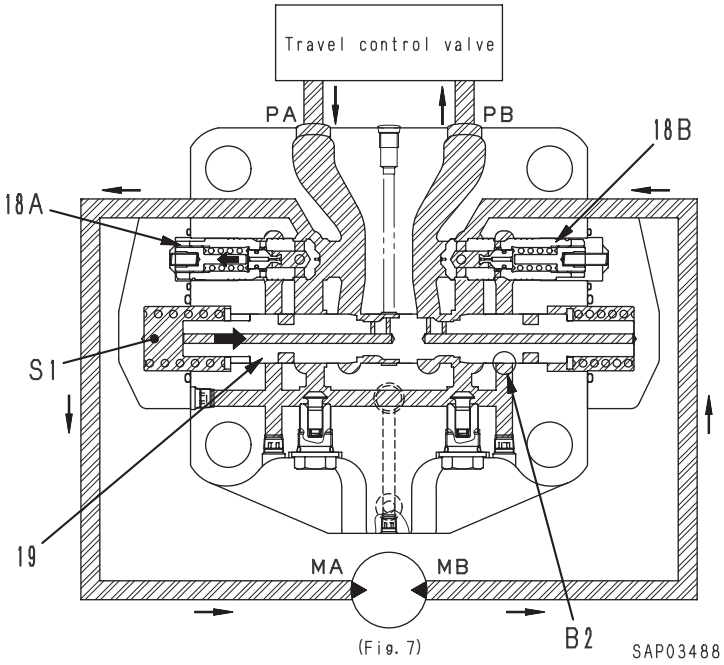
(Fig. 5) SAP03486



(Fig. 6) SAP03487

2) When starting travel (or during normal travel)

- When the travel lever is operated, the pressure oil from the pump moves counterbalance valve spool (19) to the right. When this happens, the passage to the suction-safety valve becomes the circuit flowing through the small notch B2 in the counterbalance valve spool. As a result, a big difference in pressure is created, and the pump pressure rises to provide a powerful drawbar pull. (Fig. 7)



(Fig. 7)

TRAVEL JUNCTION VALVE

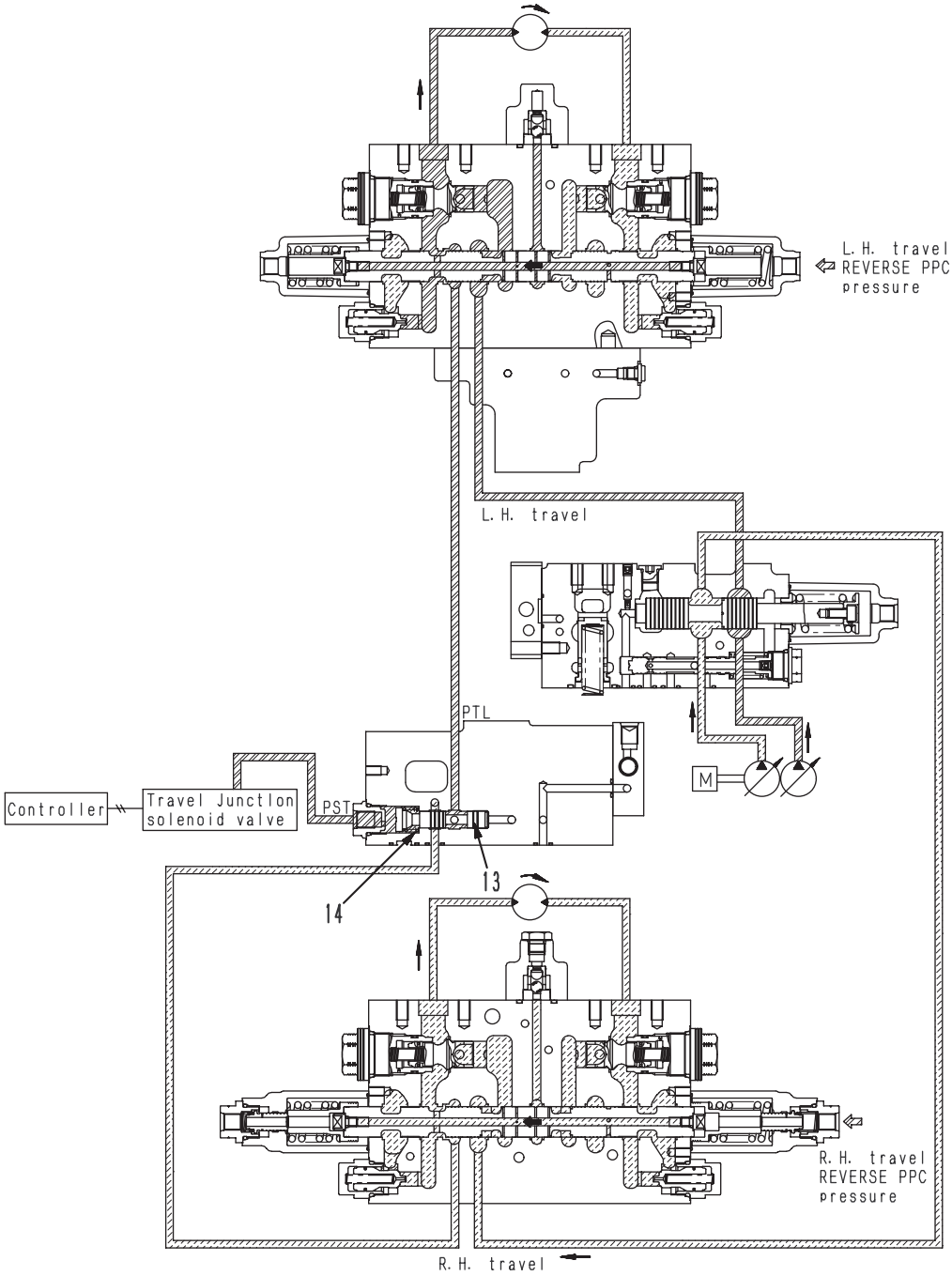
Function

- This valve connects both travel circuits to each other so that the hydraulic oil will be supplied evenly to both travel motors and the machine will travel straight.
- When the machine is steered, outside pilot pressure PST closes the travel junction valve to secure high steering performance.

Operation

When pilot pressure is turned ON

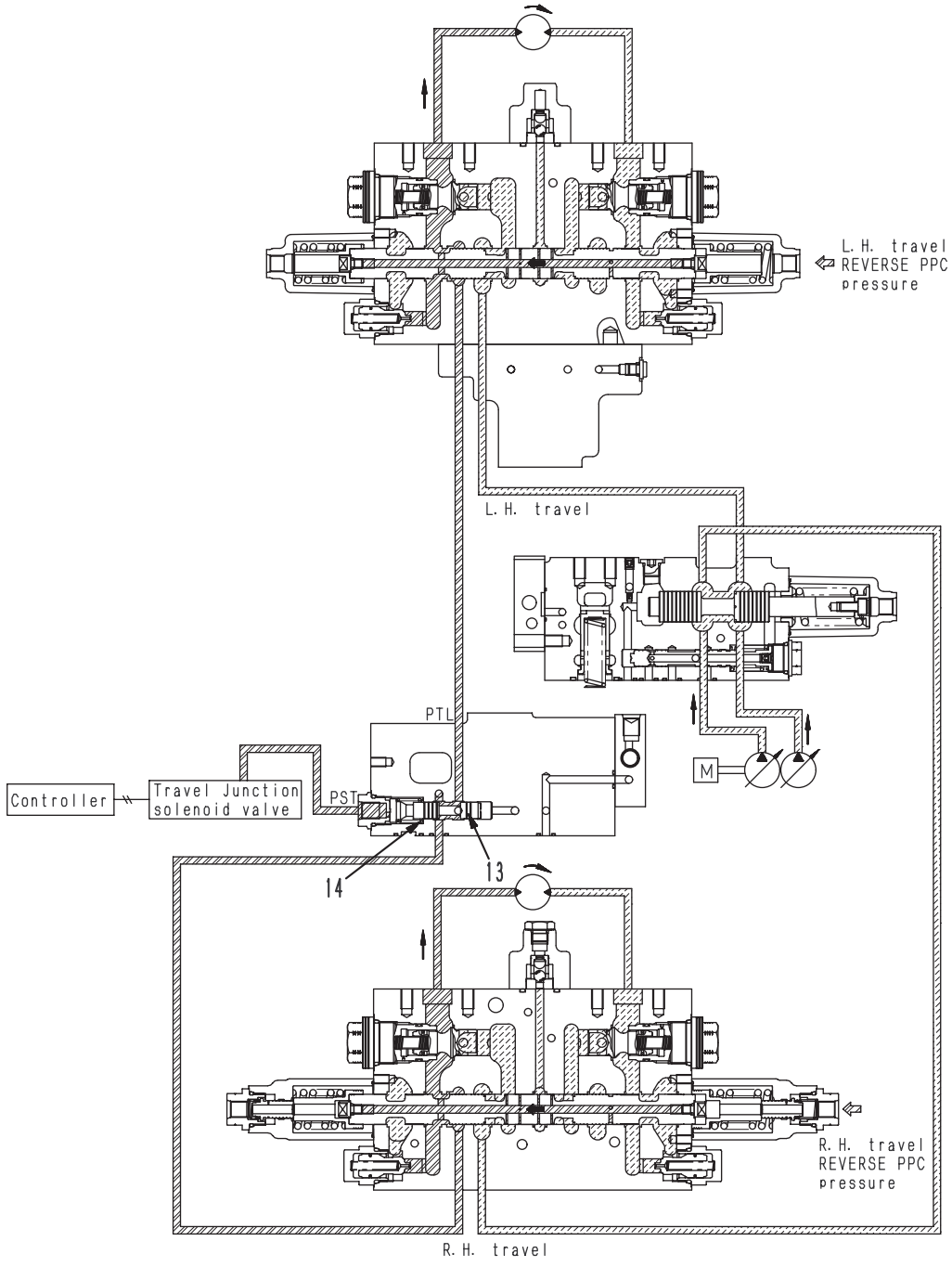
- If the pilot pressure from the travel junction solenoid valve becomes higher than the force of spring (14), travel junction spool (13) moves to the left stroke end and the junction circuit between port PTL (Left travel circuit) and PTR (Right travel circuit) is closed.



SJP08898

When pilot pressure is turned OFF

- If pilot pressure PST from the solenoid valve is 0, travel junction spool (13) is pressed by the force of spring (14) against the right side and the pass between ports PTL and PTR is open.
- If the oil flow rates in both travel motors become different from each other, the oil flows through the route between port PTL, travel junction spool (13), and port PTR so that the oil flow rates will be equalized again.



SJP08899

TRAVEL PPC SHUTTLE VALVE

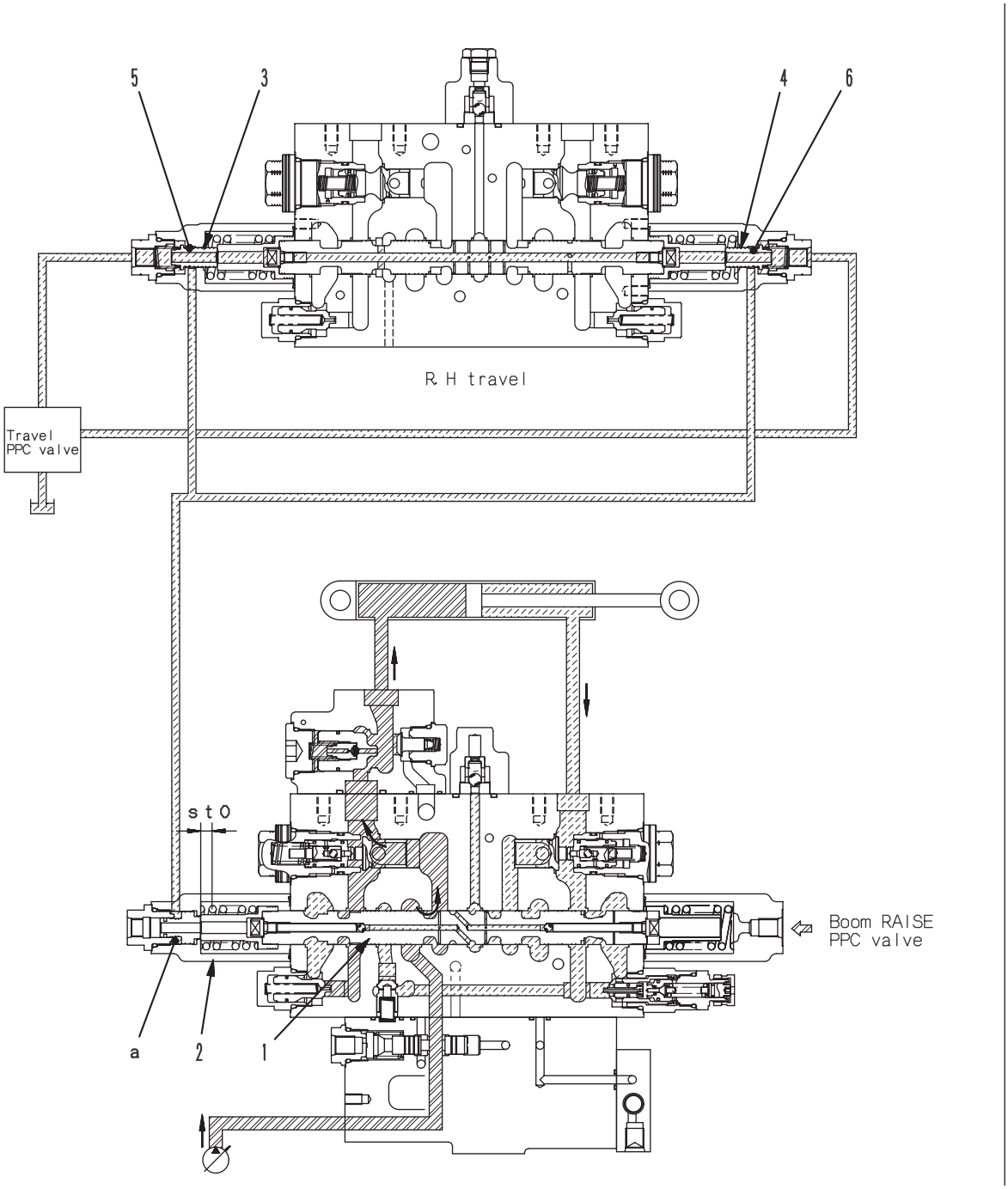
Function

- If the boom lever is set to the "RAISE" position or the arm lever is set in the "IN" or "OUT" position or the bucket lever is set in the "CURL" or "DUMP" position while the machine is travelling up a sharp slope, the travel PPC shuttle valve regulates the spool strokes of the boom, arm, and bucket control valves with the travel PPC pressure to limit the flow of the oil into the boom, arm, and bucket cylinders.
- When the strokes of the boom, arm, and bucket are regulated, the travel PPC pressure is applied through the circuit in the control valve.

Operation

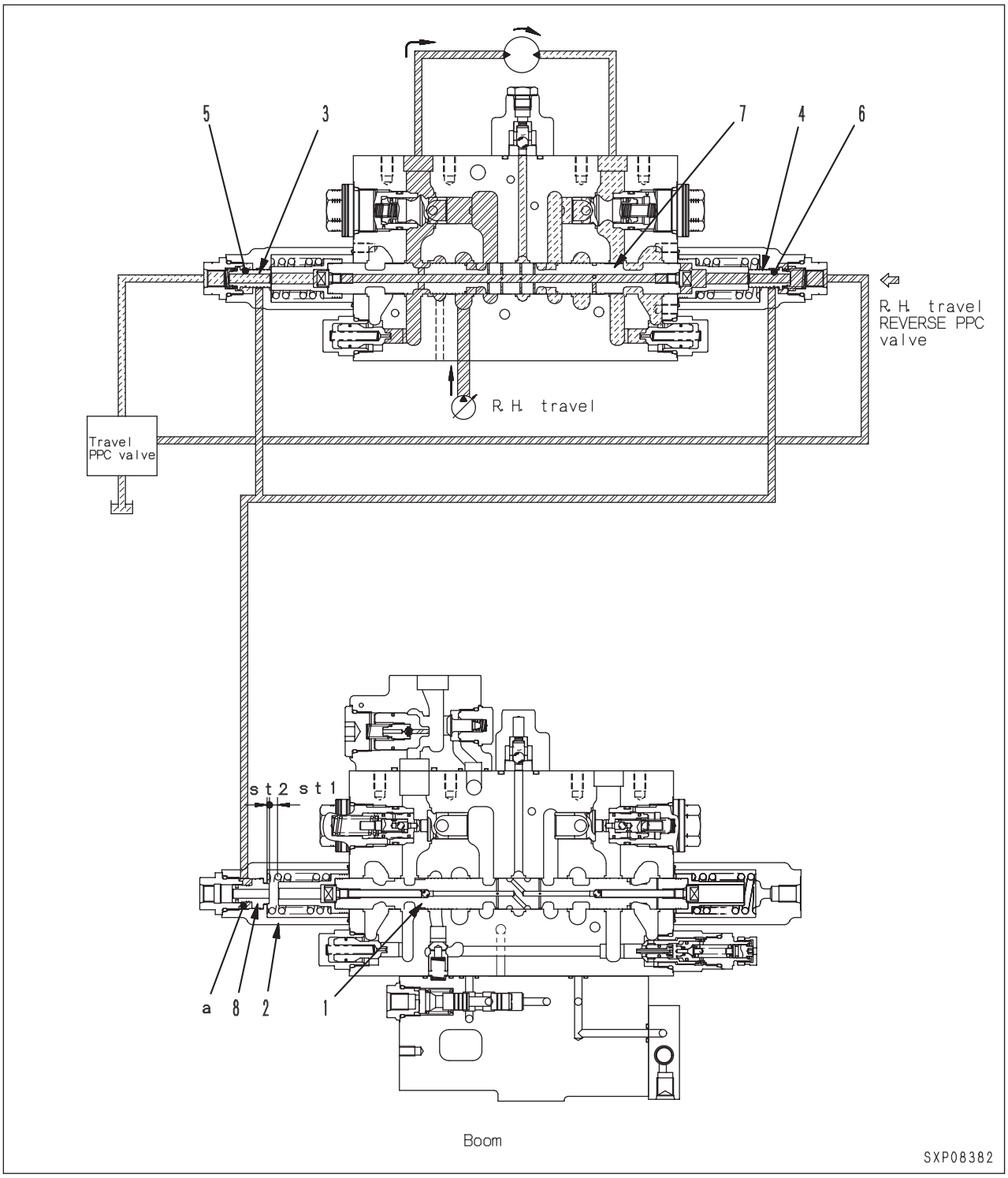
1 When travel lever is in neutral

- The oil in stroke regulation signal chamber "a" is drained through orifices (5) and (6) of pistons (3) and (4) in the travel spring case and the travel PPC valve.If the boom lever is set to the "RAISE" position (or the arm lever is set in the "IN" or "OUT" position or the bucket lever is set in the "CURL" or "DUMP" position), spool (1) moves to the left until it reaches the end of spring case (2) (st0).

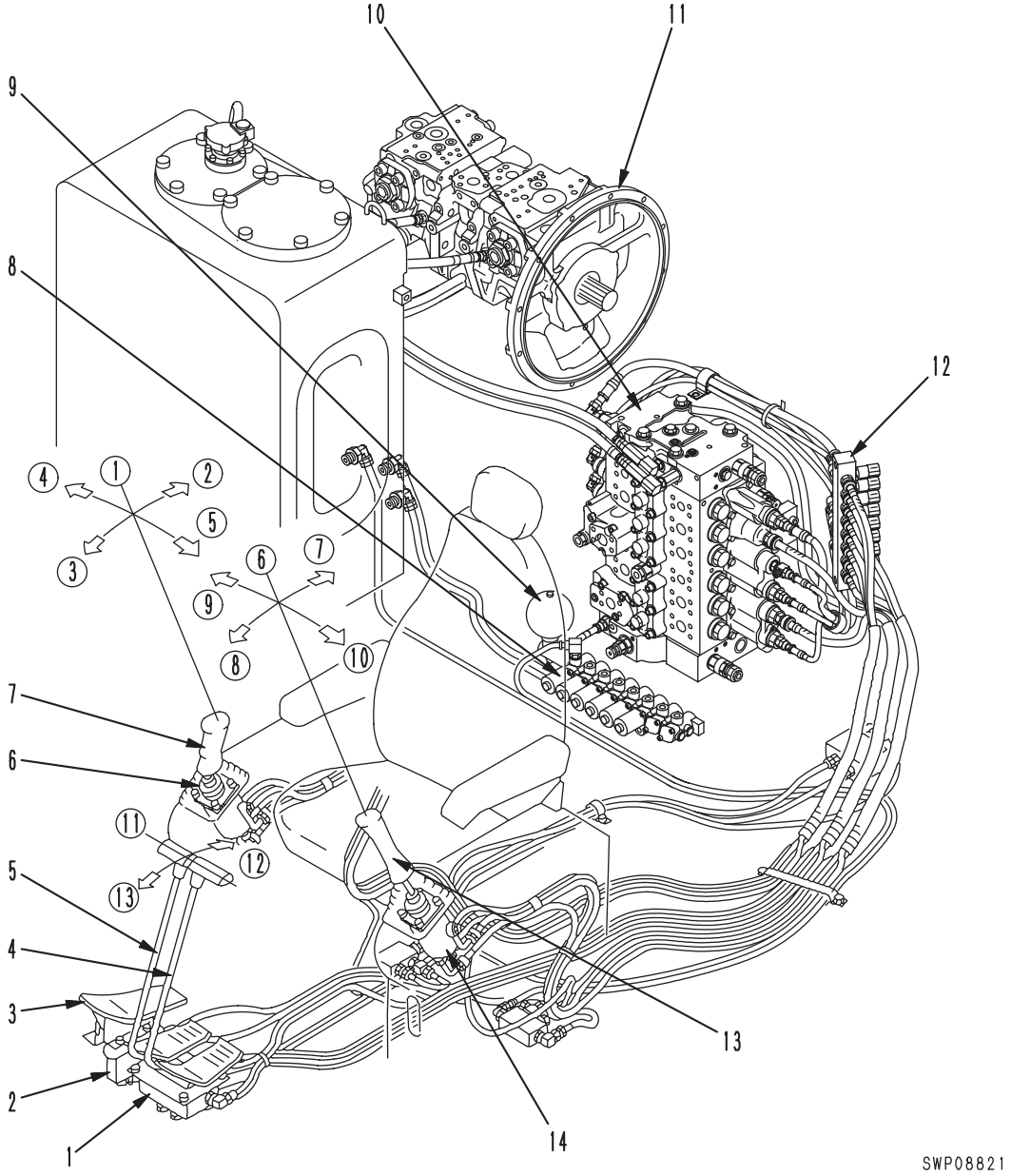


2. When travel lever is operated

- If the right travel lever is set in the reverse (or forward) direction, the right travel reverse (or forward) PPC pressure pushes spool (7) to the left (or right).
- Spool (7) pushes piston (3) to close orifice (5) and shut off stroke regulation signal chamber "a" from the drain circuit of the travel PPC valve.
- At this time, the right travel reverse (or forward) PPC pressure is applied through orifice (6) of piston (4) to the left end of piston (8) to push piston (8) to the right.
- When boom RAISE, arm IN, OUT, bucket CURL, DUMP are operated, spool (1) moves to the left, but the maximum stroke of the spool is limited to st1, the amount of movement (st2) of piston (8).



VALVE CONTROL

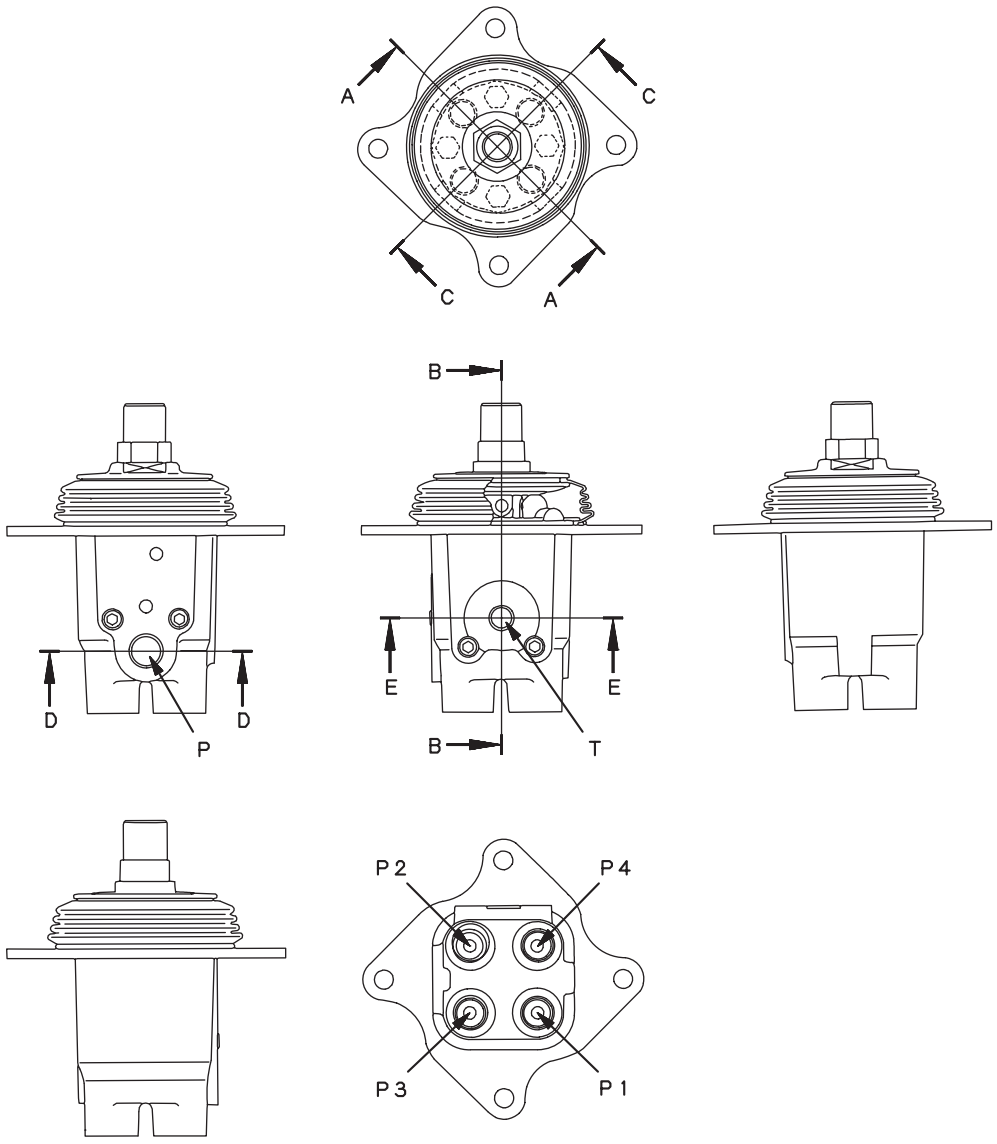


Lever positions

1. Travel PPC valve
2. Service PPC valve
3. Service pedal
4. L.H. travel lever
5. R.H. travel lever
6. R.H. PPC valve
7. R.H. work equipment control lever
8. Solenoid valve
9. Accumulator
10. Control valve
11. Hydraulic pump
12. Junction box
13. L.H. work equipment control lever
14. L.H. PPC valve

(1) Hold
(2) Boom "RAISE"
(3) Boom "LOWER"
(4) Bucket "DUMP"
(5) Bucket "CURL"
(6) Hold
(7) Arm "IN"
(8) Arm "OUT"
(9) Swing "RIGHT"
(10) Swing "LEFT"
(11) Neutral
(12) Travel "REVERSE"
(13) Travel "FORWARD"

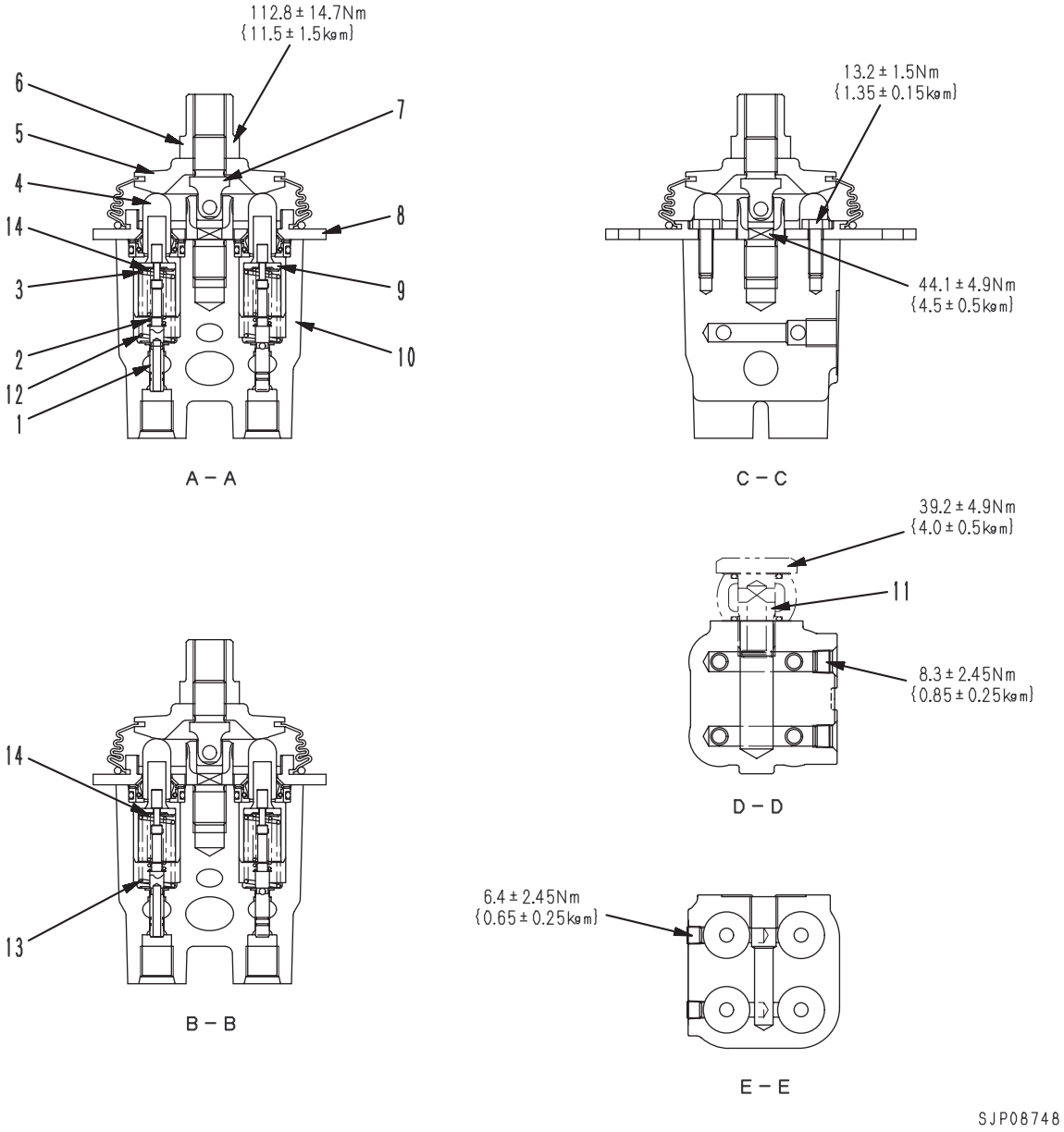
WORK EQUIPMENT • SWING PPC VALVE



SJP08747

P: From main pump
T: To tank

P1: Left: Arm OUT / Right: Boom LOWER
P2: Left: Arm IN / Right: Boom RAISE
P3: Left: Swing RIGHT / Right: Bucket CURL
P4: Left: SwingLEFT / Right: Bucket DUMP



1. Spool
2. Metering spring
3. Centering spring
4. Piston
5. Disc
6. Nut (For connection of lever)
7. Joint
8. Plate
9. Retainer
10. Body
11. Filter

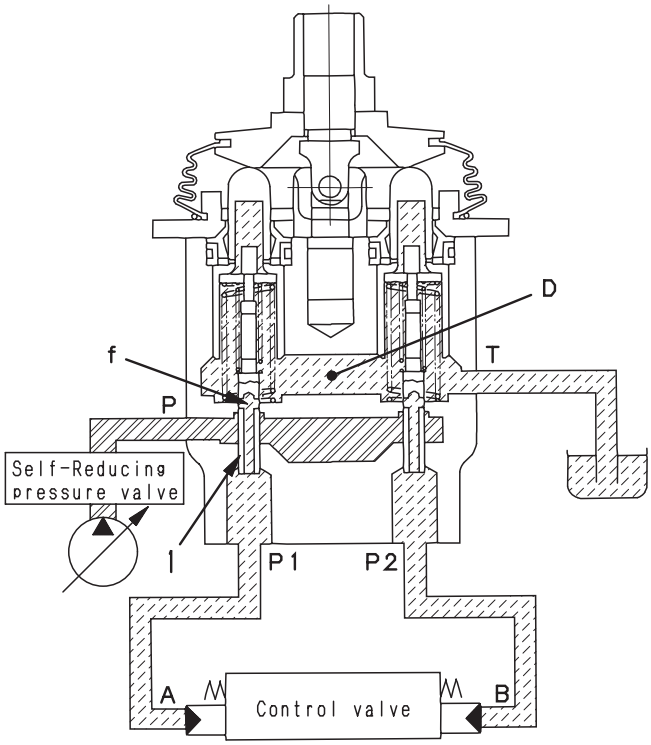
Unit: mm

No.	Check item	Criteria					Remedy
12	Centering spring (For P3 and P4)	Standard size			Repair limit		If damaged or deformed, replace spring
		Free length x Outside diameter	Installed length	Installed load	Free length	Installed load	
		42.5 x 15.5	34	17.6 N {1.8 kg}	—	13.7 N {1.4 kg}	
13	Centering spring (For P3 and P4)	44.5 x 15.5	34	29.4 N {3.0 kg}	—	23.5 N {2.4 kg}	
14	Metering spring	26.5 x 8.2	24.9	16.7 N {1.7 kg}	—	13.7 N {1.4 kg}	

OPERATION

1) At neutral

Ports **A** and **B** of the control valve and ports **P1** and **P2** of the PPC valve are connected to drain chamber **D** through fine control hole **f** in spool (1). (Fig. 1)



(Fig. 1)

SBP03493

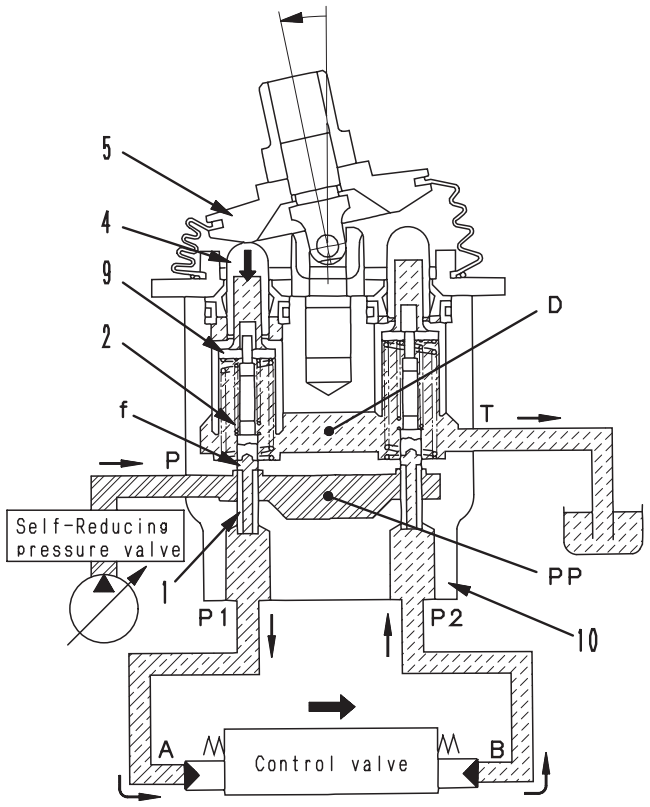
2) During fine control (neutral → fine control)

When piston (4) starts to be pushed by disc (5), retainer (9) is pushed; spool (1) is also pushed by metering spring (2), and moves down.

When this happens, fine control hole **f** is shut off from drain chamber **D**, and at almost the same time, it is connected to pump pressure chamber **PP**, so pilot pressure oil from the main pump passes through fine control hole **f** and goes from port **P1** to port **A**.

When the pressure at port **P1** becomes higher, spool (1) is pushed back and fine control hole **f** is shut off from pump pressure chamber **PP**. At almost the same time, it is connected to drain chamber **D** to release the pressure at port **P1**. When this happens, spool (1) moves up or down so that the force of metering spring (2) is balanced with the pressure at port **P1**. The relationship in the position of spool (1) and body (10) (fine control hole **f** is at a point midway between drain hole **D** and pump pressure chamber **PP**) does not change until retainer (9) contacts spool (1).

Therefore, metering spring (2) is compressed proportionally to the amount of movement of the control lever, so the pressure at port **P1** also rises in proportion to the travel of the control lever. In this way, the control valve spool moves to a position where the pressure in chamber **A** (the same as the pressure at port **P1**) and the force of the control valve spool return spring are balanced. (Fig. 2)



(Fig. 2)

SBP03494

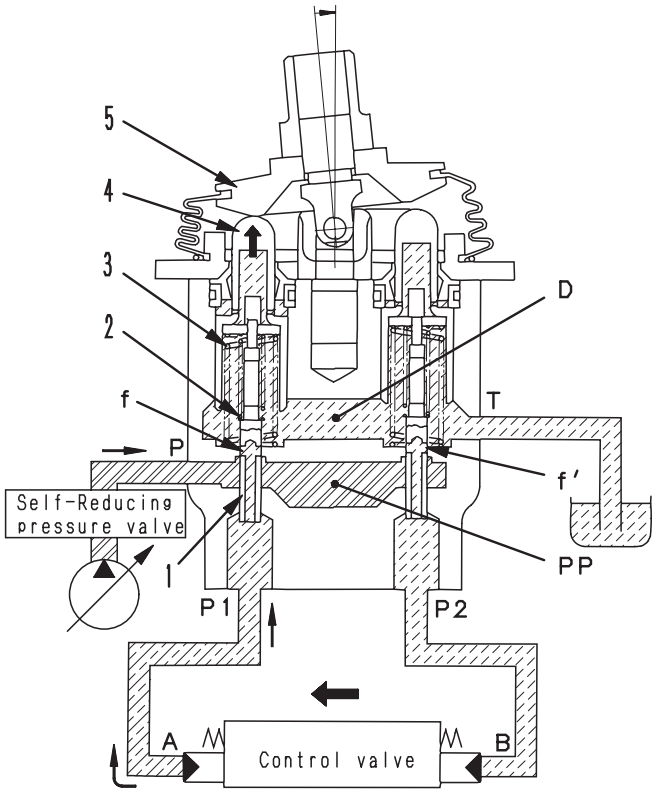
3) During fine control (when control lever is returned)

- When disc (5) starts to be returned, spool (1) is pushed up by the force of centering spring (3) and the pressure at port **P1**.

  When this happens, fine control hole **f** is connected to drain chamber **D** and the pressure oil at port **P1** is released.

  If the pressure at port **P1** drops too far, spool (1) is pushed down by metering spring (2), and fine control hole **f** is shut off from drain chamber **D**. At almost the same time, it is connected to pump pressure chamber **PP**, and the pump pressure is supplied until the pressure at port **P1** recovers to a pressure that corresponds to the lever position.

  When the spool of the control valve returns, oil in drain chamber **D** flows in from fine control hole **f** in the valve on the side that is not working. The oil passes through port **P2** and enters chamber **B** to fill the chamber with oil. (Fig. 3)



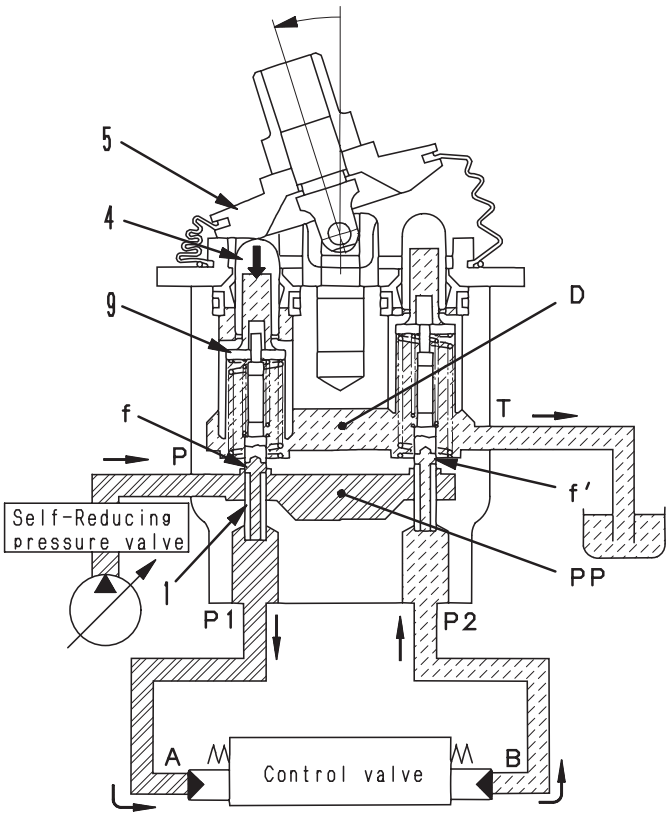
(Fig. 3)

SBP03495

4) At full stroke

When disc (5) pushes down piston (4), and retainer (9) pushes down spool (1), fine control hole **f** is shut off from drain chamber **D**, and is connected with pump pressure chamber **PP**. Therefore, the pilot pressure oil from the main pump passes through fine control hole **f** and flows to chamber **A** from port **P1**, and pushes the control valve spool.

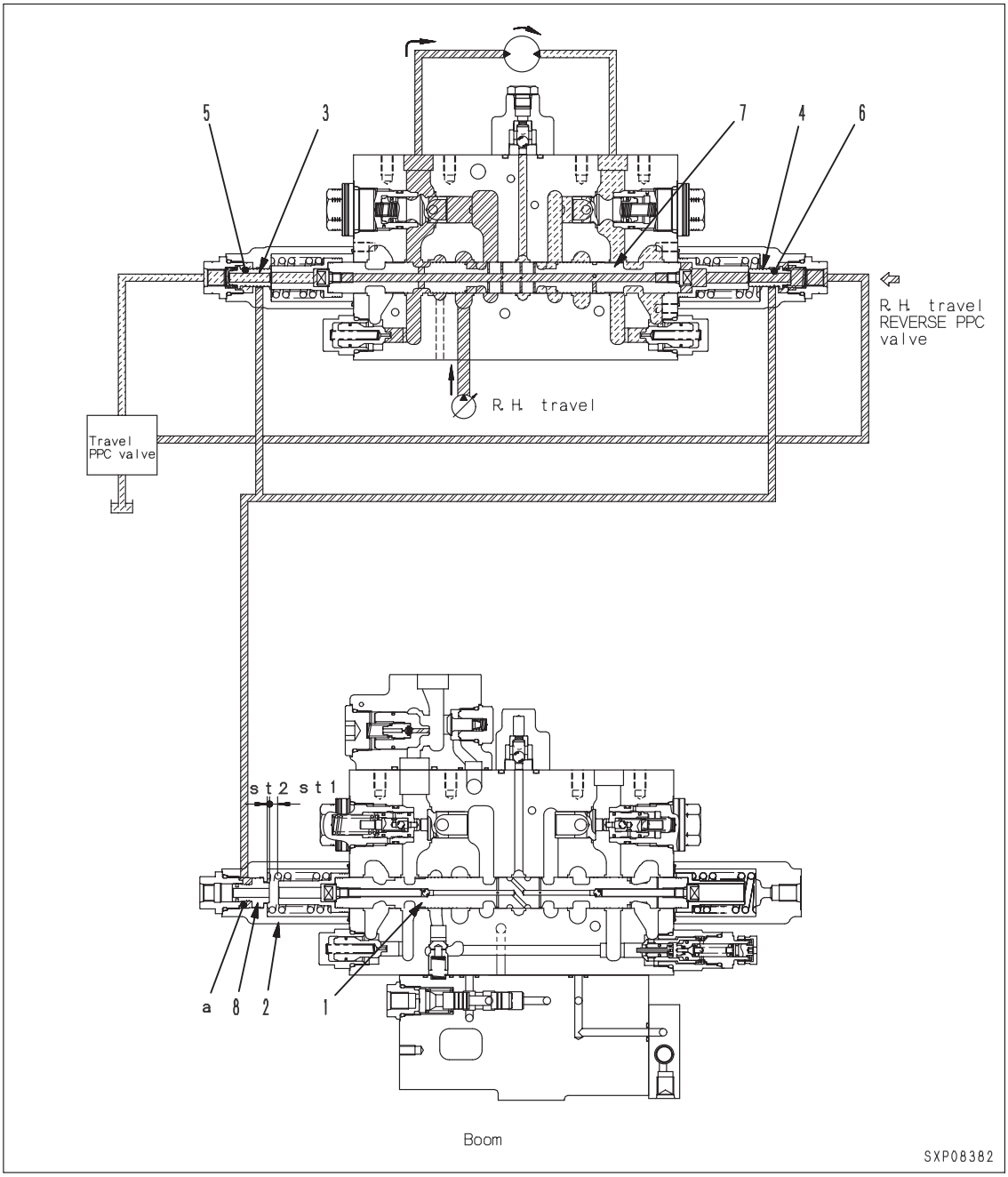
The oil returning from chamber **B** passes from port **P2** through fine control hole **f** and flows to drain chamber **D**. (Fig. 4)



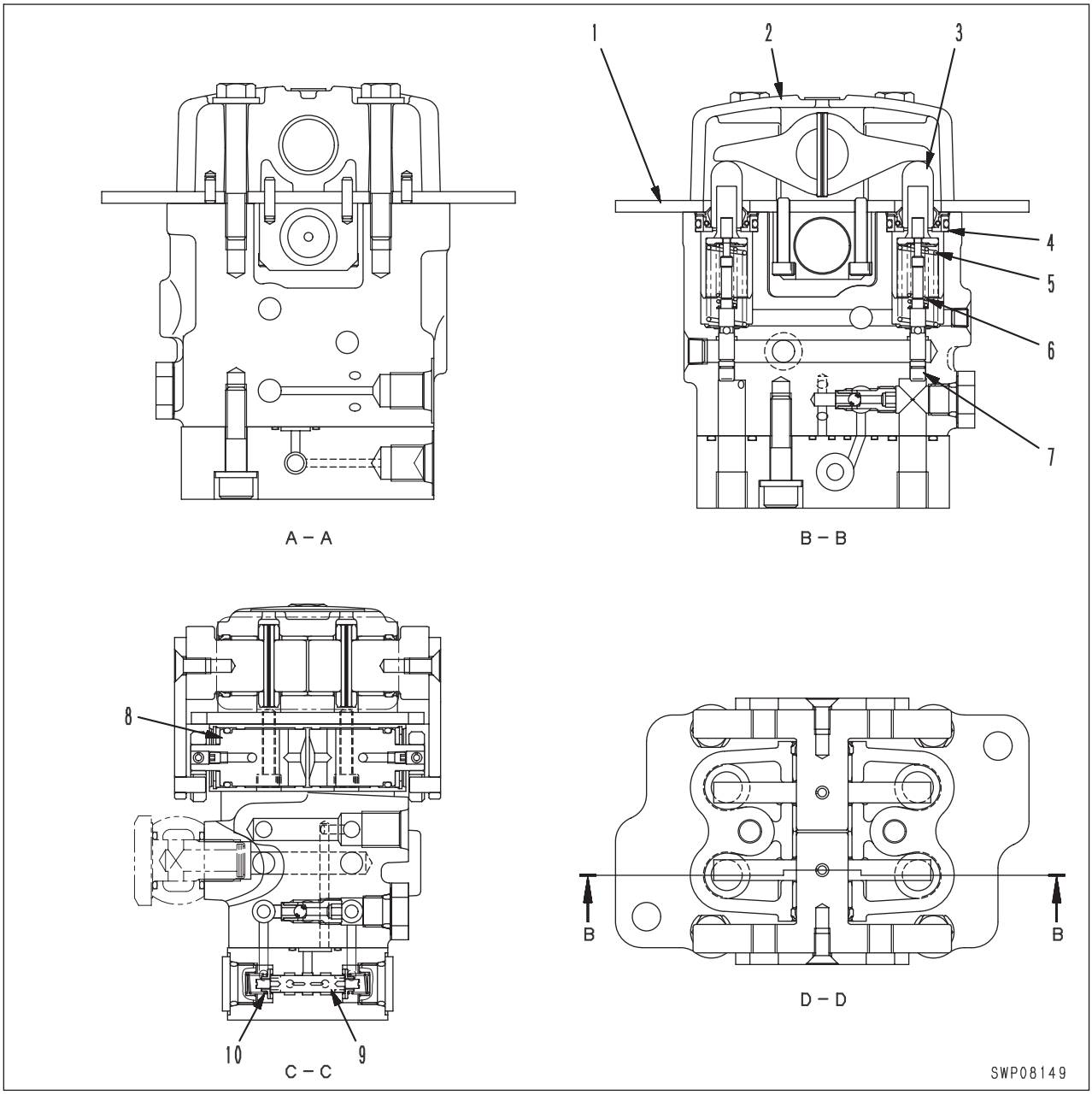
(Fig. 4)

SBP03496

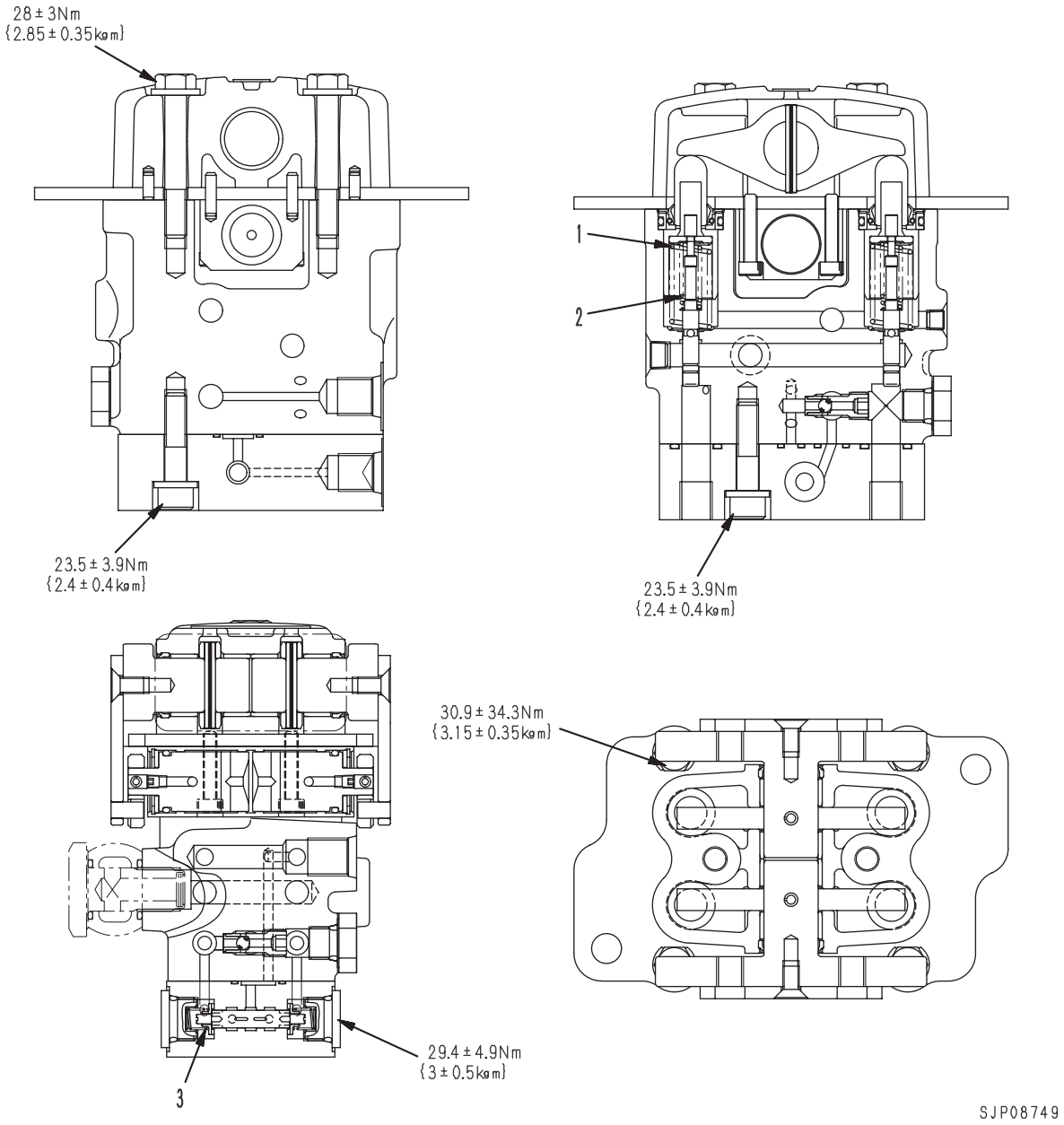
TRAVEL PPC VALVE



P : From main pump
T : To tank
P1 : Left reverse
P2 : Left forward
P3 : Right reverse
P4 : Right forward
P5 : Travel signal
P6 : Steering signal



1. Plate
2. Body
3. Piston
4. Collar
5. Metering spring
6. Centering spring
7. Valve
8. Damper
9. Steering signal
10. Steering signal valve spring



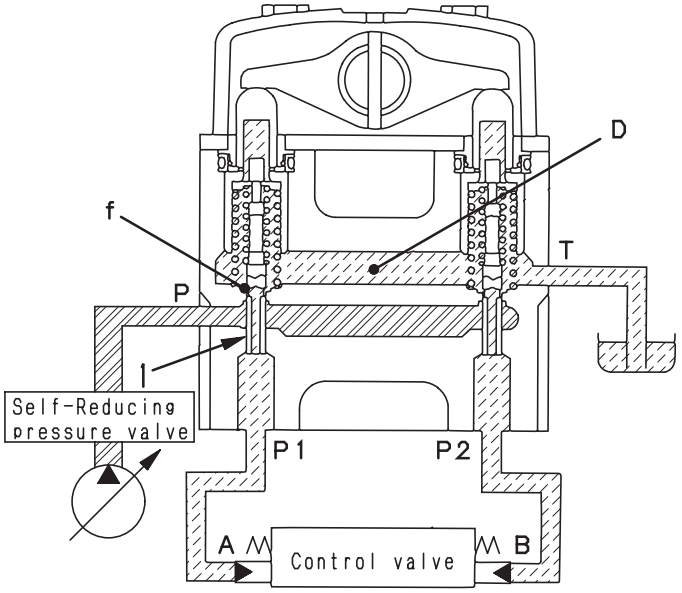
Unit: mm

No.	Check item	Criteria					Remedy
		Standard size			Repair limit		
1	Metering spring	Free length x Outside diameter	Installed length	Installed load	Free length	Installed load	If damaged or deformed, replace spring
		26.5 x 8.15	24.7	16.7 N {1.7 kg}	—	13.7 N {1.4 kg}	
2	Centering spring	48.1 x 15.5	32.5	108 N {11 kg}	—	86.3 N {8.8 kg}	
3	Steering signal spring	12.8 x 7.3	8.5	8.8 N {0.9 kg}	—	7.1 N {0.72 kg}	

OPERATION

1) At neutral

Ports **A** and **B** of the control valve and ports **P1** and **P2** of the PPC valve are connected to drain chamber **D** through fine control hole **f** in spool (1). (Fig. 1)



(Fig. 1)

SBP03497

2) Fine control (neutral → fine control)

When piston (4) starts to be pushed by disc (5), retainer (9) is pushed. Spool (1) is also pushed by metering spring (2), and moves down.

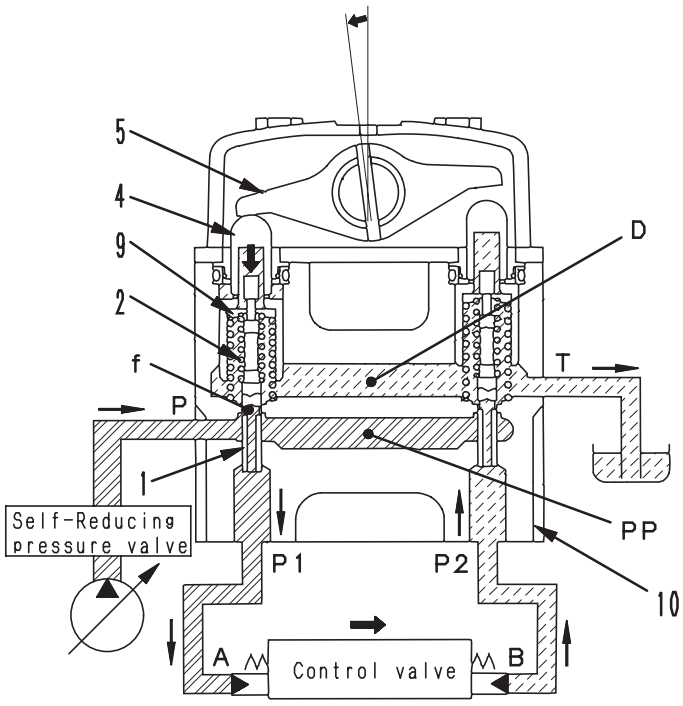
When this happens, fine control hole **f** is shut off from drain chamber **D**. At almost the same time, it is connected to pump pressure chamber **PP**, and the pilot pressure of the main pump is sent from port **A** through fine control hole **f** to port **P1.**

When the pressure at port **P1** rises, spool (1) is pushed back. Fine control hole **f** is shut off from pump pressure chamber **PP**. At almost the same time, it is connected to drain chamber **D,** so the pressure at port **P1** escapes.

As a result, spool (1) moves up and down until the force of metering spool (2) is balanced with the pressure at port **P1**.

The relationship of the position of spool (1) and body (10) (fine control hole **f** is in the middle between drain hole **D** and pump pressure chamber **PP**) does not change until retainer (9) contacts spool (1).

Therefore, metering spring (2) is compressed in proportion to the travel of the control lever, so the pressure at port **P1** also rises in proportion to the travel of the control lever. In this way, the spool of the control valve spool moves to a position where the pressure of chamber **A** (same as pressure at port **P1**) and the force of the return spring of the control valve spool are balanced. (Fig. 2)



(Fig. 2)

SBP03498

3) Fine control (control lever returned)

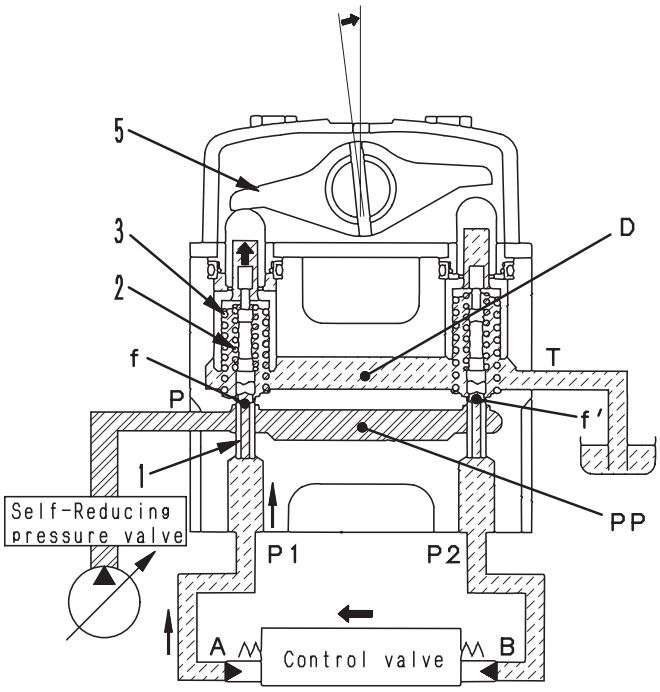
When lever (5) starts to be returned, spool (1) is pushed up by the force of centering spring (3) and the pressure at port **P1**.

Because of this, fine control hole **f** is connected to drain chamber **D**, and the pressurized oil at port **P1** is released.

If the pressure at port **P1** drops too much, spool (1) is pushed up by metering spring (2), so fine control hole **f** is shut off from drain chamber **D**. At almost the same time, it is connected to pump pressure chamber **PP**, so the pressure at port **P1** supplies the pump pressure until the pressure recovers to a pressure equivalent to the position of the lever.

When the control valve returns, oil in drain chamber **D** flows in from fine control hole **f** of the valve on the side that is not moving.

It passes through port **P2** and goes to chamber **B** to charge the oil. (Fig. 3)

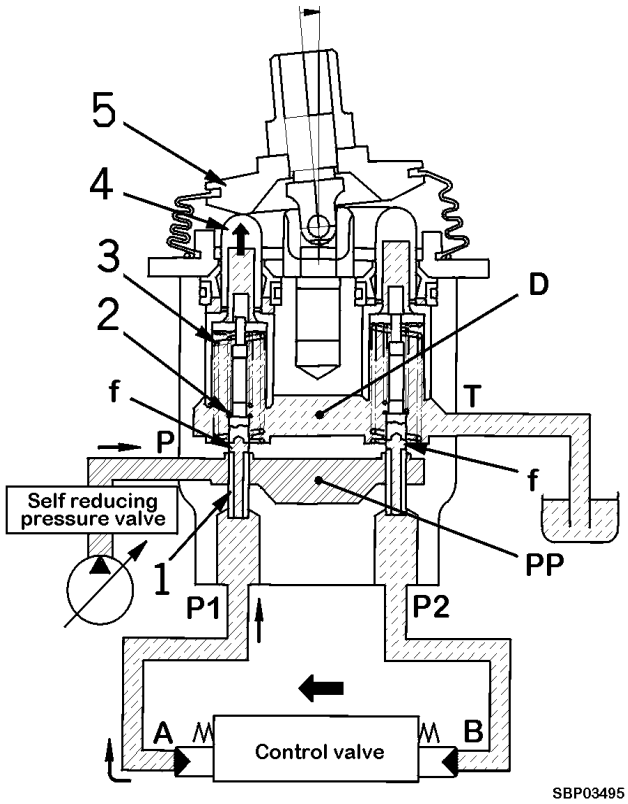


(Fig. 3)

SBP03499

4) At full stroke

Lever (5) pushes down piston (4), and retainer (9) pushes down on spool (1). Fine control hole **f** is shut off from drain chamber **D**, and is connected to pump pressure chamber **PP**. Therefore, the pilot pressure oil from the main pump passes through fine control hole **f** and flows to chamber **A** from port **P1** to push the control valve spool. The return oil from chamber **B** passes from port **P2** through fine control hole **f** and flows to drain chamber **D**. (Fig. 4)



SBP03495

2. Travel signal/Steering function

- Travel signal

  If either of the travel levers is operated, the maximum PPC output pressure on both sides is output as the travel signal. Accordingly, if the machine is traveling is judged by the signal of port P5.

- Steering signal

  If the operation quantities of both levers are different from each other as in the steering operation, the higher one of the PPC output pressures on both sides is output as the steering signal.

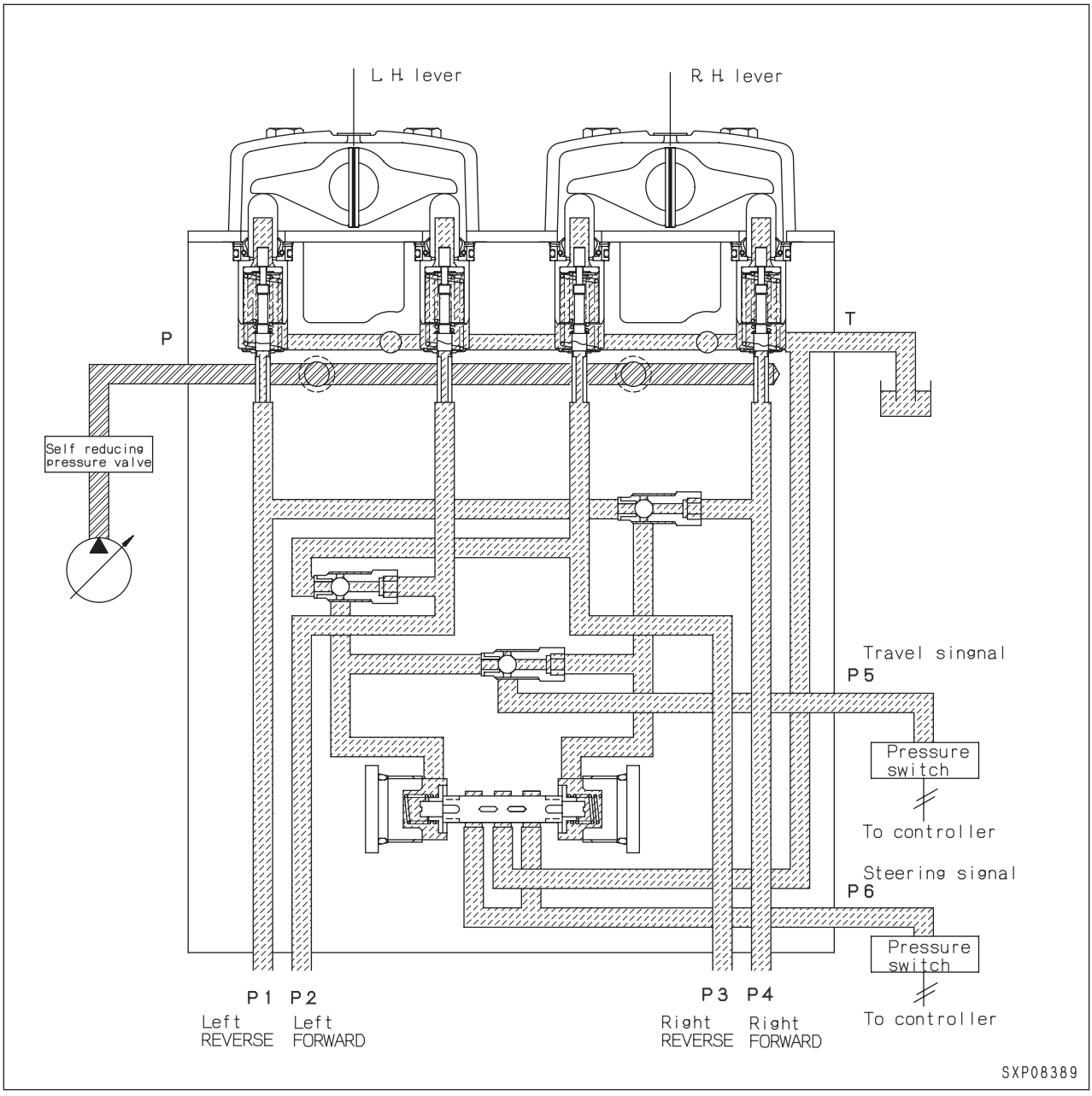
  Any signal is not output from port P6 while the machine is travelling straight (forward or reverse) or in neutral.

  Accordingly, if the machine is being steered is judged by the signal of port P6.

Operation

1) While in NEUTRAL

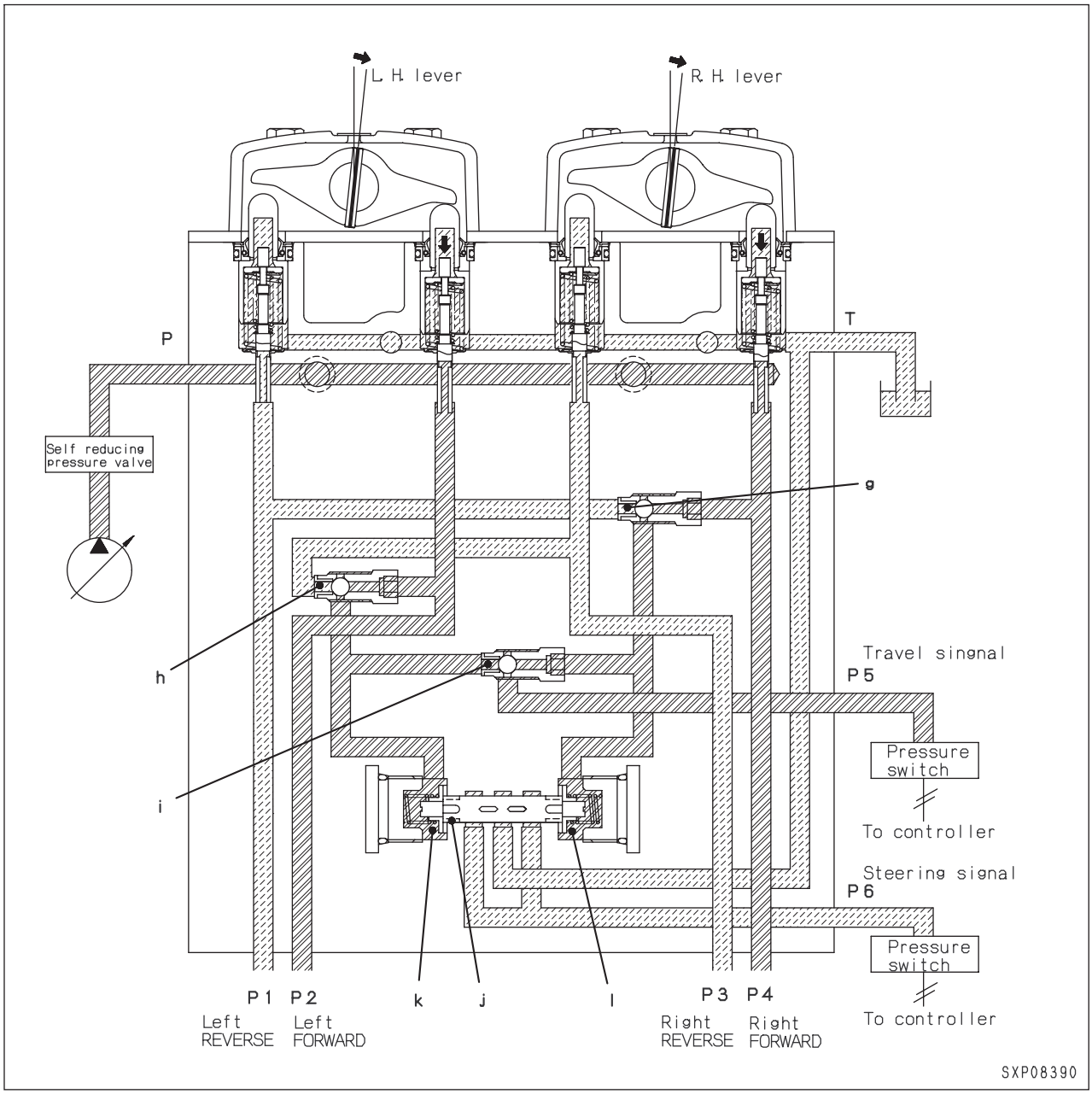
   The signals of the output ports (P1 - P4), travel signal (Port P5), and steering signal (Port P6) are not output.



2) While travelling straight

(The following drawing shows the circuit for traveling straight forward.)

While the left motor is operating for forward travel (the signal of port P2 is output) and the right motor is also operating for forward travel (the signal of port P4 is output), the pressures in left spring chamber (k) and right spring chamber (l) of steering signal valve (j) are set high. Accordingly, the steering signal valve is kept in neutral and the steering signal (Port P6) is not output.



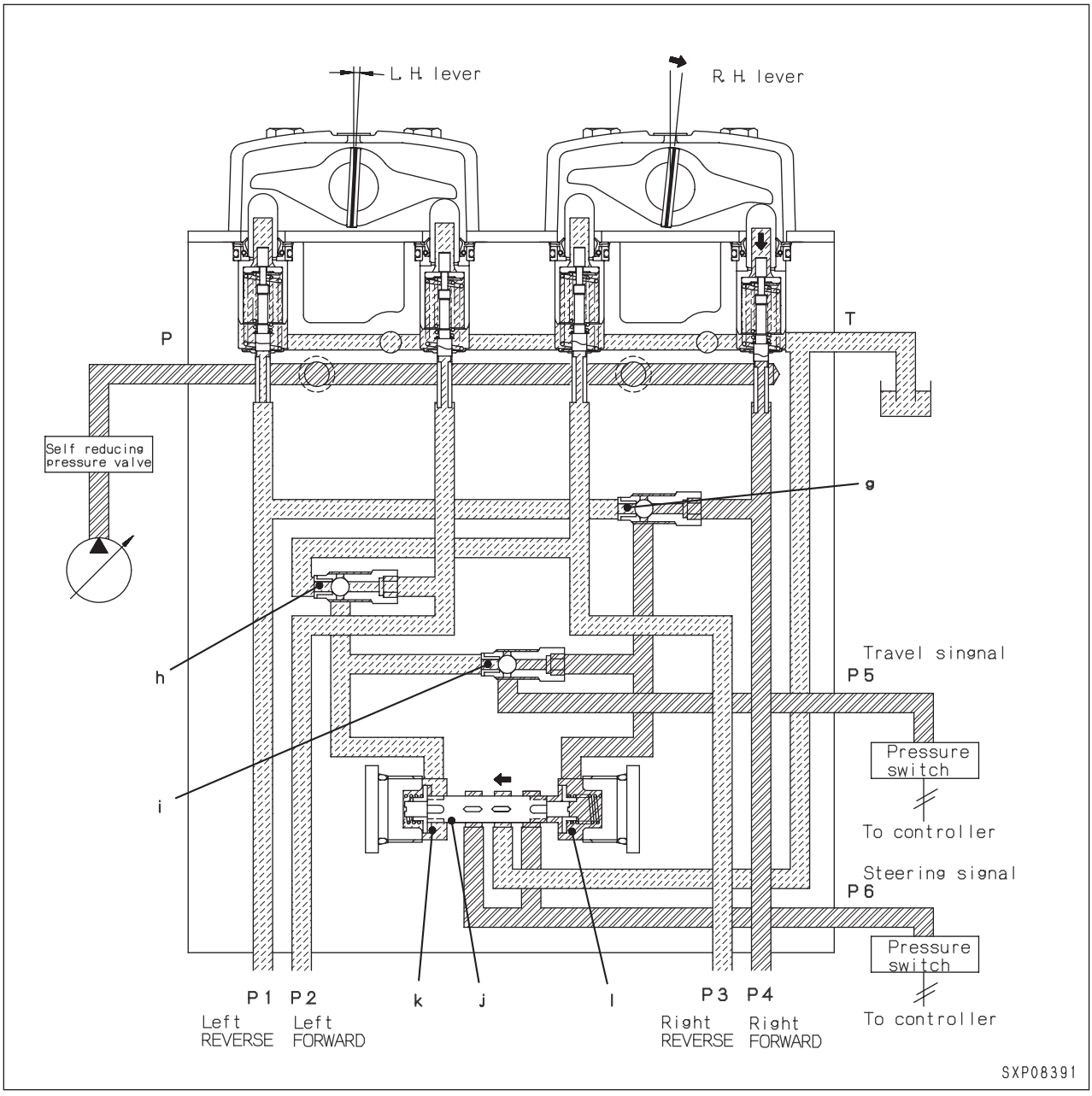
3) When steered or pivot-turned

(The following drawing shows the circuit for left forward (slow) and right forward (fast) operation.)

If the operation quantities of both levers are different from each other as in the steering operation (If the difference of the pilot pressure between both sides is higher than a certain level), the pilot pressure is output as the steering signal.

In the case of the following drawing, the pressure in left spring chamber (k) of steering signal valve (j) is P2. The pressure in right spring chamber (l) is P4.

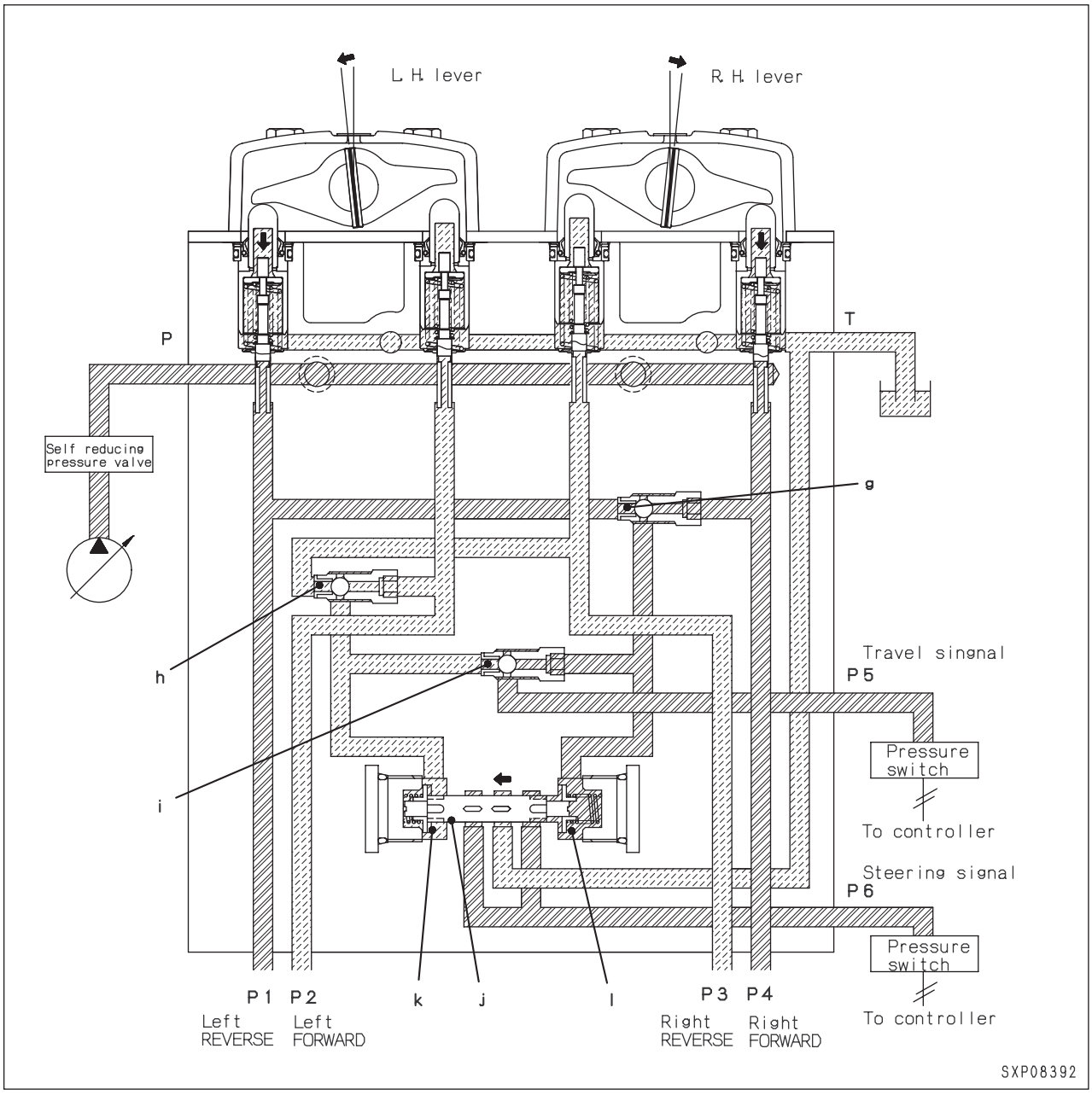
If (P4 - P2) x (Sectional area of spool) > Set spring load, the spool is changed to the direction of the arrow and the higher one of both PPC output pressures (the pressure of port P4 in this drawing) is output as the steering signal to port P6.



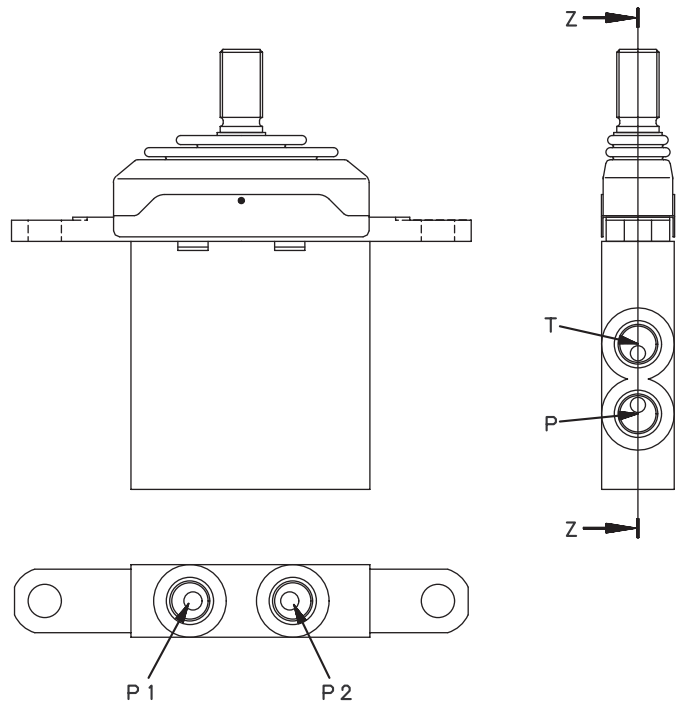
4) When pivot-turned

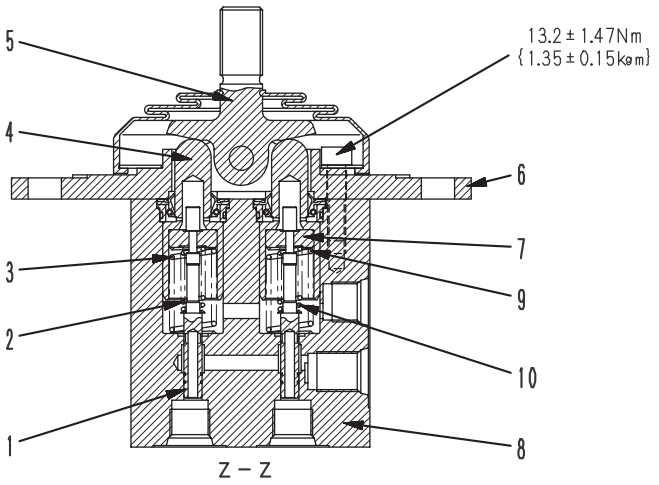
(The following drawing shows the circuit for left reverse and right forward operation.)

While the left motor is operating for reverse travel (the signal of port P1 is output) and the right motor is operating for forward travel (the signal of port P4 is output), only the pressure in right spring chamber (l) of steering signal valve (j) is set high. Accordingly, the steering signal valve moves to the left and outputs the steering signal (port P6).



SERVICE PPC VALVE





SJP08750

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

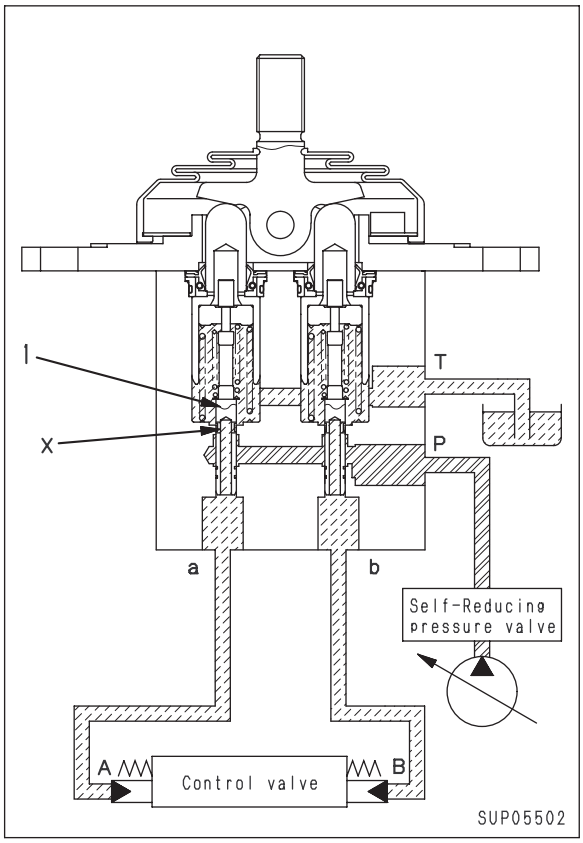
Unit: mm

No.	Check item	Criteria					Remedy
		Standard size			Repair limit		
9	Centering spring	Free length x Outside diameter	Installed length	Installed load	Free length	Installed load	If damaged or deformed, replace spring
		33.9 x 15.3	28.4	124.5 N {12.7 kg}	—	100 N {10.2 kg}	
10	Metering spring	22.7 x 8.1	22	16.7 N {1.7 kg}	—	13.7 N {1.4 kg}	

OPERATION

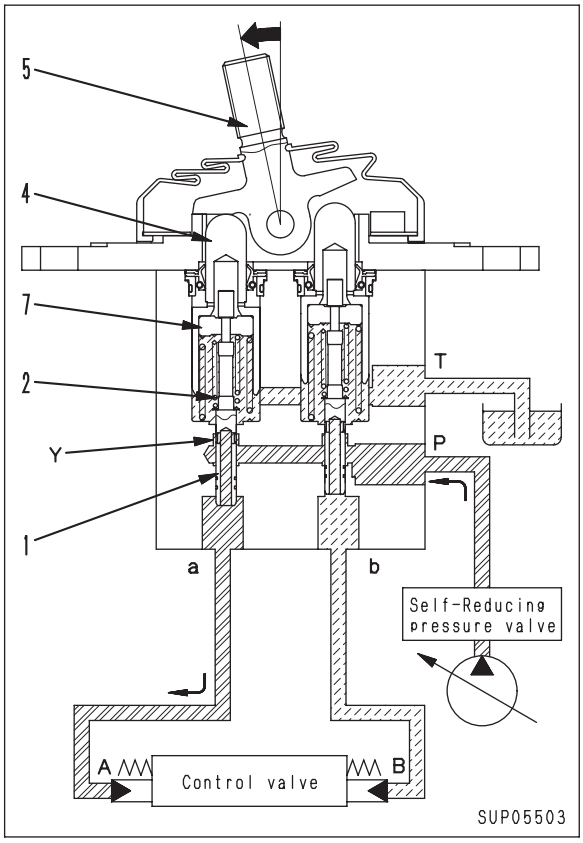
At neutral

- The pressurized oil from the main pump enters from port **P** and is blocked by spool (1).
- Ports **A** and **B** of the control valve and ports **a** and **b** of the PPC valve are connected to drain port **T** through fine control hole **X** of spool (1).



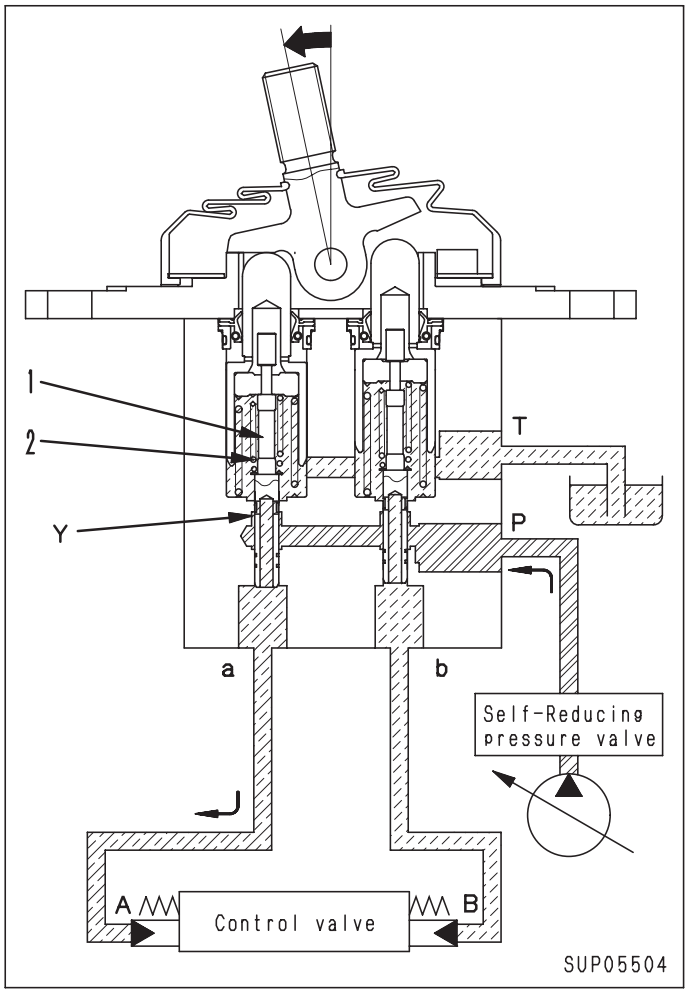
WHEN OPERATED

- When lever (5) is moved, metering spring (2) is pushed by piston (4) and retainer (7), and spool (1) is pushed down by this.
- As a result, fine control portion **Y** is connected with port **a**, and the pressurized oil from port **P** flows from port **a** to port **A** of the control valve.



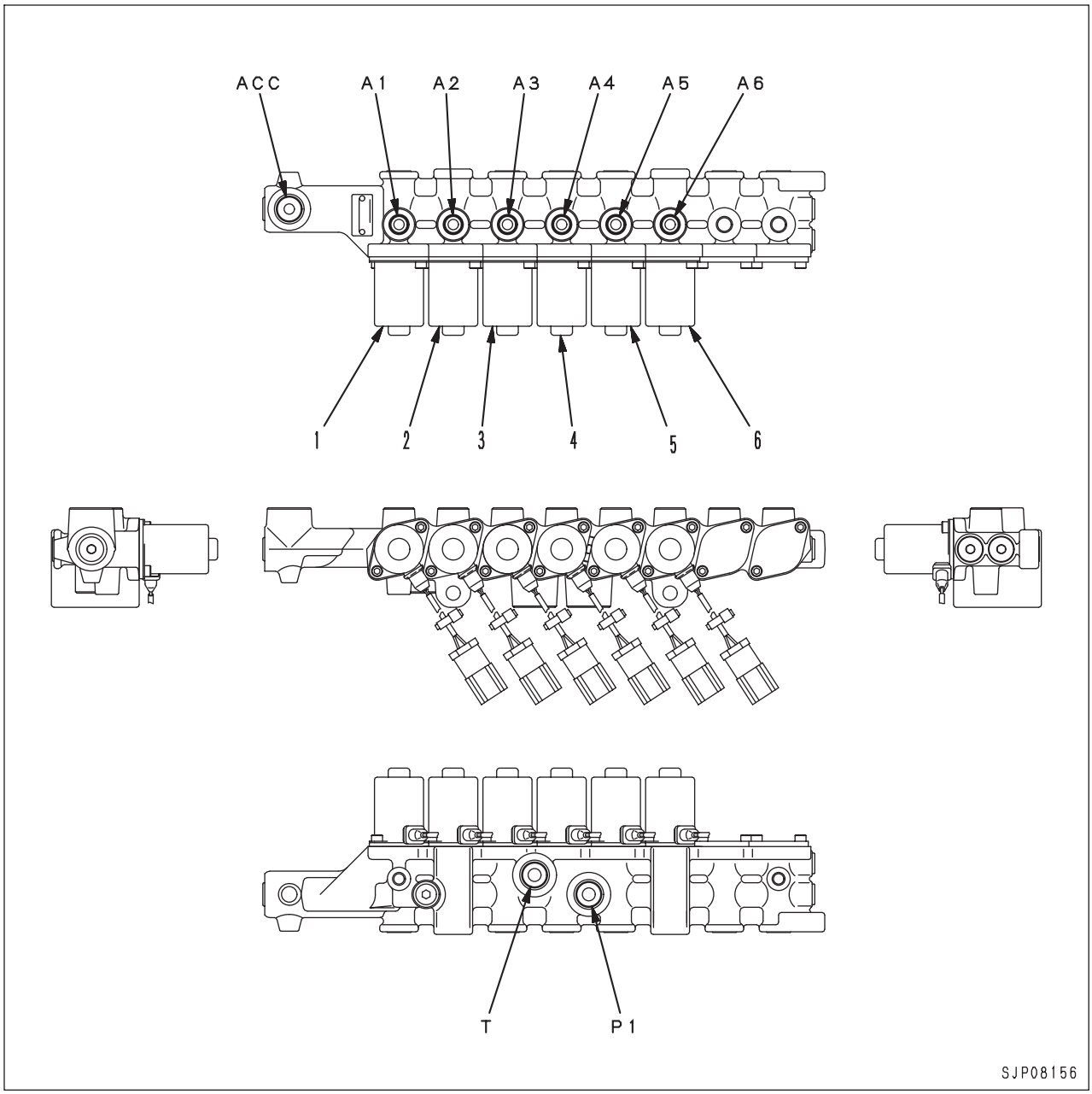
- When the pressure at port **a** becomes higher, spool (1) is pushed back by the force acting on the end of the spool, and fine control portion **Y** closes.
- As a result, spool (1) moves up and down to balance the force at port **a** and the force at metering spring (2).
- Therefore, metering spring (2) is compressed in proportion to the amount the control lever is moved. The spring force becomes larger, so the pressure at port **a** also increases in proportion to the amount the control lever is operated.

  In this way, the control valve spool moves to a position where the pressure of port **A** (the same as the pressure at port **a**) is balanced with the force of the return spring of the control valve spool.



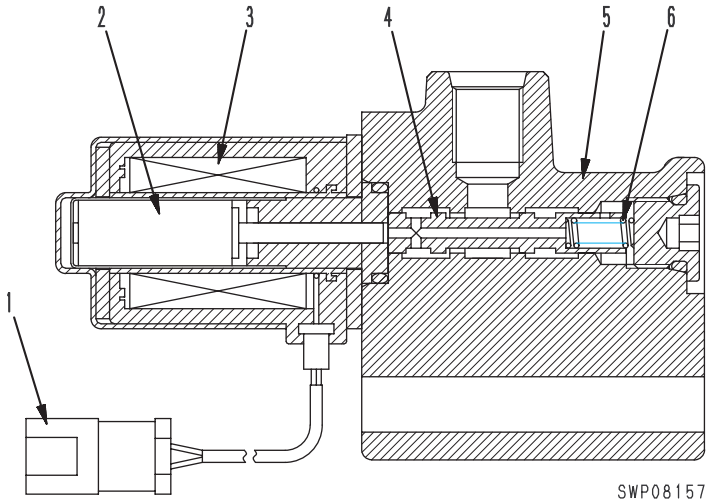
SOLENOID VALVE

PPC lock, 2-stage relief, travel speed, swing brake, merge-divider, travel junction solenoid valves



1. PPC lock solenoid valve
2. Travel junction solenoid valve
3. Merge-divider solenoid valve
4. Travel speed solenoid valve
5. Swing brake solenoid valve
6. 2-stage relief solenoid valve

T : To tank
A1 : To PPC valve
A2 : To main valve (Travel junction valve)
A3 . To main valve (Merge-divider valve)
A4 : To both travel motors
A5 : To swing motor
A6 : To main valve (2-stage relief valve)
P1 : From main pump
ACC: To accumulator



1.Connector
2.Moving core
3.Coil
4.Spool
5.Block
6.Spring

OPERATION

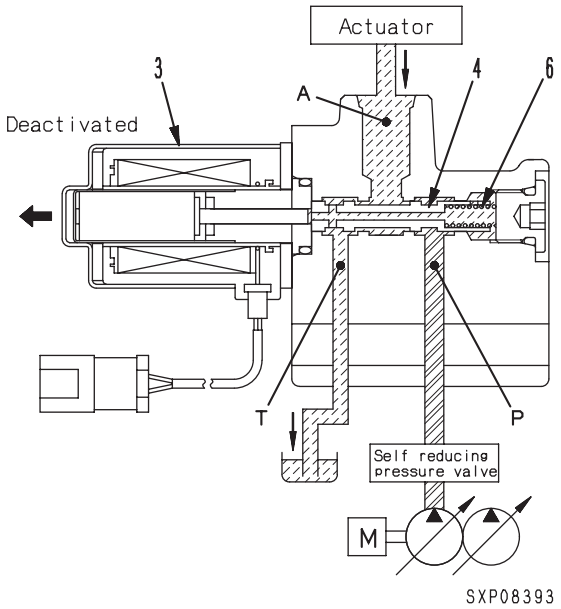
WHEN SOLENOID IS TURNED OFF

- Since the signal current does not flow from the controller, solenoid (3) is turned off.

  Accordingly, spool (4) is pressed by spring (6) against the left side.

  By this operation, the pass from **P** to **A** is closed and the hydraulic oil from the main pump does not flow into the actuator.

  At this time, the oil from the actuator is drained through ports **A** and **T** into the tank.



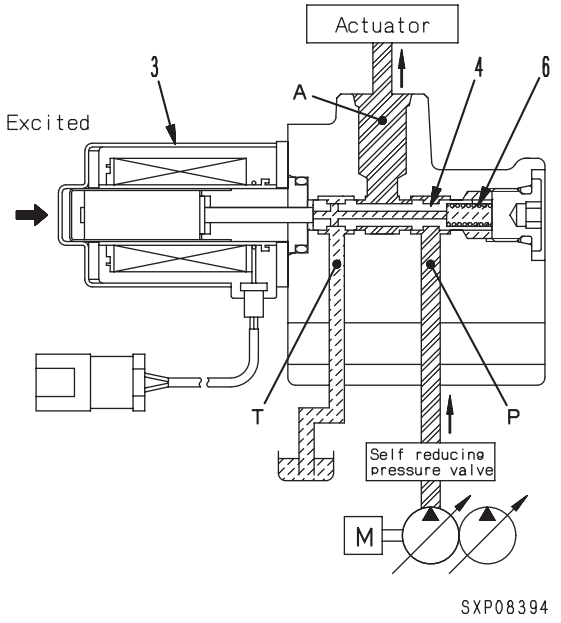
WHEN SOLENOID IS TURNED ON

The signal current flows from the controller to solenoid (3), and the latter is turned on.

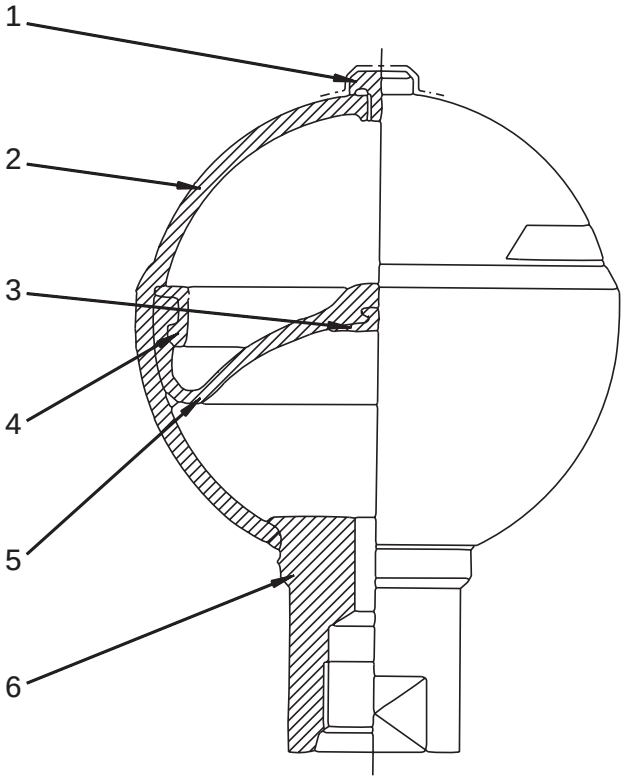
Accordingly, spool (4) is pressed against to the right side.

By this operation, the hydraulic oil from the main pump flows through port **P** and spool (4) to port **A**, then flows into the actuator.

At this time, port **T** is closed and the oil does not flow into the tank.



PPC ACCUMULATOR



SBP00290

1. Gas plug
2. Shell
3. Poppet
4. Holder
5. Bladder
6. Oil port

SPECIFICATIONS

Type of gas : Nitrogen gas
Gas capacity : 300 cc (for PPC)
Max. actuating pressure:3.1 MPa(32 kg/cm²)
Min. actuating pressure: 1.2 MPa(12 kg/cm²)

FUNCTION

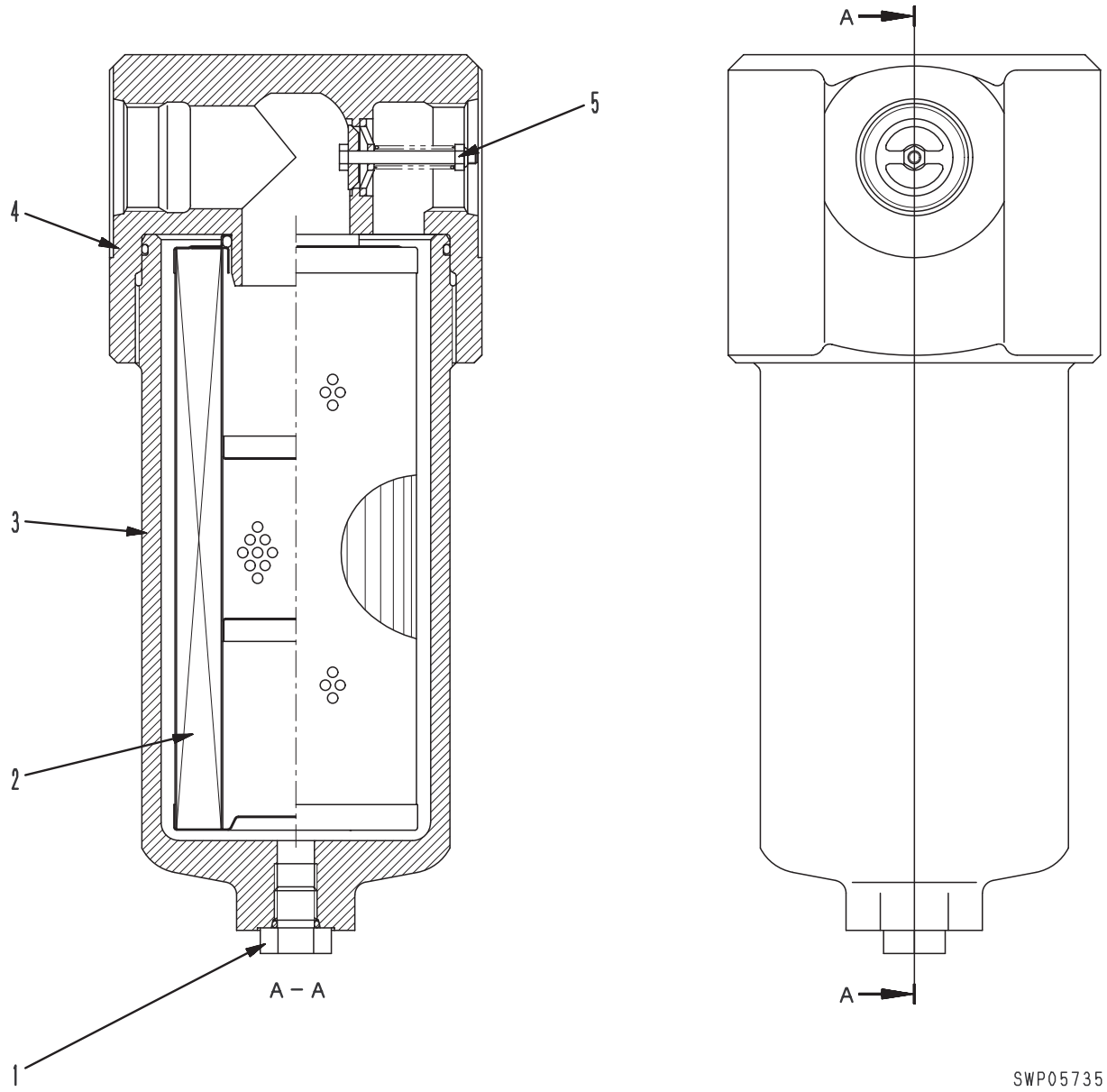
- The accumulator is installed between the PPC control pump and the PPC valve. Even if the engine is stopped with the work equipment raised, pilot oil pressure is sent to the main control valve by the pressure of the nitrogen gas compressed inside the accumulator, so it si possible to lower the work equipment under its own weight.

OPERATION

- After the engine stops, when the PPC valve is at neutral, chamber **A** inside the bladder is compressed by oil pressure in chamber **B.**
- If the PPC valve is operated, the oil pressure in chamber **B** becomes less than 2.9 MPa (30 kg/cm²), so the bladder expands under the pressure of the nitrogen gas in chamber **A**. The oil entering chamber **B** is sent as the pilot pressure to actuate the main control valve.

RETURN OIL FILTER

FOR BREAKER



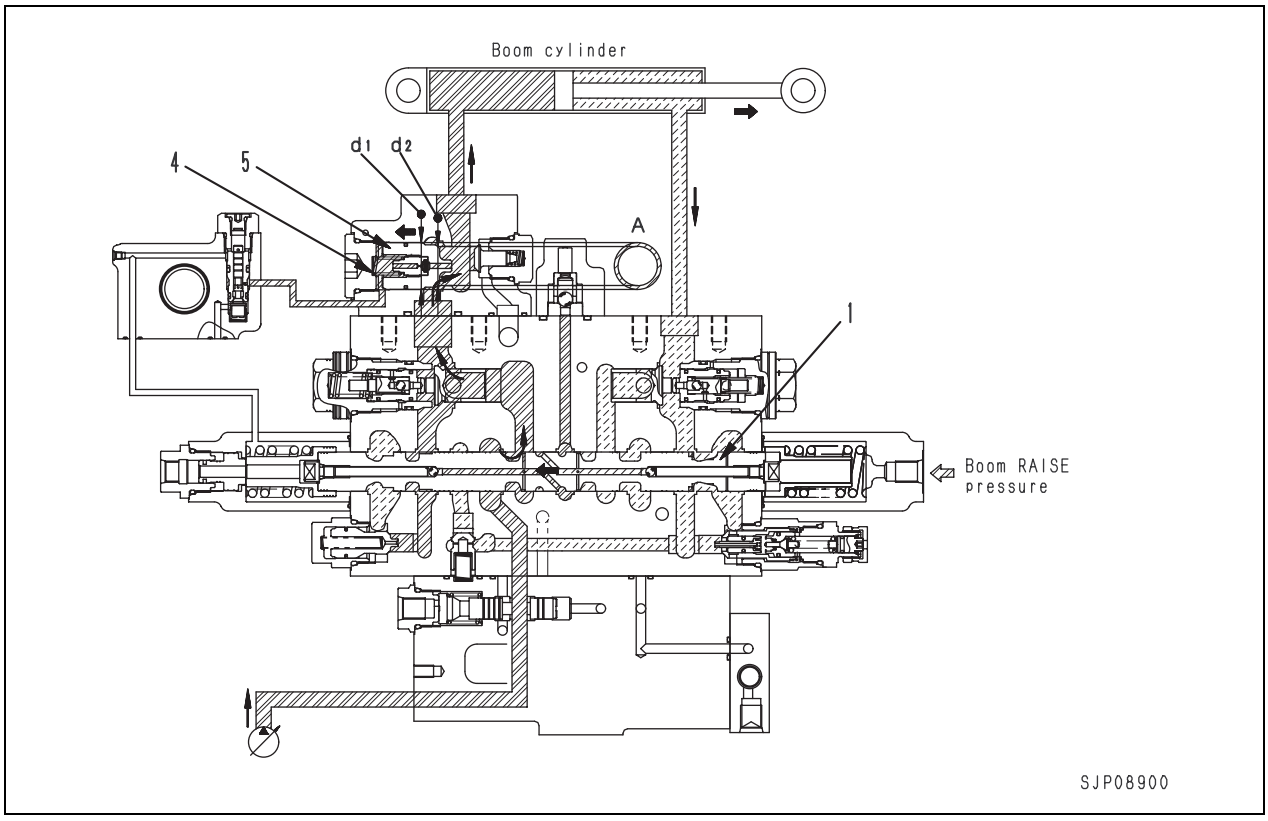
1. Drain plug
2. Element
3. Case
4. Head cover
5. Relief valve

SPECIFICATIONS

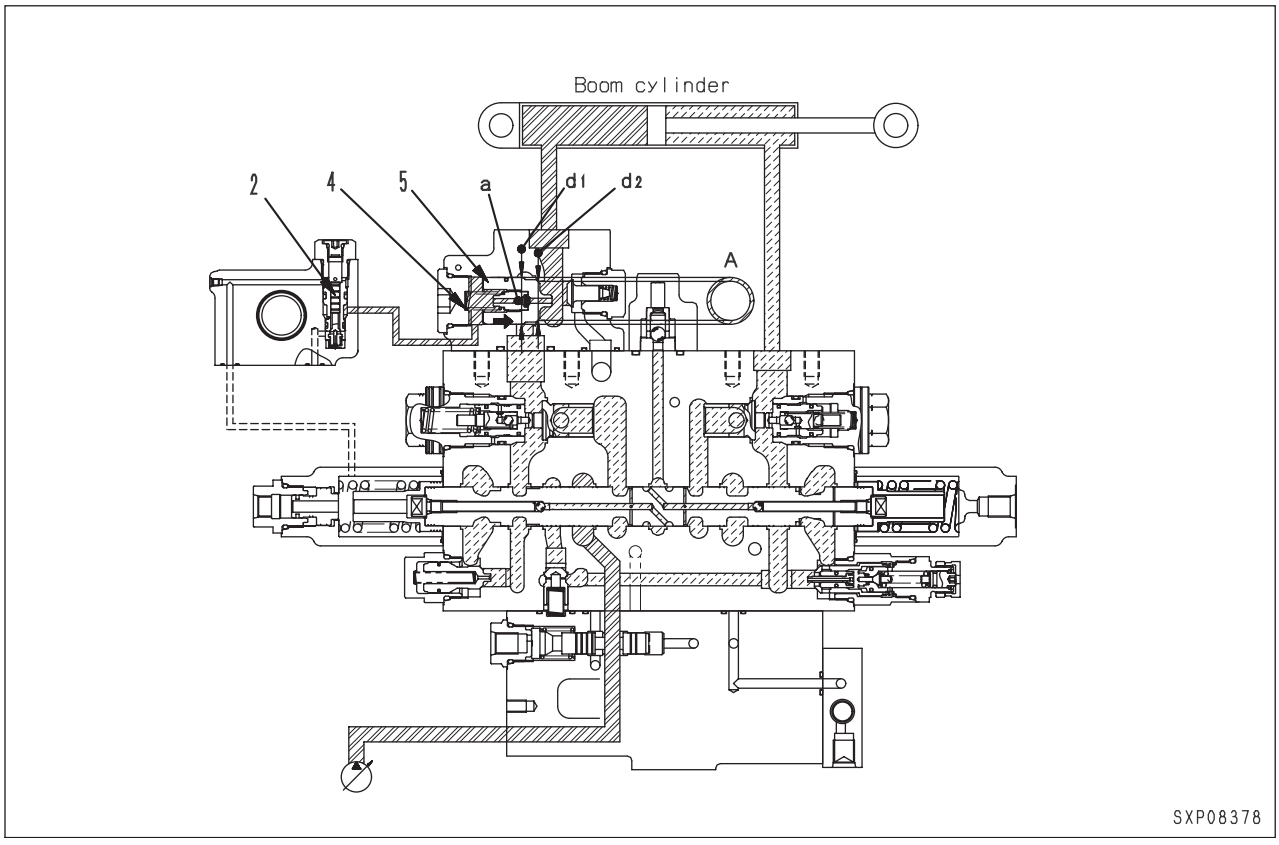
Rated pressure:		6.9 MPa {70 kg/cm^2}
Flow	:	200 **l**/min
Relief valve cracking pressure:		
		0.34 ± 0.05 MPa
		{3.5 ± 0.5 kg/cm^2}
Filter mesh size:		6 μm
Filtering area	:	4,570 cm^2

BOOM HYDRAULIC DRIFT PREVENTION VALVE

When boom control valve is at RAISE



When boom control valve is at NEUTRAL



Function

- This valve prevents the oil in the boom cylinder bottom from leaking through spool (1) and the boom from lowering under its weight while the boom lever is not operated.

Operation

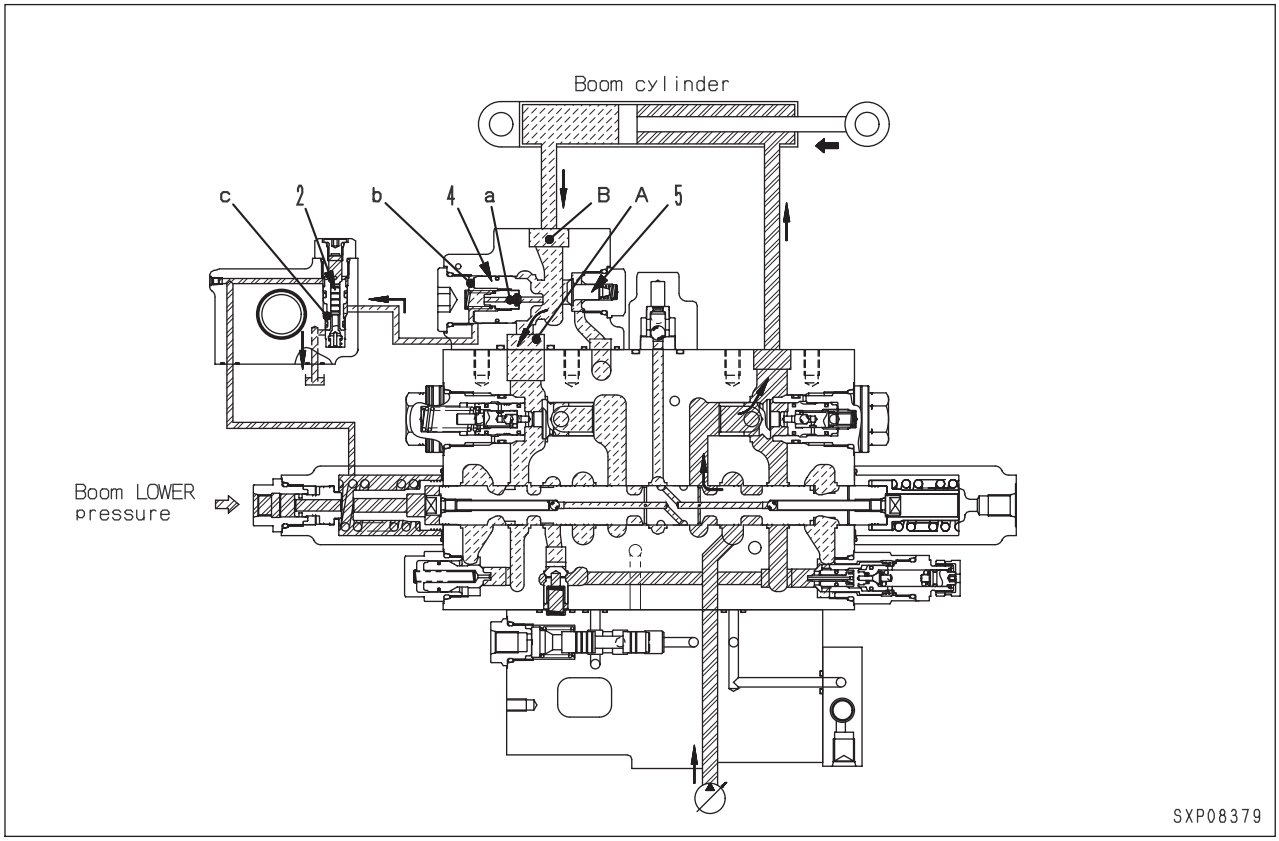
1. **When boom lever is in "RAISE" position**
   If the boom lever is set in the "RAISE" position, the pressure of the main hydraulic oil is applied toward the left to area "A" of the ring formed by the difference between outside diameter d1 of puppet (5) and seat diameter d2 (= Area of ∅d1 - Area of ∅d2). At this time, if this pressure is higher than the force of spring (4), puppet (5) moves to the left. By this operation, the main hydraulic oil from the control valve flows through the open part of puppet (5) to the boom cylinder bottom.
2. **When boom lever is in neutral**

- If the control lever is returned to the neutral position while the boom is raised, the oil in puppet (5) which has flowed through orifice "a" is sealed by pilot piston (2).

The main hydraulic oil is shut off from the holding pressure on the boom cylinder bottom side.

- At this time, the holding pressure on the boom cylinder bottom side is applied toward the right to area "A" of the ring formed by the difference between outside diameter d1 of puppet (5) and seat diameter d2 (= Area of ∅d1 - Area of ∅d2). The total of this pressure and the force of spring (4) closes puppet (5) to shut off the main hydraulic oil from the holding pressure on the boom cylinder bottom. Accordingly, the boom is held.

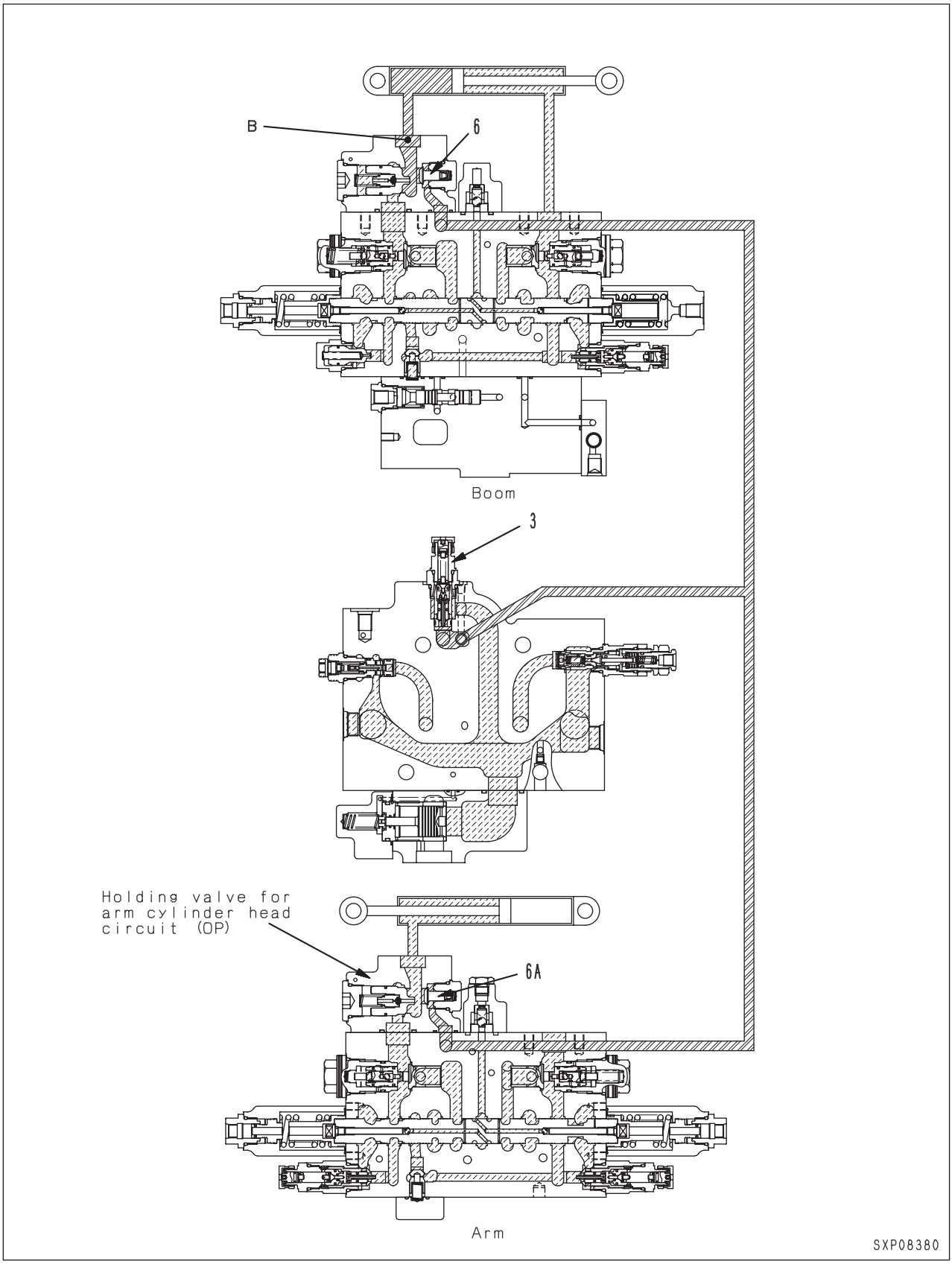
3. **When boom lever is in "LOWER" position**
   If the boom lever is set in the "LOWER" position, pilot spool (2) is pushed by the pilot pressure from the PPC valve and the hydraulic oil in chamber "b" in the puppet is drained through orifice "c".
   The oil on the boom bottom side flows from orifice "a" through chamber "b" and orifice "c" to the drain hole, and the oil pressure in chamber "b" lowers.
   If the pressure in chamber "b" lowers below the pressure at port B, puppet (4) opens and the hydraulic oil from port B flows through port A to the control valve.


Boom cylinder
c
2
b
4
a
B
A
5
Boom LOWER
pressure
SXP08379

4. When abnormally high pressure is generated

- If abnormally high pressure is generated in the boom cylinder bottom circuit, the hydraulic oil in port B pushes check valve (6) open, then safety valve (3) operates.

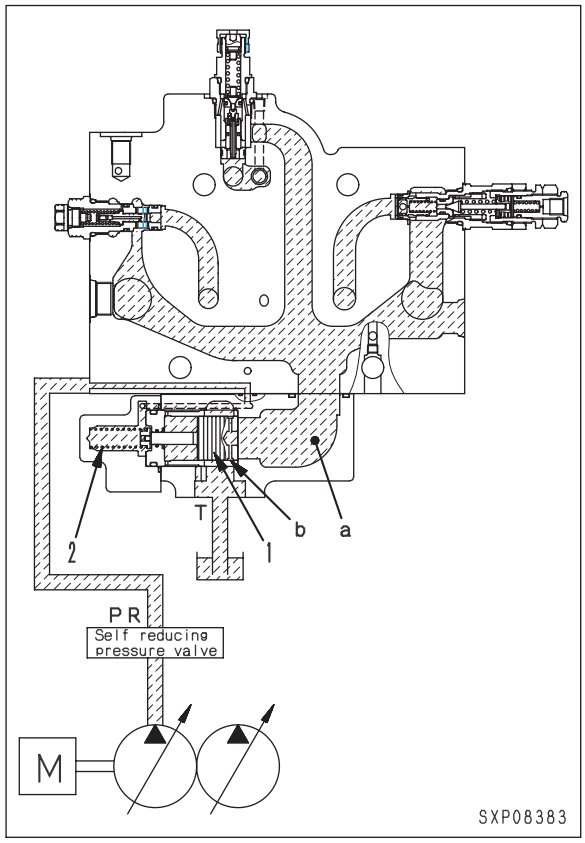
- If the hydraulic drift prevention valve for the arm cylinder head circuit is installed (optional), the hydraulic oil in the boom cylinder bottom circuit or that in the arm cylinder head circuit, having higher pressure, pushes check valve (6 or 6A) open, then safety valve (3) operates.


B
6
Boom
3
Holding valve for arm cylinder head circuit (OP)
6A
Arm
SXP08380

LIFT CHECK VALVE

Function

This valve applies back pressure to the drain circuit to prevent generation of negative pressure on the hydraulic devices for the work equipment (motors, cylinders, etc.)

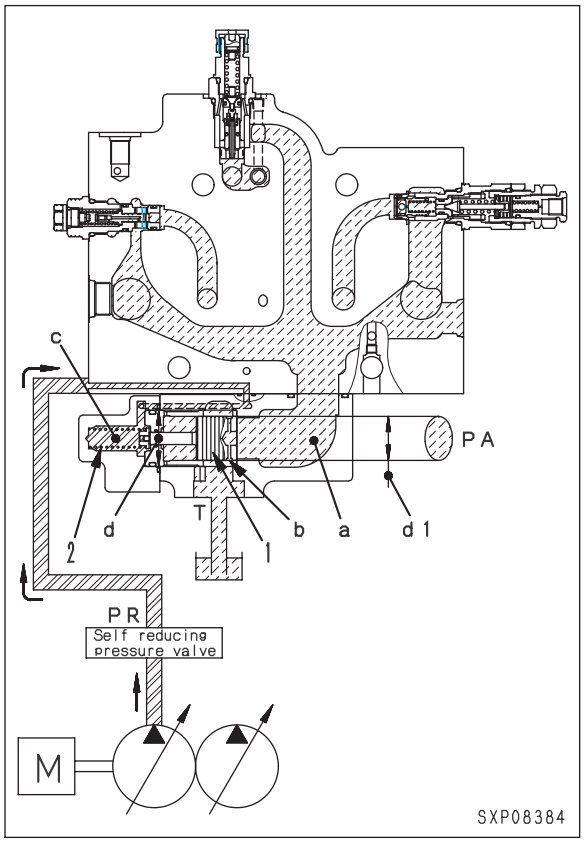


Operation

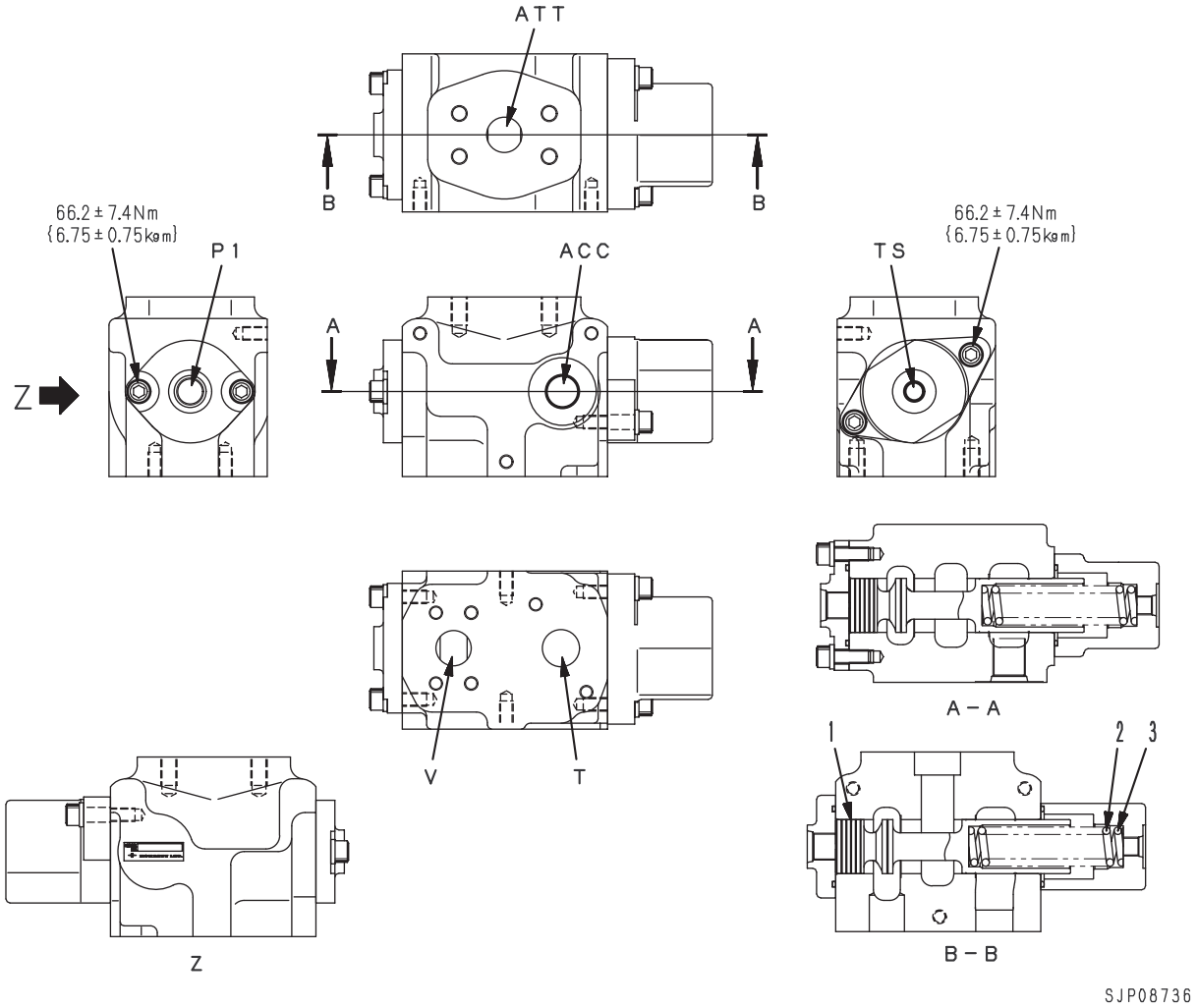
1. **While engine is stopped**
   Any oil is not supplied from the pump to the self-pressure reducing valve and valve (1) is pressed by only the force of spring (2) toward the right and drain circuit "a" of the control valve is connected through orifice "b" of valve (1) to port T.

2. **While engine is running**

- Output pressure PR of the self-pressure reducing valve is applied through the control valve to spring chamber "c" of the back pressure valve.
- Output pressure PR applied to spring chamber "c" is applied to the left end of valve (1) (area of ⌀d) to push valve (1) to the right.
- At this time, pressure PA of drain circuit "a" of the control valve is applied to the right end of valve (1) (area of ⌀d1) to push valve (1) to the left.
- Valve (1) is balanced so that the back pressure PA will be as follows.
  PA = {(Area of ⌀d) x PR + Force of spring (2)} / (Area of ⌀d1)



ATTACHMENT CIRCUIT SELECTOR VALVE



1. Spool
2. Spring

V : To control valve
T : To hydraulic tank
ATT: To attachment
ACC: To accumulator
P1 : From attachment circuit selector solenoid valve
TS : To hydraulic tank

Unit: mm

No.	Check item	Criteria					Remedy
		Standard size			Repair limit		
3	Spool return spring	Free length x Outside Dia.	Installed length	Installed load	Free length	Installed load	Replace spring if any damages or deformations are found
		132.0 x 29	114.5	833 N {85.0 Kg}	--	666 N {68.0 Kg}	

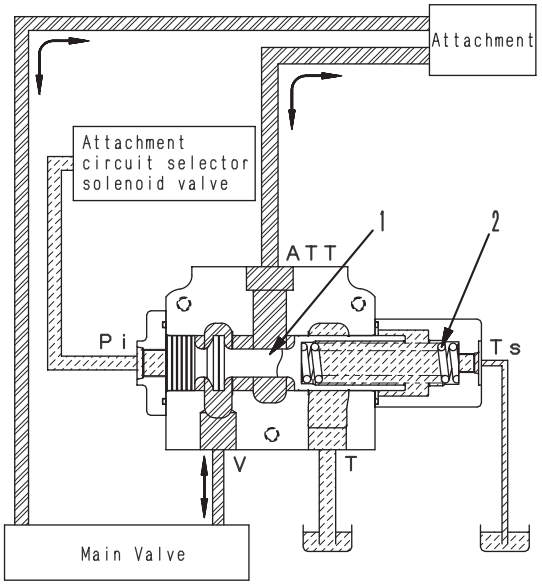
Function

When a breaker is installed, the return oil from the breaker does not pass through the main valve, but returns directly to the hydraulic tank. When other attachments (crusher, etc.) are installed, the attachment and the main valve are interconnected.

Operation

1. When attachment other than breaker is installed

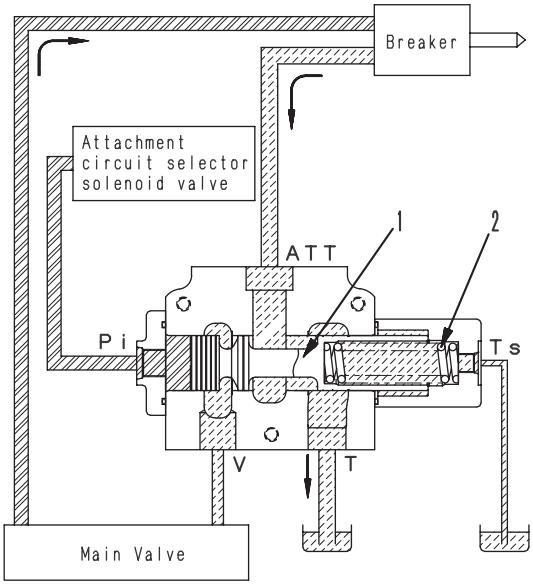
Spool (1) is pushed fully to the left by the force of spring (2), ATT port and port V are interconnected, and ATT port and port T are shut off, so the attachment and main valve are interconnected.



SJP08901

2. When breaker is installed

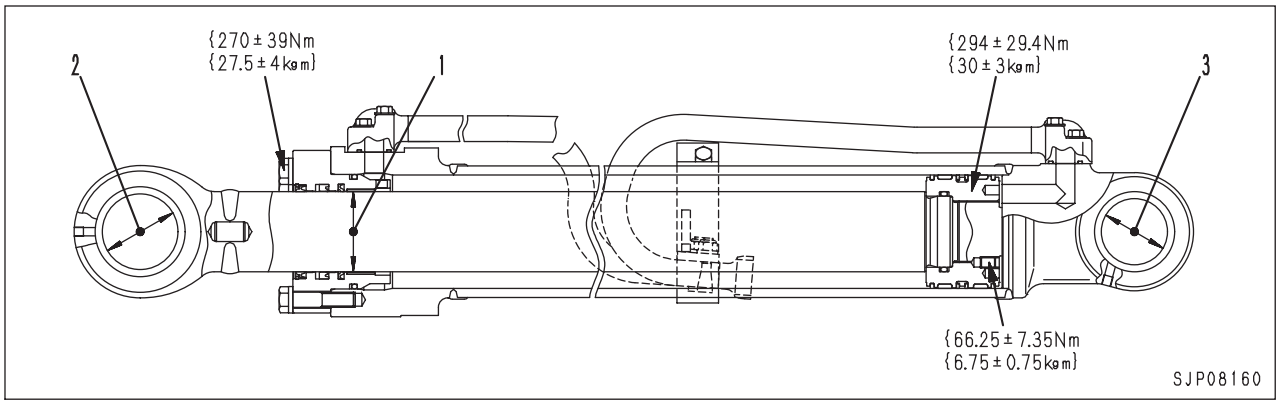
When the pilot pressure from the attachment circuit selector solenoid valve overcomes the force of spring (2), the spool (1) moves fully to the right. ATT port and port V are shut off and ATT port and port T are interconnected, so the oil returning from the breaker does not pass through the main valve, but passes through port T and returns directly to the hydraulic tank.



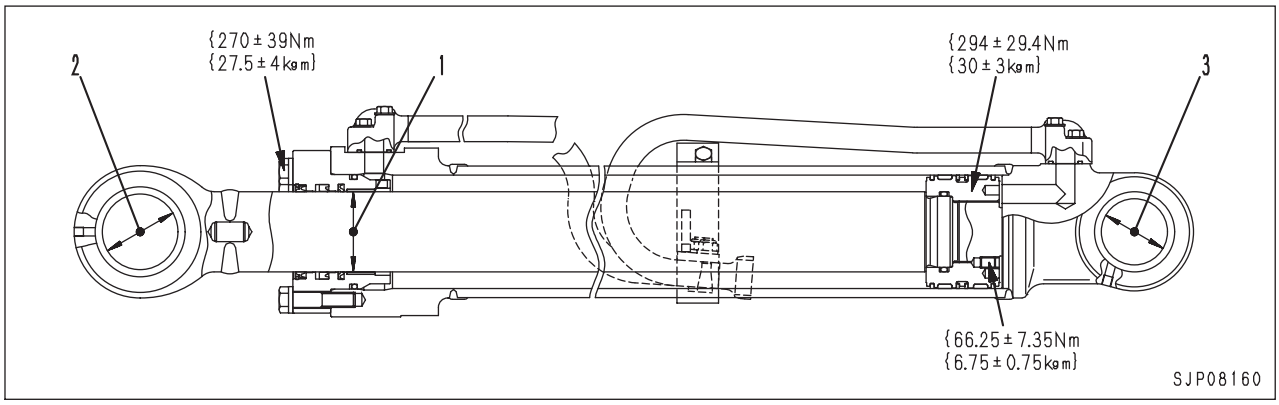
SJP08902

HYDRAULIC CYLINDER
PC210-7K, PC210LC-7K, PC210NLC-7K

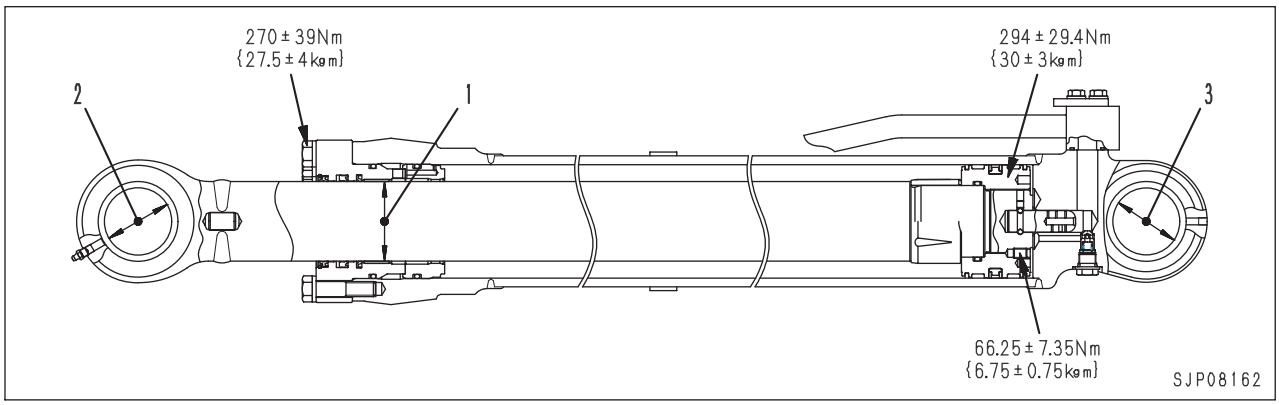
BOOM CYLINDER



ARM CYLINDER



BUCKET CYLINDER



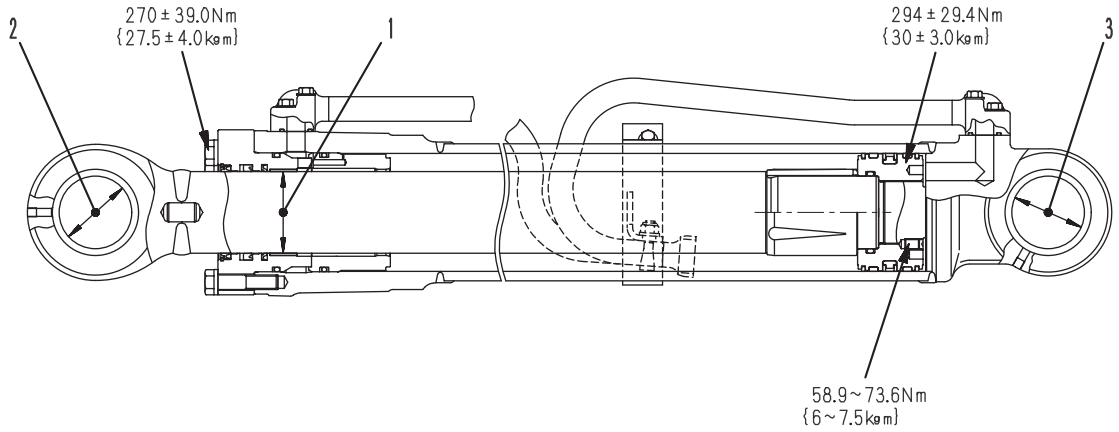
500 HOURS GREASING

Unit: mm

No.	Check item		Criteria					Remedy
		Cylinder	Standard size	Tolerance		Standard clearance	Clearance limit	
				Shaft	Hole			
1	Clearance between piston rod and bushing	Boom	85	-0.036 -0.090	+0.222 +0.047	0.083 ~ 0.312	0.412	Replace bushing
		Arm	95	-0.036 -0.090	+0.222 +0.047	0.083 ~ 0.312	0.412	
		Bucket	80	-0.030 -0.076	+0.257 +0.048	0.078 ~ 0.334	0.447	
2	Clearance between piston rod support pin and bushing	Boom	80	-0.030 -0.060	+0.190 +0.070	0.100 ~ 0.250	---	Replace pin or bushing
		Arm	80	-0.030 -0.076	+0.175 +0.075	0.105 ~ 0.251	---	
		Bucket	70	-0.030 -0.076	+0.170 +0.070	0.100 ~ 0.246	---	
3	Clearance between cylinder bottom support pin and bushing	Boom	70	-0.030 -0.060	+0.165 +0.045	0.075 ~ 0.225	---	
		Arm	80	-0.030 -0.076	+0.175 +0.075	0.105 ~ 0.251	---	
		Bucket	70	-0.030 -0.060	+0.170 +0.070	0.100 ~ 0.230	---	

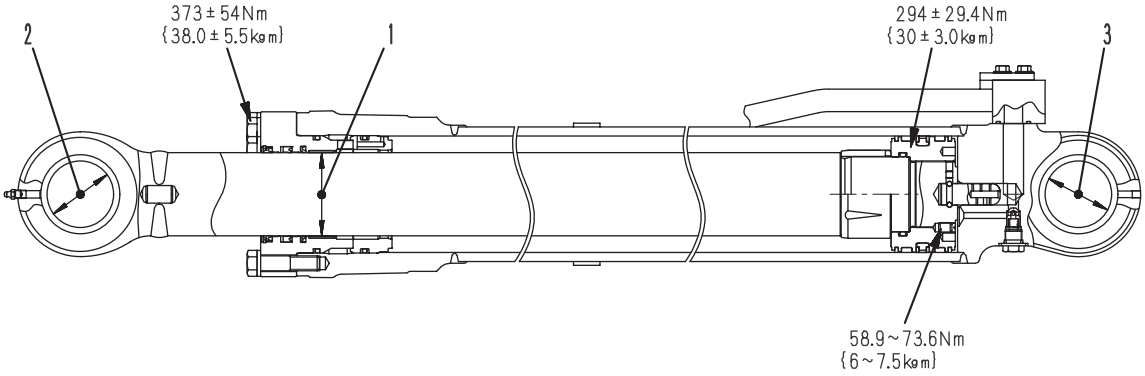
PC240LC-7K, PC240NLC-7K

BOOM CYLINDER



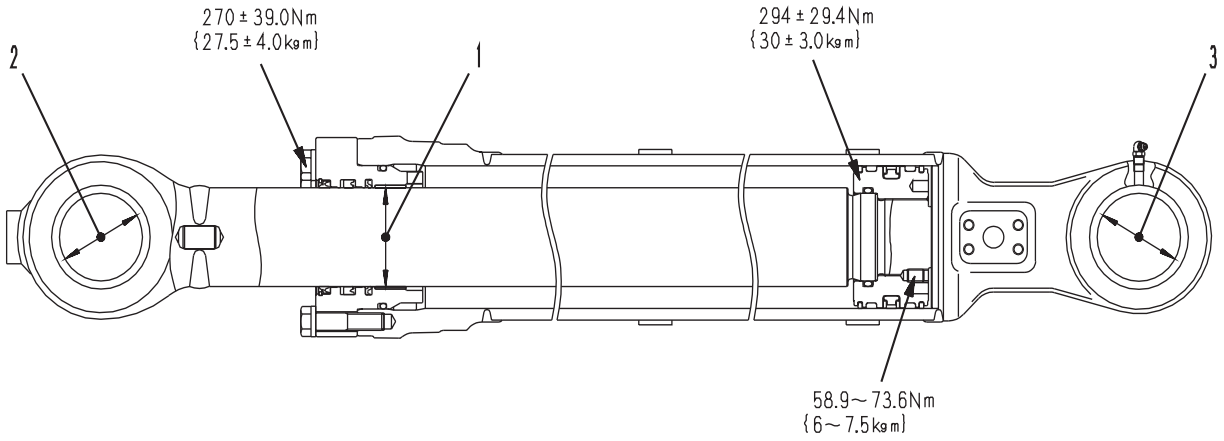
SJP09107

ARM CYLINDER



SJP09108

BUCKET CYLINDER

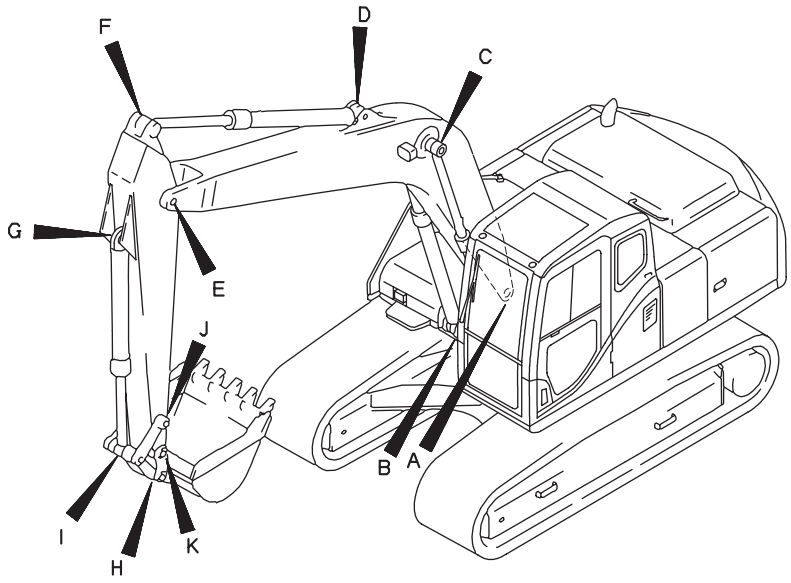


500 HOURS GREASING

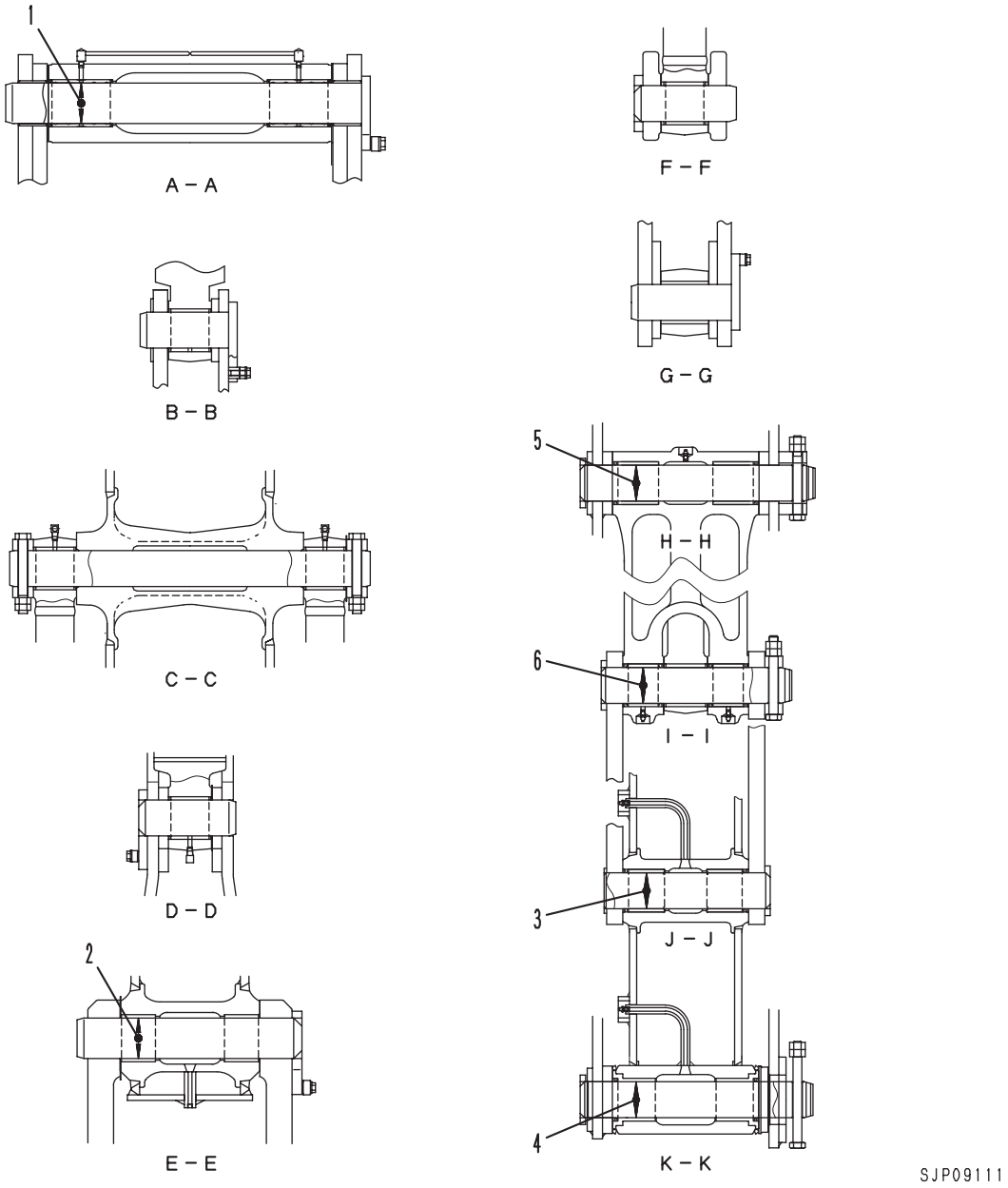
Unit: mm

No.	Check item		Criteria					Remedy
		Cylinder	Standard size	Tolerance		Standard clearance	Clearance limit	
				Shaft	Hole			
1	Clearance between piston rod and bushing	Boom	90	-0.036 -0.090	+0.257 +0.048	0.084 ~ 0.347	0.447	Replace bushing
		Arm	100	-0.036 -0.090	+0.257 +0.047	0.083 ~ 0.347	0.447	
		Bucket	90	-0.036 -0.090	+0.257 +0.048	0.084 ~ 0.347	0.447	
2	Clearance between piston rod support pin and bushing	Boom	80	-0.030 -0.060	+0.190 +0.070	0.100 ~ 0.250	---	Replace pin or bushing
		Arm	80	-0.030 -0.076	+0.175 +0.075	0.105 ~ 0.251	---	
		Bucket	80	-0.030 -0.076	+0.175 +0.075	0.105 ~ 0.251	---	
3	Clearance between cylinder bottom support pin and bushing	Boom	80	-0.030 -0.060	+0.190 +0.070	0.100 ~ 0.250	---	
		Arm	80	-0.030 -0.076	+0.175 +0.075	0.105 ~ 0.251	---	
		Bucket	80	-0.030 -0.076	+0.175 +0.075	0.105 ~ 0.251	---	

WORK EQUIPMENT



SJP09110



SJP09111

PC210-7K, PC210LC-7K, PC210NLC-7K

500 HOURS GREASING

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	

PC240LC-7K, PC240NLC-7K

500 HOURS GREASING

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	100	-0.036 -0.071	+0.186 +0.074	0.110 ~ 0.239	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	80	-0.030 -0.076	+0.166 +0.084	0.116 ~ 0.242	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	+0.166 +0.066	0.096 ~ 0.232	1.0	

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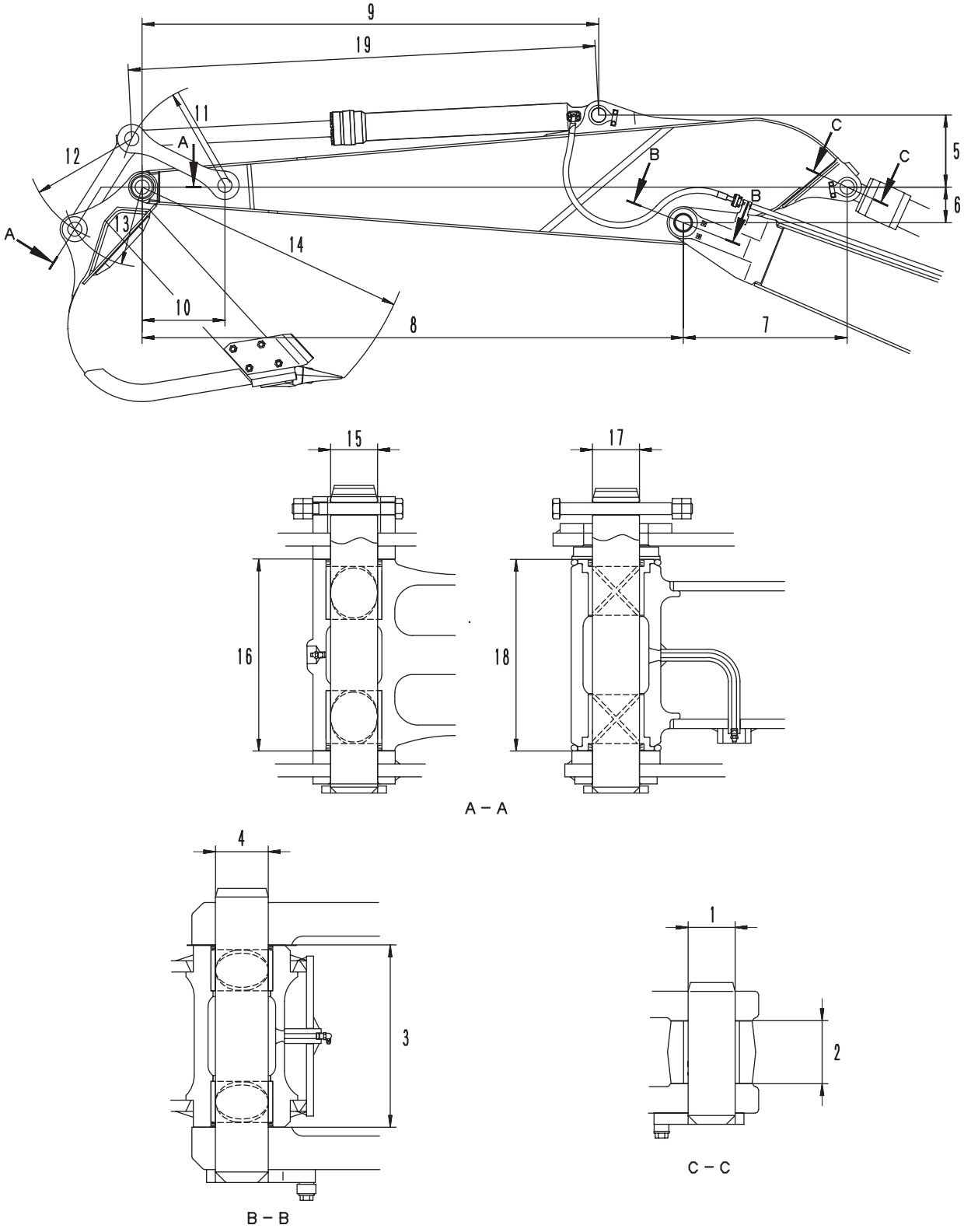
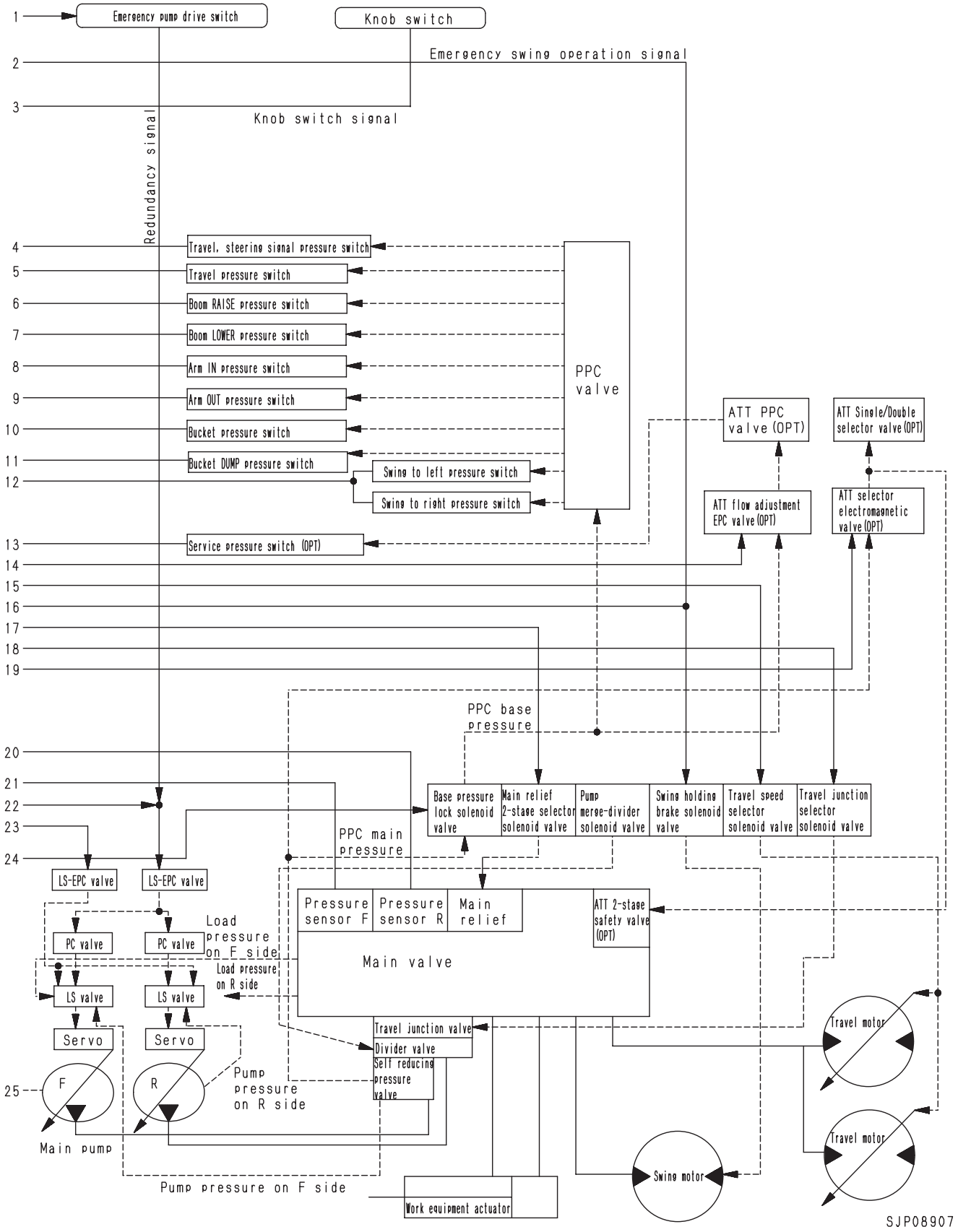
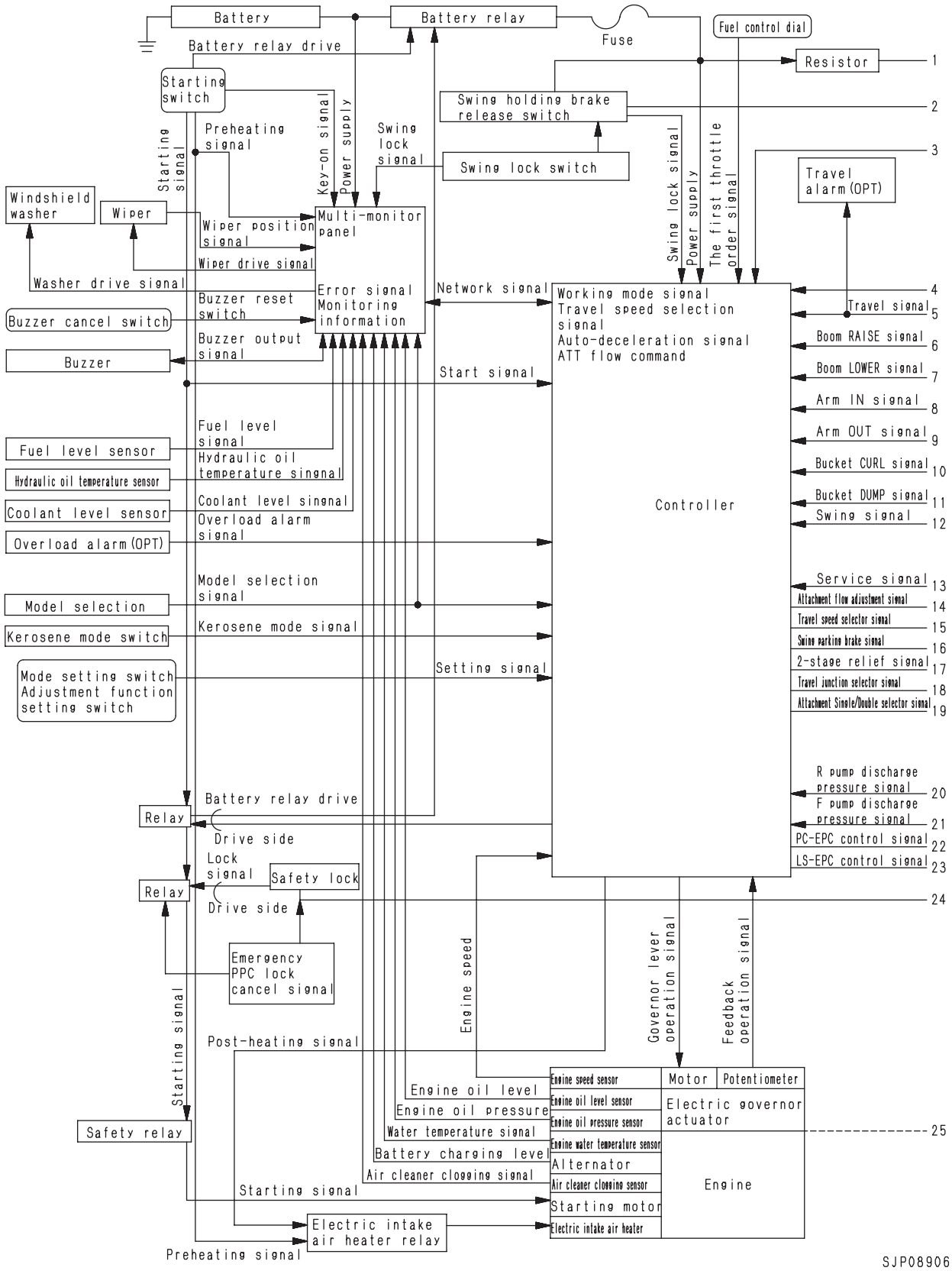
1. DIMENSION OF ARM



Unit: mm

No.	Model	PC210-7K, PC210LC-7K, PC210NLC-7K	PC240LC-7K, PC240NLC-7K
1		$\varnothing 80^{+0.1}_{0}$	$\varnothing 80^{+0.1}_{0}$
2		$109.3^{+1.5}_{0}$	$109.3^{+1.5}_{0}$
3		$305.5^{0}_{-0.5}$	$305.5^{0}_{-0.5}$
4		$\varnothing 90^{-0.036}_{-0.071}$	$\varnothing 90^{-0.036}_{-0.071}$
5		402.1 ±1	419.9 ±1
6		187.2 ±0.5	206.1 ±0.5
7		829.1 ±1	918.6 ±1
8		2,919	3,037.6
9		2,630.5 ±1	2,562.8 ±1
10		410 ±1	465 ±1
11		640 ±0.2	585 ±0.2
12		600 ±0.5	600 ±0.5
13		458.1	446.3
14		1,486	1,551.7
15		80	80
16		326.5 ±1	326.5 ±1
17		∅ 80	∅ 80
18	Arm as individual part	$311^{0}_{-0.5}$	$311^{0}_{-0.5}$
	When pressfitting bushing	325	325
19	Min.	1,680	1,605
	Max.	2,800	2,625


1
Emergency pump drive switch
Knob switch
2
Emergency swing operation signal
3
Knob switch signal
Redundancy signal
4
Travel, steering signal pressure switch
5
Travel pressure switch
6
Boom RAISE pressure switch
7
Boom LOWER pressure switch
8
Arm IN pressure switch
9
Arm OUT pressure switch
10
Bucket pressure switch
11
Bucket DUMP pressure switch
12
Swing to left pressure switch
Swing to right pressure switch
PPC valve
ATT PPC valve (OPT)
ATT Single/Double selector valve (OPT)
ATT flow adjustment EPC valve (OPT)
ATT selector electromagnetic valve (OPT)
13
Service pressure switch (OPT)
14
15
16
17
18
19
PPC base pressure
20
21
22
23
24
Base pressure lock solenoid valve
Main relief 2-stage selector solenoid valve
Pump merge-divider solenoid valve
Swing holding brake solenoid valve
Travel speed selector solenoid valve
Travel junction selector solenoid valve
PPC main pressure
LS-EPC valve
LS-EPC valve
Pressure sensor F
Pressure sensor R
Main relief
ATT 2-stage safety valve (OPT)
Load pressure on F side
PC valve
PC valve
Load pressure on R side
Main valve
LS valve
LS valve
Travel junction valve
Divider valve
Self reducing pressure valve
Servo
Servo
Travel motor
25
F
R
Pump pressure on R side
Main pump
Pump pressure on F side
Swing motor
Travel motor
Work equipment actuator
SJP08907


Battery
Battery relay
Fuse
Fuel control dial
Battery relay drive
Resistor
Starting switch
Swing holding brake release switch
Swing lock switch
Preheating signal
Key-on signal
Power supply
Swing lock signal
Starting signal
Travel alarm (OPT)
Windshield washer
Wiper
Multi-monitor panel
Wiper position signal
Wiper drive signal
Washer drive signal
Buzzer reset switch
Error signal
Monitoring information
Network signal
Working mode signal
Travel speed selection signal
Auto-deceleration signal
ATT flow command
Buzzer cancel switch
Buzzer output signal
Buzzer
Start signal
Travel signal
Boom RAISE signal
Boom LOWER signal
Arm IN signal
Arm OUT signal
Bucket CURL signal
Bucket DUMP signal
Swing signal
Fuel level sensor
Fuel level signal
Hydraulic oil temperature sensor
Hydraulic oil temperature singnal
Coolant level sensor
Coolant level singnal
Overload alarm signal
Overload alarm (OPT)
Controller
Model selection signal
Model selection
Kerosene mode signal
Kerosene mode switch
Setting signal
Mode setting switch
Adjustment function setting switch
Service signal
Attachment flow adjustment signal
Travel speed selector signal
Swing parking brake signal
2-stage relief signal
Travel junction selector signal
Attachment Single/Double selector signal
R pump discharge pressure signal
F pump discharge pressure signal
PC-EPC control signal
LS-EPC control signal
Battery relay drive
Relay
Drive side
Lock signal
Safety lock
Relay
Drive side
Emergency PPC lock cancel signal
Engine speed
Governor lever operation signal
Feedback operation signal
Starting signal
Post-heating signal
Engine oil level
Engine oil pressure
Water temperature signal
Battery charging level
Air cleaner clogging signal
Starting signal
Safety relay
Electric intake air heater relay
Preheating signal
Engine speed sensor
Engine oil level sensor
Engine oil pressure sensor
Engine water temperature sensor
Alternator
Air cleaner clogging sensor
Starting motor
Electric intake air heater
Motor
Potentiometer
Electric governor actuator
Engine
1
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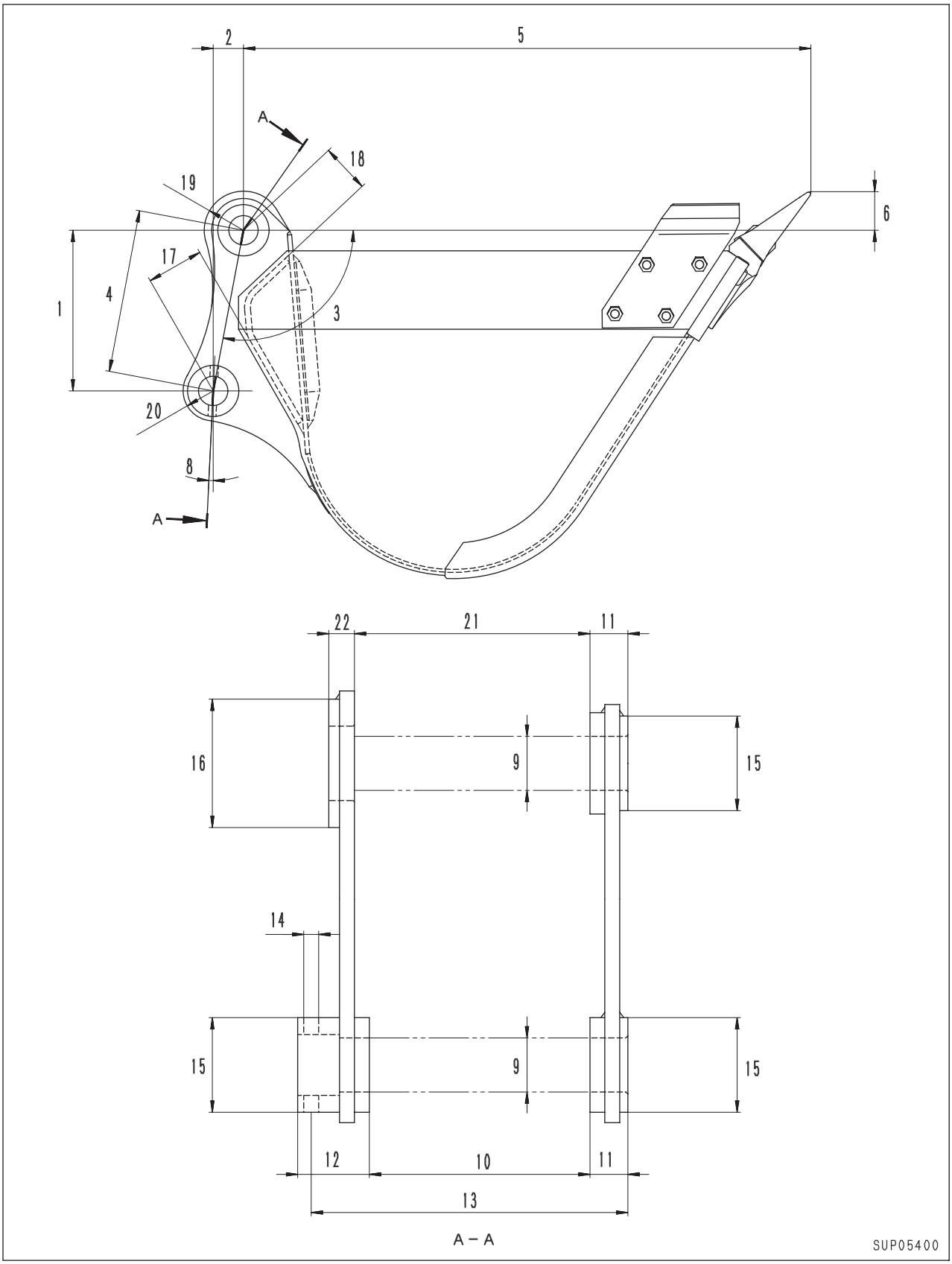
SJP08906

2.DIMENSION OF BUCKET

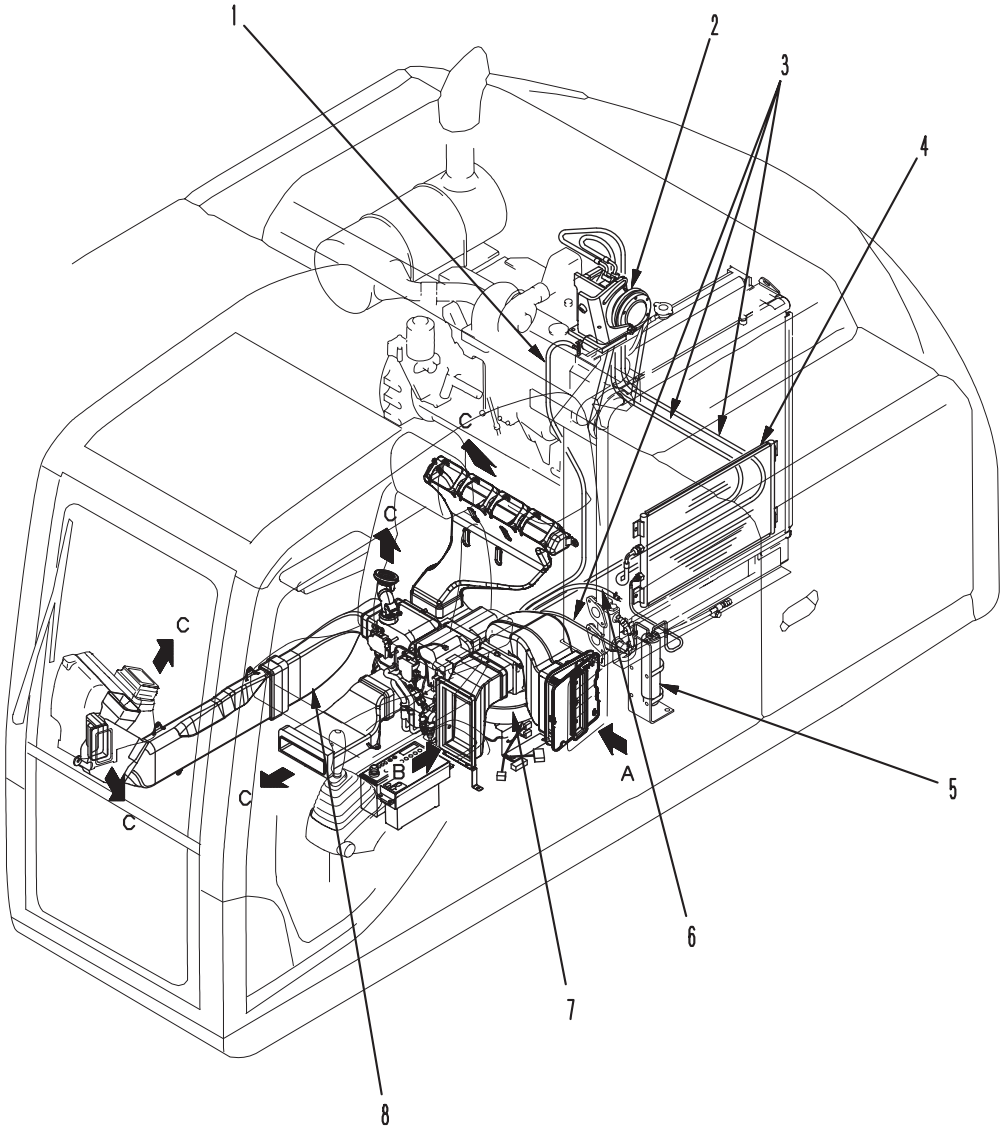


Unit: mm

No. \ Model	PC210-7K, PC210LC-7K, PC210NLC-7K	PC240LC-7K, PC240NLC-7K
1	457.6 ±0.5	442.4 ±0.5
2	22 ±0.5	59.2 ±0.5
3	92° 48’	96° 52’
4	458.1	446.3
5	1,477.3	1,540.5
6	158.6	185.7
7	—	—
8	0	7° 37’
9	$\varnothing 80\ ^{+0.1}_{0}$	$\varnothing 80\ ^{+0.2}_{0}$
10	326.5 ±1	326.5 ±1
11	56	59
12	106	104
13	470	470
14	⌀ 23.5	⌀ 23.5
15	⌀ 140	⌀ 140
16	⌀ 190	⌀ 190
17	132	155
18	129	135
19	107	107
20	85	82
21	$358.5\ ^{+2}_{0}$	$358.5\ ^{+2}_{0}$
22	38	37

AIR CONDITIONER

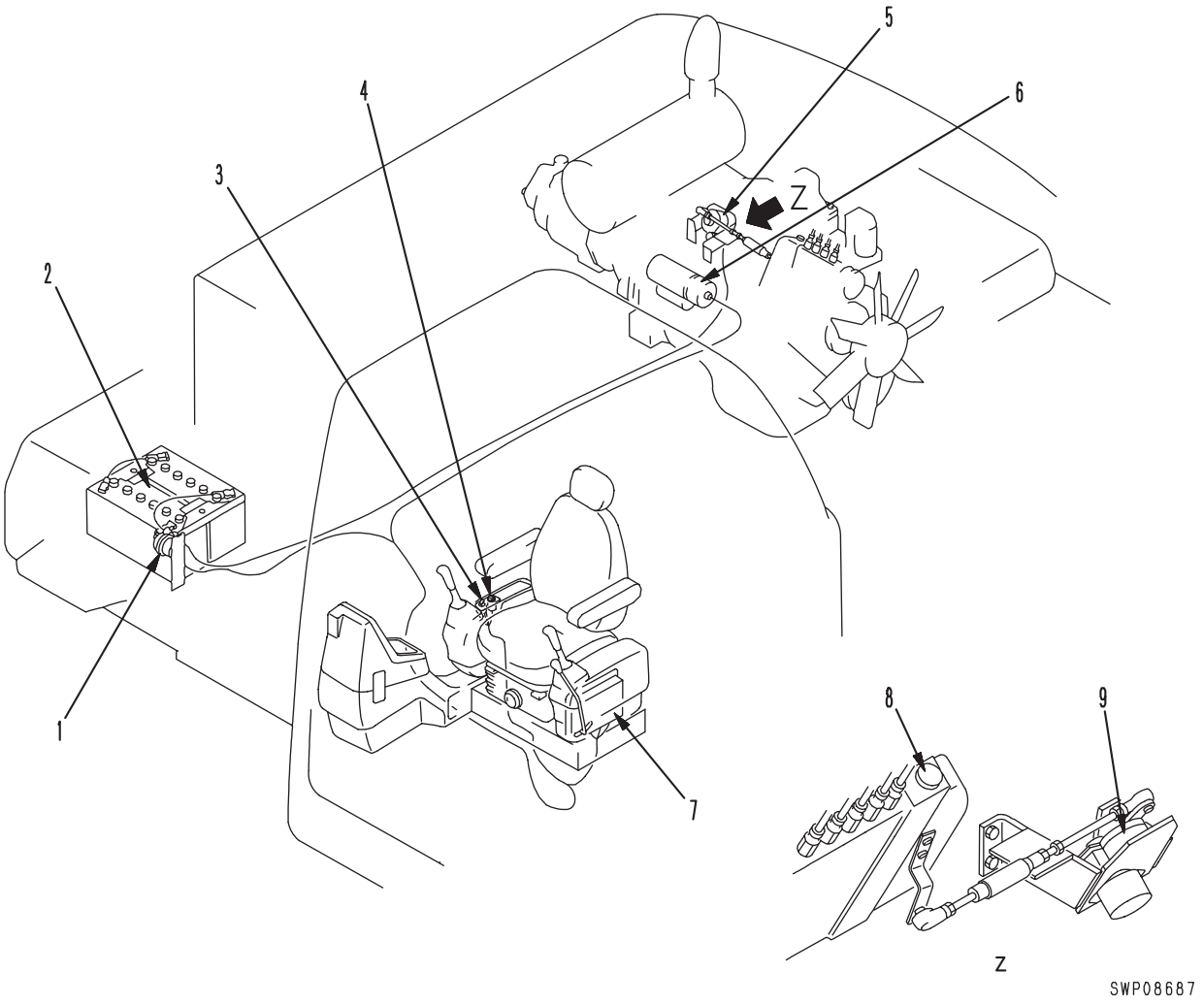
AIR CONDITIONER PIPING



1. Hot water pickup piping
2. Air conditioner compressor
3. Refrigerant piping
4. Condenser
5. Receiver tank
6. Hot water return piping
7. Air conditioner unit
8. Duct

A. Fresh air
B. Recirculated air
C. Hot air/cold air

ENGINE CONTROL



1. Battery relay
2. Battery
3. Starting switch
4. Fuel control dial
5. Linkage
6. Starting motor
7. Engine throttle and pump controller
8. Fuel injection pump
9. Governor motor

OUTLINE

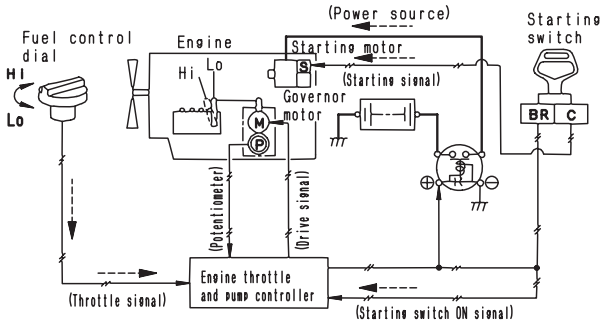
- The engine can be started and stopped with only starting switch (3).
- The engine throttle and pump controller(7) reveives the signal of fuel control dial (4) and transmits the drive signal to governor motor (9) to control the governor lever angle of fuel injection pump (8) and control the engine speed.

1. OPERATION OF SYSTEM

Starting engine

- When the starting switch is turned to the START position, the starting signal flows to the starting motor, and the starting motor turns to start the engine.

  When this happens, the engine throttle and pump controller checks the signal from the fuel control dial and sets the engine speed to the speed set by the fuel control dial.

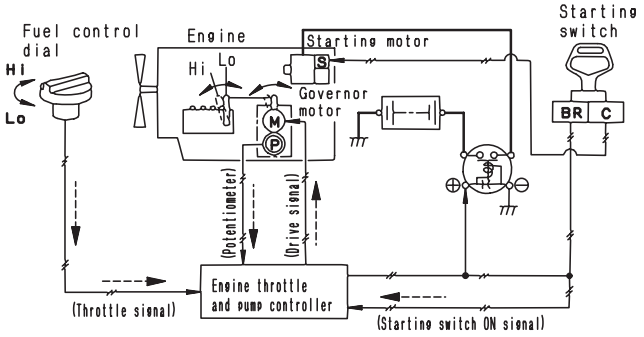


SJP08903

Engine speed control

- The fuel control dial sends a signal to the engine throttle and pump controller according to the position of the dial. The engine throttle and pump controller calculates the angle of the governor motor according to this signal, and sends a signal to drive the governor motor so that it is at that angle.

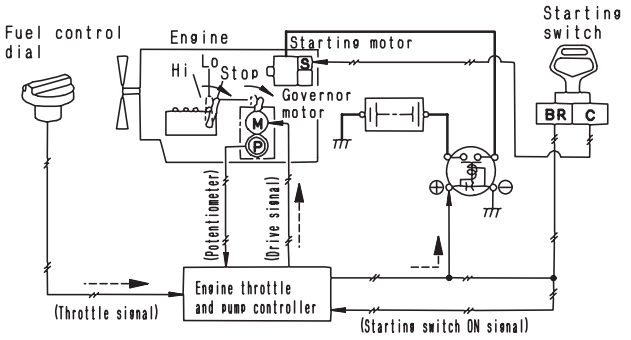
  When this happens, the operating angle of the governor motor is detected by the potentiometer, and feedback is sent to the engine throttle and pump controller, so that it can observe the operation of the governor motor.



SJP08904

Stopping engine

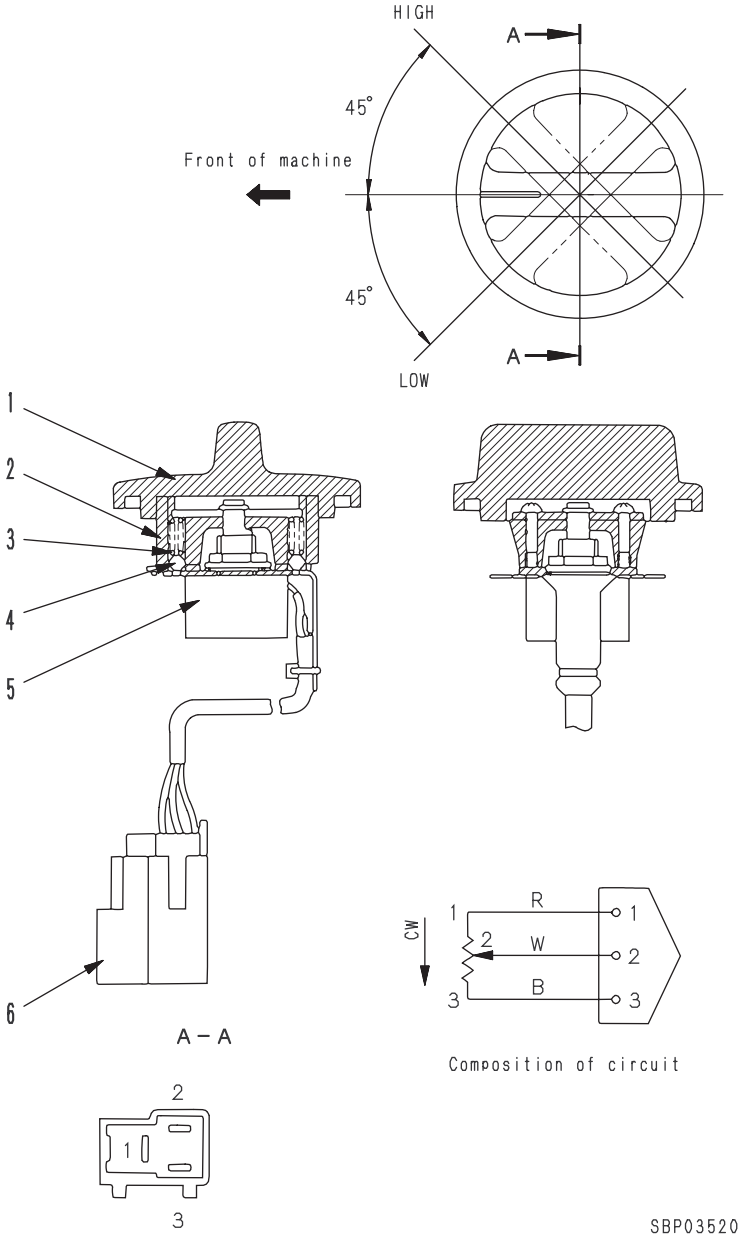
- When the starting switch is turned to the STOP position, the engine throttle and pump controller drives the governor motor so that the governor lever is set to the NO INJECTION position.
- When this happens, to maintain the electric power in the system until the engine stops completely, the engine throttle and pump controller itself drives the battery relay.



SJP08905

1. COMPONENT

Fuel control dial

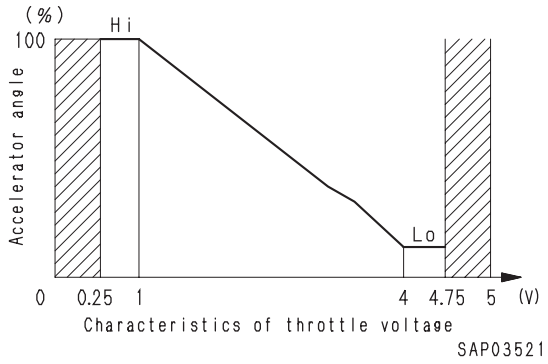


1. Knob
2. Dial
3. Spring
4. Ball
5. Potentiometer
6. Connector

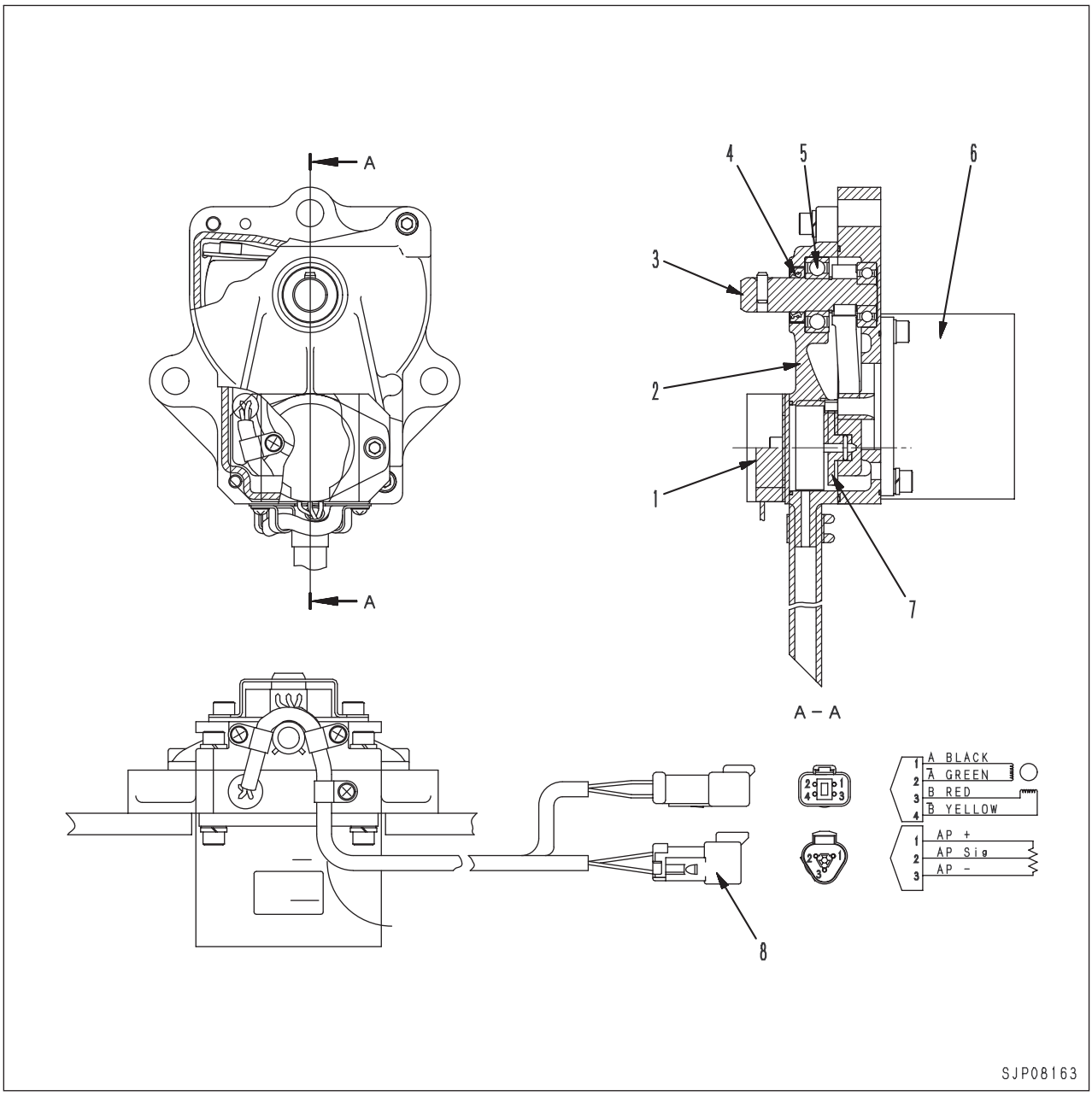
Function

- The fuel control dial is installed under the monitor panel, and a potentiometer is installed under the knob. The potentiometer shaft is turned by turning the knob.
- As the potentiometer shaft is turned, the resistance of the variable resistor in the potentiometer changes and a throttle signal is sent to the engine throttle and pump controller.

  The hatched area in the graph shown at right is the abnormality detection area.



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.

Operation

While motor is stopped

- Electric power is applied to both phases A and B of the motor.

While motor is running

- The engine throttle and pump controller supplies a pulse current to phases A and B, and the motor revolves, synchronizing to the pulse.

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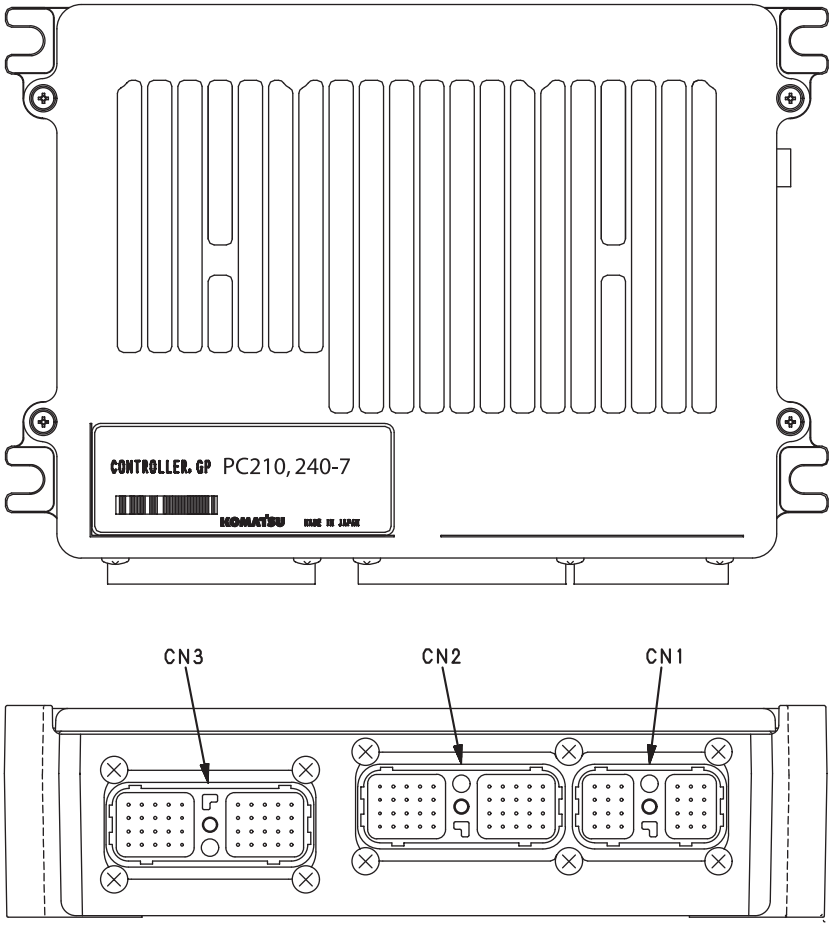
Engine throttle and pump controller



SJP08688

Input and output signals

CN-1

Pin No.	Signal name	Input/ output
1	Boom bottom pressure sensor	Input
2	R pump pressure sensor	Input
3	Arm angle potentiometer	Input
4	Signal GND	Input
5	Abnormality in auto-greasing controller	Input
6	NC	Input
7	Overload sensor (analog)	Input
8	F boom pressure sensor	Input
9	Boom angle potentiometer	Input
10	Signla GND	Input
11	Knob SW	Input
12	NC	Input
13	Governor motor FB potentiometer	Input
14	Boom head pressure sensor	Input
15	NC	Input
16	SENS_PWR	Output
17	Key Switch (Terminal C)	Input
18	NC	Input
19	Throttle potentiometer	Input
20	NC	Input
21	GND (analog GND)	
22	POT_PWR	Output
23	Key switch (terminal ACC)	Input
24	Arm crane relay actuation observation	Input

CN-2

Pin No.	Signal name	Input/ output
1	NC	Output
2	Swing emergency switch	Input
3	NC	Input
4	232C_RxD	Input
5	Overload sensor (ON/OFF)	Input
6	Overload alarm valid switch	Input
7	Model selection 4	Input
8	Attachment circuit selector signal	Output
9	NC	Output
10	NC	Input
11	NC	Output
12	CAN shield	
13	Model selection 5	Input
14	232C_TxD	Output
15	NC	Input
16	Travel steering signal pressure SW	Input
17	Model selection 3	Input
18	Relay drive signal for arm crane	Output
19	NC	Output
20	NC	Input
21	S_NET	Input/ output
22	CAN0_L	Input/ output
23	CAN1_L	Input/ output
24	Flash memory write permission signal	Input
25	NC	Input
26	NC	Input
27	Model selection 2	Input
28	NC	Input
29	GND (pulse GND)	
30	NC	Input
31	GND (S_NET GND)	
32	CAN0_H	Input/ output
33	CAN1_H	Input/ output
34	GND (232C GND)	
35	Service valve pressure switch	Input
36	NC	Input
37	Model selection switch 1	Input
38	Swing lock switch	Input
39	GND (pulse GND)	
40	Engine speed sensor	Input

CN-3

Pin No.	Signal name	Input/ output
1	VB (controller power)	Input
2	VIS (solenoid power)	Input
3	SOL_COM (solenoid common gnd)	
4	Battery relay drive	Output
5	Governor motor A phase (+)	Output
6	LS-EPC	Output
7	Travel junction SOL	Output
8	NC	Output
9	Bucket CURL pressure SW	Input
10	Boom RAISE pressure SW	Input
11	VB (controller power)	Input
12	VIS (solenoid power)	Input
13	SOL_COM (solenoid common gnd)	
14	KEY_SIG	Input
15	Governor motor A phase (-)	Output
16	PC-EPC	Output
17	Pump merge/divider solenoid	Output
18	Heater relay drive	Output
19	Bucket DUMP pressure switch	Input
20	Boom LOWER pressure switch	Input
21	GND (controller GND)	
22	VIS (solenoid PWR)	Input
23	SOL_COM (solenoid common gnd)	
24	KEY_SIG	Input
25	Governor motor B phase (+)	Output
26	Service flow adjustment EPC (1)	Output
27	Travel Hi/Lo selector solenoid	Output
28	2-stage relief solenoid	Output
29	Swing pressure switch	Input
30	Arm IN pressure switch	Input
31	GND (controller GND)	
32	GND (controller GND)	
33	GND (controller GND)	
34	NC	
35	Governor motor B phase (-)	Output
36	NC	Output
37	Swing parking brake solenoid	Output
38	NC	Output
39	Travel pressure switch	Input
40	Arm OUT pressure switch	Input

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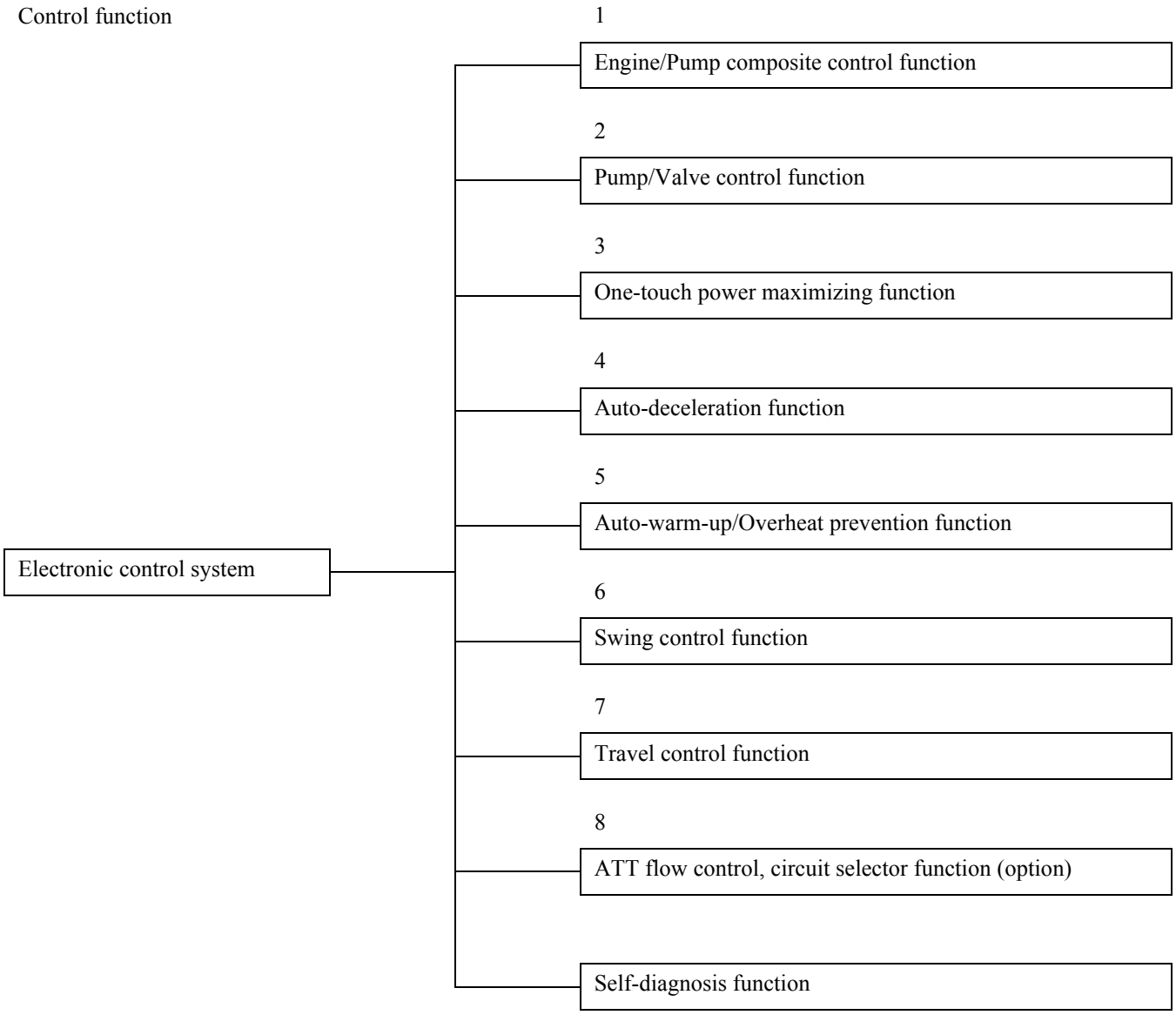
ELECTRONIC CONTROL SYSTEM



★ For the self-diagnosis function, see "TROUBLE SHOOTING".

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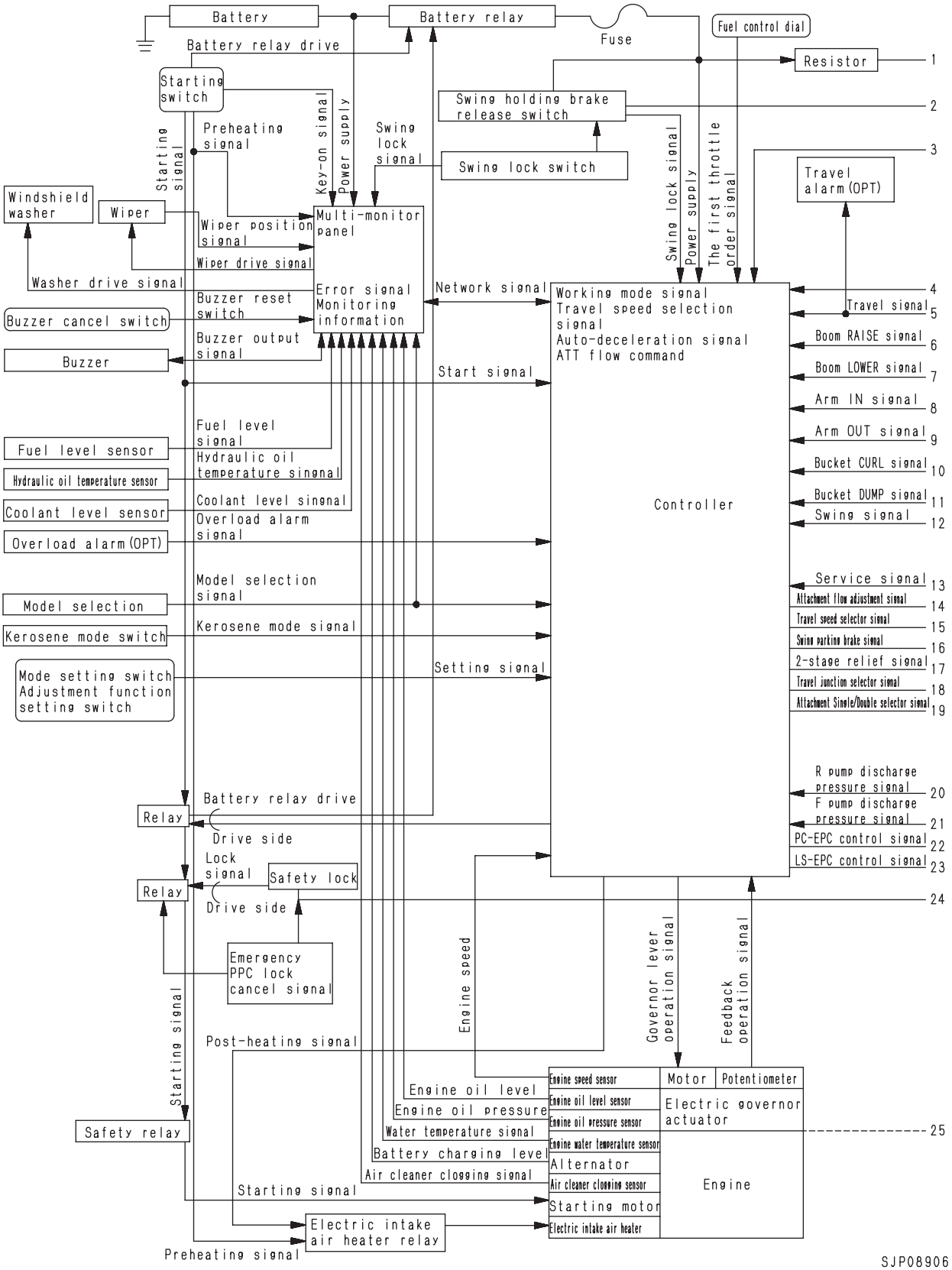
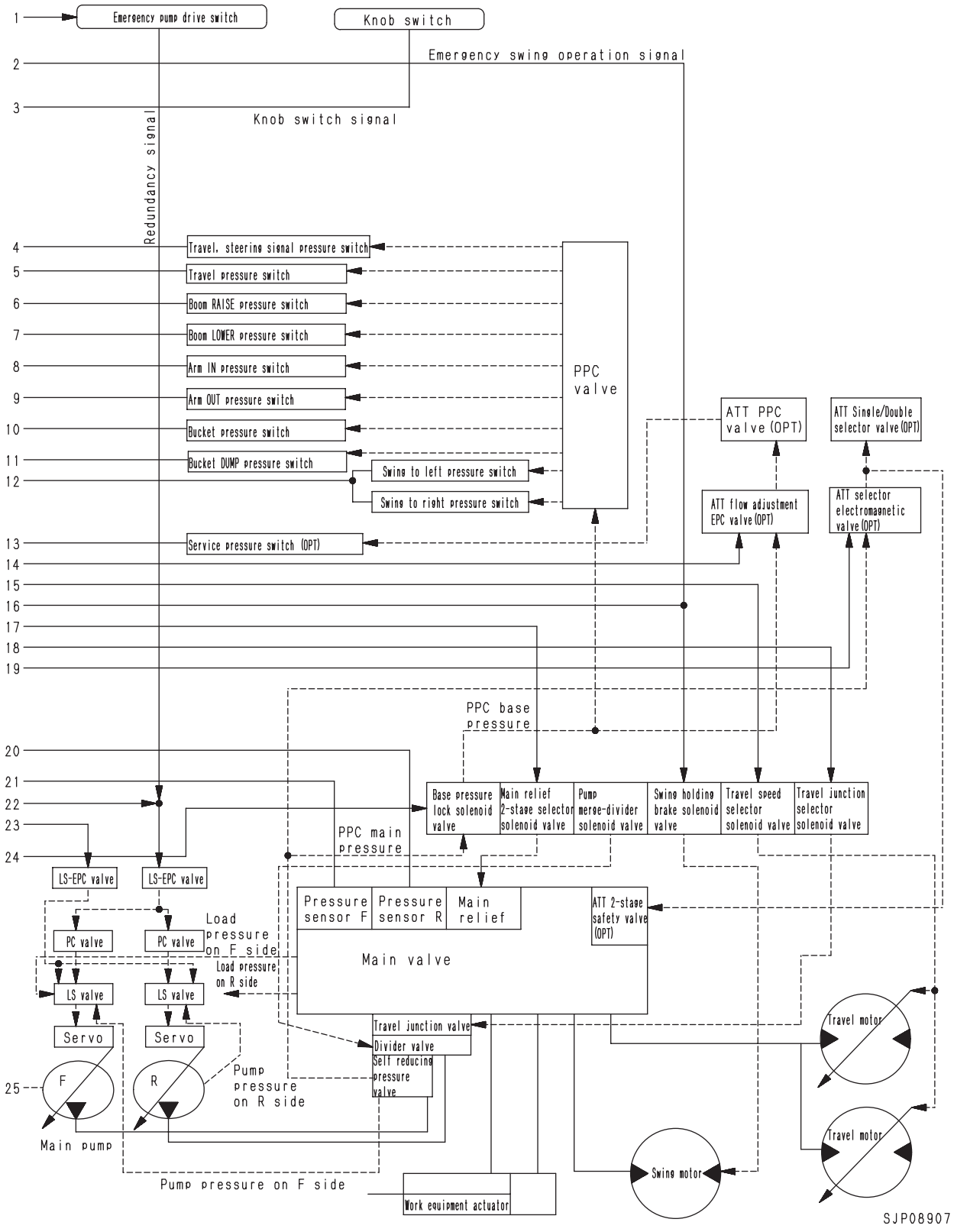
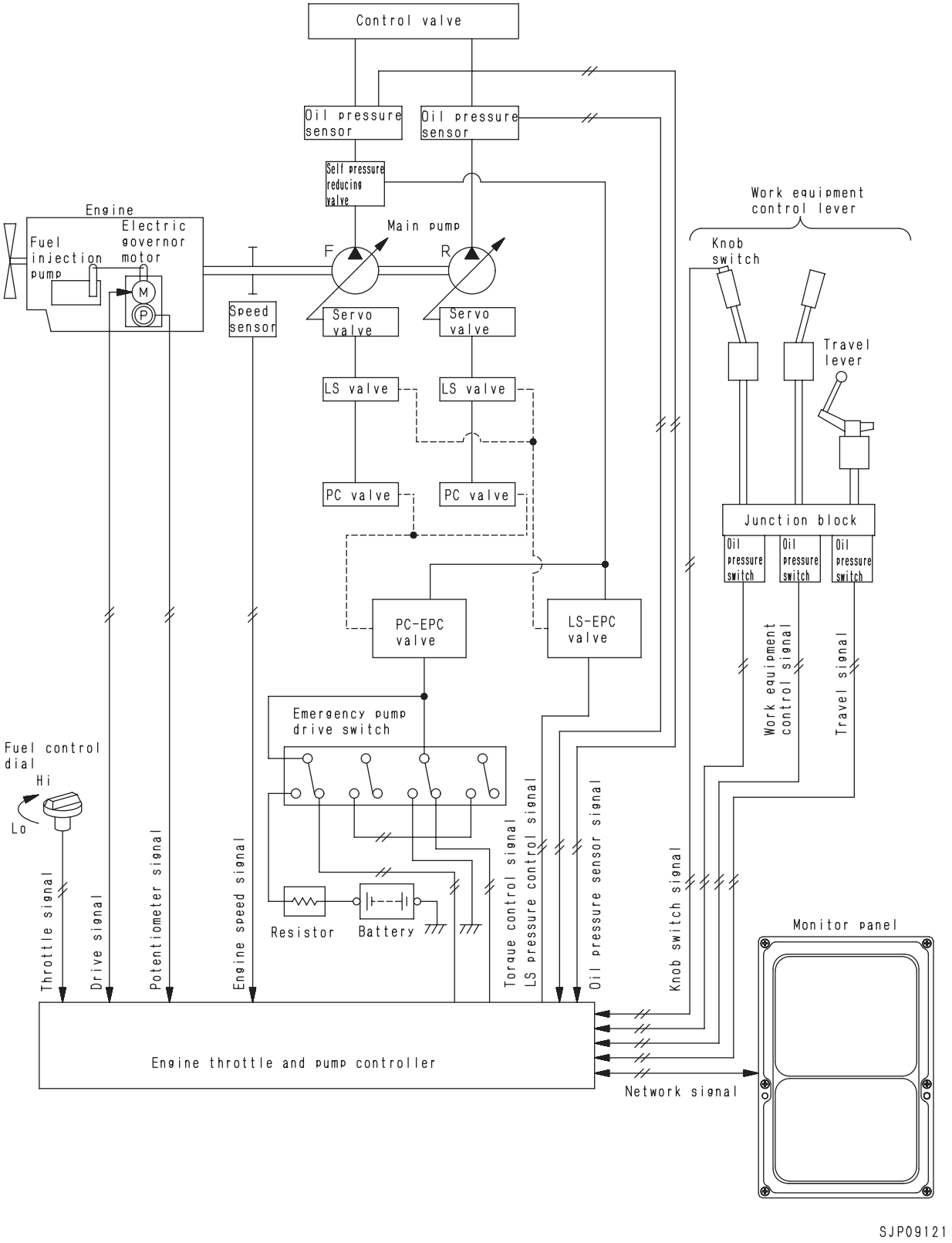
MACHINE CONTROL SYSTEM DIAGRAM




1
Emergency pump drive switch
Knob switch
2
Emergency swing operation signal
3
Knob switch signal
Redundancy signal
4
Travel, steering signal pressure switch
5
Travel pressure switch
6
Boom RAISE pressure switch
7
Boom LOWER pressure switch
8
Arm IN pressure switch
9
Arm OUT pressure switch
10
Bucket pressure switch
11
Bucket DUMP pressure switch
12
Swing to left pressure switch
Swing to right pressure switch
PPC valve
ATT PPC valve (OPT)
ATT Single/Double selector valve (OPT)
ATT flow adjustment EPC valve (OPT)
ATT selector electromagnetic valve (OPT)
13
Service pressure switch (OPT)
14
15
16
17
18
19
PPC base pressure
20
21
22
23
24
Base pressure lock solenoid valve
Main relief 2-stage selector solenoid valve
Pump merge-divider solenoid valve
Swing holding brake solenoid valve
Travel speed selector solenoid valve
Travel junction selector solenoid valve
PPC main pressure
LS-EPC valve
LS-EPC valve
Pressure sensor F
Pressure sensor R
Main relief
ATT 2-stage safety valve (OPT)
Load pressure on F side
PC valve
PC valve
Load pressure on R side
Main valve
LS valve
LS valve
Servo
Servo
Travel junction valve
Divider valve
Self reducing pressure valve
Travel motor
Travel motor
25
F
R
Pump pressure on R side
Main pump
Pump pressure on F side
Swing motor
Work equipment actuator
SJP08907

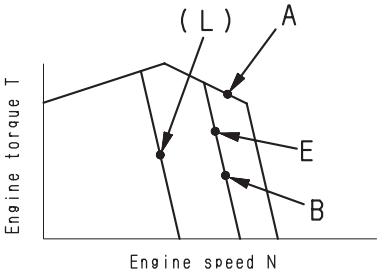
1. Engine and Pump control function



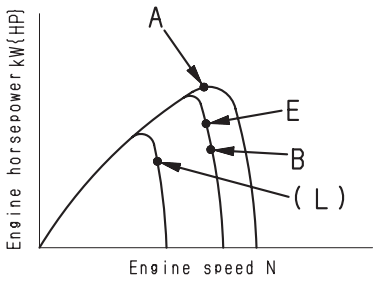
SJP09121

FUNCTION

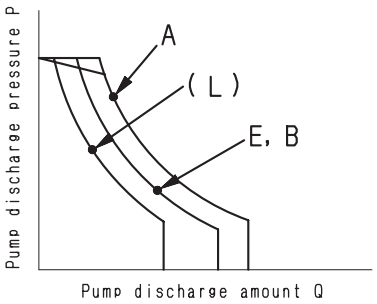
- The operator can set the work mode switch on the monitor panel to mode A, E, or B (or L) and select proper engine torque and pump absorption torque according to the type of work.
- The engine throttle and pump controller detects the speed of the engine governor set with the fuel control dial and the 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.



SJP09122



SJP09123



SJP09124

1) Control method in each mode

Mode A

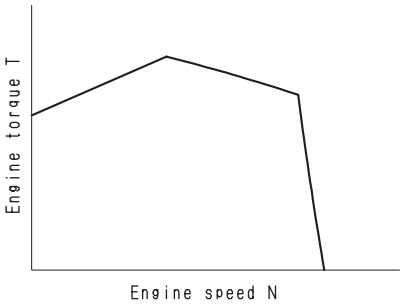
- Matching point in mode A: Rated speed

Model	PC210-7K, PC240-7K
Mode A	106.6 kW/1,900 rpm {143 HP/1,900 rpm}

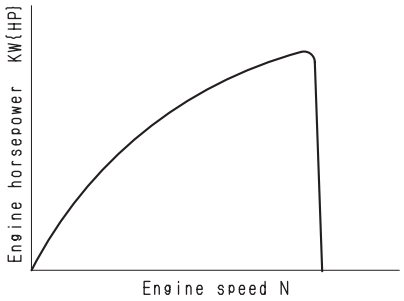
- If the pump load increases and the pressure rises, the engine speed lowers.

  At this time, the controller lowers the pump discharge so that the engine speed will be near the full output point. If the pressure lowers, the controller increases the pump discharge so that the engine speed will be near the full output point.

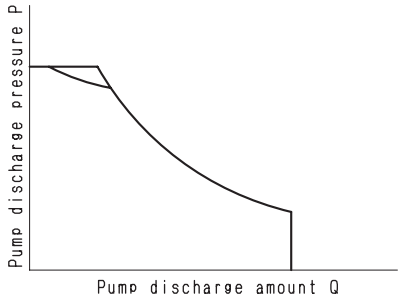
  By repeating these operations, the controller constantly uses the engine near the full output point.



SJP08912



SJP08913



SJP08914

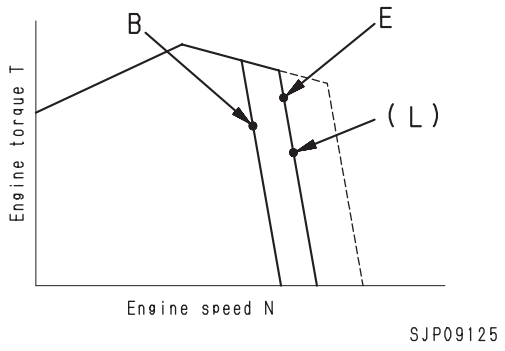
Mode E / Mode B / (Mode L)

Mode	Digging	Breaker	Finishing
Partial output point	85%	75%	70%

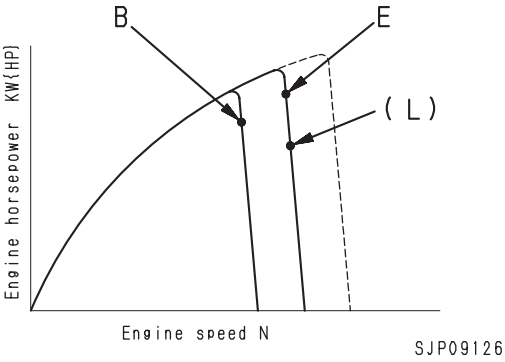
Model	PC210-7K, PC240-7K
Mode E	123 HP / 1,750 RPM
Mode B	108 HP / 1,650 RPM
(Mode ✻L)	99 HP / 1,800 RPM

- At this time, the controller keeps the pump absorption torque along the constant horsepower curve and lower the engine speed by the composite control of the engine and pump.

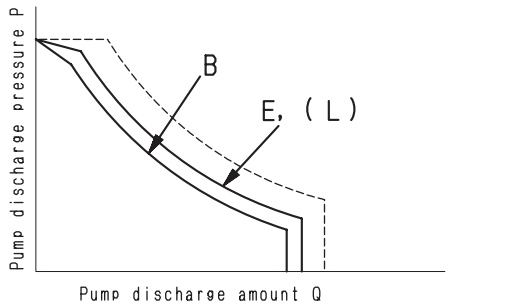
  By this method, the engine is used in the low fuel consumption area.



SJP09125



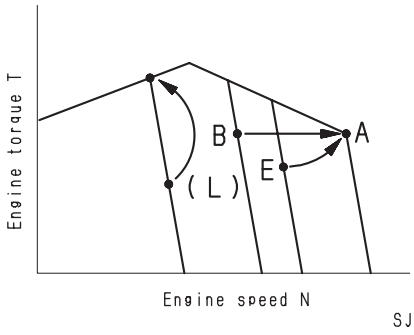
SJP09126



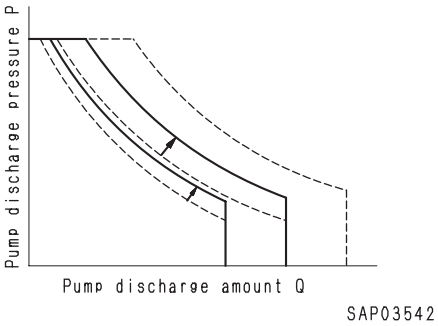
SJP09127

2) Function to control pump during travel

- If the machine travels in mode A, either of engine speed and pump absorption torque does not change.
- If the machine travels in mode E or B, the working mode does not change, but the engine speed and pump absorption torque rise to the same value as in mode A.



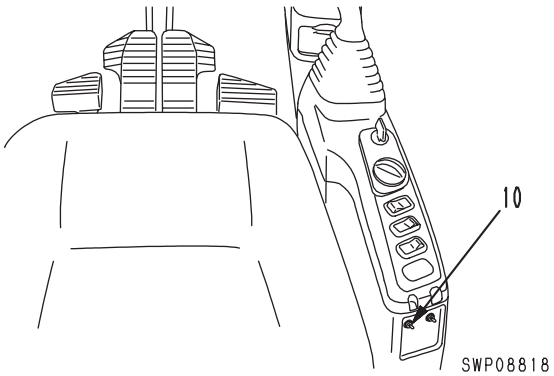
- If the machine travels in mode L, the working mode and engine speed do not change, but the pump absorption torque is increased.

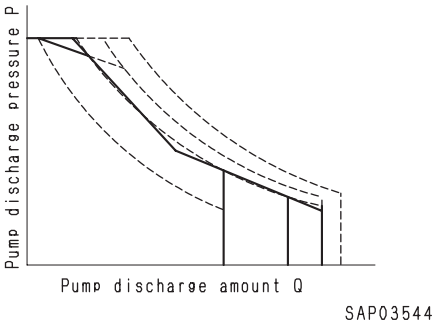


3) Function to control when emergency pump drive switch is turned ON

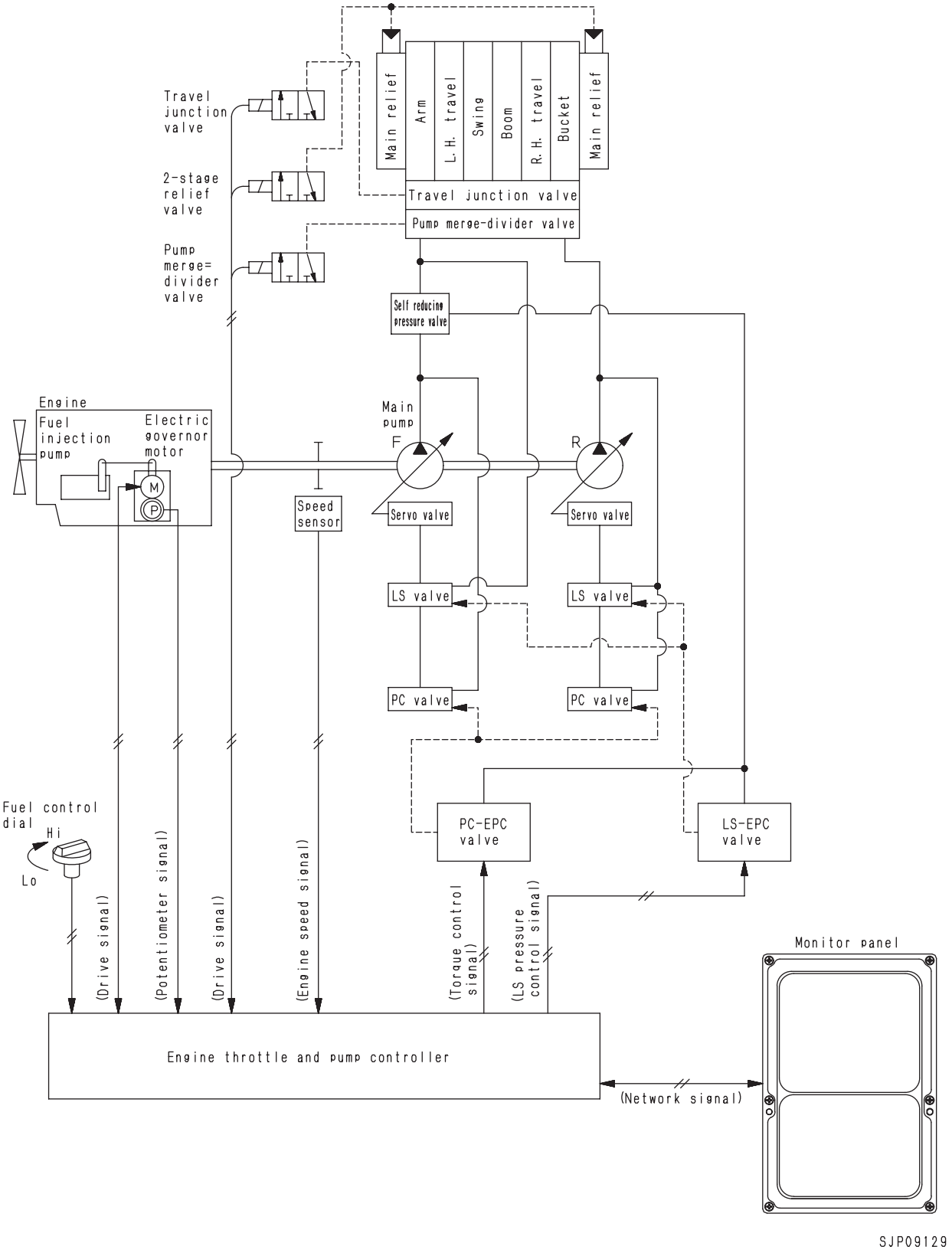
- Even if the controller or a sensor has a trouble, the functions of the machine can be secured with pump absorption torque almost equivalent to mode E by turning on emergency pump drive switch (10).

  In this case, a constant current flows from the battery to the EPC valve for PC and the oil pressure is sensed by only the EPC valve for PC.





2. Pump/Valve control function



SJP09129

Function

- The machine is matched to various types of work properly with the 2-stage relief function to increase the digging force, etc.

1) LS control function

- The change point (LS set differential pressure) of the pump discharge in the LS valve is changed by changing the output pressure from the LS-EPC valve to the LS valve according to the operating condition of the actuator.
- By this operation, the start-up time of the pump discharge is optimized and the composite operation and fine control performance is improved.

2) Cut-off function

- When the cut-off function is turned on, the PC-EPC current is increased to near the maximum value.

  By this operation, the flow rate in the relief state is lowered to reduce fuel consumption.
- Operating condition for turning on cut-off function

Condition
• The average value of the front and rear pressure sensors is above 27.9 MPa {285 kg/cm²} and the one-touch power maximizing function is not turned on

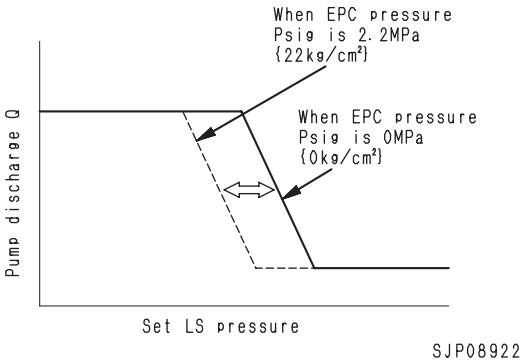
The cut-off function does not work, however, while the machine is travelling in mode A or the arm crane operation width swing lock switch is turned on.

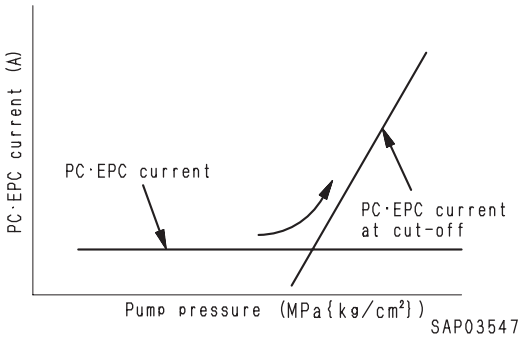
1. 2-stage relief function

- The relief pressure in the normal work is 34.8 MPa {355 kg/cm²}. If the 2-stage relief function is turned on, however, the relief pressure rises to about 37.2 MPa {380 kg/cm²}.

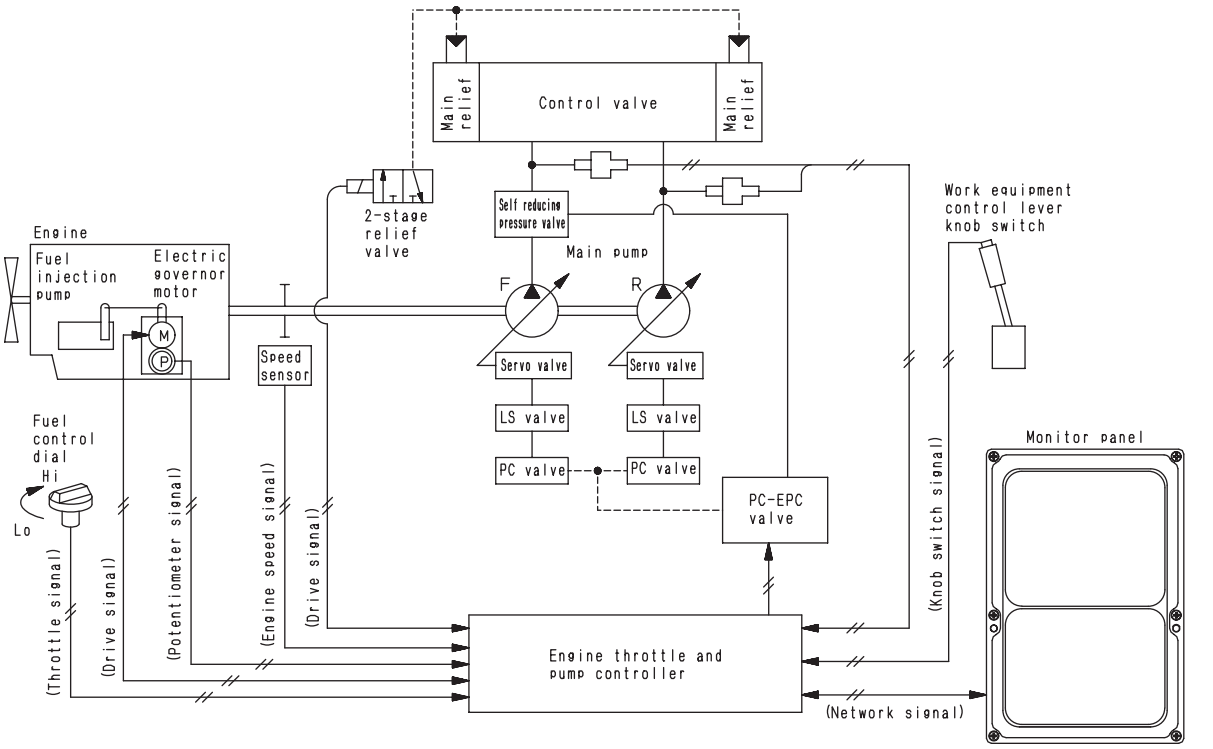
  By this operation, the hydraulic force is increased further.
- Operating condition for turning on 2-stage relief function

Condition	Relief pressure
• During travel • When swing lock switch is turned on • When boom is lowered • When one-touch power maximizing function is turned on • When L mode is operated	34.8 MPa {355 kg/cm²} ⇓ 37.2 MPa {380 kg/cm²}





3. One-touch power maximizing function



SJP09130

FUNCTION

- Power can be increased for a certain time by operating the left knob switch.

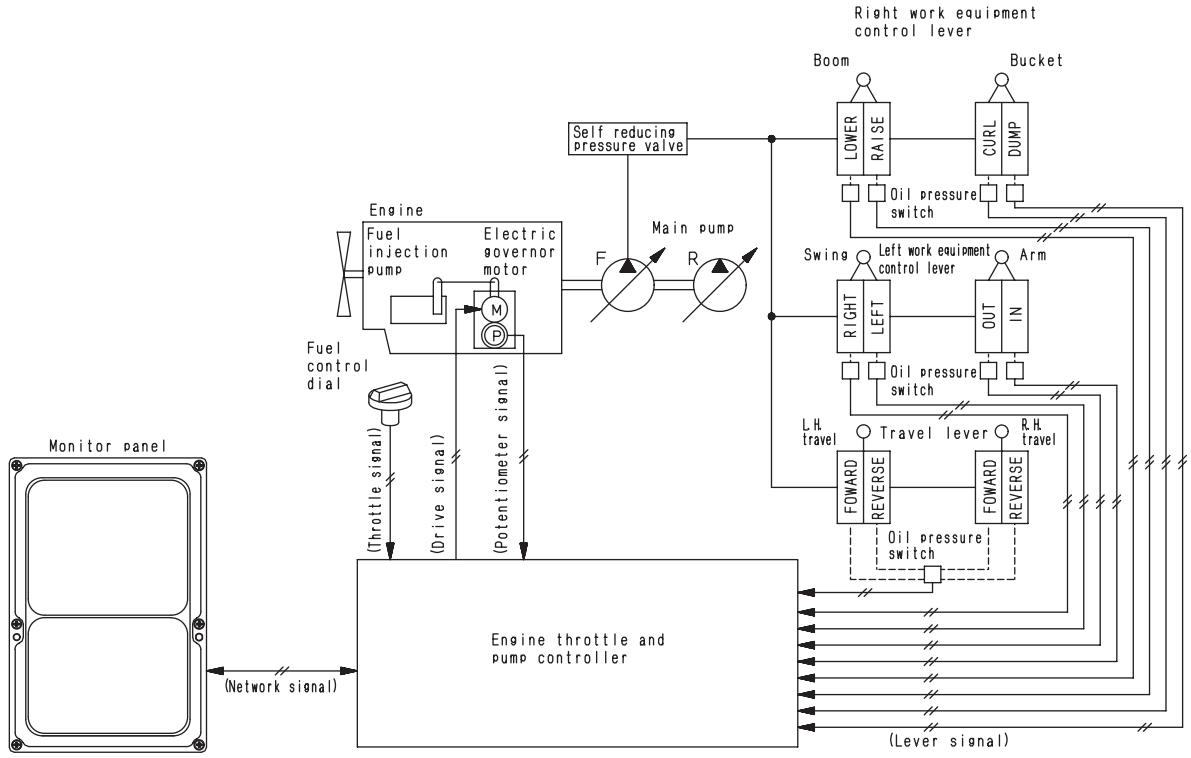
1) One-touch power maximizing function

- When the operator needs more digging force to dig up a large rock, etc., if the left knob switch is pressed, the hydraulic force is increased about 7% to increase the digging force.
- If the left knob switch is turned on in working mode "A" or "E", each function is set automatically as shown below.

Software cut-off function

Working mode	Engine/Pump control	2-stage relief function	Operation time	
A, E	Matching at rated output point	34.8 MPa {355 kg/cm²} ⇓ 37.2 MPa {380 kg/cm²}	Automatically reset at 8.5 sec	Cancel

4. Auto-deceleration function



SJP09131

FUNCTION

- If the all control levers are set in NEUTRAL while waiting for a dump truck or work, the engine speed is lowered to the medium level automatically to reduce the fuel consumption and noise.
- If any lever is operated, the engine speed rises to the set level instantly.

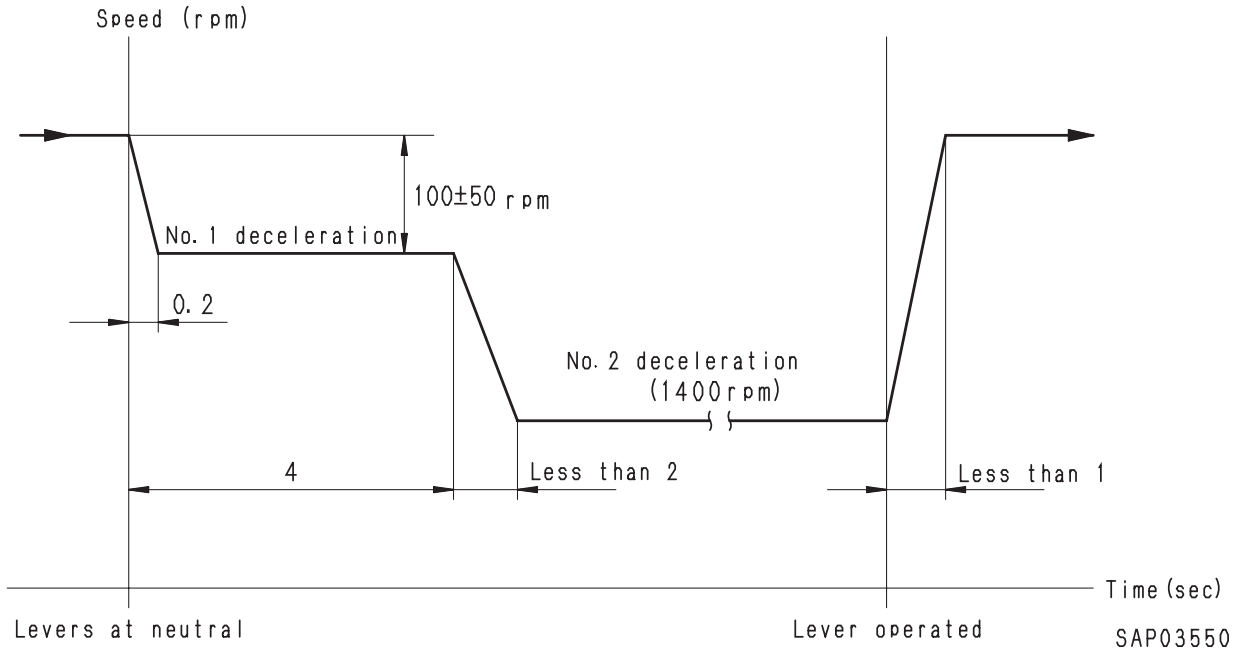
OPERATION

WHEN CONTROL LEVERS ARE SET IN NEUTRAL

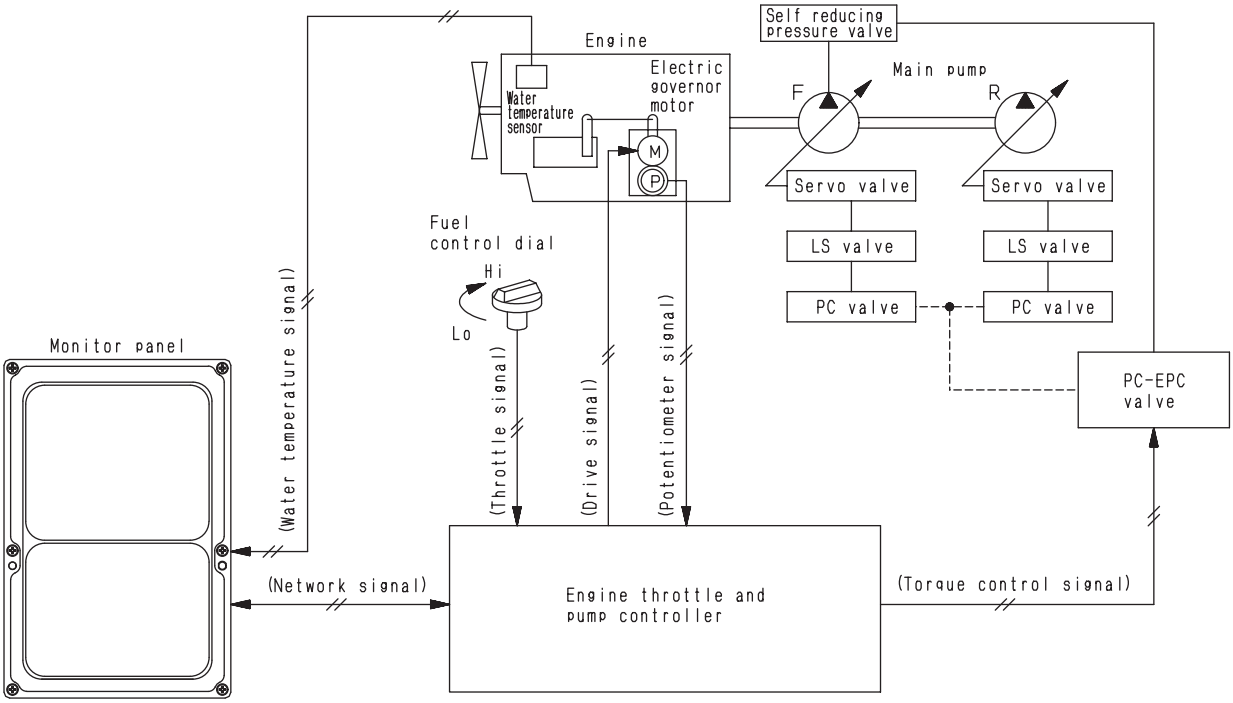
- If all the control levers are set in NEUTRAL while the engine speed is above the decelerator operation level (about 1,400 rpm), the engine speed lowers instantly to the first deceleration level about 100 rpm lower than the set speed.
- If 4 more seconds pass, the engine speed lowers to the second deceleration level (about 1,400 rpm) and keeps at that level until any lever is operated again.

WHEN ANY CONTROL LEVER IS OPERATED

- If any control lever is operated while the engine speed is kept at the second deceleration level, the engine speed rises instantly to the level set with the fuel control dial.



1. Auto-warm-up/Overheat prevention function



SJP09132

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.

1) Auto-warm-up 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.

Operating condition (All)
Water temperature: Below 30°C. Engine speed: Max. 1,200 rpm

⇒

Operated
Engine speed: Max. 1,200 rpm

⇓

Resetting condition (Any one)	
Auto	Water temperature: Above 30°C
	Auto-warm-up operation time: Min. 10 minutes
Manual	Fuel control dial: Kept at 70% of full level for 3 sec. or longer

⇒

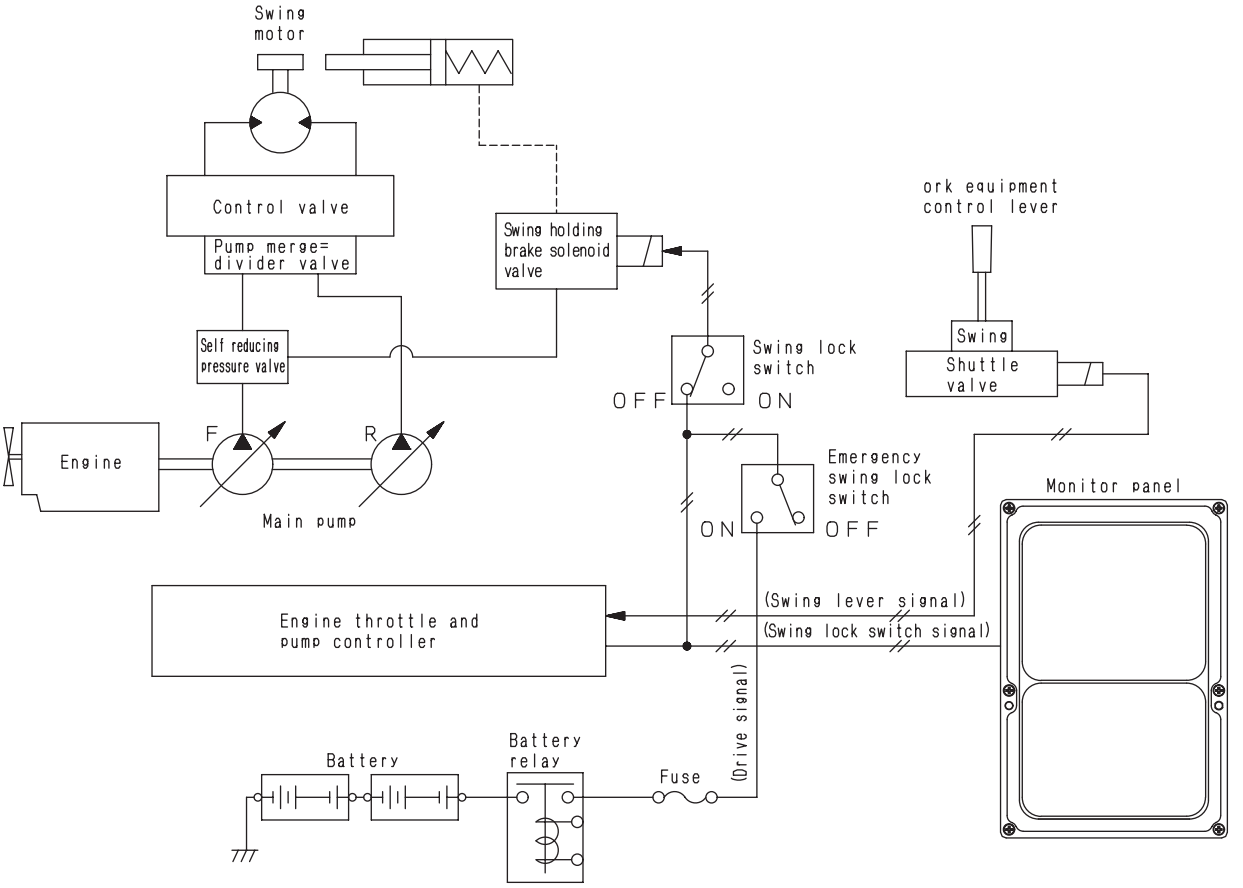
Reset
Engine speed: Any level

2) Overheat prevention function

- If the engine cooling water temperature rises too high during work, the pump load and engine speed are reduced to prevent overheating.
- This function is turned on when the water temperature rises above 95°C.

Operating condition	Operation/Remedy	Resetting condition
Water temperature: Above 105°C	Work mode: Any mode Engine speed: Low idle Monitor alarm lamp: Lights up Alarm buzzer: Sounds	Water temperature: Below 105°C Fuel control dial: Return to low idle position once. • Under above condition, controller is set to condition before operation of function. (Manual reset)
Water temperature: Above 102°C	Work mode: Mode A, E, OR B Engine speed: Keep as is. Monitor alarm lamp: Lights up. Lower pump discharge.	Water temperature: Below 102°C • Under above condition, controller is set to condition before operation of function. (Automatic reset)
Water temperature: Above 100°C	Work mode: Mode A Engine speed: Keep as is. Lower pump discharge.	Water temperature: Below 100°C • Under above condition, controller is set to condition before operation of function. (Automatic reset)
Water temperature: Above 95°C	Work mode: Travel Engine speed: Keep as is. Lower travel speed.	Water temperature: Below 95°C • Under above condition, controller is set to condition before operation of function. (Automatic reset)

6. Swing control function



FUNCTION

The swing lock and swing holding brake functions are installed.

1) Swing lock and swing holding brake functions

- The swing lock function (manual) is used to lock machine from swinging at any position. The swing holding brake function (automatic) is used to prevent hydraulic drift after the machine stops swinging.
- Swing lock switch and swing lock/holding brake

Lock switch	Lock lamp	Function	Operation
OFF	OFF	Swing holding brake	If swing lever is set in neutral, swing brake operates in about 5 sec. If swing lever is operated, brake is released and machine can swing freely.
ON	ON	Swing lock	Swing lock operates and machine is locked from swinging. Even if swing lever is operated, swing lock is not reset and machine does not swing.

※ Operation of swing holding brake release switch

- If the controller, etc. has a problem, the swing holding brake does not work normally, and the machine cannot swing, the swing lock can be reset with the swing holding brake release switch.

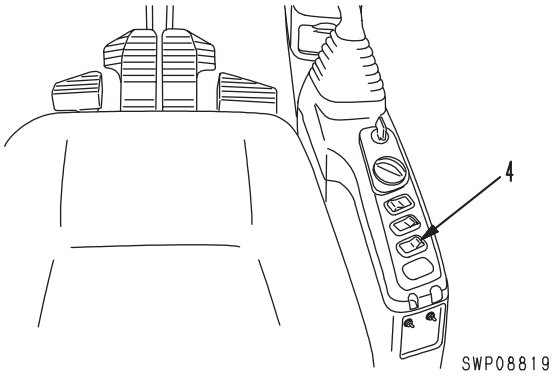
Swing holding brake release switch	ON (When control has trouble)		OFF (When controller is normal)	
Swing lock switch	ON	OFF	ON	OFF
Swing brake	Swing lock is turned on.	Swing lock is canceled.	Swing lock is turned on.	Swing holding brake is turned on.

★ Even if the swing holding brake release switch is turned on, if the swing lock switch is turned on, the swing brake is not released.

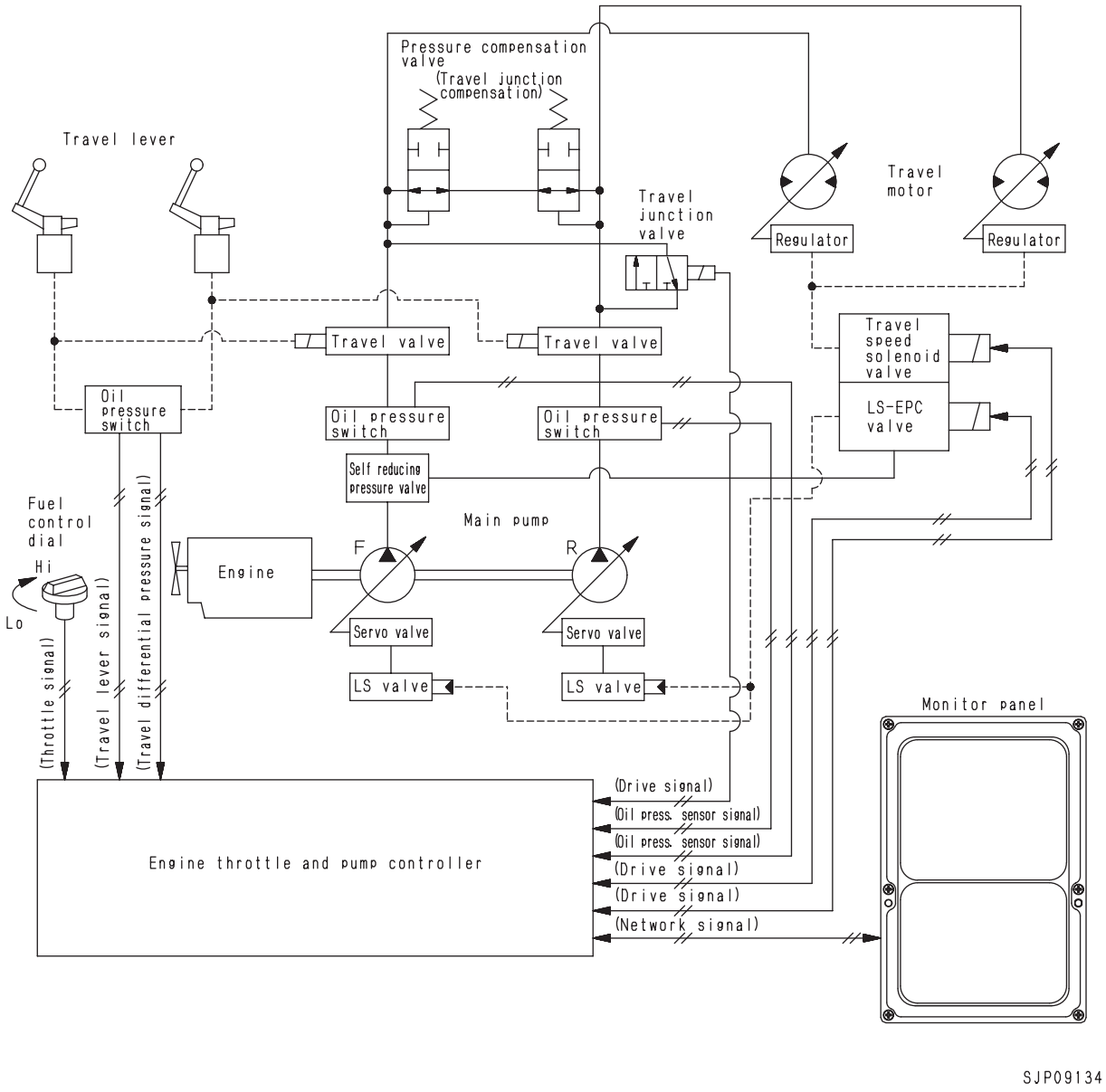
★ If the swing lock is reset, swinging is stopped by only the hydraulic brake of the safety valve. Accordingly, if swinging is stopped on a slope, the upper structure may drift hydraulically.

2) Quick hydraulic oil warm-up function when swing lock switch is turned on

- If swing lock switch (4) is turned on, the pump-cut function is cancelled and the relief pressure rises from 34.8 MPa {355 kg/cm²} to 37.2 MPa {380 kg/cm²}. If the work equipment is relieved under this condition, the hydraulic oil temperature rises quickly and the warm-up time can be shortened.



7. Travel control function



FUNCTION

- The pumps are controlled and the travel speed is changed manually or automatically, to secure proper travel performance matched to the type of work and jobsite during travel.

1) Pump control function during travel

- If the machine travels in a work mode other than mode A, the work mode and the engine speed are kept as they are and the pump absorption torque is increased.

★ For details, see ENGINE/PUMP COMPOSITE CONTROL FUNCTION.

1. Travel speed change function

i) Manual change with travel speed switch

If the travel speed switch is changed between Lo, (※ Mi), and Hi, the governor/pump controller controls the pump capacity and motor capacity at each gear speed as shown at right to change the travel speed.

Travel speed switch	Lo (Low speed)	(※ Mi) (Middle Speed)	Hi (High speed)
Pump capacity (%)	60	90	100
Motor capacity	Max.	Max.	Min.
Travel speed (km/h)	3.0	4.1	5.5

ii) Automatic change by engine speed

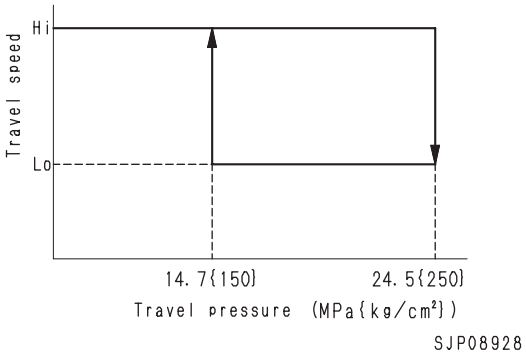
If the engine speed is lowered to 1,500 rpm or less with the fuel control dial during travel;

- the travel speed does not change even if the travel speed switch is changed from Lo, (※ Mi) to Hi,
- the travel speed changes to Mi level automatically if the travel speed has been Hi.

iii) Automatic change by pump discharge pressure

While the machine is traveling with the travel speed switch at Hi, if the load is increased because of an upslope ground, etc. and the travel pressure keeps above 24.5 MPa {250 kg/cm²} for 0.5 seconds, the travel motor capacity is changed automatically and the travel speed is lowered (to the Mi level) (The travel speed switch is kept at Hi, however).

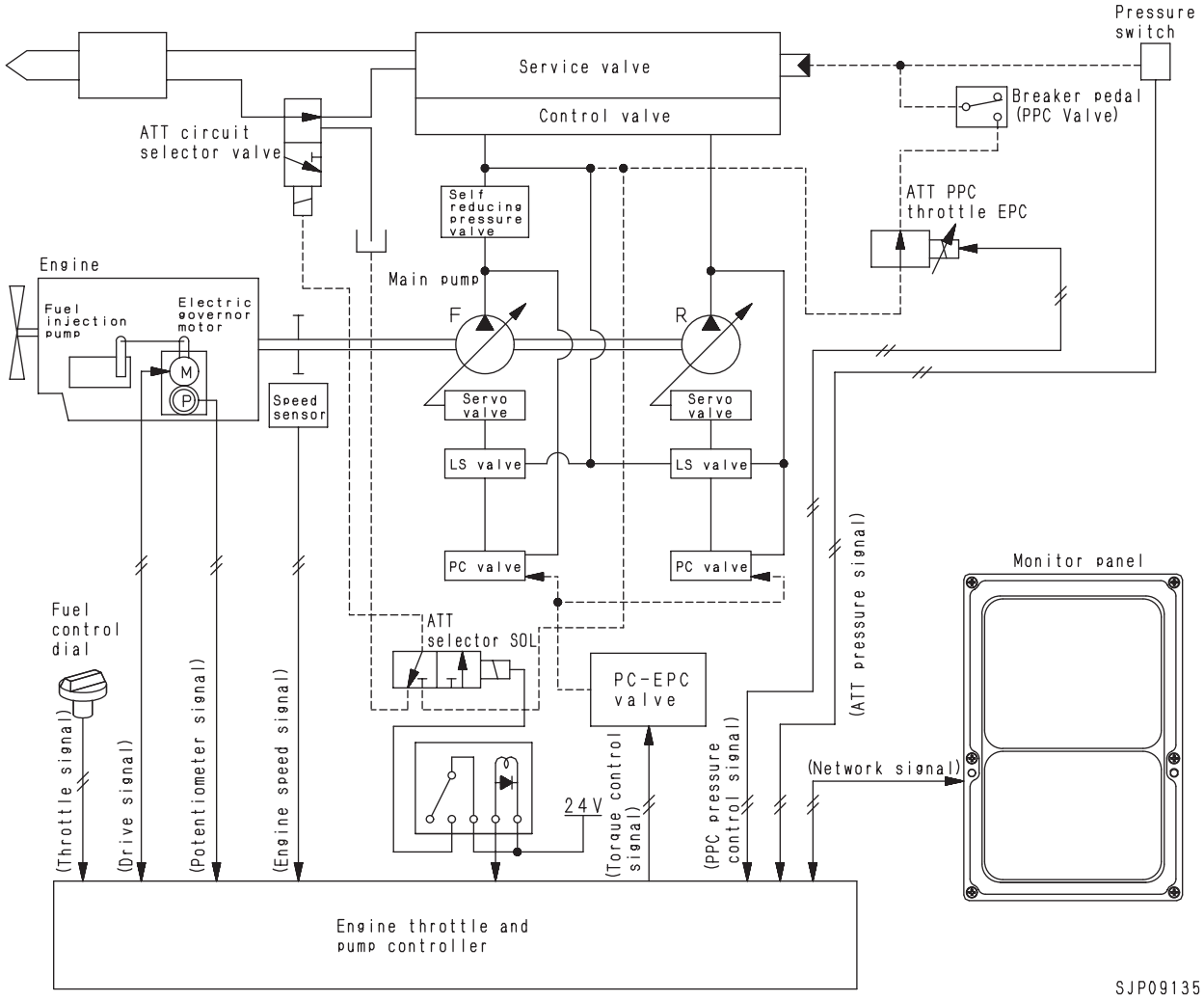
While the machine is travelling at Mi level, if the load is reduced on a flat or downslope ground, etc. and the travel pressure keeps below 14.7 MPa {150 kg/cm²} for 0.5 seconds, the travel motor capacity is changed automatically and the travel speed is set to Hi again.



SJP08928

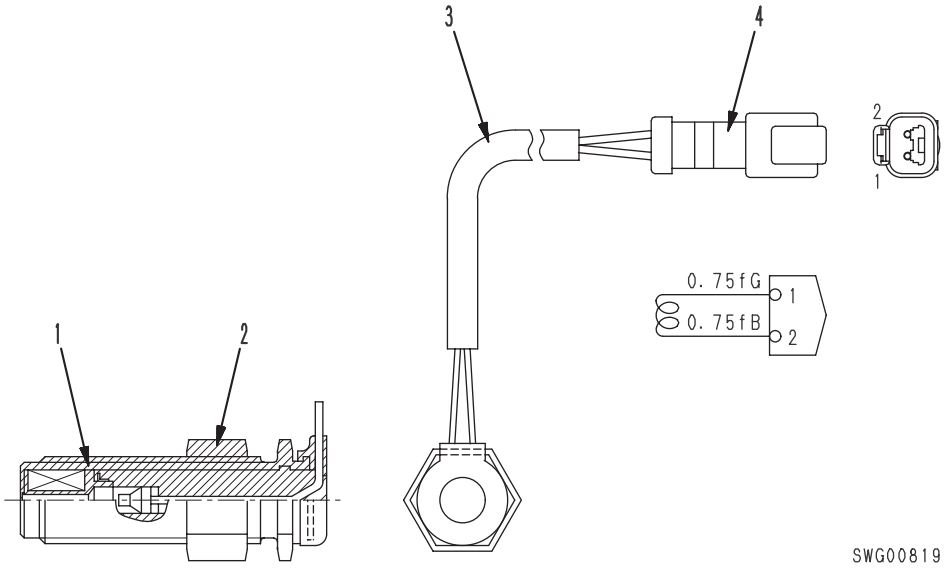
※ : The "Mi" mode is on the multi-monitor specification machine only.

8. ATT flow control, circuit selector function (option)



9. System component parts

1) Engine revolution sensor

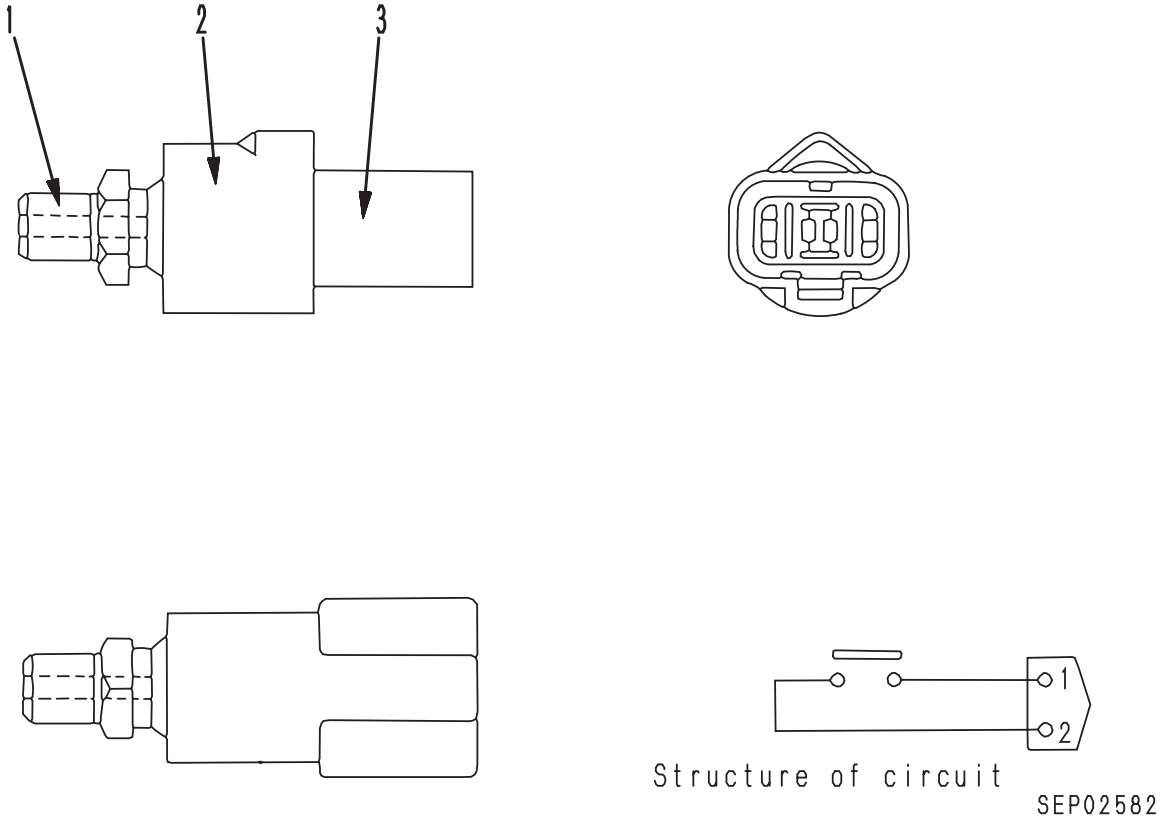


1. Sensor
2. Locknut
3. Wiring harness
4. Connector

FUNCTION

- The engine revolution sensor is installed to the ring gear of the engine flywheel. It electrically calculates the number of the gear teeth which pass in front of it and transmits the result to the engine throttle and pump controller.
- A magnet is used to sense the gear teeth. Each time a gear tooth passes in front of the magnet, a current is generated.

2) PPC oil pressure switch



1. Plug
2. Switch
3. Connector

SPECIFICATIONS

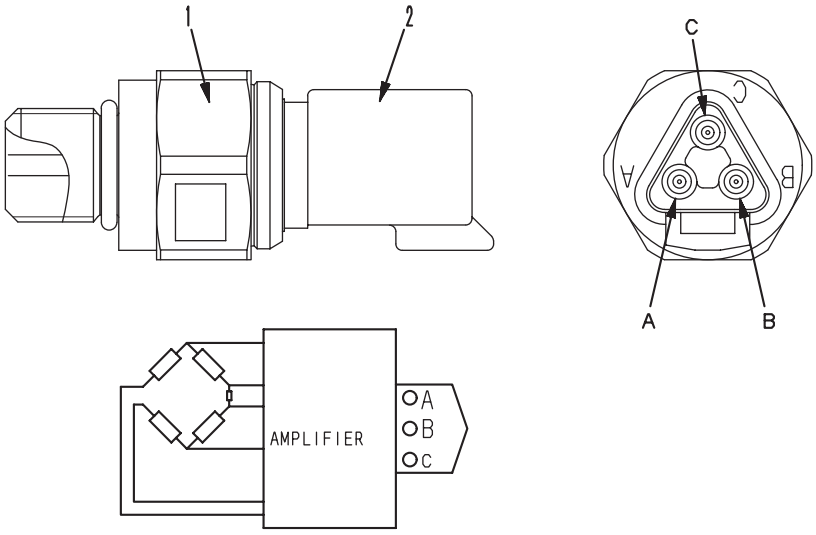
Type of contacts: Normally open contacts

Operating (ON) pressure:	0.5 ± 0.1 MPa {5.0 ± 1.0 kg/cm²}
Resetting (OFF) Pressure:	0.3 ± 0.5 MPa {3.0 ± 0.5 kg/cm²}

FUNCTION

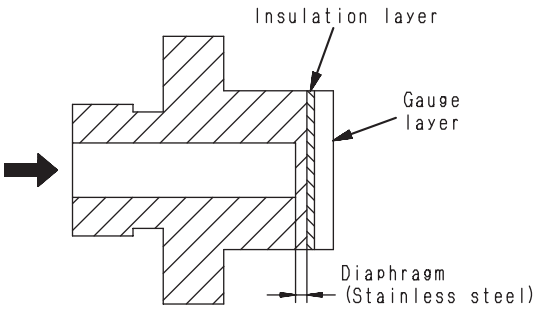
- The junction block has 9 pressure switches, which check the operating condition of each actuator by the PPC pressure and transmit it to the governor/pump controller.

3) Pump pressure sensor



SJP08773

1. Sensor
2. Connector



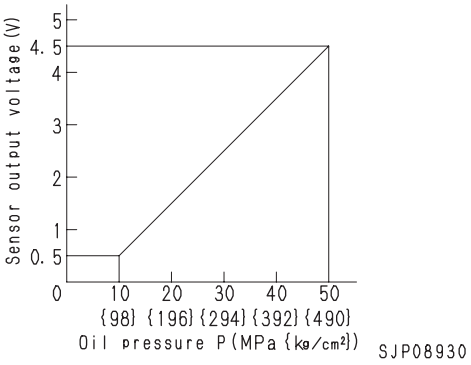
SDP02585

FUNCTION

- The pump pressure sensor is installed to the inlet circuit of the control valve. It converts the pump discharge pressure into a voltage and transmits it to the governor/pump controller.

OPERATION

- The oil pressure applied from the pressure intake part presses the diaphragm of the oil pressure sensor, the diaphragm is deformed.
- The gauge layer facing the diaphragm measures the deformation of the diaphragm by the change of its resistance, then converts the change of the resistance into a voltage and transmits it to the amplifier (voltage amplifier).
- The amplifier amplifies the received voltage and transmits it to the governor/pump controller.
- Relationship between pressure P (MPa {kg/cm²}) and output voltage (V) is as follows.
  V = 0.08 [0.008] x P + 0.5



SJP08930

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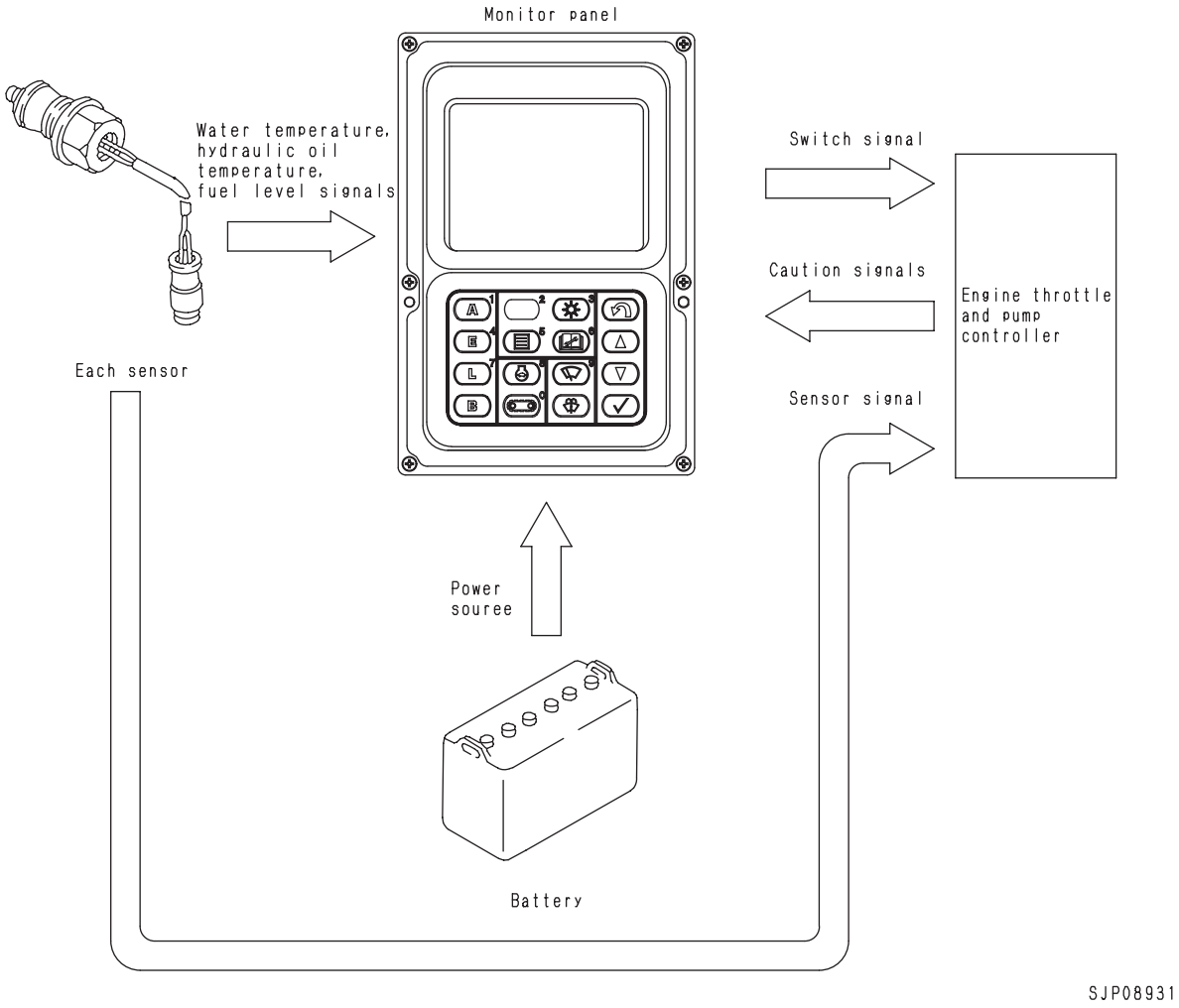
MULTI MONITOR SYSTEM



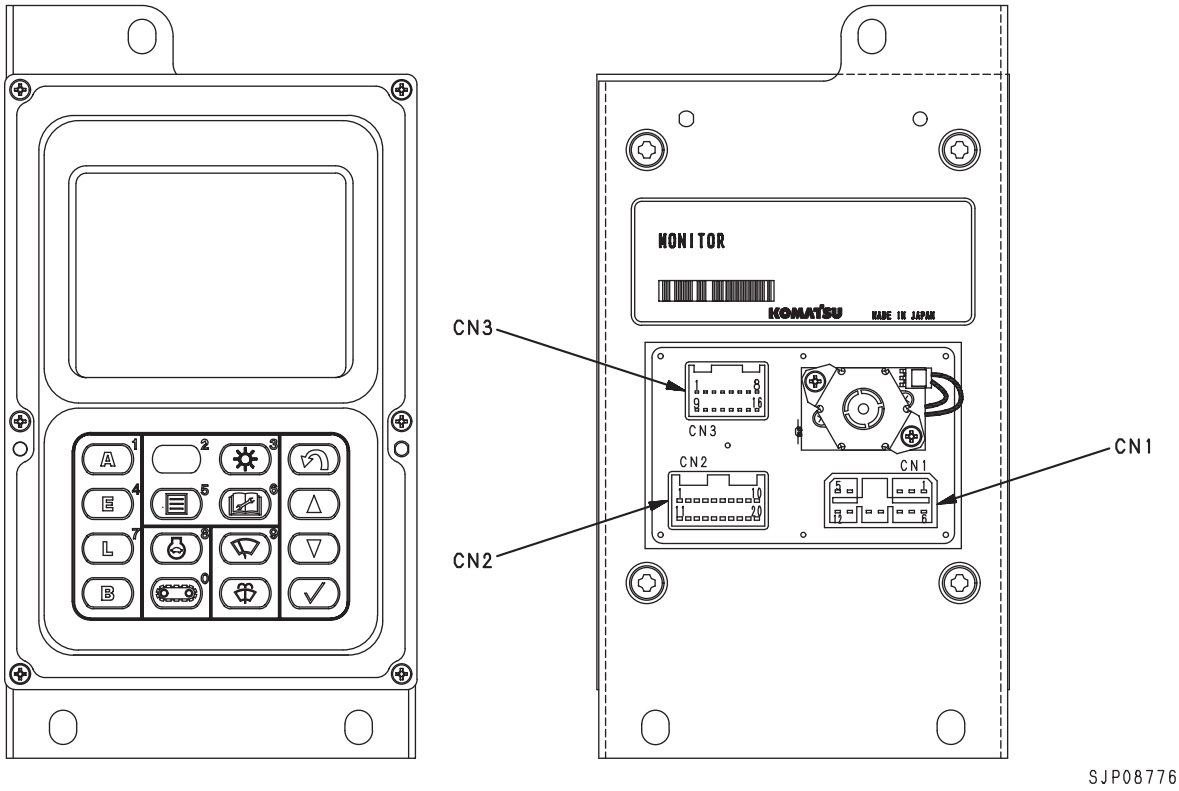
- The monitor system monitors the condition of the machine with sensors installed on various parts of the machine. It processes and immediately displays the obtained information on the panel notifying the operator of the condition of the machine.

  The panel is roughly divided as follows.

  1. Monitor section to output alarms when the machine has troubles
  2. Gauge section to display the condition constantly (Coolant temperature, hydraulic oil temperature, fuel level, etc.)

- The monitor panel also has various mode selector switches and functions to operate the machine control system.

1. Monitor panel



OUTLINE

- The monitor panel has the functions to display various items and the functions to select modes and electric parts.

  The monitor panel has a CPU (Central Processing Unit) in it to process, display, and output the information.

  The monitor display unit consists of LCD (Liquid Crystal Display). The switches are flat sheet switches.

Input and output signals

CN-1

Pin No.	Signal name	Input/ output
1	Key ON	Input
2	Key ON	Input
3	Washer motor output	Output
4	Starting signal	Input
5	Limit switch (W)	Input
6	GND	
7	GND	
8	VB +	Input
9	Wiper motor (+)	Output
10	Wiper motor (-)	Output
11	Buzzer ON signal	Input
12	Limit switch (P)	Input

CN-2

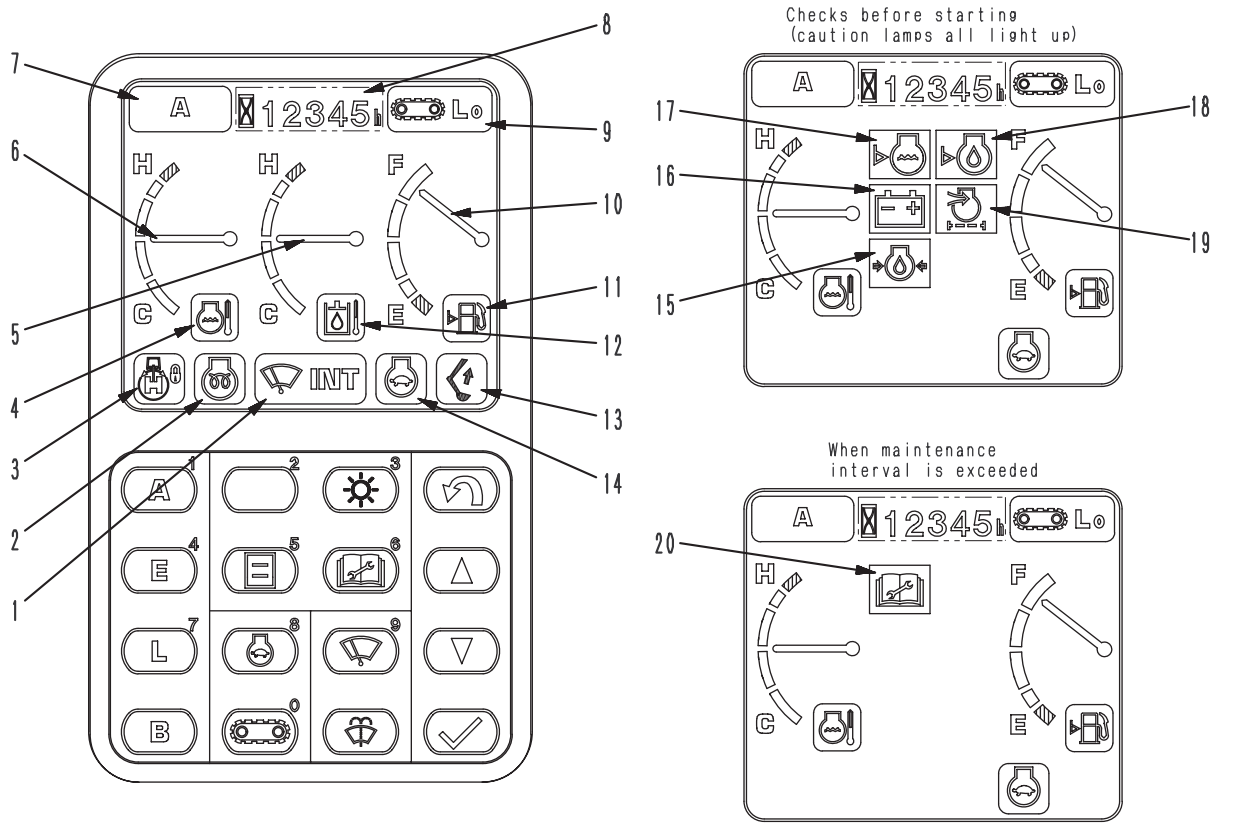
Pin No.	Signal name	Input/ output
1	Engine water temperature	Input
2	Fuel level	Input
3	Radiator water level	Input
4	(Hydraulic oil level)	Input
5	Air cleaner clogging	Input
6	NC	Input
7	Engine oil pressure	Input
8	Engine oil level	Input
9	N/W signal	Input/ Output
10	N/W signal	Input/ Output
11	Battery charge	Input
12	Hydraulic oil temperature (analog)	Input
13	GND (for analog signal)	
14	Buzzer drive	Input
15	Limit SW (window)	Input
16	Buzzer cancel	Input
17	Swing lock	Input
18	Preheat	Input
19	Light switch	Input
20	N/W GND	

CN-3

Pin No.	Signal name	Input/ output
1	NC	Input
2	NC	Input
3	NC	Input
4	NC	Input
5	NC	Input
6	NC	Input
7	RS230C CTS	Input
8	RS230C RXD	Input
9	RS230C RXD	Input/ Output
10	RS230C RXD	Input/ Output
11	BOOTSW	Input
12	NC	Input
13	GND	
14	CAN (SHIELD)	Input
15	CAN (+)	Input
16	CAN (-)	Input

MONITOR CONTROL, DISPLAY PORTION

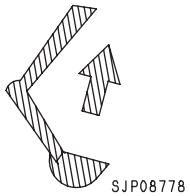
MONITOR PORTION

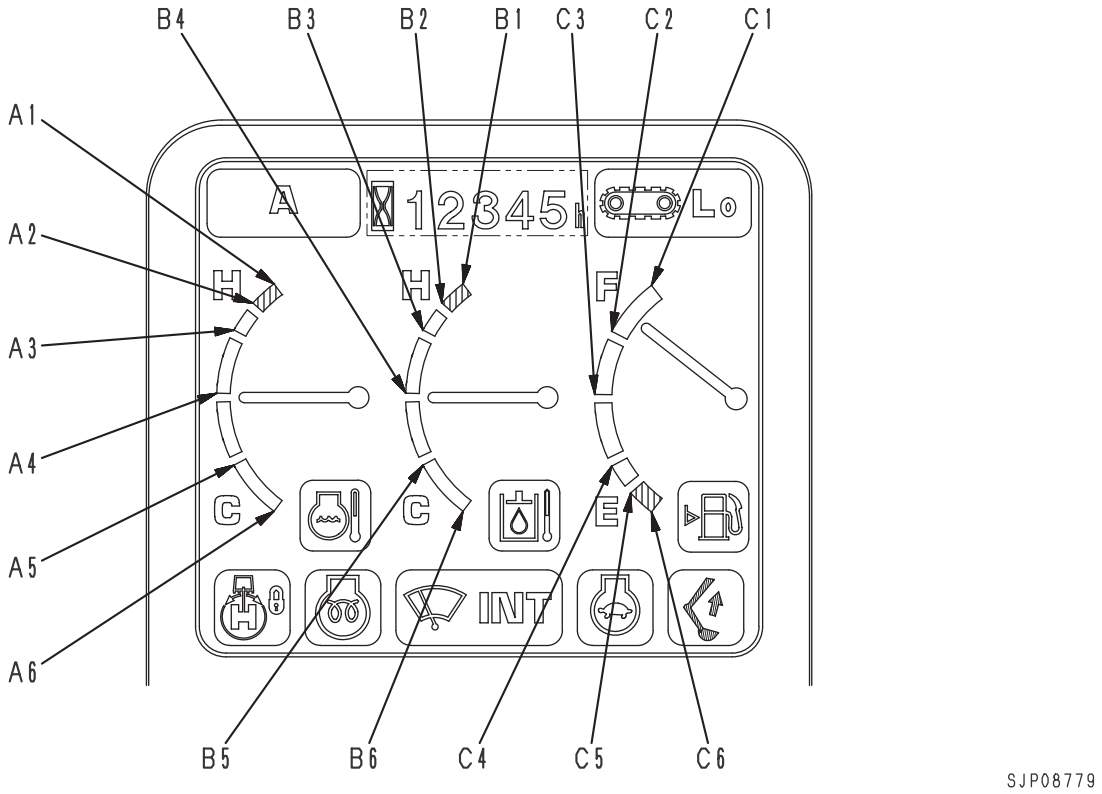


SJP08932

1. Wiper motor
2. Preheating monitor
3. Swing lock monitor
4. Engine water temperature monitor
5. Hydraulic oil temperature gauge
6. Engine water temperature gauge
7. Working mode monitor
8. Service monitor
9. Travel speed monitor
10. Fuel gauge
11. Fuel level monitor
12. Hydraulic oil temperature monitor
13. Power max. monitor
14. Auto-deceleration monitor
15. Engine oil pressure caution
16. Battery charge caution
17. Radiator water level caution
18. Engine oil level caution
19. Air cleaner clogging
20. Maintenance time warning caution

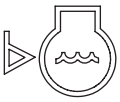
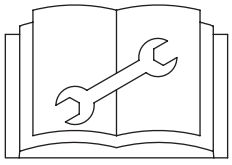
MONITOR ITEMS AND DISPLAY

<table>
<tr><th>Symbol</th><th>Display item</th><th>Display method</th></tr>
<tr><td>  </td><td>Swing lock</td><td>
<table>
<tr><th>Swing lock switch</th><th>Swing holding brake release switch</th><th>Swing lock monitor</th></tr>
<tr><td>OFF</td><td>OFF</td><td>OFF</td></tr>
<tr><td>ON</td><td>OFF</td><td>ON</td></tr>
<tr><td>OFF</td><td>ON</td><td>Flashes</td></tr>
<tr><td>ON</td><td>ON</td><td>ON</td></tr>
</table>
</td></tr>
<tr><td>  </td><td>Preheating</td><td>
<table>
<tr><th>Continuous set time</th><th>Preheating monitor status</th></tr>
<tr><td>Up to 30 sec.</td><td>ON</td></tr>
<tr><td>From 30 sec. to 40 sec.</td><td>Flashes</td></tr>
<tr><td>More than 40 sec.</td><td>OFF</td></tr>
</table>
</td></tr>
<tr><td> 
</td><td>Power Max.</td><td>
<table>
<tr><th>Power Max. switch status</th><th>Power max. monitor status</th></tr>
<tr><td>Being pressed</td><td>Lights up but goes out after approx. 9 sec. when kept pressed</td></tr>
<tr><td>Not being pressed</td><td>Flashes</td></tr>
</table>
</td></tr>
<tr><td rowspan="3"></td><td>Engine water temperature</td><td rowspan="3">See gauge display on the next page</td></tr>
<tr><td>Hydraulic oil temperature</td></tr>
<tr><td>Fuel level</td></tr>
</table>



Gauge	Range	Temperature, volume	Indicator	Buzzer sound
Engine water temperature (°C)	A1	105	Red	❍
	A2	102	Red	
	A3	100	Green	
	A4	80	Green	
	A5	60	Green	
	A6	30	White	
Hydraulic oil temperature (°C)	B1	105	Red	
	B2	102	Red	
	B3	100	Green	
	B4	80	Green	
	B5	40	Green	
	B6	20	White	
Fuel level (L)	C1	289	Green	
	C2	244.5	Green	
	C3	200	Green	
	C4	100	Green	
	C5	60	Green	
	C6	41	Red	

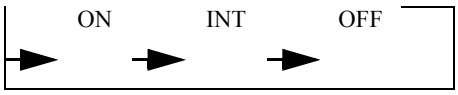
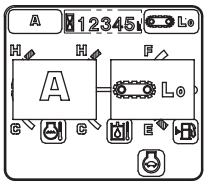
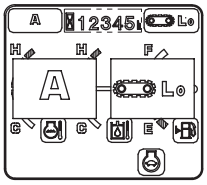
Checks before starting (caution lamps all light up), when maintenance interval is exceeded.
If the checks before starting or maintenance interval is exceeded items light up, the display of the hydraulic oil temperature gauge and the hydraulic oil temperature monitor are stopped, and the following cautions are displayed.

Symbol	Display item	Check before starting item	When engine is stopped	When engine is running
 SAP00520	Engine oil pressure	●	--	When abnormal, lights up and buzzer sounds
 SAP00522	Battery charge	●	--	Lights up when abnormal
 SAP00519	Radiator water level	●	Lights up when abnormal	When abnormal, lights up and buzzer sounds
 SAP00523	Engine oil level	●	Lights up when abnormal	--
 SAP00521	Air cleaner clogging	●	--	Lights up when abnormal
 SJP08780	Maintenance		Lights up when there is a warning. Lights up for only 30 sec. after key is turned ON, then goes out.	

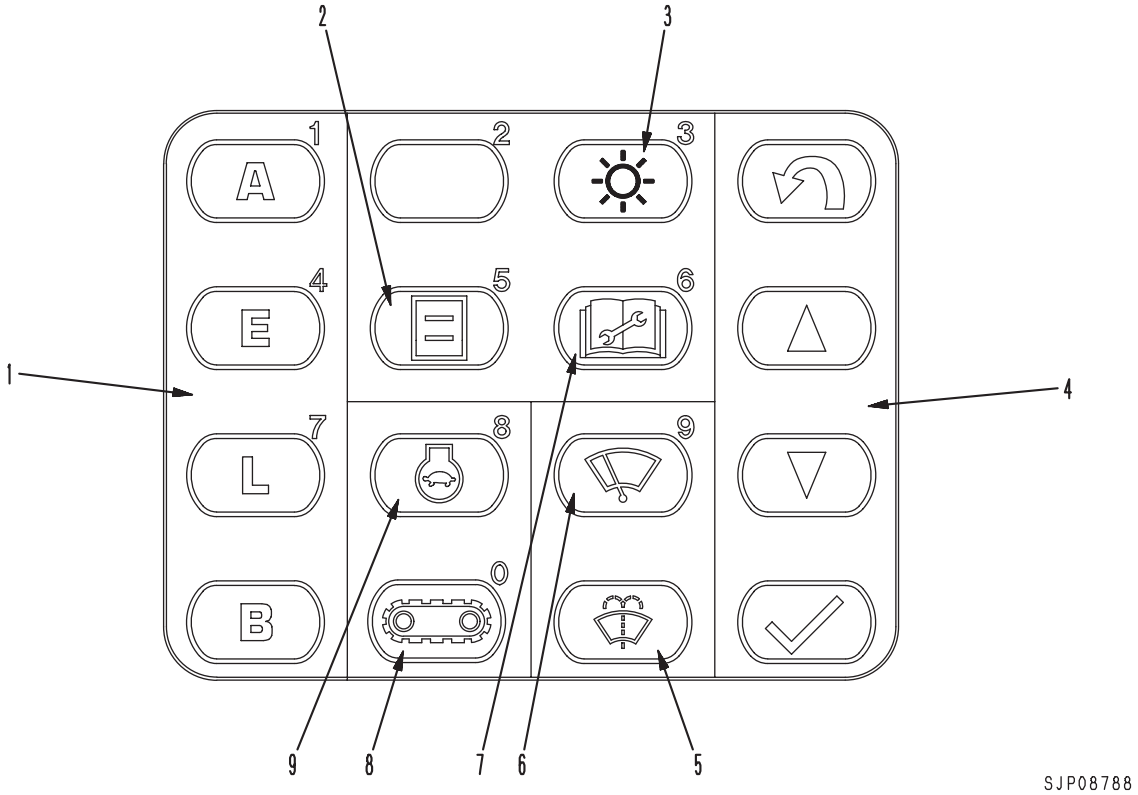
The problems that have occurred are displayed in order from the left.

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

Condition of hydraulic oil	Color 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

Display category	Symbol	Display item	Display range	Display method
Monitor	 SJP08781	Wiper		Displays set condition
	 SJP08782	Working mode	 Lo, Mi, Hi SJP08787	Displays set mode
	 SJP08783	Travel speed	 Lo, Mi, Hi SJP08787	Displays set speed
	 SJP08784	Auto-deceleration	ON ⇔ OFF	Displays actuation status
Service meter	 SJP08785	Service meter indicator	When service meter is working	Lights up when service meter is working

SWITCHES



1. Working mode selector switch
2. Selector switch
3. Display brightness, contrast adjustment switch
4. Control switch
5. Window washer switch
6. Wiper switch
7. Maintenance switch
8. Travel speed selector switch
9. Auto-deceleration switch

- Working mode selector switch

  The condition of the machine changes according to the switch that is pressed (A, E, L, B). It is possible to check the condition on the working mode monitor display. The relationship between each working mode and the monitor display is shown in the table on the right.

Switch that is pressed	Display	Working mode status after setting
[A]	A	A mode (default)
[E]	E	E mode
[L]	L	L mode
[B]	B	B mode

- Selector switch

  This is used when making detailed settings in each working mode. (For details, see ATTACHMENT FLOW CONTROL FUNCTION for modes A and E.)

- Maintenance switch

  Check the condition of the maintenance items. (For details, see MAINTENANCE FUNCTION.)

- Auto-deceleration switch

  Each time the auto-deceleration switch is pressed, the auto-deceleration function is switched ON/OFF.

  Use the auto-deceleration monitor display to check the present condition.

  When the working mode switch is operated to switch the working mode, it is automatically set to ON.

- Travel speed selector switch

  Each time the travel speed selector switch is pressed, the travel speed changes.

  Lo → Mi → Hi → Lo . . . . . .

  Use the travel speed monitor display to check the present condition.

  The relationship between the set speed and the monitor display in the table on the right.

Display	Setting
Crawler symbol + Lo	Low speed (default)
Crawler symbol + Mi	Medium speed
Crawler symbol + Hi	High speed

- Wiper switch

  Each time the wiper switch is pressed, the wiper setting changes OFF → INT → ON → OFF → . . . . . .

  Use the wiper monitor display to check the present condition.

  The relationship between the wiper setting and the monitor display is as shown in the table on the right.

Display	Setting	Wiper actuation status
None	OFF	Stowing stopped or now stowing
Wiper symbol + INT	INT	Intermittent actuation
Wiper symbol + ON	ON	Continuous actuation

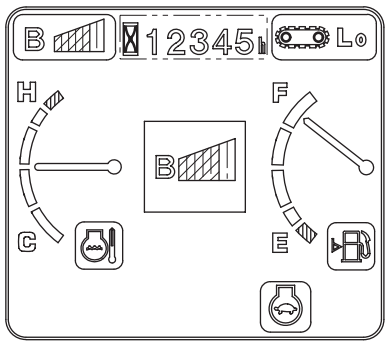
- Window washer switch
  While the switch is being pressed, window washer liquid is sprayed out. There is a time delay before the wiper starts.

- Control switch
  This is used for control when using the maintenance function or select function.
  (For details, see each function.)

- Display brightness, contrast adjustment switch
  Use this switch when adjusting the display brightness and contrast.
  (For details, see each function.)

SELECT MODE FUNCTION

- This is used when setting the flow in each working mode. It is possible to make the setting when genuine attachment piping is installed and the initial value setting function on the service menu has been used to set to ATTACHMENT INSTALLED.
- It is possible to check on the working mode monitor if this function can be set.



SJP08789

Working mode	Monitor display
A mode	[A] + crusher symbol
E mode	[E] + crusher symbol
B mode	[B] + flow symbol

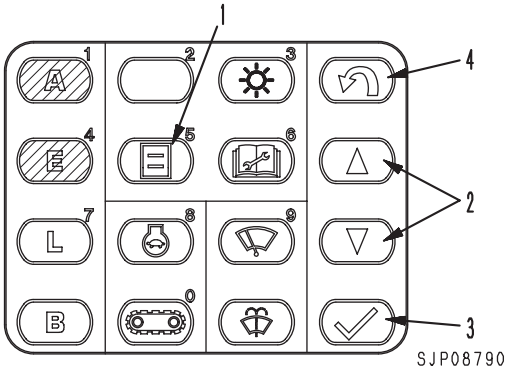
METHOD OF USE

★ Carry out the setting on the normal screen

1. A mode, E mode

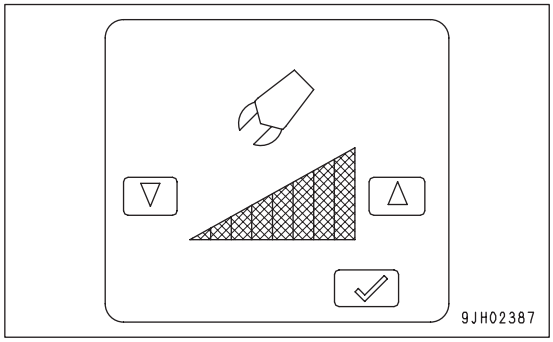
   1) Press select switch (1) on the monitor to move to the adjustment screen.

   2) Press control switch (2) to select the flow level.



SJP08790

Control switch	Actuation
△ SJP08933	Flow level bar graph extends to the right
▽ SJP08934	Flow level bar graph retracts to the left


9JH02387

   3) After completing the level selection, press input confirmation switch (3).
   The selection flow level is confirmed and the screen moves to the normal screen.
   From the moment that the flow level is selected, the content of the selection is reflected for the attachment flow.

   ★ Before the input confirmation switch is pressed, the flow levelis not confirmed, so press return switch (4) to return to the normal screen. This function can be used to return to the previously set flow.

   The relationship between the set flow level and the flow value is as shown in the table on the right.

Flow level	Flow (L/min.)	Remarks
8	430	❉ Default
7	350	
6	250	
5	170	
4	140	
3	115	
2	90	
1	30	

2. B mode

1) Press select switch (1) on the monitor to move to the screen for selecting the 3-stage flow level.

2) Press control switch (2), or input [01] - [03] with the numeral 10-key pad to choose one on the three flow levels.

No.	10-key pad operation
01	SJP08791 → SJP08792
02	SJP08791 → SJP08793
03	SJP08791 → SJP08794

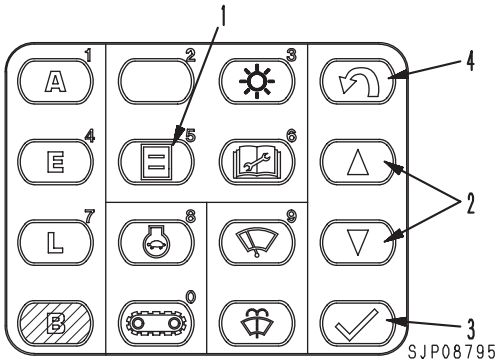
3) After completing the level selection, press input confirmation switch (3).
The selected flow level is selected.

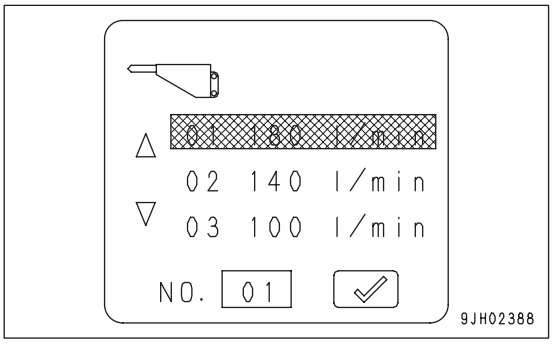
★ Before the input confirmation switch is pressed, the flow level is not confirmed, so press return switch (4) to return to the operator screen. This function can be used to return to the previously set flow.

4) After the flow level is confirmed, the screen changes to the screen shown in the diagram on the right.
With this screen, it is possible to make fine adjustment to the flow.

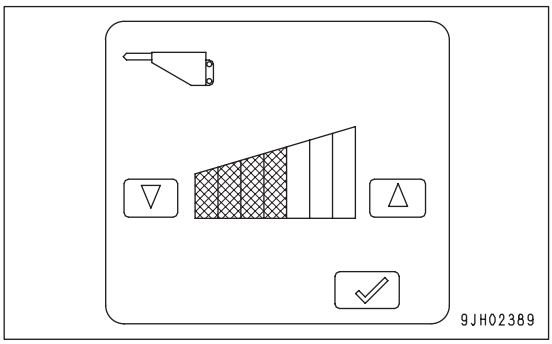
5) Press control switch (2) and select the flow level.

Control switch	Actuation
△ SJP08933	Flow level bar graph extends to the right
▽ SJP08934	Flow level bar graph retracts to the left





No.	Flow level (L/min.)	Remarks
01	180	❊ Default
02	140	
03	100	



6) After completing the level selection, press input confirmation switch (3).
The selected flow level is confirmed and the screen moves to the operator screen.
From the moment that the flow level is selected, the content of the selection is reflected for the attachment flow.
★ Before the input confirmation switch is pressed, the flow level is not confirmed, se press return switch (4) to return to the normal screen. This function can be used to return to the previously set flow.
The relationship between the set flow level and the flow value is as shown in the table on the right.

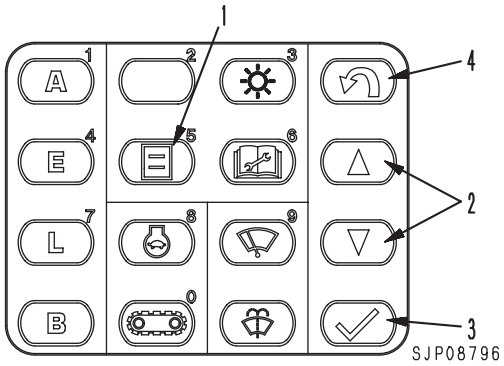
7) Check the set value with the working mode monitor.
The relationship between the display level and the set value is as shown in the table on the right, and it is possible to check the level of the flow that can be set.

Flow level	When flow is 100 L/min.	When flow is 140 L/min.	When flow is 180 L/min.	Remarks
7	130	170	210	
6	120	160	200	
5	110	150	190	
4	100	140	180	❉ Default
3	90	130	170	
2	80	120	160	
1	70	110	150	

Display level	Set value (**l**/min.)
8	200 or 210
7	180 or 190
6	160 or 170
5	140 or 150
4	120 or 130
3	100 or 110
2	80 or 90
1	70

MAINTENANCE FUNCTION

When the maintenance time for replacement, inspection, or filling has approached for the 10 maintenance items, press maintenance switch (1) and the caution display (yellow or red) appears on the monitor display for 30 seconds after the key is turned ON to remind the operator to carry out lubrication maintenance.



★ Maintenance items

No.	Item	Replacement interval (hours)
01	Engine oil	500
02	Engine oil filter	500
03	Fuel filter	500
04	Hydraulic filter	1000
05	Hydraulic tank breather	500
06	Corrosion resistor	❊ (1000)
07	Damper case oil	1000
08	Final case oil	2000
09	Machinery case oil	1000
10	Hydraulic oil	5000

❊ Option, so not set

★ The above replacement intervals are set for each item, and the time remaining to maintenance is reduced as the machine is operated.

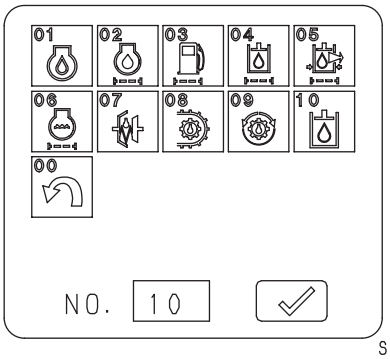
The content of the caution display differs according to the ramaining time. The relationship is as shown in the table below.

Display	Condition
None	Remaining time for maintenance for all items is more than 30 hours
Notice display (black symbol displayed on yellow background)	There is one or more items with less than 30 hours remaining time for maintenance
Warning display (wiper symbol displayed on red background)	There is one or more items with less than 0 hours remaining time for maintenance

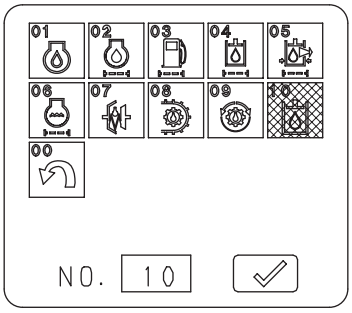
METHOD OF CHECKING STATUS MAINTENANCE ITEMS

★ Operate as follows when on the operator screen.

1. Press maintenance switch (1) and switch to the maintenance list display screen.
   ★ The maintencance items are displayed as symbols on the screen.
2. Press control switch (2), or use the 10-key pad to input the number (01 - 10) of the maintenance item to select the item.
   ★ The cursor moves and the item is highlighted.
   ★ The display method is the same as described on the previous page (relationship between remaining time and caution display). If the remaining time is less than 30 hours, the item is displayed in yellow, and if it is less than 0 hours, it is displayed in red.



SJP08797



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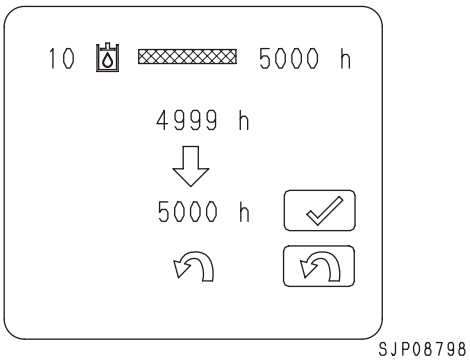
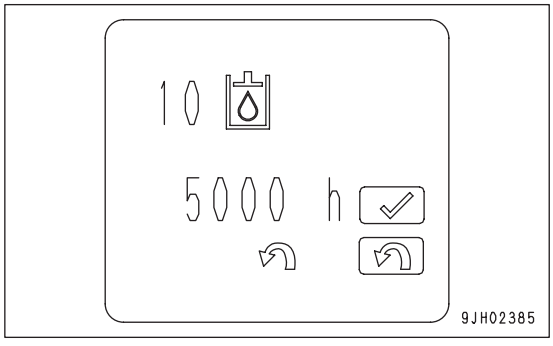
MAINTENANCE OPERATION

1. After completing the selection, press input confirmation switch (3).
   The screen will change to the maintenance reset screen.
2. Use the maintenance reset screen to check the content, and if there is any problem, press input confirmation switch (3) to move to the check screen.
   If the wrong item is selected, press return switch (4) to return to the maintenance list screen.
3. Check the content on the check screen, and if there is no problem, press input confirmation switch (3) to reset the maintenance time.
   After the reset is completed, the screen returns to the maintenance list display screen. To check the remaining time, or if the wrong item is selected, press return switch (4) to return to the maintenance list screen.
   ★ The check screen shows the symbol for the maintenance item and the set time in large letters.
   ★ The background color of the symbol for the item where the maintenance tiem was reset is the same as the background of the screen, so it is possible to check that it has been reset.



SJP08798



9JH02385

BRIGHTNESS, CONTRAST ADJUSTMENT FUNCTION

This function is used to adjust the brightness and contrast of the display.

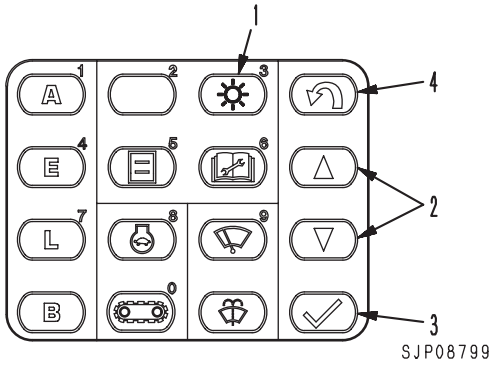
ADJUSTMENT METHOD

★ Operate as follows when on the operator screen.

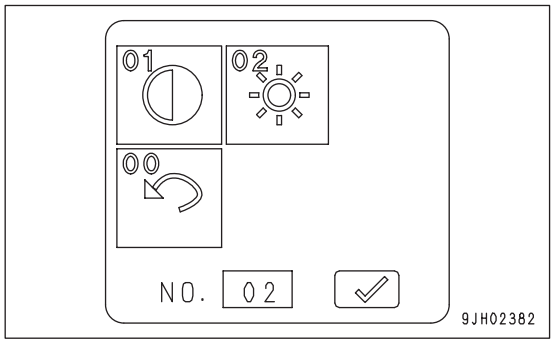
1. Press display brightness/contrast adjustment switch (1) and switch to the adjustment screen.

★ Relationship between menu symbol and content.

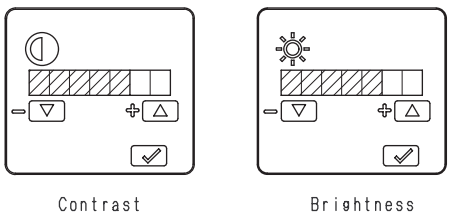
No.	Symbol	Content
01	Return mark	Return
02	SJP08935	Contrast
03	SJP08936	Brightness



2. Press control switch (2), or use the 10-key pad to input the number (00 - 02) to select either contrast or brightness.
   After completing the selection, press input confirmation switch (3) and return to the adjustment screen. Then press return switch (4) or use the 10-key pas to set to [00] and press input confirmation switch (3) to return to the normal screen.
3. Press control switch (2) and adjust the brightness and contrast as desired.



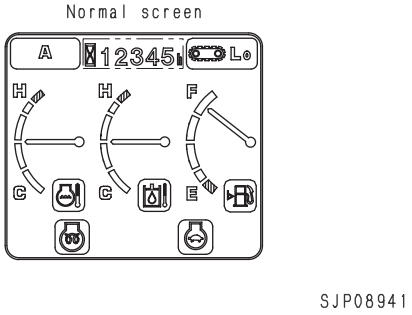
Control switch	Actuation
SJP08933	Flow level bar graph extends to the right
SJP08934	Flow level bar graph retracts to the left



SJP08937

PASSWORD FUNCTION

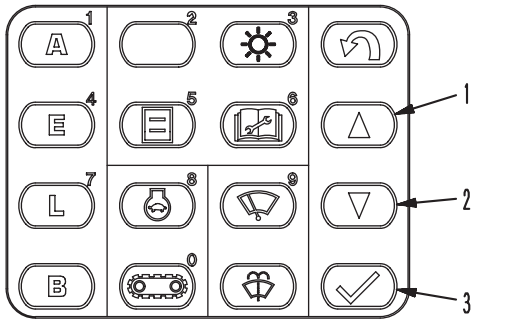
- If a passport is input, the engine will not start unless the password is input correctly when starting.
- When setting this function or when changing the password, it is necessary to go from the normal screen to the setting screen and input the password.
  This becomes posssible 10 minutes after the starting switch is turned ON and the monitor screen has changed to the normal screen.



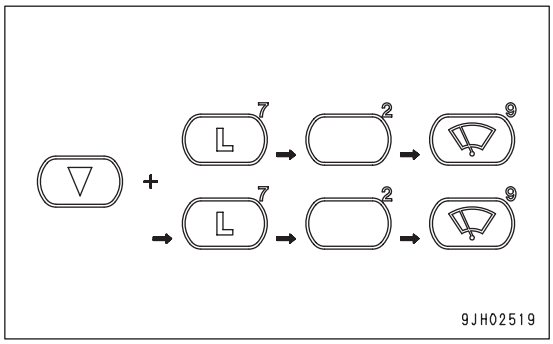
SJP08941

METHOD OF SETTING, CHANGING PASSWORD

1. Turn the starting switch ON, keep starting switch (2) pressed, use the 10-key pad to input 7 → 2 → 9 → 7 → 2 → 9 in succession, and the screen will change to the 8-digit numeral input screen.

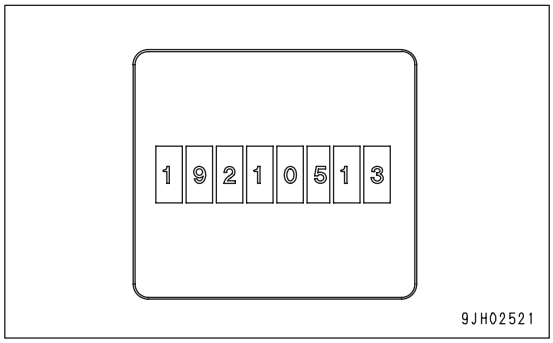


SJP08806



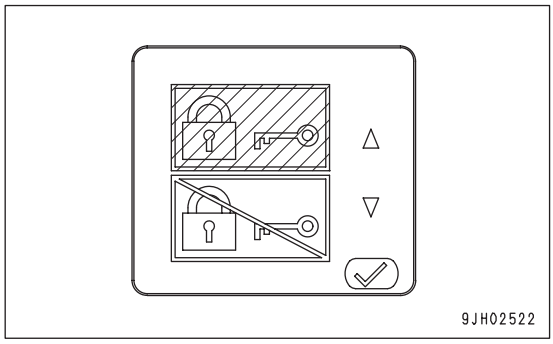
9JH02519

2. On the input screen, use the 10-key pad to input an 8-digit number [19210513]. When the final digit [number 3] is input, the screen will change to the Valid/ Invalid screen for the password function.

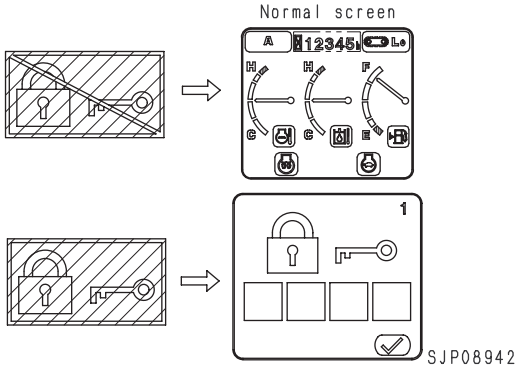


9JH02521

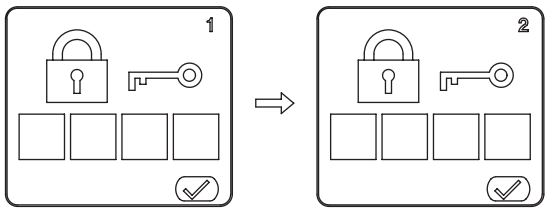
3. Press control switch (1) or (2) to set to Valid/Invalid.
   The diagram on the right shows the screen when control switch (1) is pressed and the screen is set to [Valid].



   If [Invalid] is selected and input confirmation switch (3) is pressed, the password function will be made invalid, and the screen will return to the normal screen.
   If [Valid] is selected and input confirmation switch (3) is pressed, the password function will be made valid, and the screen will change to the screen for inputting the 4-digit number.



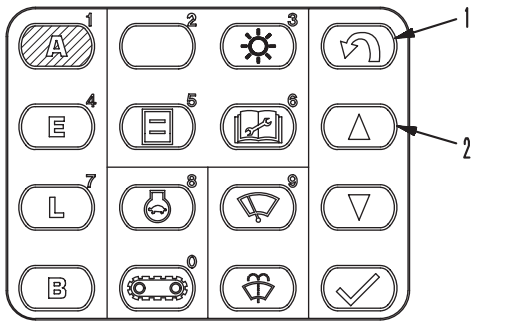
4. Input a 4-digit number on the input screen (the lock and key symbol are displayed), then press input confirmation switch (3).
   When the input confirmation switch is pressed, you will be requested to input the same 4-digit number again, so input the same 4-digit number, then press input confirmation switch (3) to confirm the password.
   Numerals 1 and 2 are displayed at the top right corner of the screen to distinguish between the 1st input screen and the 2nd input screen.
   When the password is confirmed, the screen will return to the normal screen.
   ★ If the number input the second time is different from the number input the first time, the password will not be confirmed and the screen will return to the first screen, so input the same 4-digit password 2 times in succession.



SERVICE METER CHECK FUNCTION

- When the starting switch is at the OFF position, keep return switch (1) and control switch (2) of the monitor pressed at the same time, and the service meter is shown on the display.
- This display is shown only while the two switches are being pressed. When the switches are released, the display goes out.

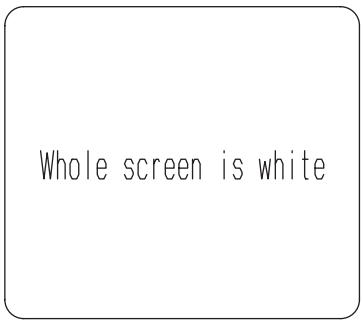
  Note that it takes 3 - 5 seconds after the switches are pressed for the service meter display to appear.



SJP08809

DISPLAY LCD CHECK FUNCTION

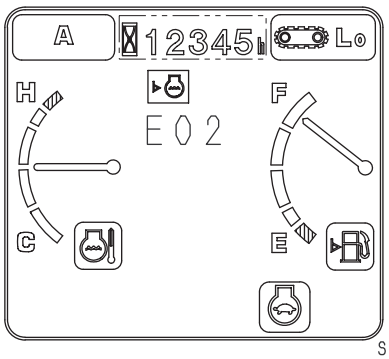
- On the password input screen or on the normal screen, if monitor return switch (1) and working mode (A) switch are kept pressed at the same time, all the LCD display will light up and the whole screen will become white, so the display can be checked.
- If any part of the display is black, the LCD is broken.



SJP08943

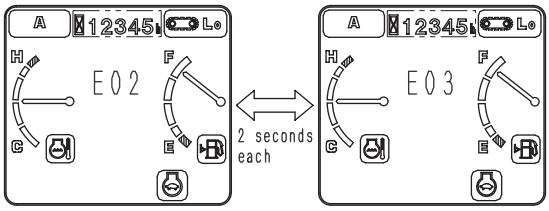
USER CODE DISPLAY FUNCTION

- If there is any problem in operating the machine, the user code is displayed on the monitor to advise the operator of the steps to take.
  This code display appears on the operator screen.
- On the operator screen, the user code is displayed on the portion for the hydraulic oil temperature gauge.



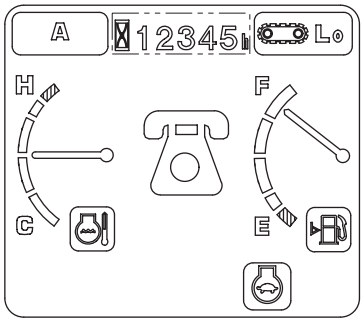
SJP08810

- If more than one user code is generated at the same time, the user codes are displayed in turn for 2 seconds each to display all the user codes.



SJP08945

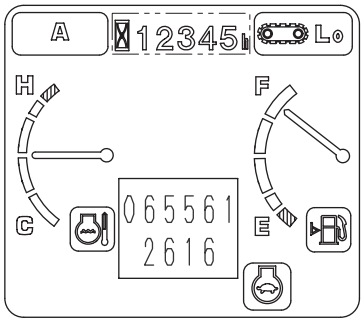
- While the user code is being displayed, if the input confirmation switch is pressed, the service code and failure code can be displayed.



BWP10529

- If there is more than one service code or failure code, the display switches every 2 seconds and displays all the service codes/failure codes that caused the user code to be displayed.

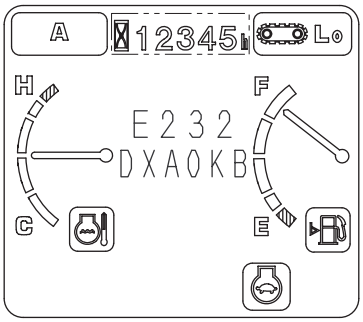
  Even if service codes/failure codes have occurred, if they did not cause the user code to be displayed, this function does not display them.



SJP09136

- If the telephone number has been set using the telephone number input on the service menu, it is possible to switch on the service code/failure code and display the telephone symbol and telephone number.

  For details of inputting and setting the telephone number, see SPECIAL FUNCTIONS OF MONITOR PANEL in the TESTING AND ADJUSTING section.



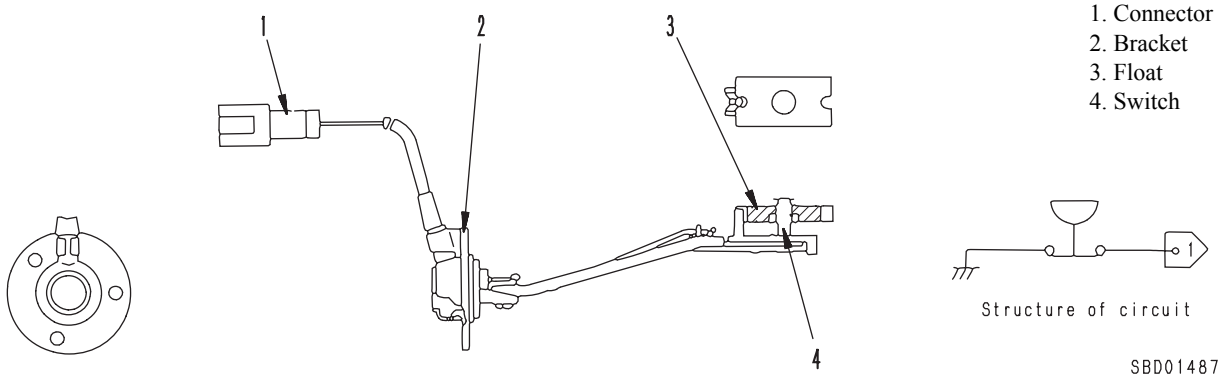
BWP10531

SENSOR

- The signals from the sensors are input to the panel directly. Either side of a sensor of contact type is always connected to the chassis ground.

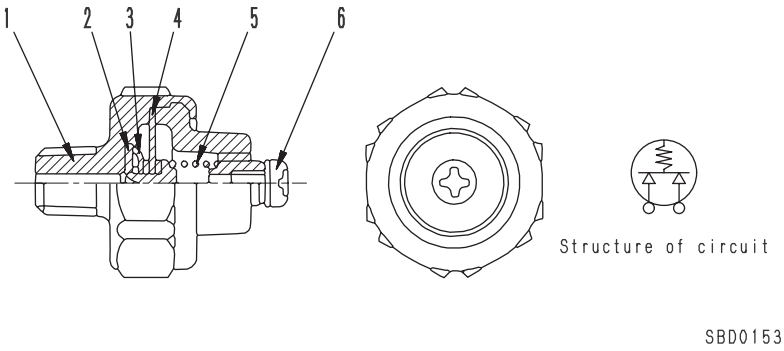
Sensor name	Type of sensor	When normal	When abnormal
Engine oil level	Contact	ON (Closed)	OFF (Open)
Engine oil pressure	Contact	OFF (Open)	ON (Closed)
Hydraulic oil temperature	Resistance	—	—
Coolant temperature	Resistance	—	—
Fuel level	Resistance	—	—
Air cleaner clogging	Contact	OFF (Closed)	ON (Open)

Engine oil level sensor



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

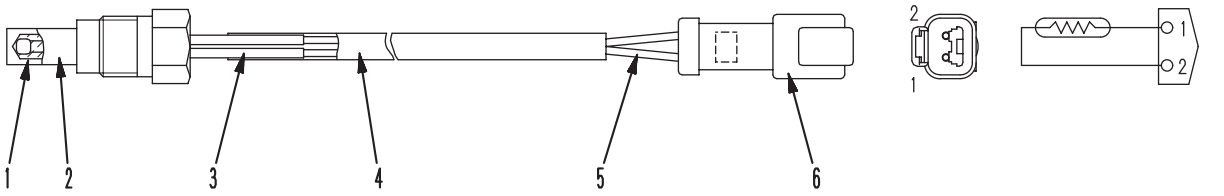
Engine oil pressure sensor (For low pressure)



1. Plug
2. Contact ring
3. Contact
4. Diaphragm
5. Spring
6. Terminal

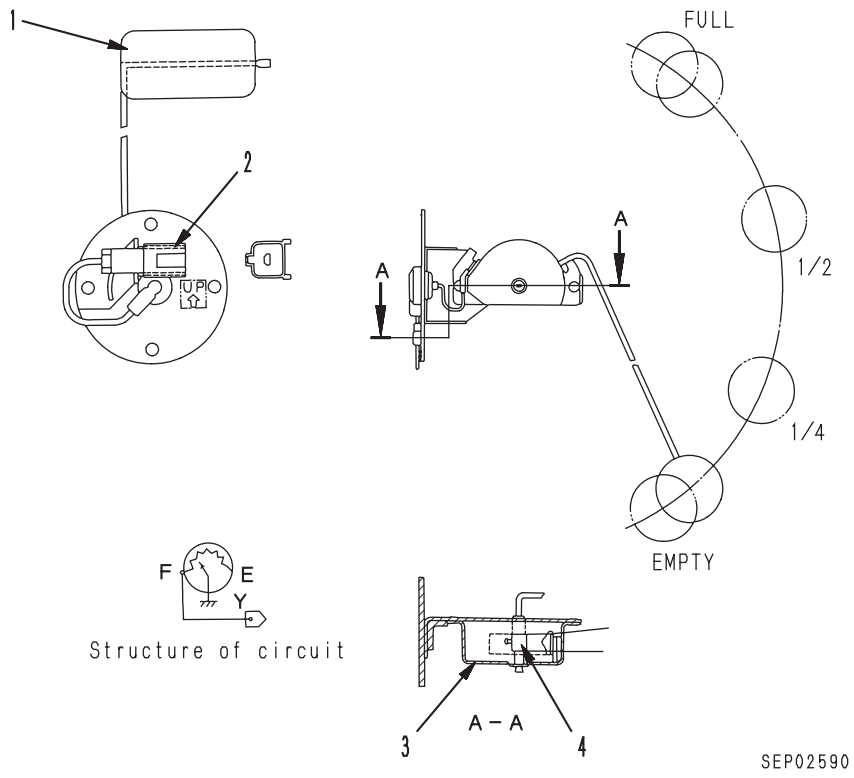
Hydraulic oil temperature sensor

Coolant temperature sensor



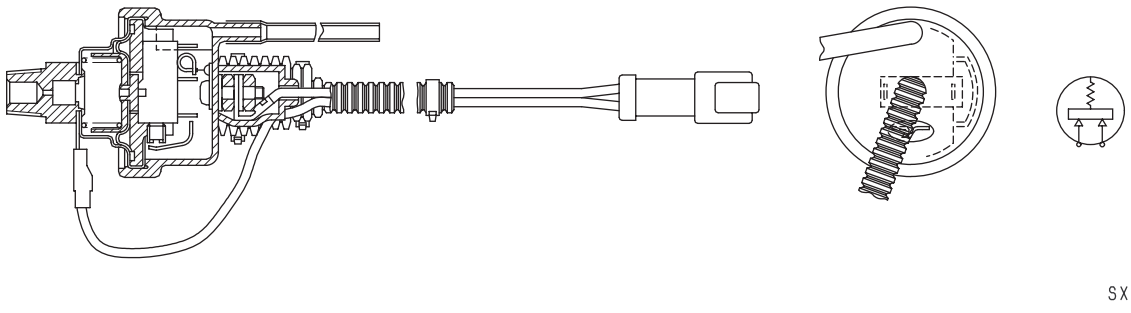
1. Thermistor
2. Body
3. Tube
4. Tube
5. Wire
6. Connector

Fuel level sensor



1. Float
2. Connector
3. Cover
4. Variable resistor

Air cleaner clogging sensor



20 TESTING AND ADJUSTING

★ Note the following when making judgements using the standard value tables for testing, adjusting, or troubleshooting.

1. The standard value for a new machine given in the table is the value used when shipping the machine from the factory and is given for reference. It is used as a guideline for judging the progress of wear after the machine has been operated, and as a reference value when carrying out repairs.
2. The service limit value given in the tables is the estimated value for the shipped machine based on the results of various tests. It is used for reference together with the state of repair and the history of operation to judge if there is a failure.
3. These standard values are not the standards used in dealing with claims.

k When carrying out testing, adjusting, or troubleshooting, park the machine on level ground, insert the safety pins, and use blocks to prevent the machine from moving.
k When carrying out work together with other workers, always use signals and do not let unauthorized people near the machine.
k When checking the water level, always wait for the water to cool down. If the radiator cap is removed when the water is still hot, the water will spurt out and cause burns.
k Be careful not to get caught in the fan, fan belt or other rotating parts.

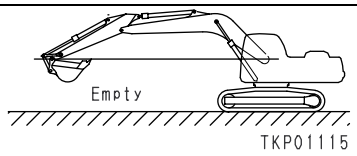
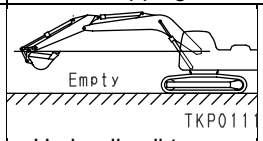
STANDARD VALUE TABLE FOR ENGINE RELATED PARTS

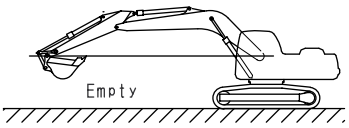
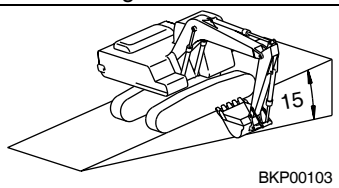
Applicable model			PC210, 210LC, 210NLC-7K		PC240LC, 240NLC-7K	
Engine			SAA6D102E-2		SAA6D102E-2	
Item	Measurement condition	Unit	Standard value for new machine	Service limit value	Standard value for new machine	Service limit value
Engine speed	High idling	rpm	2,150±70	2,150±70	2,200±70	2,200±70
	Low idling		1,030±50	1,030±50	1,030±50	1,030±50
	Rated speed		1,950	1,950	2,000	2,000
Exhaust gas color	At sudden acceleration	Bosch index	Max. 1.0	Max. 2.0	Max. 1.0	Max. 2.0
	At high idling		Max. 0.5	Max. 1.5	Max. 0.5	Max. 1.5
Valve clearance (Normal temperature)	Intake valve	mm	0.25	—	0.25	—
	Exhaust valve		0.51	—	0.51	—
Compression pressure	Oil temperature: 40–60ºC Engine speed: 250rpm	MPa {kg/cm^2}	Min. 2.4 {Min. 24.6}	Difference between cyinders Min. 1.0 {Min. 10.3}	Min. 2.4 {Min. 24.6}	Difference between cyinders Min. 1.0 {Min. 10.3}
Blow-by pressure	(Water temperature: operating range) At rated output	kPa {mmH_2O}	Max. 1.2 {Max. 123}	5.1 {520}	Max. 1.2 {Max. 123}	5.1 {520}
Oil pressure (SAE15W-40)	(Water temperature: operating range) At high idling At low idling	MPa {kg/cm^2}	0.39–0.64 {4.0–6.5} Min. 0.15 {Min. 1.5}	0.25 {2.6} 0.09 {0.9}	0.39–0.64 {4.0–6.5} Min. 0.15 {Min. 1.5}	0.25 {2.6} 0.09 {0.9}
Oil temperature	Whole speed range (inside oil pan)	ºC	80–110	120	80–110	120
Fuel injection timing	Before Top Dead Center	°(degree)	11±1	11±1	11±1	11±1
Fan belt tension	Deflection when pressed with finger force of approx. 58.8 N{6 kg}	mm	8	Min. 6, Max. 10	8	Min. 6, Max. 10
Air conditioner compressor belt tension		mm	5–8	5–8	5–8	5–8

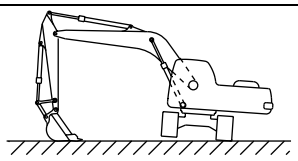
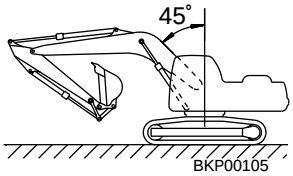
STANDARD VALUE TABLE FOR CHASSIS RELATED PARTS

Applicable model					PC210, 210LC, 210NLC-7K		PC240LC, 240NLC-7K	
Cate-gory	Item		Measurement Condition	Unit	Standard value	Permissible value	Standard value	Permissible value
Engine speed	2 pumps at relief		• Engine water temperature: Within operation range • Hydraulic oil temperature: Within operation range • Engine at high idling • Arm in relief condition	rpm	2,000±100	2,000±100	2,050±100	2,050±100
	At 2-pump relief + one touch power up		• Engine water temperature: Within operation range • Hydraulic oil temperature: Within operation range • Engine at high idling • Arm relief + One-touch power max. switch in ON condition		1,900±100	1,900±100	1,950±100	1,950±100
	Speed when auto-deceleration is operated		• Engine at high idling • Auto-deceleration switch in ON condition • All control levers in NEUTRAL condition		1,400±100	1,400±100	1,400±100	1,400±100
Spool stroke	Boom control valve			mm	9.5±0.5	9.5±0.5	9.5±0.5	9.5±0.5
	Arm control valve							
	Bucket control valve							
	Swing control valve							
	Travel control valve							
Travel of control levers	Boom control lever		• Engine stopped • At center of control lever grip • Max. reading up to stroke end (excepting lever play in NEUTRAL position)	mm	85±10	85±10	85±10	85±10
	Arm control lever				85±10	85±10	85±10	85±10
	Bucket control lever				85±10	85±10	85±10	85±10
	Swing control lever				85±10	85±10	85±10	85±10
	Travel control lever				115±12	115±12	115±12	115±12
	Play of control lever				Max. 10	Max. 15	Max. 10	Max. 15
Operating force of control levers	Boom control lever		• Hydraulic oil temperature: Within operation range • Engine at high idling • At center of control lever grip • At tip in case of pedal • Max. reading up to stroke end	N{kg}	15.7±3.9 {1.6±0.4}	Max. 24.5 {Max. 2.5}	15.7±3.9 {1.6±0.4}	Max. 24.5 {Max. 2.5}
	Arm control lever				15.7±3.9 {1.6±0.4}	Max. 24.5 {Max. 2.5}	15.7±3.9 {1.6±0.4}	Max. 24.5 {Max. 2.5}
	Bucket control lever				12.7±2.9 {1.3±0.3}	Max. 21.6 {Max. 2.2}	12.7±2.9 {1.3±0.3}	Max. 21.6 {Max. 2.2}
	Swing control lever				12.7±2.9 {1.3±0.3}	Max. 21.6 {Max. 2.2}	12.7±2.9 {1.3±0.3}	Max. 21.6 {Max. 2.2}
	Travel control lever	Lever			24.5±5.9 {2.5±0.6}	Max. 39.2 {Max. 4.0}	24.5±5.9 {2.5±0.6}	Max. 39.2 {Max. 4.0}
		Pedal			74.5±18.6 {7.6±1.9}	Max. 107.6 {Max. 11}	74.5±18.6 {7.6±1.9}	Max. 107.6 {Max. 11}

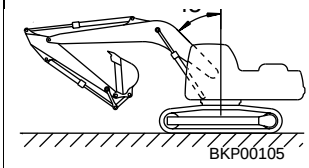
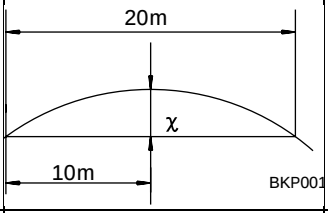
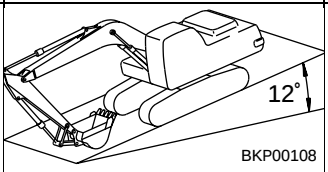
Applicable model					PC210, 210LC,210NLC-7K		PC240LC, 240NLC-7K	
Cate-gory	Item	Measurement Condition		Unit	Standard value	Permissible value	Standard value	Permissible value
Hydraulic pressure	Unload pressure	• Hydraulic oil temperature: Within operation range • Engine at high idling • Working mode: A mode • Hydraulic pump output pressure with all control levers in NEUTRAL position		MPa {kg/cm^2}	3.9±1.0 {40±10}	3.9±1.0 {40±10}	3.9±1.0 {40±10}	3.9±1.0 {40±10}
	Boom	• Hydraulic oil temperature: Within operation range • Engine at high idling • Working mode: A mode • Hydraulic pump output pressure with all measurement circuits relieved • Values inside parenthesis: Hydraulic oil pressure with one-touch power max. switch in ON mode (reference only)			34.8±1.0 {335±10}	33.3–36.8 {340–375}	34.8±1.0 {335±10}	33.3–36.8 {340–375}
	Arm							
	Bucket				37.3±1.0 {380±10}	36.3–39.2 {370–400}	37.3±1.0 {380±10}	36.3–39.2 {370–400}
	Swing				30.9±1.5 {315±15}	28.9–32.9 {295–335}	30.9±1.5 {315±15}	28.9–32.9 {295–335}
	Travel				38.2±1.0 {390±10}	37.3–40.2 {380–410}	38.7±1.0 {395±10}	37.3–40.2 {380–410}
	Control circuit source pressure	• Hydraulic oil temperature: Within operation range • Engine running at high idling • Self-reducing pressure valve output pressure with all control levers in NEUTRAL position			3.23±0.2 {33±2}	2.84–3.43 {29–35}	3.23±0.2 {33±2}	2.84–3.43 {29–35}
	Self-reducing pressure valve	• Hydraulic oil temperature: Within operation range • Engine at high idling • Working mode: A mode • Traveling speed: Hi • Hydraulic oil pump pressure - LS pressure	When all control levers in NEUTRAL position		3.9±1.0 {40±10}	3.9±1.0 {40±10}	3.9±1.0 {40±10}	3.9±1.0 {40±10}
			When traveling at half stroke (without load)		2.2±0.1 {22±1}	2.2±0.1 {22±1}	2.2±0.1 {22±1}	2.2±0.1 {22±1}

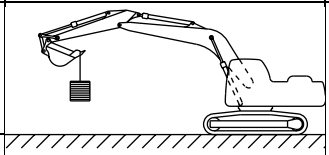
Applicable model					PC210, 210LC,210NLC-7K		PC240LC, 240NLC-7K	
Cate-gory	Item	Measurement Condition		Unit	Standard value	Permissible value	Standard value	Permissible value
Swing	Swing brake angle	 • Hydraulic oil temperature: Within operation range • Engine running at high idling • Working mode: A mode • Swing circle misalignment amount when stopping after one turn		deg. (mm)	Max. 100 (–)	Max. 130 (–)	Max. 165 (–)	Max. 200 (–)
	Time taken to start swing	 • Hydraulic oil temperature: Within operation range • Engine running at high idling • Working mode: A mode • Time required for passing points 90 and 180 degrees from starting point	90°	sec.	3.1±0.3	Max. 3.7	2.9±0.3	Max. 3.5
			180°		4.4±0.4	Max. 5.5	4.3±0.4	Max. 5.4

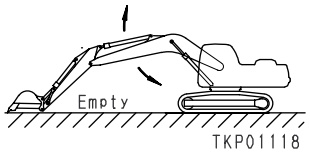
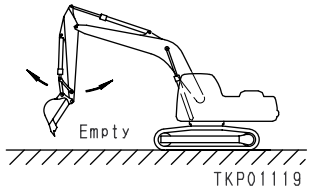
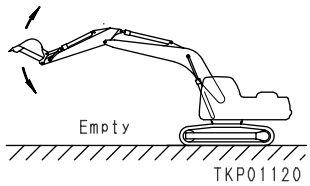
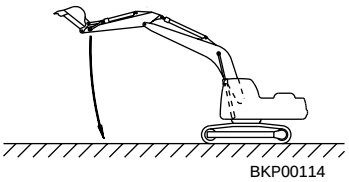
Applicable model				PC210, 210LC, 210NLC-7K		PC240LC, 240NLC-7K	
Cate-gory	Item	Measurement Condition	Unit	Standard value	Permissible value	Standard value	Permissible value
Swing	Time taken to swing	 TKP01115 • Hydraulic oil temperature: Within operation range • Engine running at high idling • Working mode: A mode • Time required for 5 more turns after making initial one turn	sec.	24.2±2.5	Max. 30	$25.7^{+2.8}_{-2.4}$	Max. 31
	Hydraulic drift of swing	 BKP00103 • Hydraulic oil temperature: Within operation range • Engine stopped • Keeping upper structure transverse on slope of 15 degrees • Notching a mating mark on inner and outer races of swing circle • Mating mark misalignment amount during 5 minutes	mm	0	0	0	0
	Leakage from swing motor	• Hydraulic oil temperature: Within operation range • Engine running at high idling • Swing lock switch: ON • Leakage amount for one minute during swing relief	¶/ min	Max. 5	Max. 10	Max. 5	Max. 10

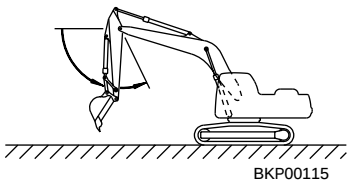
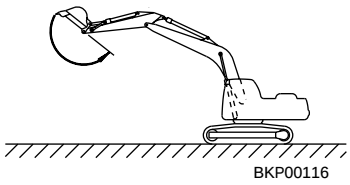
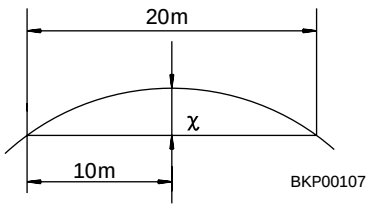
Applicable model					PC210, 210LC, 210NLC-7K		PC240LC, 240NLC-7K	
Cate-gory	Item	Measurement Condition		Unit	Standard value	Permissible value	Standard value	Permissible value
Travel	Travel speed (1)	 BKP00104 • Hydraulic oil temperature: Within operation range • Engine running at high idling • Working mode: A mode • Time required for track shoes to make 5 turns after making one initial idle turn	Lo	sec.	PC210LC: 51.3±5.1 PC210NLC: 55.9±5.6	PC210LC: 46.2–60.4 PC210NLC: 50.3–65.5	PC240LC: $53.6^{+6.0}_{-4.9}$ PC240NLC: $58.1^{+6.5}_{-5.3}$	PC240LC: 48.7–63.6 PC240NLC: 52.8–68.6
			(※ Mi)		PC210LC: 37.5±3.8 PC210NLC: 40.8±4.1	PC210LC: 33.7–45.3 PC210NLC: 36.7–48.9	PC240:LC $39.2^{+4.4}_{-3.6}$ PC240NLC: $42.5^{+4.7}_{-3.9}$	PC240LC: 35.6–47.6 PC240NLC: 38.6–51.2
			Hi		PC210LC: 28.0±1.4 PC210NLC: 30.5±1.5	PC210LC: 26.6–31.4 PC210NLC: 29.0–34.0	PC240LC: $28.0^{+1.5}_{-1.3}$ PC240NLC: $30.3^{+1.6}_{-1.4}$	PC240LC: 26.7–31.5 PC240NLC: 28.9–33.9
	Travel speed (2)	 BKP00105 • Hydraulic oil temperature: Within operation range • Engine running at high idling • Working mode: A mode • Flat ground • Time required for traveling 20 m after 10 m trial run	Lo		24±2.5	21.5–27.5	24±2.5	21.5–27.5
			(※ Mi)		17±2.5	14.5–20.5	17±2.0	15.0–20.0
			Hi		13±1.0	12.0–15.0	13±1.0	12.0–15.0

※: The “Mi” mode is on the multi-monitor specification machine only.

Applicable model				PC210, PC210LC, 210NLC-7K		PC240LC, 240NLC-7K	
Cate-gory	Item	Measurement Condition	Unit	Standard value	Permissible value	Standard value	Permissible value
Travel	Travel deviation	 BKP00105 • Hydraulic oil temperature: Within operation range • Engine at high idling • Working mode: A mode • Travel speed: Lo • Solid and flat ground • Swerving amount while traveling 20 m (X) after initial 10 m trial run  	mm	Max. 150	Max. 250	Max. 150	Max. 250
	Hydraulic drift of travel	 • Hydraulic oil temperature: Within operation range • Engine stopped • Parking machine on slope of 12 degrees with sprocket facing upslope • Sliding distance for 5 minutes	mm	0	0	0	0
	Leakage of travel motor	• Hydraulic oil temperature: Within operation range • Engine at high idling • Traveling with sprocket locked • Oil leakage amount for one minute with traveling in relief condition	¶/min	13.6	27.2	13.6	27.2

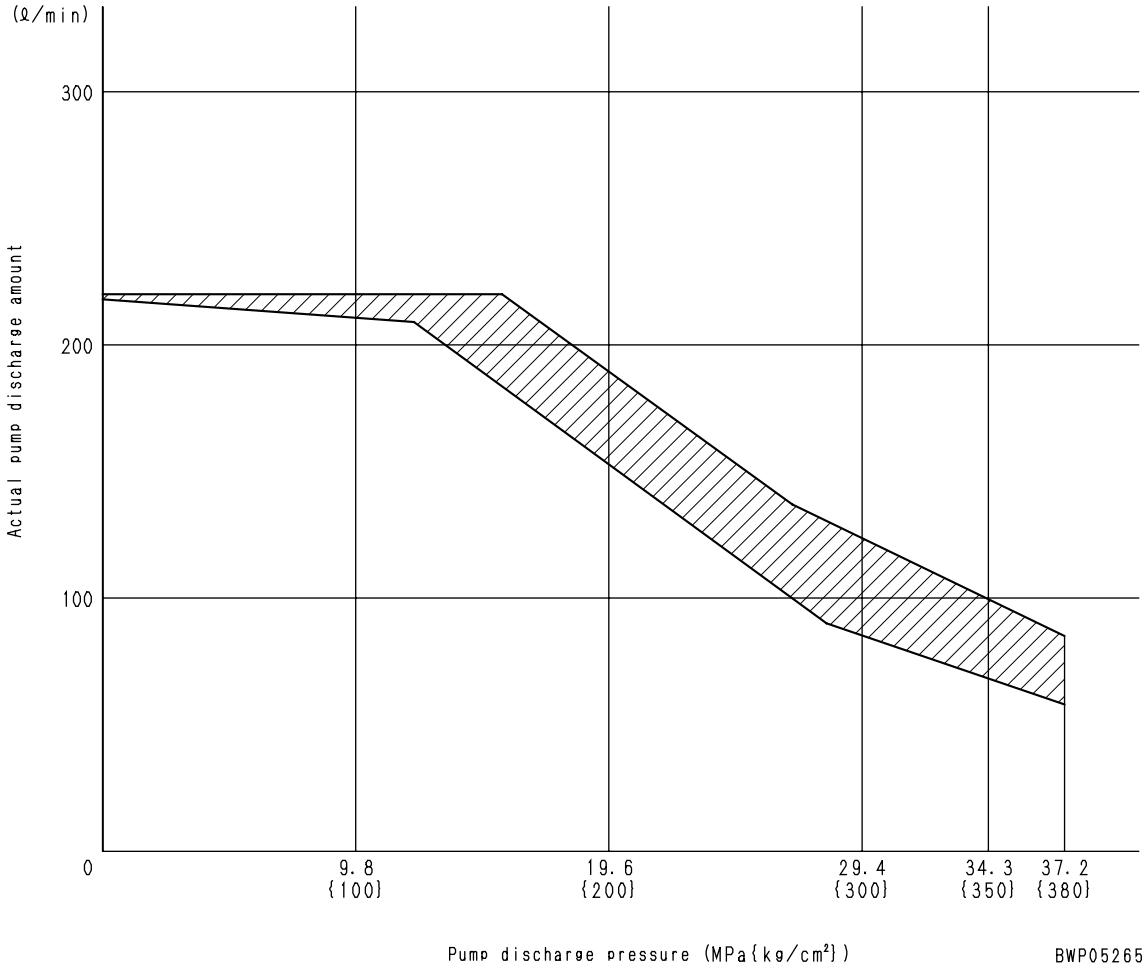
Applicable model					PC210, PC210LC, 210NLC-7K		PC240LC, 240NLC-7K	
Cate-gory	Item		Measurement Condition	Unit	Standard value	Permissible value	Standard value	Permissible value
Work equipment	Hydraulic drift of work equipment	Whole work equipment (tooth tip fall amount)	 BKP00110 • Hydraulic oil temperature: Within operation range • Flat and level ground • Work equipment in measurement posture as illustrated above • Engine stopped • Work equipment control lever in NEUTRAL position • Fall amount for 15 minutes as measured every 5 minutes starting immediately after initial setting	mm	Max. 600	Max. 900	Max. 600	Max. 900
		Boom cylinder (cylinder retraction amount)			Max. 18	Max. 27	Max. 18	Max. 27
		Arm cylinder (cylinder extension amount)			Max. 160	Max. 240	Max. 160	Max. 240
		Bucket cylinder (cylinder retraction amount)			Max. 40	Max. 58	Max. 40	Max. 58

Applicable model					PC210, 210LC, PC210NLC-7K		PC240LC, 240NLC-7K	
Cate-gory	Item	Measurement Condition		Unit	Standard value	Permissible value	Standard value	Permissible value
Work equipment	Work equipment speed	Boom	 • Hydraulic oil temperature: Within operation range • Engine running at high idling • Working mode: A mode • Time required from raise stroke end till bucket touches ground	RAISE	sec.	3.3±0.4	Max. 4.7	$3.4^{+0.5}_{-0.3}$	Max. 4.9
				LOWER		2.4±0.3	Max. 3.7	2.7±0.3	Max. 4.4
		Arm	 • Hydraulic oil temperature: Within operation range • Engine running at high idling • Working mode: A mode • Time required from dumping stroke end to digging stroke end	IN		3.5±0.3	Max. 4.5	3.8±0.4	Max. 4.5
				OUT		2.7±0.3	Max. 3.5	$2.9^{+0.4}_{-0.2}$	Max. 3.5
		Bucket	 • Hydraulic oil temperature: Within operation range • Engine running at high idling • Working mode: A mode • Time required from dumping stroke end to digging stroke end	CURL		2.6±0.3	Max. 3.3	2.9±0.3	Max. 3.3
				DUMP		1.9±0.2	Max. 2.7	2.2±0.3	Max. 2.7
	Time lag	Boom	 • Hydraulic oil temperature: Within operation range • Engine running at low idling • Working mode: A mode • Time required from raise stroke end till bucket touches ground and pushes up machine front		sec.	Max. 1.0	Max. 1.2	Max. 1.0	Max. 1.2

Applicable model					PC210, PC210LC, 210NLC-7K		PC240LC, 240NLC-7K	
Cate-gory	Item		Measurement Condition	Unit	Standard value	Permissible value	Standard value	Permissible value
Work equipment	Time lag	Arm	 BKP00115 • Hydraulic oil temperature: Within operation range • Engine running at low idling • Working mode: A mode • Time required from dumping stroke end till bucket stops momentarily after control lever is tilted to digging and starts to move again	sec.	Max. 2.0	Max. 2.8	Max. 2.0	Max. 2.8
		Bucket	 BKP00116 • Hydraulic oil temperature: Within operation range • Engine running at low idling • Working mode: A mode • Time required from dumping stroke end till bucket stops momentarily after control lever is tilted to digging and starts to move again		Max. 1.0	Max. 3.6	Max. 1.0	Max. 3.6
	Internal	Cylinders	• Hydraulic oil temperature: Within operation range • Engine running at high idling • Leakage amount for one minute with cylinder or travel to be measured in relief condition	cc/ min	4.5	20	4.5	20
		Center swivel joint			10	50	10	50
Performance in compound operation	Swerving amount in simultaneous operation of work equipment and travel		• Hydraulic oil temperature: Within operation range • Engine at high idling • Working mode: A mode • Traveling speed: Lo • Flat and level ground • Swerving amount (X) when traveling 20 m after initial trial run of 10 m  BKP00107	mm	Max. 200	Max. 220	Max. 200	Max. 220

Applicable model				PC210, PC210LC, 210NLC-7K		PC240LC, 240NLC-7K	
Cate-gory	Item	Measurement Condition	Unit	Standard value	Permissible value	Standard value	Permissible value
Performance of hydraulic pump	Hydraulic pump delivery	See next page	¶/min	See next page		See next page	

Applicable model				PC210, PC210LC, 210NLC-7K	
Cate-gory	Item	Measurement Condition	Unit	Standard value	Permissible value
Performance of hydraulic pump	Discharge amount of hydraulic pump (A mode)				



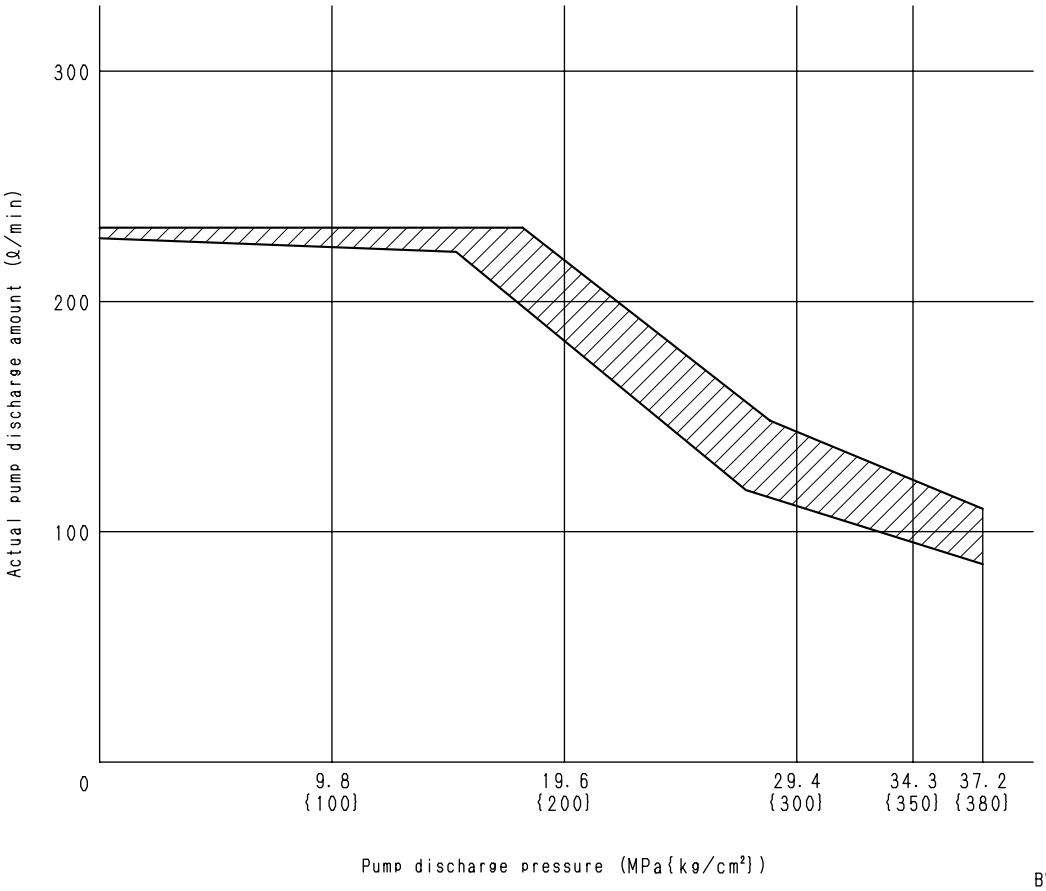
• Pump speed: At 1,950 rpm, PC current 310 mA

Check point	Test pump discharge pressure (MPa {kg/cm^2})	Discharge pressure of other pump (MPa {kg/cm^2})	Average pressure (MPa {kg/cm^2})	Standard value for discharge amount Q (¶/min)	Judgement standard lower limit Q (¶/min)
As desired	P1	P2	$\frac{P1+P2}{2}$	See graph	See graph

★ As far as possible, bring pump discharge pressure P1 and P2 as close as possible to the average pressure when measuring.
The error is large near the point where the graph curves, so avoid measuring at this point.

★ When measuring with the pump mounted on the machine, if it is impossible to set the engine speed to the specified speed with the fuel control dial, take the pump discharge amount and the engine speed at the point of measurement, and use them as a base for calculating the pump discharge amount at the specified speed.

Applicable model				PC240LC, 240NLC-7K	
Cate-gory	Item	Measurement Condition	Unit	Standard value	Permissible value
Performance of hydraulic pump	Discharge amount of hydraulic pump (A mode)				



• Pump speed: At 2,050 rpm, PC current 310 mA

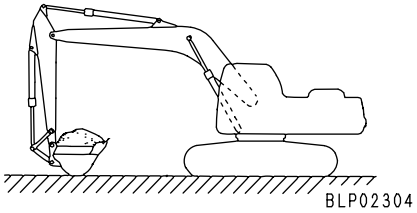
Check point	Test pump discharge pressure (MPa {kg/cm^2})	Discharge pressure of other pump (MPa {kg/cm^2})	Average pressure (MPa {kg/cm^2})	Standard value for discharge amount Q (¶/min)	Judgement standard lower limit Q (¶/min)
As desired	P1	P2	$\frac{P1+P2}{2}$	See graph	See graph

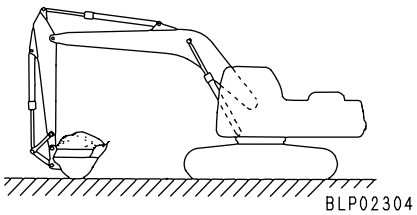
★ As far as possible, bring pump discharge pressure P1 and P2 as close as possible to the average pressure when measuring.
The error is large near the point where the graph curves, so avoid measuring at this point.

★ When measuring with the pump mounted on the machine, if it is impossible to set the engine speed to the specified speed with the fuel control dial, take the pump discharge amount and the engine speed at the point of measurement, and use them as a base for calculating the pump discharge amount at the specified speed.

Flow control characteristic of PC valve (STD)

★ The values in this table are used as reference values when carrying out troubleshooting.

Applicable model				PC210, 210LC, PC210NLC-7K
Category	Item	Measurement Condition	Unit	Reference Value
Characteristics of PC flow control valve	Time required for turning from 0 to 90 degrees with boom raised	 BLP02304 • Hydraulic oil temperature: Within operation range • Engine at high idling • Working mode: A mode • Rated load applied to bucket • Solid and flat ground • Time required till passing spot of 90 degrees starting from illustrated posture and with boom raised	sec.	4.2±0.4

Applicable model				PC240LC, 240NLC-7K
Category	Item	Measurement Condition	Unit	Reference Value
Characteristics of PC flow control valve	Time required for turning from 0 to 90 degrees with boom raised	 BLP02304 • Hydraulic oil temperature: Within operation range • Engine at high idling • Working mode: A mode • Rated load applied to bucket • Solid and flat ground • Time required till passing spot of 90 degrees starting from illustrated posture and with boom raised	sec.	4.3±0.4

TESTING AND ADJUSTING

INSPECTION AND ADJUSTMENT OF ENGINE RPM

★ Engine inspection and maintenance tools

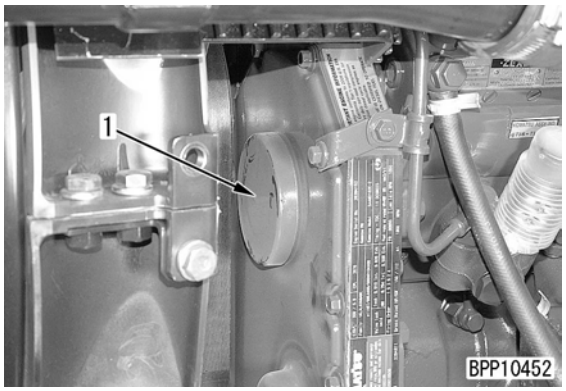
Mark		Part No.	Part Name
A	1	799-203-8001	Multi-tachometer
	2	795-790-2500	Adapter

★ Engine RPM may be detected using a monitoring function in the monitor panel (special function furnished to the monitor panel).

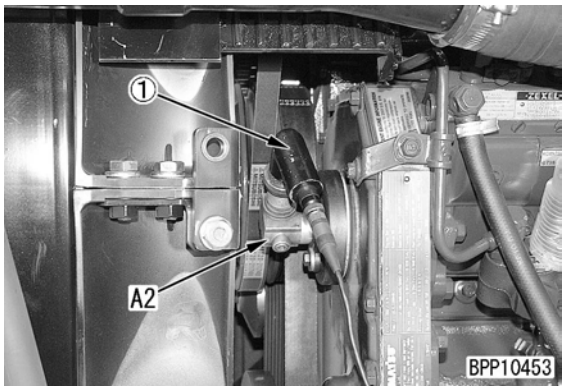
k Be careful not to touch the strongly heated portion of the engine by accident while installing a measurement equipment.

Inspection

1. Open up the engine hood and take off cover (1).
★ Use a filter wrench to take off the cover.



2. Fit adapter **A2**, and connect pickup set ① and meter ② of multi-tachometer **A1**.



3. Measure the engine RPM after setting each measurement condition.
1) RPM at low idling:
   i) Set the fuel dial at low idling (MIN).
   ii) Move all the control levers of work equipment, swing and travel to the NEUTRAL position.
2) RPM at high idling:
   i) Turn the auto-decelerator OFF.
   ii) Set the fuel dial at high idling (MAX).
   iii) Move all the control levers of work equipment, swing and travel to the NEUTRAL position.
3) RPM at fuel pump relief
   i) Set the fuel dial at high idling (MAX)
   ii) Put the arm in the digging relief position.
4) RPM when 2 pump relief and one-touch power max. switch are set (near rated RPM)
   i) Set the fuel dial at high idling (MAX).
   ii) Put the arm in digging relief position and keep the one-touch max. power switch depressed.
   ★ The one-touch power max. function is automatically released in 8.5 seconds, even if the knob switch is kept depressed. Take measurement during the period.
5) RPM when auto-decelerator is set
   i) Turn the auto-decelerator ON.
   ii) Set the fuel dial at high idling (MAX).
   iii) Move all the control levers of work equipment, swing and travel to the NEUTRAL position.
   ★ Approx. 5 seconds after all the control levers are moved to the NEUTRAL position, the rpm falls automatically. That is when the rpm with the auto-decelerator in motion should be measured.

4. Detach all the measurement tools after the inspection, and make sure that the machine is back to normal condition.

Adjustment

1. **Adjustment of RPM at low idling**
   - ★ If the rpm at low idling deviates from the standard value, make adjustment using the adjustment function provided in the monitor panel.
   - ★ For the adjustment procedures, refer to the section, "Special Function of Monitor Panel"

2. **Adjustment of Governor Spring**
   - ★ If the rpm at high idling deviates from the standard value, or it is unsteady (hunting), adjust the governor spring securing dimensions, using the adjustment function in the monitor panel.
   - ★ For the adjustment procedures, refer to the section, "Special Function of Monitor Panel"

MEASUREMENT OF EXHAUST GAS COLOR

★ Exhaust gas color measurement tool

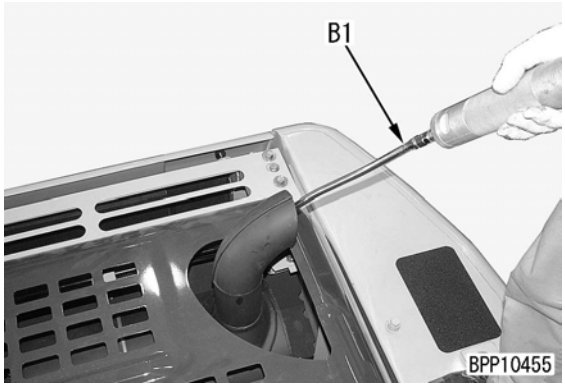
Mark		Part No.	Part Name
B	1	799-201-9000	Handy Smoke Checker
	2	Commercial product	Smoke Meter

k Be careful not to touch the highly heated parts, while fitting and detaching a measurement tool.

★ If no compressed air or power is not available in the field, use Handy Smoke Checker **B1**. For recording official data, use Smoke Meter **B2**.

1. Measurement with Handy Smoke Checker B1

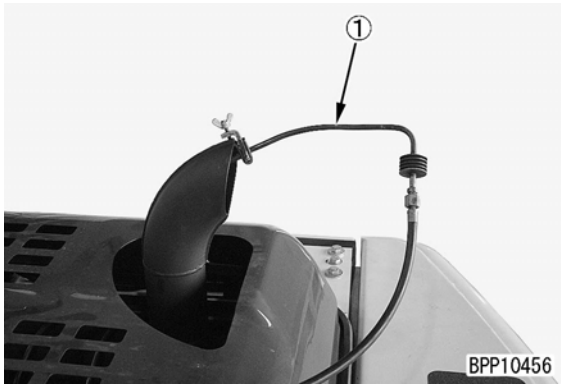
1) Fit a filtering paper to Handy Smoke Checker **B1**.
2) Insert the exhaust gas intake pipe into the exhaust pipe.
3) Start the engine and keep it running until the engine cooling water temperature comes within the operating range.
4) Let the exhaust gas stay on the filtering paper by operating a handle of Handy Smoke Checker **B1**, when the engine speed is suddenly accelerated or kept at high idling.



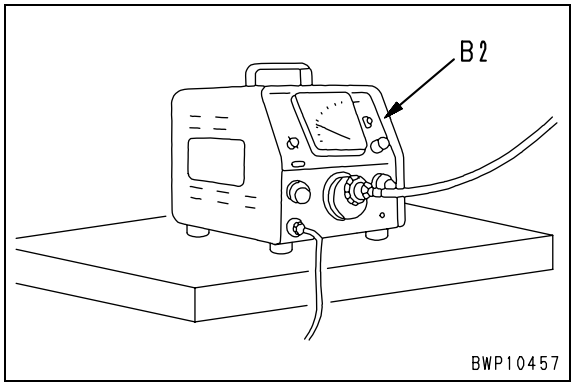
5) Take out the filtering paper and compare it with the attached scale for judgement.
6) Detach the measurement tool after the measurement, and make sure the machine is back to normal condition.

2. Measurement with Smoke Meter B2

1) Insert probe ① of the Smoke Meter **B2** into the exhaust gas pipe outlet, and fasten it to the outlet with a clip.



2) Connect the probe hose, accelerator switch outlet and air hose to the Smoke Meter **B2**.
   ★ Keep the pressure of the supplied compressed air below 1.5 MPa {15 kg/cm^2}.
3) Connect the power cable to an outlet of AC100V.
   ★ Confirm that the Smoke Meter power switch is in the OFF position, before connecting the power cable to an outlet.
4) Fit a filtering paper by loosening the suction pump cap nut.
   ★ Fit the filtering paper securely so that air may not leak.
5) Move the Smoke Meter **B2** power switch to the ON position.



6) Start the engine and keep it running until the engine water temperature rises to the operating range.
7) Let the exhaust gas stay on the filtering paper by depressing the accelerator pedal of Smoke Meter **B2**, when the engine speed is suddenly accelerated or kept at high idling.
8) Put the polluted filtering paper on non-polluted filtering paper (more than 10 sheets) in the filtering paper holder, and read the indicated value.
9) Detach the measurement tool after the measurement, and make sure that the machine is back to normal condition.

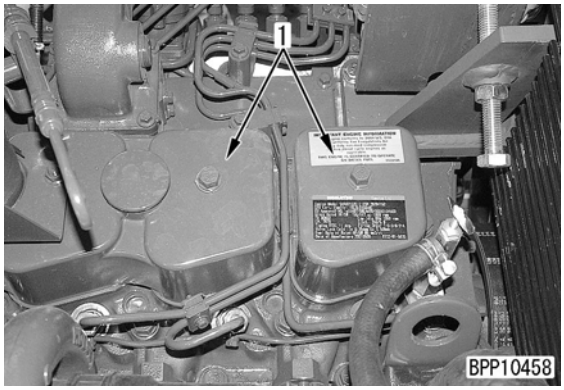
ADJUSTMENT OF VALVE CLEARANCE

★ Valve clearance adjustment tools

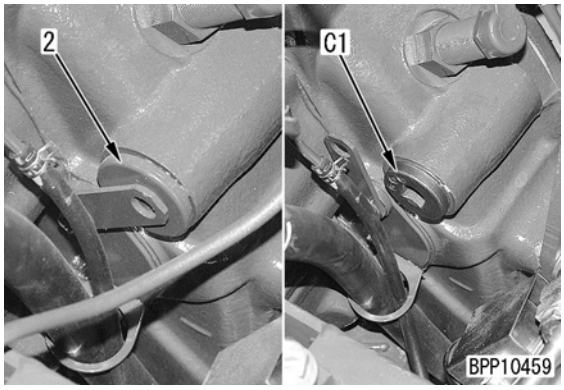
Mark		Part No.	Part Name
C	1	795-799-1131	Gear
	2	Commercial product	Filler Gauge

1. Open up the engine hood, and remove the fan guard on the counterweight side.

2. Remove all cylinder head covers (1).

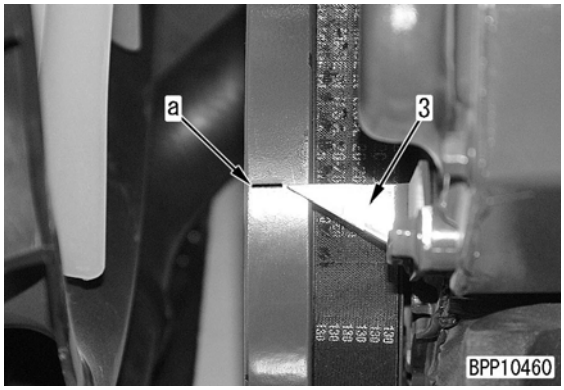


3. Take off cap (2) and fit gear **C1**.

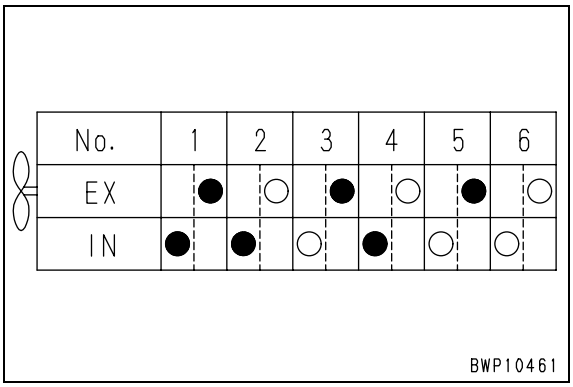


4. Turn the crankshaft clockwise with gear **C1**, then match 1.6 TOP notch "**a**" of the crank pulley with pointer (3), and bring up No.1 cylinder to the top dead center.

★ When No. 1 cylinder is at the top dead center, its rocker arm can be manually moved as much as the valve clearance. If it cannot be moved, that means that No. 1 cylinder is not yet at the top dead center. In that case, rotate it by one more turn.

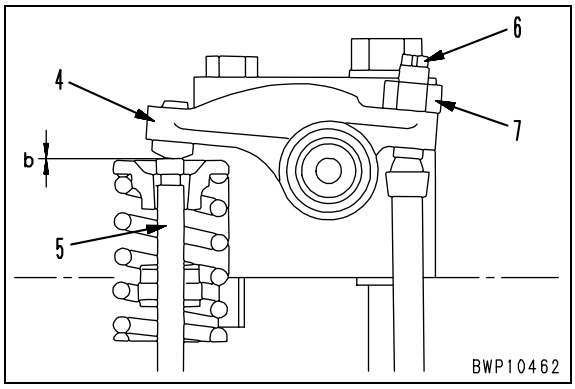


5. When No. 1 cylinder is at the top dead center, adjust valve clearances indicated with a black bullet mark (●) in the chart below in the following manner.



1) Insert filler gauge **C2** in between rocker arm (4) and valve stem (5), and adjust the valve clearance with adjusting screw (6).
   ★ For the adjustment, turn the adjusting screw with filler gauge **C2** inserted to the extent that filler gauge **C2** can be lightly moved.
2) Fix adjusting screw (6) and then tighten lock nut (7).
   3 Lock nut: **24±4 Nm{2.45±0.41kgm}**
   ★ Check the valve clearance again after tightening lock nut (7).

★ Proceed to the next step once all the adjustments of valve clearance indicated with a black bullet mark (●) have been completed.



6. Turn the crankshaft clockwise with gear **C1**, then match 1.6 TOP notch "**a**" of the crank pulley with pointer (3), and bring up No. 6 cylinder to the top dead center.

7. When No. 6 cylinder is at the top dead center, adjust valve clearances indicated with a white bullet mark (○) in the chart.
★ The adjustment procedures are the same as introduced in Item 5 above.

8. After the adjustment, make sure that the machine is back to normal condition.
3 Cylinder head cover securing bolt:
24±4 Nm{2.45±0.41 kgm}

MEASUREMENT OF COMPRESSION PRESSURE

★ Compression pressure measurement tools

Mark		Part No.	Part Name
D	1	795-502-1205	Compression Gauge
	2	795-502-1700	Adapter

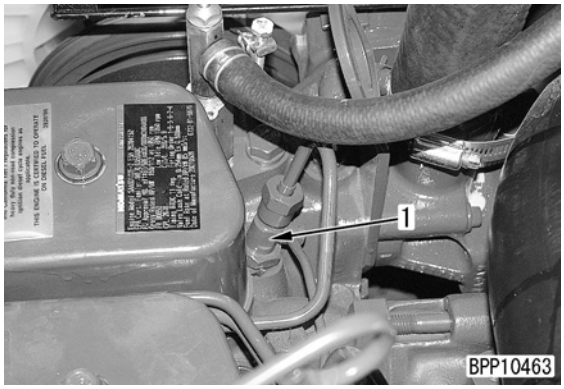
k Be careful not to get burnt by touching the exhaust manifold or muffler, or get caught with a rotating parts, while taking measurement of compression pressure.

1. Adjust the valve clearances.
★ For the adjustment, refer to the section, "Adjustment of Valve Clearance".

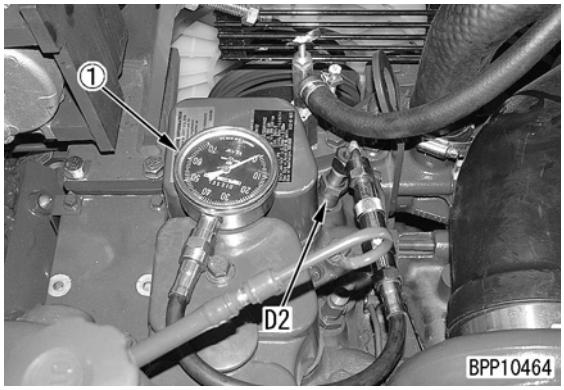
2. Make preparations for measuring the engine rpm.
★ For the preparations, refer to the section, "Inspection and adjustment of Engine RPM".

3. Warm up the engine until the engine oil temperature rises up to 40 – 60°C.

4. Detach nozzle holder (1) of a cylinder to be measured.

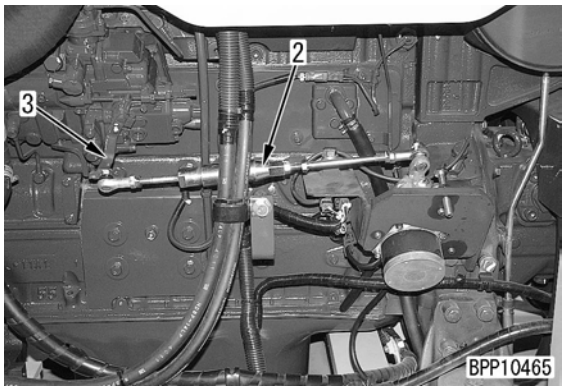


5. Fit Adapter **D2** to the nozzle holder mounting, and connect with gauge ass'y ① of compression gauge **D1**.
3 Adapter: **60±9 Nm{6.12±0.92 kgm}**



6. Take off governor spring (2).

7. Fasten governor lever (3) of the fuel injection pump, as it is in contact with the stopper on the STOP side.



8. Crank up the engine with the engine starting motor, and measure the compression pressure.
★ Read off the value, when the needle of the compression gauge steadies itself.
★ When taking measurement of the compression pressure, be sure to measure the engine rpm, too, so that it stays within the range of designated measurement conditions.

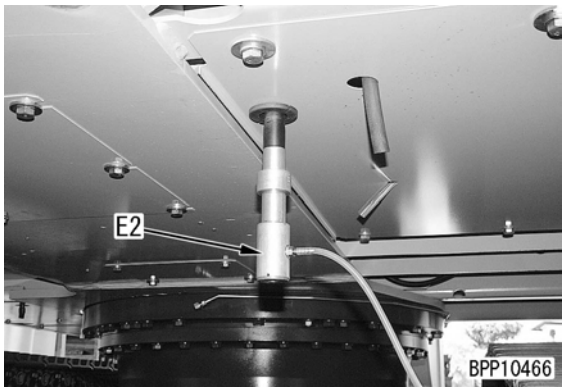
9. Detach the measurement tools after the measurement, and make sure that the machine is back to normal condition.
2 Nozzle holder:
Seizure preventive (Molycoat 1000)
3 Nozzle holder:
60±9 Nm{6.12±0.92 kgm}

MEASUREMENT OF BLOW-BY PRESSURE

★ Blow-by pressure measurement tools

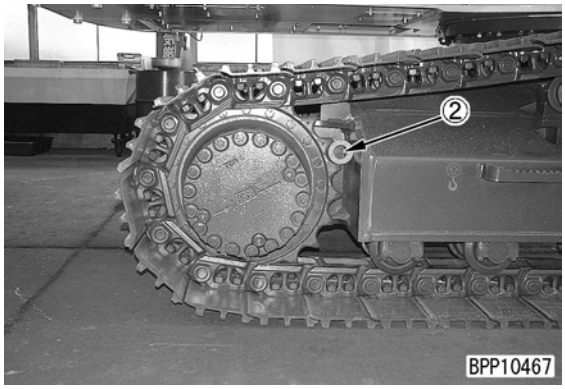
Mark		Part No.	Part Name
E	1	799-201-1504	Blow-by Kit
	2	795-790-1950	Tool (Nozzle)

1. Fit tool **E2** to blow-by hose and connect it with gauge ① of blow-by kit **E1**.



2. Start the engine, and lock the travel.

k Insert pin ② in between the sprocket and the track frame to make sure to block the travel.



3. Start the engine and keep it running until the engine cooling water temperature rises to the operating range.

4. Measure the blow-by pressure at high idling and under the following conditions.

- Working mode: A mode
- Work equipment, swing and travel:

Travel relief

★ Read off the blow-by pressure value, when the needle of the gauge steadies itself.

5. Detach the measurement tools after the measurement, and make sure that the machine is back to normal condition.

INSPECTION AND ADJUSTMENT OF FUEL INJECTION TIMING

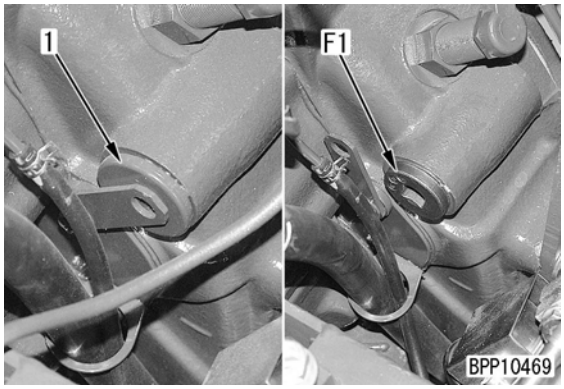
★ Fuel injection timing inspection and adjustment tools

Mark		Part No.	Part Name
F	1	795-799-1131	Gear
	2	795-799-1900	Pin Ass'y
	3	795-799-1950	Lock Pin

Inspection

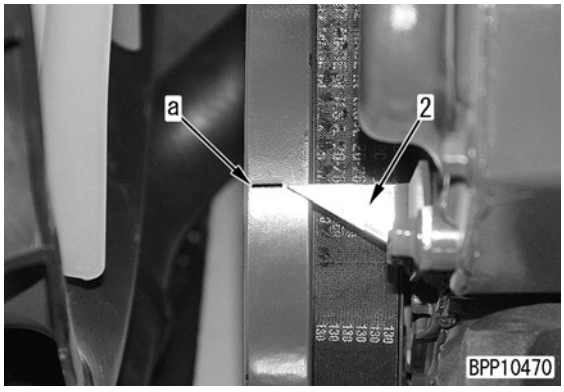
1. Open up the engine hood, and then detach the fan guard on the counterweight side.

2. Take off cover (1) and fit gear **F1**.



3. Turn the crankshaft clockwise with gear **F1**, then match 1.6 TOP notch "**a**" of the crank pulley with pointer (2), and bring up No.1 cylinder to the top dead center.

★ Take off the cylinder head cover for No.1 cylinder, and confirm that its rocker arm can be manually moved as much as the valve clearance. If it cannot be moved, that means that No.1 cylinder is not yet at the top dead center. In that case, rotate it by one more turn.



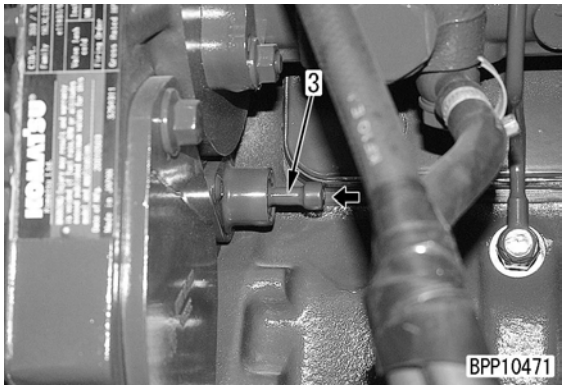
4. Fix the fuel injection pump drive gear to match injection timing by pushing drive gear timing pin (3) in the direction of the front cover.

★ Injection timing requires adjustment of high precision. Be sure to fix the drive gear with timing pin (3) so as to match injection timing.

★ Push-in depth: 8 mm

★ If timing pin (3) cannot be pushed in, turn the crankshaft a bit fore or aft with gear **F1**.

★ If it is found difficult to confirm the push-in depth with timing pin (3) as installed in the engine, metallic pin ass'y **F2** may well be used instead.



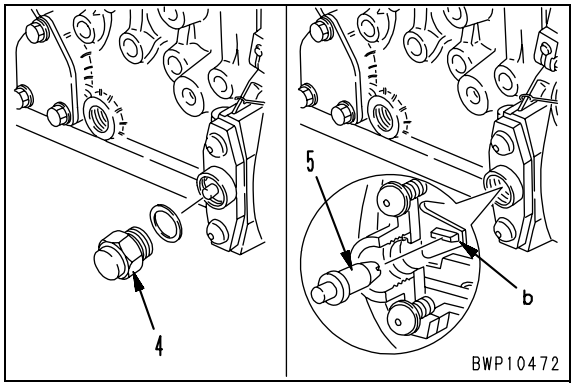
5. Disconnect plug (4) of the fuel injection pump.

6. Reverse and push in timing pin (5) of the fuel injection pump, and confirm its cut-out portion matches with protruding portion **b** inside the pump.

★ If timing pin (5) can be pushed in smoothly, then injection timing is correct.

★ If timing pin (5) cannot be pushed in smoothly, injection timing is incorrect and requires adjustment.

★ If it is found difficult to confirm the push-in depth with timing pin (5) as installed in the engine, metallic pin ass'y **F3** may well be used instead.



7. Detach the measurement tools after the measurement, and make sure that the machine is back to normal condition.

3 Cylinder head cover securing bolt:
24±4 Nm{2.45±0.45 kgm}

k Do not forget to bring driving gear timing pin (3) and injection pump timing pin (5) back to the pre-inspection condition.

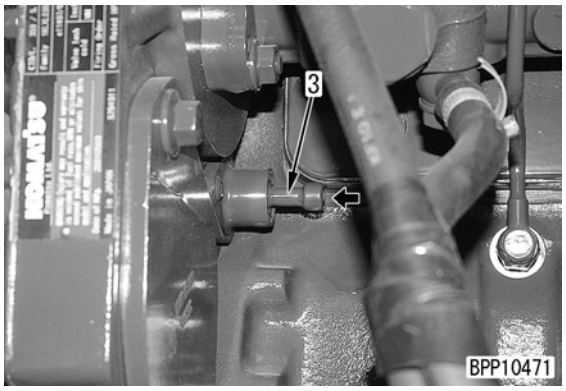
★ In case the adjustment follows, leave gear **F1** and timing pin (3) as they are.

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 foregoing inspection procedures.

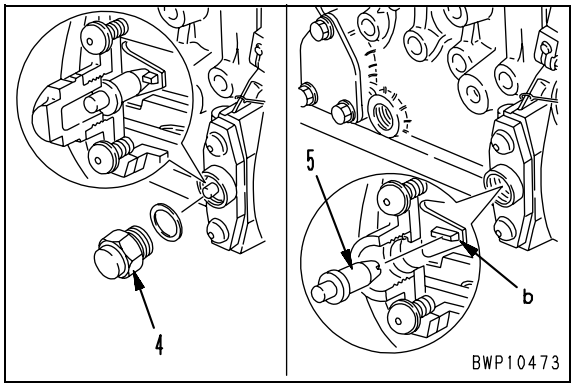


2. Dismantle the fuel injection pump.

★ For dismantling the fuel injection pump, refer to the section, "FUEL INJECTION PUMP ASSEMBLY" in the chapter of "DISASSEMBLY AND ASSEMBLY".

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.

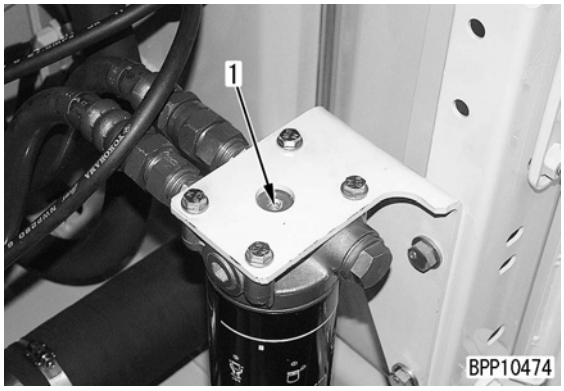
k Before starting the engine again, check that driving gear timing pin (3) and fuel injection pump timing pin (5) have been brought back to the pre-adjustment condition.

MEASUREMENT OF ENGINE OIL PRESSURE

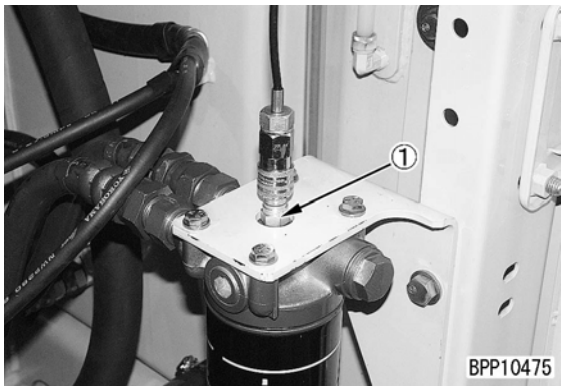
★ Engine oil pressure measurement tools

Mark		Part No.	Part Name
G	1	799-101-5002	Hydraulic Tester
		790-261-1203	Digital type hydraulic tester
	2	799-401-2320	Hydraulic Tester (1.0MPa{10 kg/cm^2})

1. Take off engine oil pressure measurement plug (1) on top of the engine filter.



2. Install fitting ① of the hydraulic tester **G1**, and connect it to hydraulic tester **G2**.



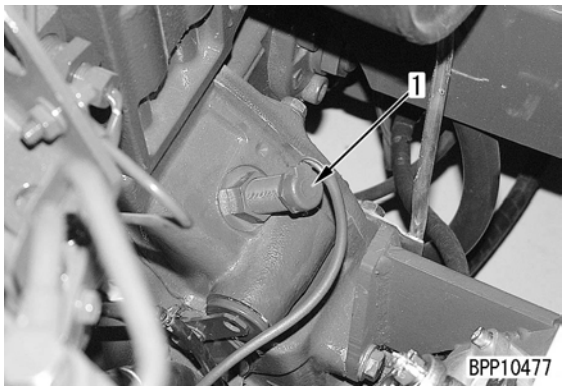
3. Start the engine and keep it running until the engine cooling water temperature rises to the operating range.

4. Measure engine oil pressure at low idling as well as at high idling.

5. Detach the measurement tools after the measurement, and make sure that the machine is back to normal condition.

ADJUSTMENT OF ENGINE SPEED SENSOR

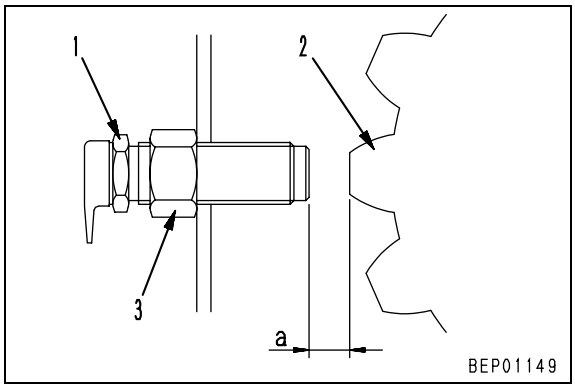
★ Detach engine speed sensor (1) before the adjustment, then check that there is no metal dust stuck or damage at the tip and fit it again.



1. Screw in sensor (1) until its tip comes to contact with the tip of flywheel ring gear teeth (2).
3 Threaded portion:
Gasket sealant (LG-6)

2. Screw back sensor (1) from that position by the prescribed angle.
★ Screw-back angle: 1±1/6 turn
★ Adjust clearance "**a**" between the sensor tip and gear tooth tip to be 1.25–1.75 mm.

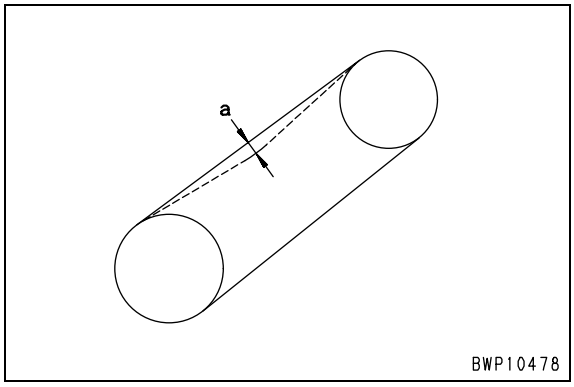
3. Fasten sensor (1) with nut (3).
3 Nut: **49.0–68.6 Nm{5–7 kgm}**



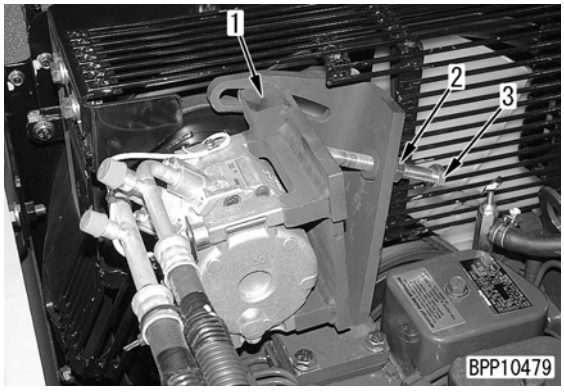
4. After the adjustment, confirm that correct engine speed is displayed in the monitor panel, using the special monitoring function.
★ For monitoring engine speed, refer to the section, "Special Function of Monitor Panel".

INSPECTION AND ADJUSTMENT OF AIR COMPRESSOR BELT TENSION

Inspection
Check belt deflection amount **a** when depressing the mid point between the fan pulley and the compressor with a thumb.
• Belt depressing force: Equivalent to **58.8 N{6 kg}**



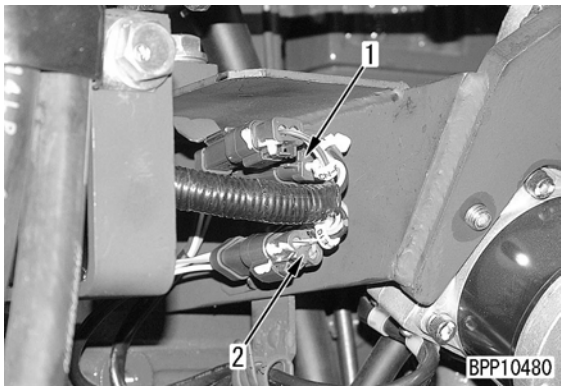
Adjustment
★ If the belt deflection amount is not proper, adjust it in the following manner.
1. Loosen two compressor bracket securing bolts (1) (upper and lower).
2. Loosen lock nut (2), and adjust the belt tension by shifting the position of compressor bracket (1).
3. Tighten lock nut (2).
4. Tighten two compressor bracket (1) securing bolts.
★ Check the belt tension again after the adjustment.



EMERGENT ESCAPE FROM FAILURE IN ENGINE CONTROL SYSTEM

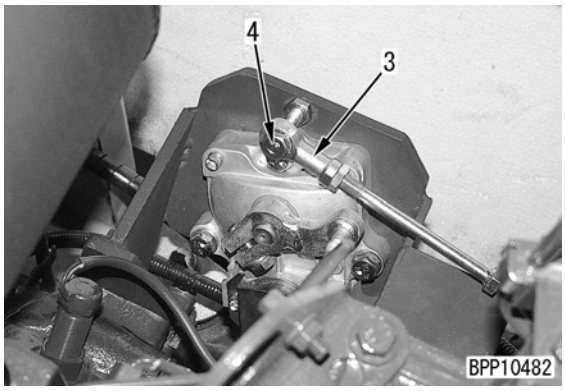
★ If a failure occurs on any of the engine control devices like fuel dial, governor pump controller or governor motor potentiometer, and the engine gets out of control, first fix the engine rpm and take the following steps to avoid the immediate danger.
★ The suggested steps are provisional ones. Identify the cause for the failure and carry out repairs promptly thereafter.

1. Disconnect **E11** connector (1) of the governor motor from **E10** connector (2) of the governor potentiometer.
k If the governor motor connector is left connected, the governor motor will be suddenly activated while the engine is running, causing a mechanical damage. Be sure to disconnect it.



2. Detach governor spring (3) on the governor motor side.

3. Remove bolt (4), connect governor spring (3) and fix it at the original position.
★ Tilt the governor motor lever to the fuel injection pump side, but stop short of the governor spring.
★ The governor lever of the fuel injection pump is fixed at a near-idling position.



4. Start the engine again and travel the machine to a safe place.

5. Disconnect governor spring (3) and stop the engine.
k Operation of stopping the engine is to be carried out while the engine is running at high speed. Be careful not to touch the parts of high temperature or get caught in rotating parts.
★ If the governor spring is tilted all the way to the fuel injection pump, the pump stops with no more injection.
★ Hold the governor spring until the engine comes to a complete stop. Otherwise the fuel injection pump automatically returns to the low idling position, and the engine does not stop.

MEASUREMENT OF CLEARANCE IN SWING CIRCLE BEARINGS

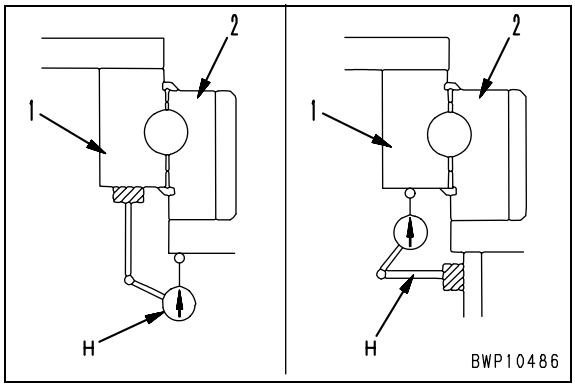
★ Swing circle bearing clearance measurement tools

Mark	Part No.	Part Name
H	Commercial Product	Dial Gauge

★ Follow the steps explained below, when measuring clearance in the swing circle bearing in the actual machine.

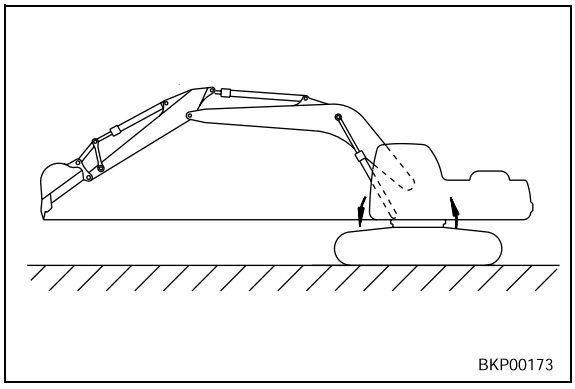
k Be careful not to put a hand or foot under the undercarriage, while taking measurement.

1. Fasten dial gauge **H** to swing circle outer race (1) or inner race (2), and contact the probe with the end surface of inner race (2) or outer race (1) on the opposite side.
★ Set dial gauge **H** at the machine front or rear.



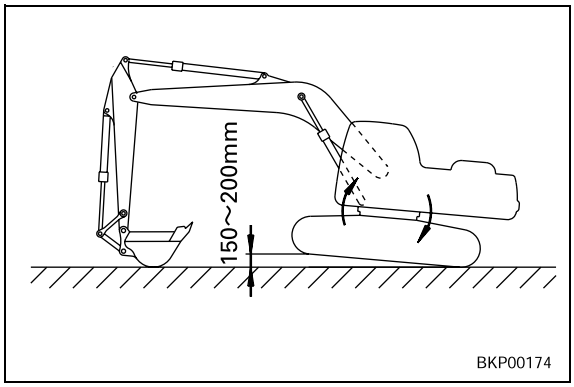
2. Keep the work equipment in the max. reach posture and keep the height of the bucket teeth tip level with the lower height of the revolving frame.
★ The upper structure is lowered at the front and raised at the rear at that time.

3. Set dial gauge **H** at zero point.



4. Hold the arm nearly perpendicular to the ground, and lower the boom until the track shoes will be lifted at the machine front.
★ The upper structure is raised at the front and lowered at the rear at that time.

5. Read off the value in dial gauge **H** in this condition.
★ The value indicated in dial gauge **H** expresses clearance in the bearings.



6. Return the machine to the posture in Item 2 above, and confirm reading of dial gauge **H** is zero.
★ If zero value is not indicated, repeat the steps in Items 3 through 5.

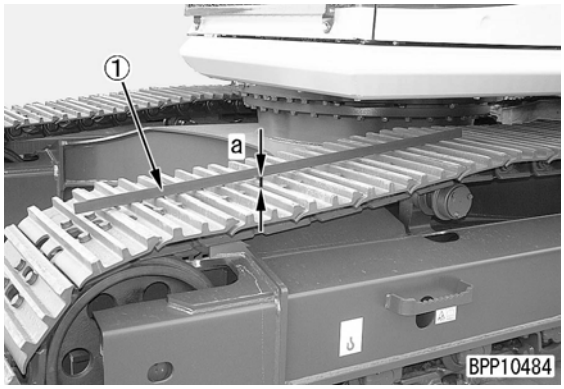
INSPECTION AND ADJUSTMENT OF TRACK SHOE TENSION

Inspection

1. Travel the machine forward by the length of track on ground, keeping the engine at low idling, and stop the machine slowly.

2. Place straight bar ① on the track shoe between the idler and the 1st carrier roller.
   ★ L beam is recommended for bar ①, because of its deflection-free nature.

3. Measure max. clearance **a** between bar ① and the track shoe.
   • Max. standard clearance **a**: 10–30 mm

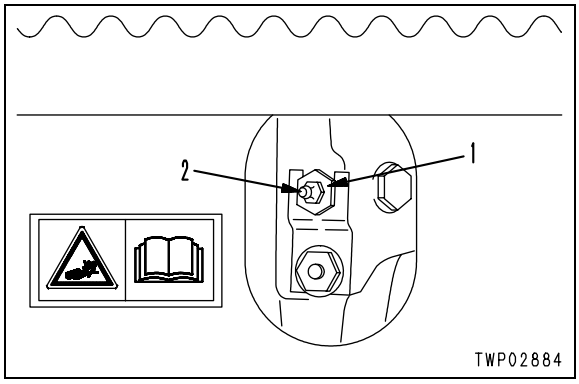


Adjustment

★ If the track shoe tension is not proper, adjust it in the following manner.

1. **When the tension is too strong**
   Discharge grease by loosening valve (1).
   k Do not loosen valve (1) by more than one turn, because grease will spurt out due to its internal high pressure.

2. **When the tension is too weak**
   Add grease through grease fitting (2).
   ★ If the normal track shoe tension is not restored even after greasing, move the machine slowly back and forth.



INSPECTION AND ADJUSTMENT OF HYDRAULIC OIL PRESSURE IN HYDRAULIC CIRCUIT FOR WORK EQUIPMENT, SWING AND TRAVEL

★ Inspection and adjustment tools for hydraulic oil pressure in hydraulic circuit for work equipment, swing and travel

Mark		Part No.	Part Name
J	1	799-101-5002	Hydraulic Tester
		790-261-1203	Digital Type Hydraulic Tester
	2	799-101-5220	Grease Fitting (10 x 1.25 mm)
		07002-11023	O-ring

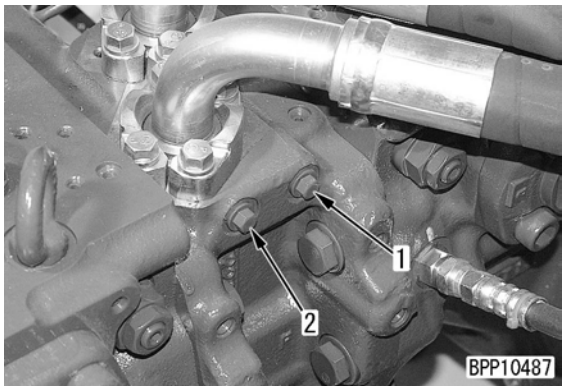
★ Hydraulic oil pressure in the hydraulic circuit for work equipment, swing and travel (hydraulic pump output pressure) may be also confirmed with a monitoring function in the monitor panel (special function of monitor panel).

Measurement

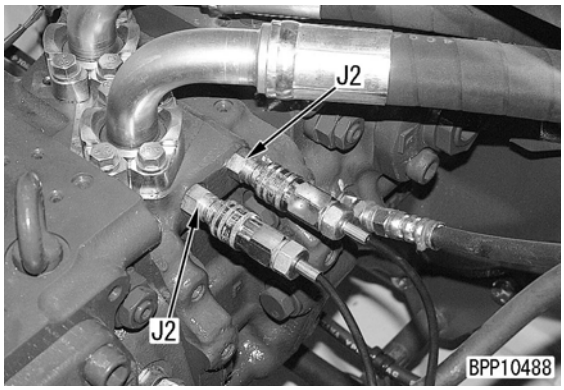
1. Pre-measurement work

k Lower the work equipment to the ground, then release the remaining pressure in the piping by operating the control lever several times after stopping the engine, and release the pressure inside the hydraulic tank by gradually loosening the oil filler cap.

1) Remove hydraulic oil pressure measuring plugs (1) and (2).
   - Plug (1): For the circuit of front hydraulic pump
   - Plug (2): For the circuit of rear hydraulic pump



2) Fit fitting **J2** and connect it to oil pressure gauge ① of hydraulic tester **J1**.
   ★ Use an oil pressure gauge with the capacity of 58 MPa{600 kg/cm^2}.



3) Start the engine and keep it running until the hydraulic oil temperature rises to the operating range.

2. Combination of pump, actuator and valve

★ You will know that when oil flow from the pumps is divided, the front and rear pumps work independently of each other for each actuator, as well as that different relief valves are activated then.

★ Oil flow from the pumps is merged in the single pressure relief when the work equipment swings, while it is divided in the single pressure relief when the machine travels.

★ The actuators in the table below are arranged in the order that the control valves are viewed from the machine front.

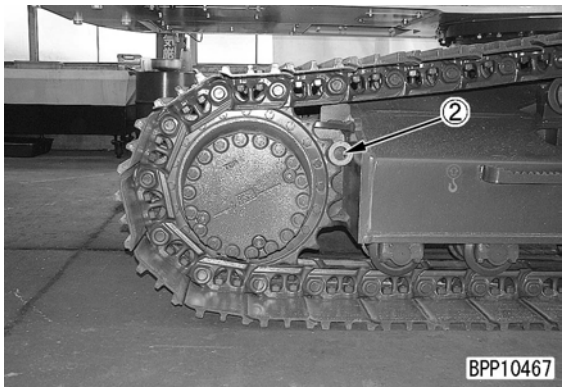
Pump	Actuator	Relieve valve activated
Rear pump	(Unload)	R unload valve
	Service	Safety valve
	Bucket	R main relief valve
	Travel, left	R main relief valve
	Boom	RAISE: R main relief valve LOWER: Safety valve
Front pump	Swing	Swing motor safety valve
	Travel, right	F main relief valve
	Arm	F main relief valve
	(Unload)	F unload valve

3. Measurement of Unload Pressure
1) Start the engine.
2) Measure hydraulic oil pressure, when the engine is running at high idling and all the control levers are moved to the NEUTRAL position.
★ Hydraulic oil pressure when the unload valve unloads is displayed.

4. Measurement of work equipment relief pressure
1) Start the engine and move the cylinder to be measured to its stroke end.
2) Measure hydraulic oil pressure, when the engine is running at high idling and the cylinder is in relief condition.
★ Hydraulic oil pressure when the main relief valve is in relief condition is displayed.
★ If one-touch power max. switch is depressed, the oil pressure is turned to high relief pressure, and if released, it is turned to low relief pressure.
★ Keep the swing lock switch in the ON position during the inspection. If it is moved to the OFF position, hydraulic oil pressure is turned to high relief pressure, as the constant 2-stage relief valve is moved to the ON position.

5. Measurement of swing relief pressure
1) Start the engine and move the swing lock switch to the ON position.
2) Measure hydraulic oil pressure when the engine is running at high idling and the swing circuit is relieved.
★ Hydraulic oil pressure when the swing motor safety valve is relieved is displayed.
★ The swing motor relief pressure is lower than the main relief pressure.

6. Measurement of travel circuit relief pressure
1) Start the engine and lock travel.
k Put pin ② in between the sprocket and the track frame to make sure locking travel.

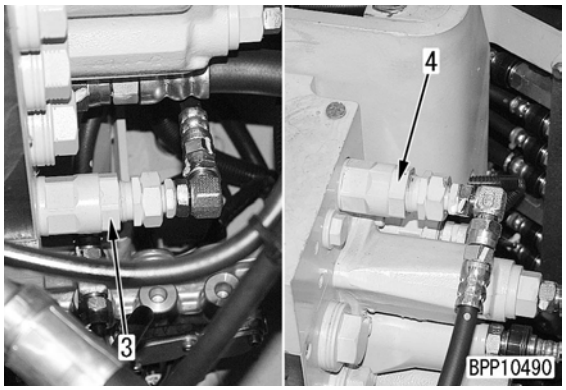


2) Measure hydraulic oil pressure when the engine is running at high idling and the travel circuit is relieved.
★ Hydraulic oil pressure with the main relief valve in relief condition is displayed. In the travel circuit relief, the pressure is high pressure relief all the time.

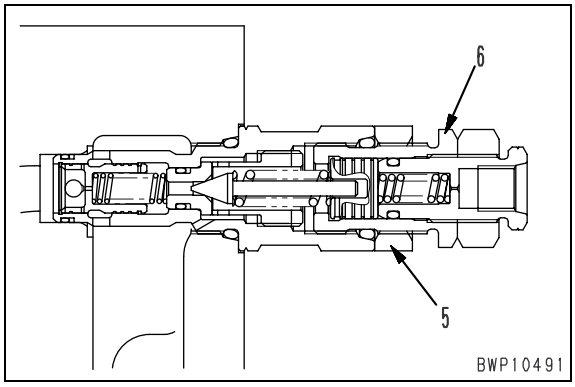
Adjustment
★ The unload valve and the safety valve for boom LOWER cannot be adjusted.

1. Adjustment of main relief pressure (high pressure setting side)
★ If relief pressure of the high pressure in the work equipment and travel circuits is not normal, adjust the high pressure setting side of main relief valves (3) and (4) in the following manner.
- Main relief valve (3): For the front hydraulic pump circuit
- Main relief valve (4): For the rear hydraulic pump circuit

★ The relief pressure at high pressure indicates that when the 2- stage relief valve is ON and pilot pressure is applied to the switching port.



1) Disconnect the pilot hose.
2) Loosen lock nut (5) and adjust the pressure by turning holder (6).
   ★ If the holder is turned to the right, the pressure rises.
   If the holder is turned to the left, the pressure falls.
   ★ Adjustment amount per turn of holder:
   Approx. 12.5 MPa{approx. 128 kg/cm^2}
   3 Lock nut:
   53.5±4.9 Nm{5.5±0.5 kgm}

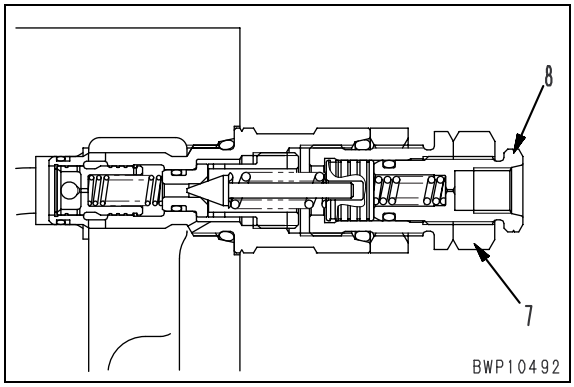


3) Check the pressure again after the adjustment, following the aforementioned steps for measurement.
   ★ When measuring the pressure, connect the pilot hose.
   ★ If high pressure setting side is adjusted, low pressure setting side is also affected, so adjust it, too.

2. Adjustment of main relief pressure (low pressure setting side)

★ When low pressure relief pressure of the work equipment is not normal, or when adjustment is made of the high pressure setting side, adjust the low pressure side of the main relief valve, too.
★ The relief pressure at high pressure indicates that when the 2-stage relief valve is OFF and pilot pressure is not applied to the switching port.

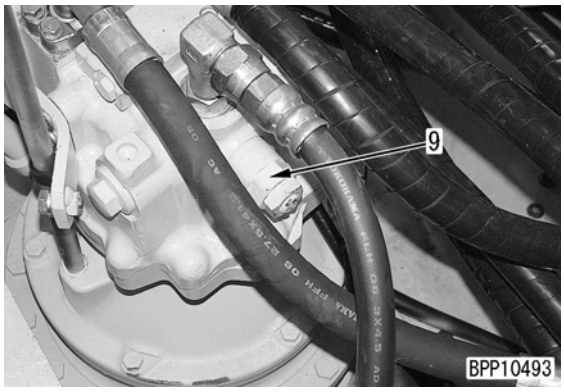
1) Disconnect pilot hose.
2) Loosen lock nut (7) and adjust the pressure by turning holder (8).
   ★ If the holder is turned to the right, the pressure rises.
   If the holder is turned to the left, the pressure falls.
   ★ Adjustment amount per turn of holder:
   Approx. 12.5 MPa{approx. 128 kg/cm^2}
   3 Lock nut:
   53.5±4.9 Nm{5.5±0.5 kgm}



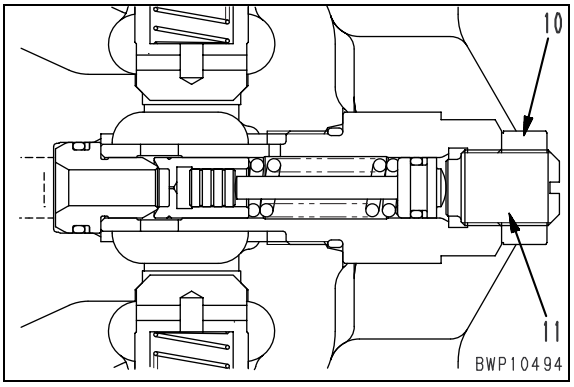
3) Check the pressure again after the adjustment, following the aforementioned steps for measurement.
   ★ When measuring the pressure, connect the pilot hose.

3. Adjustment of swing relief pressure

★ If the swing relief pressure is not normal, adjust it with swing motor safety valve (9) in the following manner.



1) Loosen lock nut (10) and adjust the pressure by turning adjusting screw (11).
   ★ If the holder is turned to the right, the pressure rises.
   If the holder is turned to the left, the pressure falls.
   ★ Adjustment amount per turn of adjusting screw:
   Approx. 6.71 MPa{approx. 68.4 kg/cm^2}
   3 Lock nut:
   78–103 Nm{8.0–10.5 kgm}



2) Check the pressure again after the adjustment, following the aforementioned steps for measurement.

INSPECTION AND ADJUSTMENT OF CONTROL CIRCUIT OIL PRESSURE

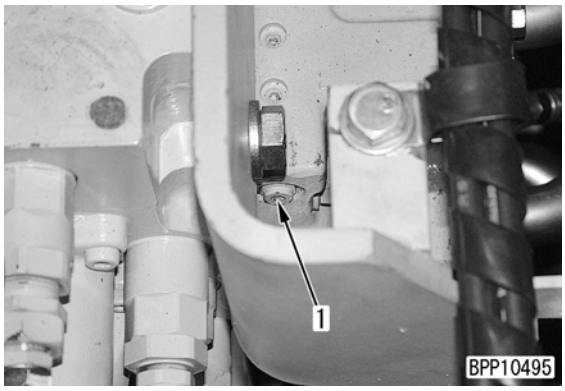
★ Control circuit oil pressure inspection and adjustment tools

Mark		Part No.	Part Name
J	1	799-101-5002	Hydraulic Tester
		790-261-1203	Digital Type Hydraulic Tester
	2	799-101-5220	Grease Fitting (10 x 1.25 mm)
		07002-11023	O-ring

Measurement

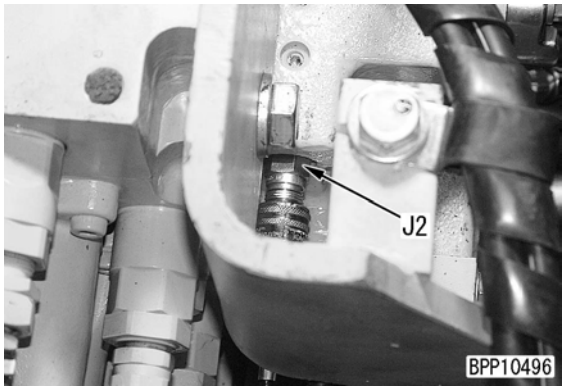
k Lower the work equipment to the ground and stop the engine. After the engine stops, operate the control lever several times to release the remaining pressure in the piping. Then loosen the oil filler cap to release the pressure inside the hydraulic tank.

1. Remove oil pressure measurement plug (1).



2. Fit fitting **J2** and connect it to oil pressure gauge ① of hydraulic tester **J1**.

★ Use an oil pressure gauge with the capacity of 5.9 MPa{60 kg/cm^2}.



3. Start the engine and keep it running until the hydraulic oil temperature rises to the operating range.

4. Measure oil pressure with the engine running at high idling and all the control levers in the NEUTRAL position.

5. Detach all the measurement tools after the measurement, and make sure that the machine is back to normal condition.

★ Do not attempt to adjust the control circuit oil pressure relief valve.

INSPECTION AND ADJUSTMENT OF PUMP PC CONTROL CIRCUIT OIL PRESSURE(PC240LC/NLC)

★ Pump PC control circuit oil pressure inspection and adjustment tools

Mark		Part No.	Part Name
J	1	799-101-5002	Hydraulic Tester
		790-261-1203	Digital Type Hydraulic Tester
	2	799-101-5220	Grease Fitting (10 x 1.25 mm)
		07002-11023	O-ring

Measurement

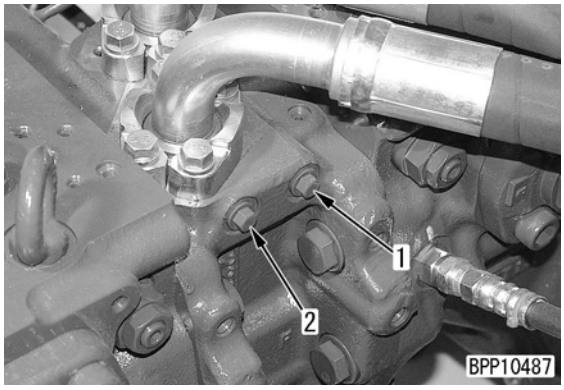
★ Implement measuring the pump PC control circuit oil pressure after confirming that the work equipment, swing and travel circuit oil pressure as well as the control circuit original oil pressure are normal.

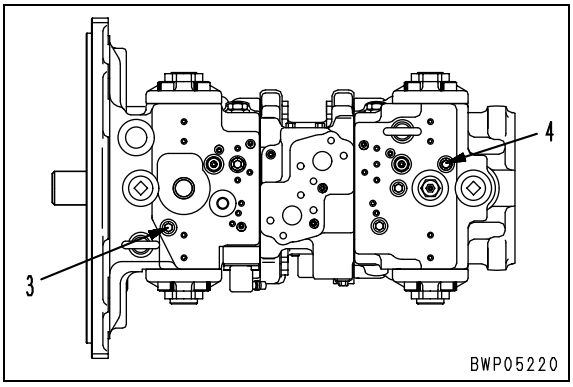
k Lower the work equipment to the ground and stop the engine. After the engine stops, operate the control lever several times to release the remaining pressure in the piping. Then loosen the oil filler cap to release the pressure inside the hydraulic tank.

1. Measurement of PC valve output pressure (servo piston inlet pressure)

★ Measure PC valve output pressure (servo piston inlet pressure) and pump delivery pressure together, and compare the two pressures.

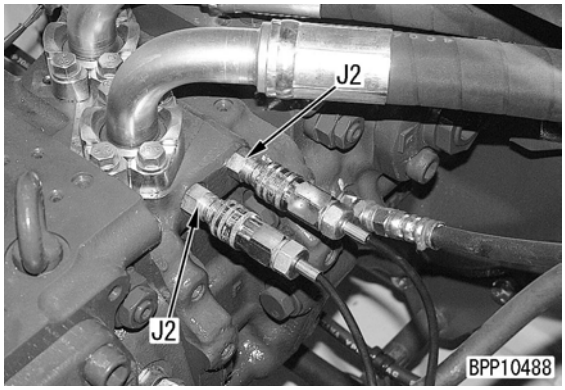
1) Remove oil pressure measurement plugs (1), (2), (3) and (4).
   - Plug (1): For measuring the front pump delivery pressure
   - Plug (2): For measuring the rear pump delivery pressure
   - Plug (3): For measuring the front pump PC valve delivery pressure
   - Plug (4): For measuring the rear pump PC valve delivery pressure

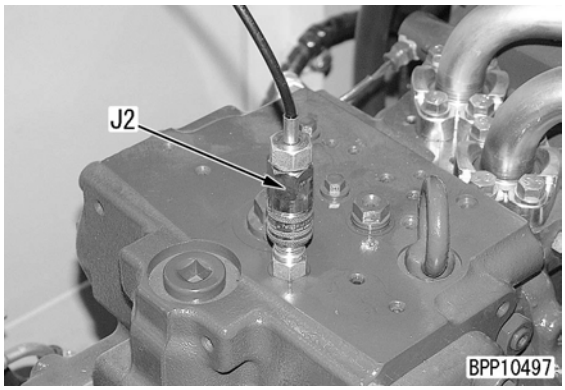




2) Fit fitting **J2** and connect to oil pressure gauge ① of hydraulic tester **J1**.

★ Use an oil pressure gauge with the capacity of 58.8 MPa{600 kg/cm^2}.





3) Start the engine and keep it running until the hydraulic oil temperature rises to the operating range.

4) Measure the pump delivery pressure and PC valve output pressure (servo piston inlet pressure) together with the engine running at high idling, after setting the machine at the following conditions.
   - Working mode: A mode
   - Swing lock switch: ON (switched to high pressure relief with 2-stage relief turned ON)
   - Work equipment, swing and travel circuit: Arm digging relief

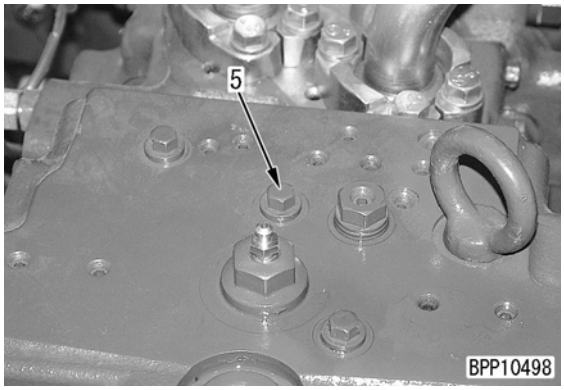
   ★ Judgement method:
   When the ratio between the pump delivery pressure and PC valve output pressure (servo piston output pressure) reaches the following values, both pressures are judged normal.

Pressure to be measured	Pressure ratio
Pump delivery pressure	1
PC valve outlet pressure	Approx. 3/5

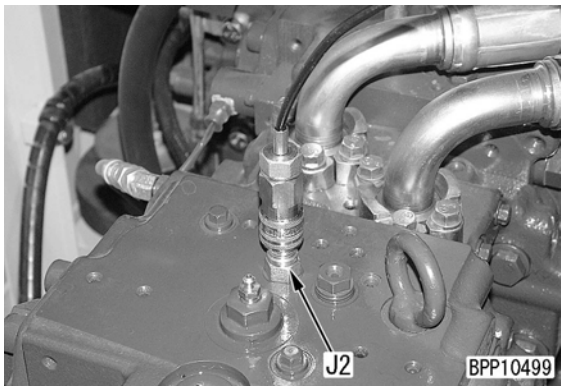
   ★ If there is any abnormality with PC valve or servo piston, the PC valve output pressure (servo piston output pressure) equals to the pump delivery pressure, or approximates to 0 pressure.

2. Measurement of PC-EPC output pressure

1) Remove oil pressure measurement plug (5).



2) Fit fitting **J2** and connect it to oil pressure gauge ① of hydraulic tester **J1**.
   ★ Use an oil pressure gauge with the capacity of 5.9 MPa{60 kg/cm^2}.



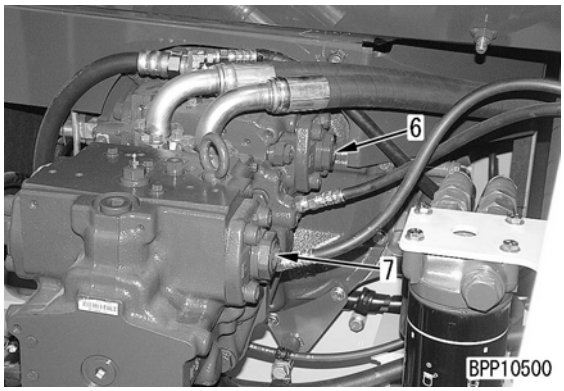
3) Start the engine and keep it running until the hydraulic oil pressure rises to the operating range.

4) Measure the hydraulic oil pressure with all the control levers kept in the NEUTRAL position and the engine running at high idling and at low idling.
   ★ If PC-EPC valve output pressure changes to the following values, it is judged normal.

Engine speed	Control lever	Hydraulic oil pressure
Low idling	Neutral	2.9 MPa {30 kg/cm^2}
High idling		0{0}

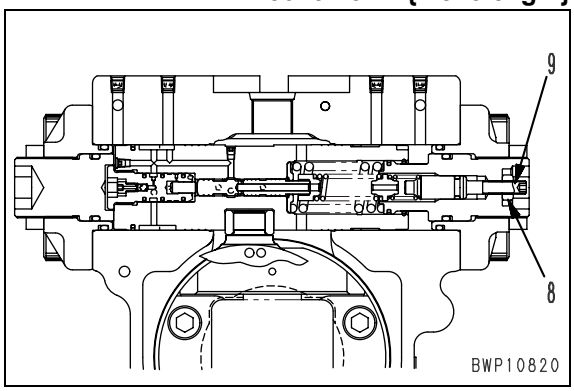
Adjustment

★ If any of the phenomena mentioned below occurs and PC valve malfunctioning is suspected, adjust PC valves (6) and (7) in the following manner.
   • As workload increases, the engine rpm sharply drops.
   • While the engine rpm is normal, the work equipment moves slowly.



1. Loosen lock nut (8) and make adjustment, turning adjusting screw (9).
   ★ If the holder is turned to the right, the pump absorption torque rises.
   If the holder is turned to the left, the pump absorption torque falls.
   ★ The adjustable range with the adjusting screw is as shown below.
      • Left turn: Less than 1 turn
      • Right turn: Less than 1/2 turn (less than 180 degrees)

   3 Lock nut:
   27.50–34.3Nm{2.8–3.5kgm}



2. Confirm that the PC valve output pressure (servo piston inlet pressure) is normal after the adjustment, following the measurement steps explained earlier.

INSPECTION AND ADJUSTMENT OF PUMP PC CONTROL CIRCUIT OIL PRESSURE(PC210/LC/NLC)

★ Pump PC control circuit oil pressure inspection and adjustment tools

Mark		Part No.	Part Name
J	1	799-101-5002	Hydraulic Tester
		790-261-1203	Digital Type Hydraulic Tester
	2	799-101-5220	Grease Fitting (10 x 1.25 mm)
		07002-11023	O-ring

Measurement

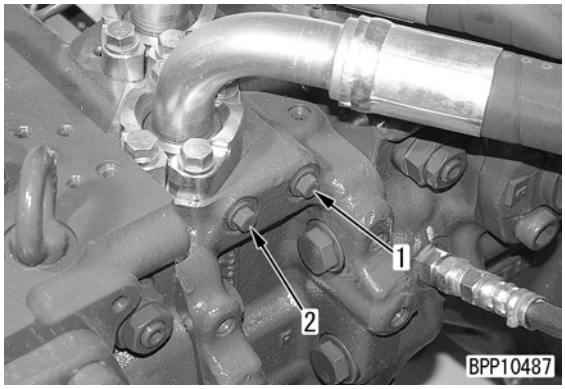
★ Implement measuring the pump PC control circuit oil pressure after confirming that the work equipment, swing and travel circuit oil pressure as well as the control circuit original oil pressure are normal.

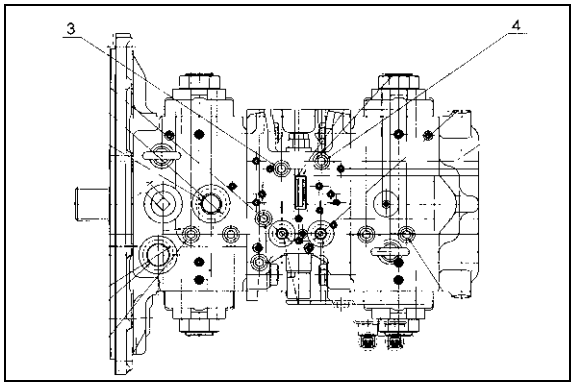
k Lower the work equipment to the ground and stop the engine. After the engine stops, operate the control lever several times to release the remaining pressure in the piping. Then loosen the oil filler cap to release the pressure inside the hydraulic tank.

1. Measurement of PC valve output pressure (servo piston inlet pressure)

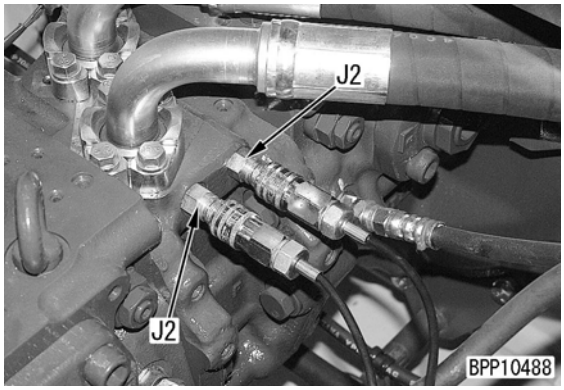
★ Measure PC valve output pressure (servo piston inlet pressure) and pump delivery pressure together, and compare the two pressures.

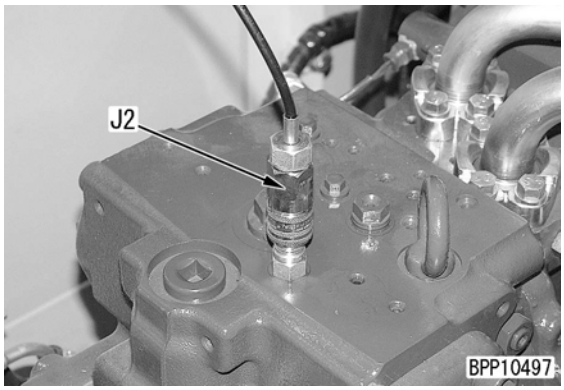
1) Remove oil pressure measurement plugs (1), (2), (3) and (4).
   - Plug (1): For measuring the front pump delivery pressure
   - Plug (2): For measuring the rear pump delivery pressure
   - Plug (3): For measuring the front pump PC valve delivery pressure
   - Plug (4): For measuring the rear pump PC valve delivery pressure





2) Fit fitting **J2** and connect to oil pressure gauge ① of hydraulic tester **J1**.
   ★ Use an oil pressure gauge with the capacity of 58.8 MPa{600 kg/cm^2}.





3) Start the engine and keep it running until the hydraulic oil temperature rises to the operating range.

4) Measure the pump delivery pressure and PC valve output pressure (servo piston inlet pressure) together with the engine running at high idling, after setting the machine at the following conditions.
   - Working mode: A mode
   - Swing lock switch: ON (switched to high pressure relief with 2-stage relief turned ON)
   - Work equipment, swing and travel circuit: Arm digging relief

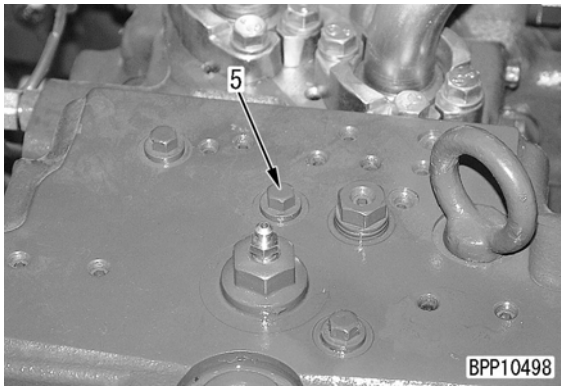
   ★ Judgement method:
   When the ratio between the pump delivery pressure and PC valve output pressure (servo piston output pressure) reaches the following values, both pressures are judged normal.

Pressure to be measured	Pressure ratio
Pump delivery pressure	1
PC valve outlet pressure	Approx. 3/5

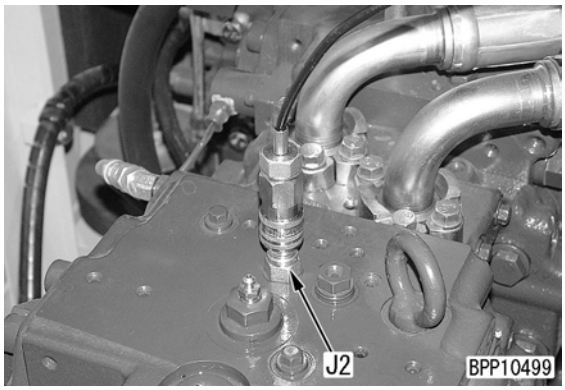
   ★ If there is any abnormality with PC valve or servo piston, the PC valve output pressure (servo piston output pressure) equals to the pump delivery pressure, or approximates to 0 pressure.

2. Measurement of PC-EPC output pressure

1) Remove oil pressure measurement plug (5).



2) Fit fitting **J2** and connect it to oil pressure gauge ① of hydraulic tester **J1**.
   ★ Use an oil pressure gauge with the capacity of 5.9 MPa{60 kg/cm^2}.



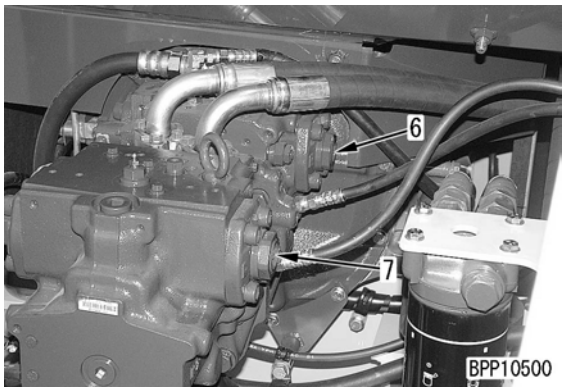
3) Start the engine and keep it running until the hydraulic oil pressure rises to the operating range.

4) Measure the hydraulic oil pressure with all the control levers kept in the NEUTRAL position and the engine running at high idling and at low idling.
   ★ If PC-EPC valve output pressure changes to the following values, it is judged normal.

Engine speed	Control lever	Hydraulic oil pressure
Low idling	Neutral	2.9 MPa {30 kg/cm^2}
High idling		0{0}

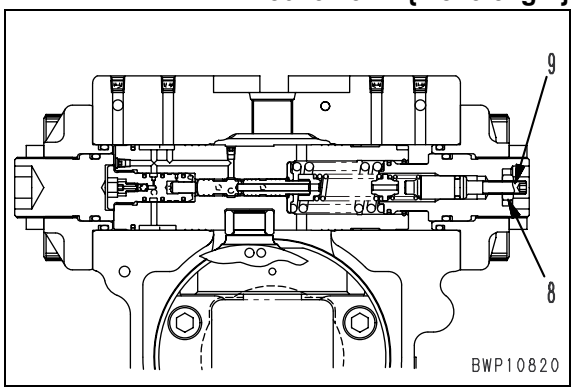
Adjustment

★ If any of the phenomena mentioned below occurs and PC valve malfunctioning is suspected, adjust PC valves (6) and (7) in the following manner.
   • As workload increases, the engine rpm sharply drops.
   • While the engine rpm is normal, the work equipment moves slowly.



1. Loosen lock nut (8) and make adjustment, turning adjusting screw (9).
   ★ If the holder is turned to the right, the pump absorption torque rises.
   If the holder is turned to the left, the pump absorption torque falls.
   ★ The adjustable range with the adjusting screw is as shown below.
      • Left turn: Less than 1 turn
      • Right turn: Less than 1/2 turn (less than 180 degrees)

3 Lock nut:
27.50–34.3Nm{2.8–3.5kgm}



2. Confirm that the PC valve output pressure (servo piston inlet pressure) is normal after the adjustment, following the measurement steps explained earlier.

INSPECTION AND ADJUSTMENT OF PUMP LS CONTROL CIRCUIT OIL PRESSURE(PC240LC/NLC)

★ Pump LS control circuit oil pressure inspection and adjustment tools

Mark		Part No.	Part Name
K	1	799-101-5002	Hydraulic Tester
		790-261-1203	Digital Type Hydraulic Tester
	2	799-101-5220	Grease Fitting (10 x 1.25 mm)
		07002-11023	O-ring
	3	799-401-1340	Differential Pressure Gauge

Measurement

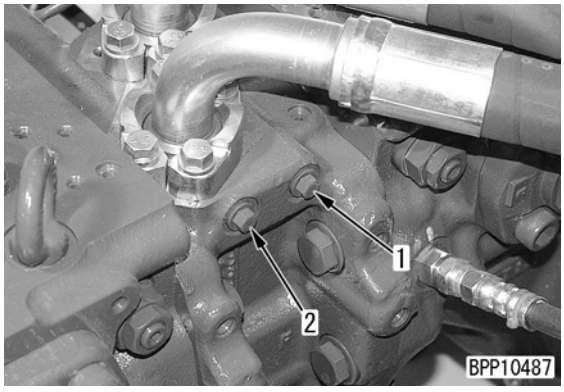
★ Measure pump LS control circuit oil pressure after confirming that the work equipment, swing and travel circuit oil pressure as well as control circuit original pressure are normal.

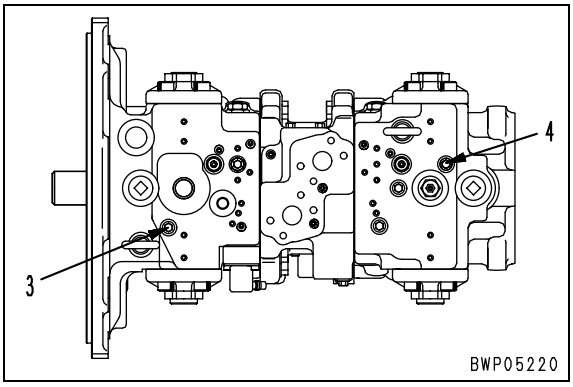
k Lower the work equipment to the ground and stop the engine. After the engine stops, operate the control lever several times to release the remaining pressure in the piping. Then loosen the oil filler cap to release the pressure inside the hydraulic tank.

1. Measurement of LS valve output pressure (servo piston inlet pressure)

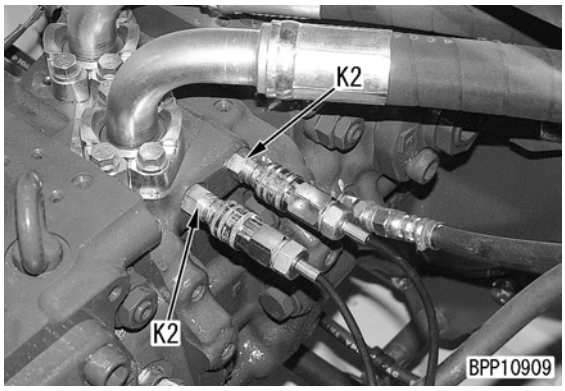
★ Measure LS valve output pressure (servo piston inlet pressure) and pump delivery pressure together, and compare both pressures thereafter.

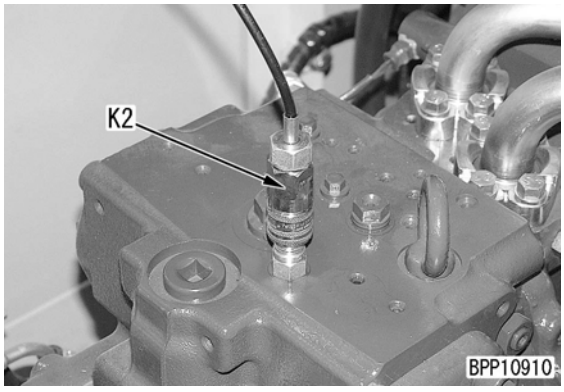
1) Remove oil pressure measurement plugs (1), (2), (3) and (4).
   - Plug (1): For measuring the front pump delivery pressure
   - Plug (2): For measuring the rear pump delivery pressure
   - Plug (3): For measuring the front pump LS valve delivery pressure
   - Plug (4): For measuring the rear pump LS valve delivery pressure





2) Fit fitting **K2** and connect it to oil pressure gauge ① of hydraulic tester **K1**.
   ★ Use an oil pressure gauge with the capacity of 58.5 MPa{600 kg/cm^2}.





3) Start the engine and raise the track shoe to be measured with the work equipment.
   - For measuring oil pressure in front circuit: Right track shoe
   - For measuring oil pressure in rear circuit: Left track shoe

k Provide a working area of sufficient space, as the raised track shoe will be idly rotated.

4) Wait until the hydraulic oil temperature rises to the operating range.

5) Measure pump delivery pressure and PC valve output pressure (servo piston inlet pressure) together with the machine set at the following conditions and the engine running at high idling.
   - Working mode: A mode
   - All the control levers of the work equipment, swing and travel are kept in the NEUTRAL position and the travel control lever is kept at half stroke (one side of the track shoes idly rotates).
   - ★ Let the raised track shoe idly rotate, paying enough attention to the surroundings for safety.
   - ★ Judgement method:
     When the ratio between the pump delivery pressure and LS valve output pressure (servo piston output pressure) reaches the following values, both pressures are judged normal.

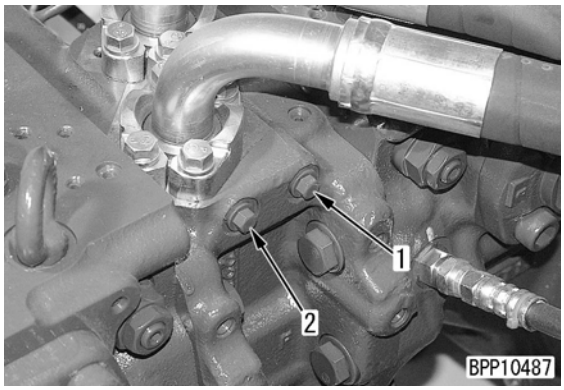
Oil pressure to be measured	Oil pressure ratio	
	All control levers in NEUTRAL	Travel at half stroke
Pump delivery pressure	Nearly equal pressure	1
LS valve delivery pressure		Approx. 3/5

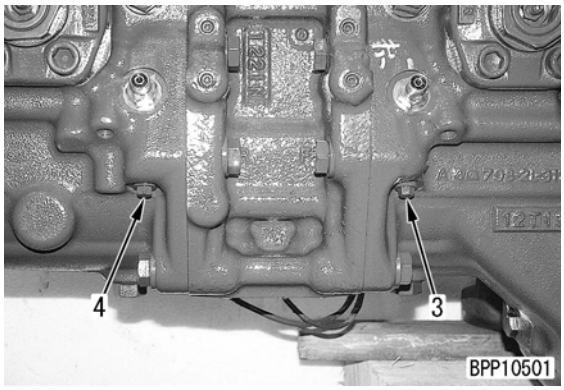
6) Detach all the measurement tools after the measurement and make sure that the machine is back to normal condition.

2. Measurement of LS differential pressure

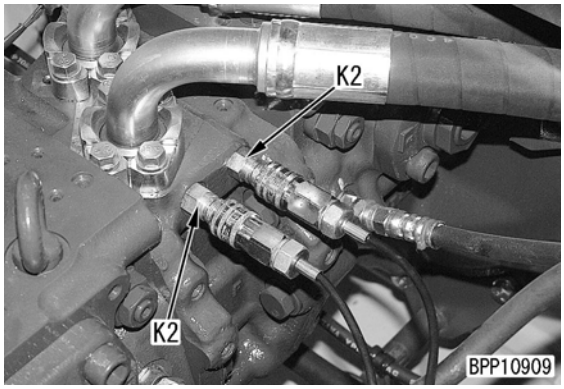
★ LS differential pressure can be obtained by measuring pump delivery pressure and LS pressure (actuator loaded pressure) at the same time and computing the difference of both pressures.

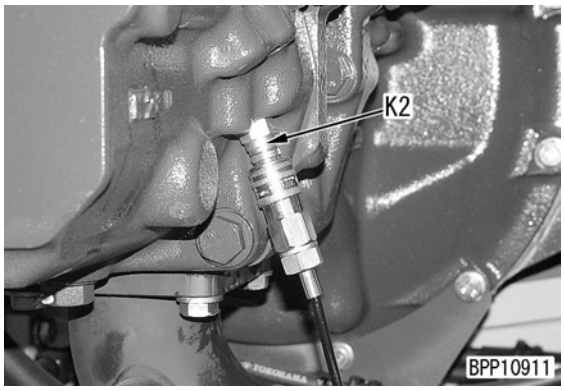
1) Remove oil pressure measurement plugs (1), (2), (3) and (4).
   - Plug (1): For measuring the front pump delivery pressure
   - Plug (2): For measuring the rear pump delivery pressure
   - Plug (3): For measuring the front pump LS pressure
   - Plug (4): For measuring the rear pump LS pressure





2) Fit fitting **K2** and connect it to oil pressure gauge ① of hydraulic tester **K1** or differential pressure gauge **K3**.
   - ★ When using a differential pressure gauge:
     Connect pump delivery pressure to the high pressure side and LS pressure to the low pressure side.
     A differential pressure gauge requires DC 12V power. Connect it with one battery.
   - ★ When using an oil pressure gauge:
     Use an oil pressure gauge with the capacity of 58.5 MPa{600 kg/cm^2}.
     The max. differential pressure is no more than approx. 40 MPa{3.9 kg/cm^2}.
     The same gauge may be used throughout the measurement.





3) Start the engine and raise the track shoe to be measured with the work equipment.
   - For measuring oil pressure in front circuit: Right track shoe
   - For measuring oil pressure in rear circuit: Left track shoe

   k Provide a working area of sufficient space, as the raised track shoe will be idly rotated.
4) Wait until the hydraulic oil temperature rises to the operating range.

5) Measure pump delivery pressure and LS pressure (actuator loaded pressure) together with the machine set at the following conditions and the engine running at high idling.
   - Working mode: A mode
   - Traveling speed: Hi
   - All the control levers of the work equipment, swing and travel are kept in the NEUTRAL position and the travel control lever is kept at half stroke (one side of the track shoes idly rotates).

   ★ Let the raised track shoe idly rotate, paying enough attention to the surroundings for safety.

   ★ Calculation of LS differential pressure: LS differential pressure = Pump delivery pressure – LS pressure

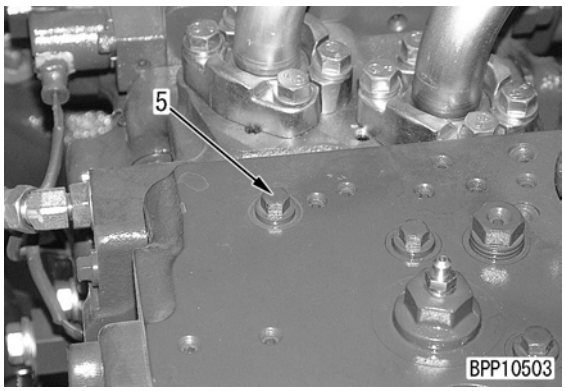
   ★ If LS differential pressure is in the following conditions, it is judged normal.

Control lever position	LS differential pressure
All levers in NEUTRAL	Unload pressure (see standard value table)
Travel lever at half stroke	Max. LS differential pressure (see standard value table)

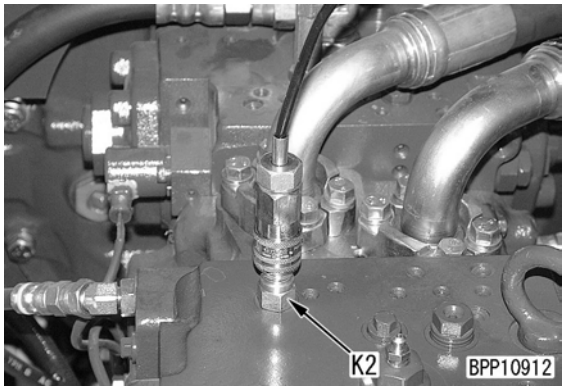
6) Detach all the measurement tools after the measurement, and make sure that the machine is back to normal condition.

3. Measurement of LS-EPC valve output pressure

1) Remove oil pressure measurement plug (5).



2) Fit fitting **K2** and connect it with oil pressure gauge ① of hydraulic tester **K1**.
   ★ Use an oil pressure gauge with the capacity of 5.9 MPa{60 kg/cm^2}.



3) Start the engine and keep it running until the hydraulic oil temperature rises to the operating range.

4) Measure the oil pressure when the engine is running at high idling and the travel speed switch and travel lever are operated.
   ★ If LS-EPC valve output pressure changes to the following values, the pressure is normal.

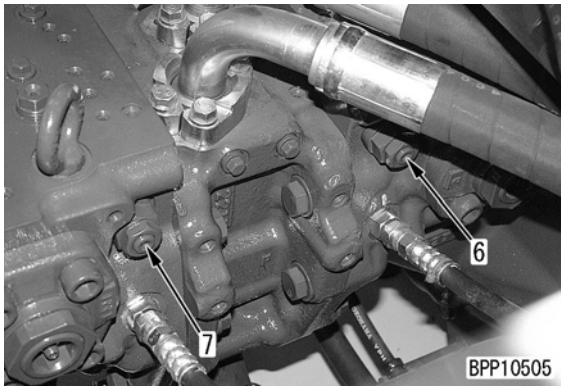
Travel Speed	Travel Control Lever	Hydraulic Pressure
Lo	Neutral	Approx. 2.9 MPa {approx. 30 kg/cm^2}
Hi	Fine control (Note)	0{0}

Note: Operate the travel control lever slightly to the extent that the PPC hydraulic oil pressure is turned ON. (Stop the operation short of starting the machine)

5) Detach all the measurement tools after the measurement, and make sure that the machine is back to normal condition.

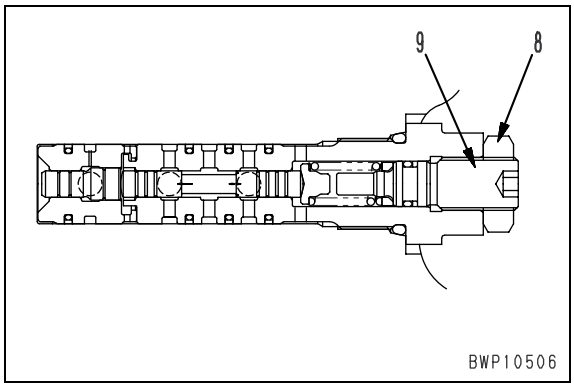
Adjustment

★ When LS differential pressure is not normal, adjust it with LS valves (6) and (7).



1. Loosen lock nut (8) and adjust the pressure by tuning adjusting screw (9).
   ★ If the adjusting screw is turned to the right, the differential pressure rises.
   If the adjusting screw is turned to the left, the differential pressure falls.
   ★ Adjustment amount (LS differential pressure) per turn of adjusting screw:
   1.3 MPa{13.3 kg/cm^2}

3 Lock nut: **49–64 Nm{5–7 kgm}**



2. After the adjustment, confirm that LS differential pressure is normal, following the steps for measurement explained earlier.

INSPECTION AND ADJUSTMENT OF PUMP LS CONTROL CIRCUIT OIL PRESSURE(PC210/LC/NLC)

★ Pump LS control circuit oil pressure inspection and adjustment tools

Mark		Part No.	Part Name
K	1	799-101-5002	Hydraulic Tester
		790-261-1203	Digital Type Hydraulic Tester
	2	799-101-5220	Grease Fitting (10 x 1.25 mm)
		07002-11023	O-ring
	3	799-401-1340	Differential Pressure Gauge

Measurement

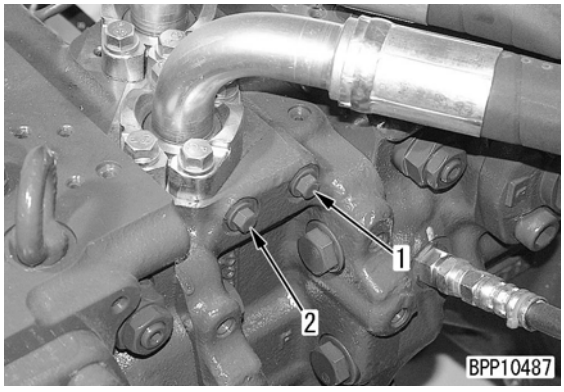
★ Measure pump LS control circuit oil pressure after confirming that the work equipment, swing and travel circuit oil pressure as well as control circuit original pressure are normal.

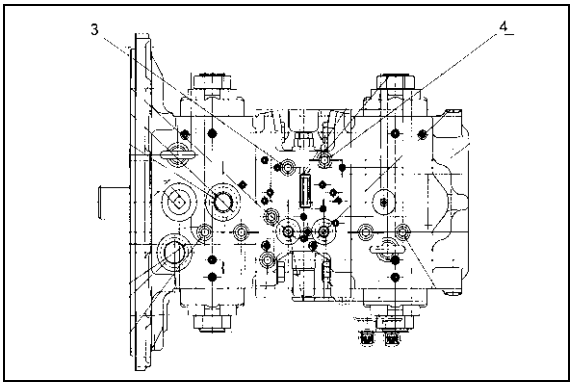
k Lower the work equipment to the ground and stop the engine. After the engine stops, operate the control lever several times to release the remaining pressure in the piping. Then loosen the oil filler cap to release the pressure inside the hydraulic tank.

1. Measurement of LS valve output pressure (servo piston inlet pressure)

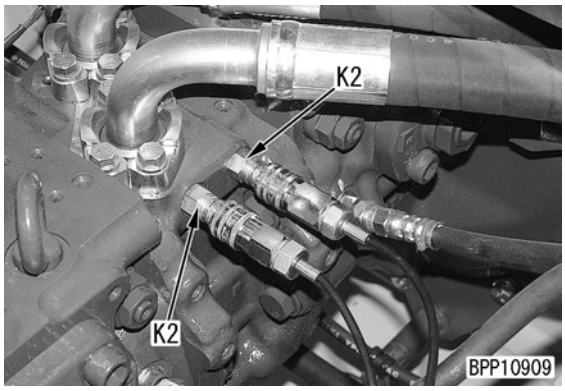
★ Measure LS valve output pressure (servo piston inlet pressure) and pump delivery pressure together, and compare both pressures thereafter.

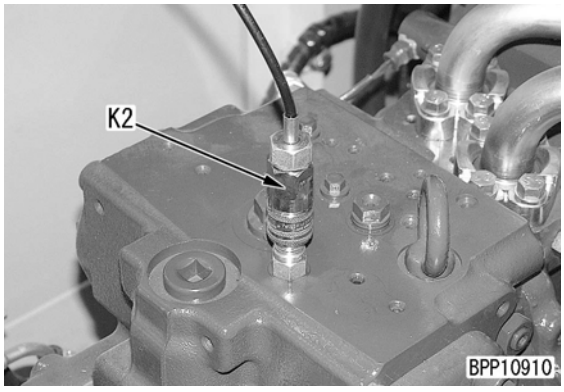
1) Remove oil pressure measurement plugs (1), (2), (3) and (4).
   - Plug (1): For measuring the front pump delivery pressure
   - Plug (2): For measuring the rear pump delivery pressure
   - Plug (3): For measuring the front pump LS valve delivery pressure
   - Plug (4): For measuring the rear pump LS valve delivery pressure





2) Fit fitting **K2** and connect it to oil pressure gauge ① of hydraulic tester **K1**.
   ★ Use an oil pressure gauge with the capacity of 58.5 MPa{600 kg/cm^2}.





3) Start the engine and raise the track shoe to be measured with the work equipment.
   - For measuring oil pressure in front circuit: Right track shoe
   - For measuring oil pressure in rear circuit: Left track shoe

k Provide a working area of sufficient space, as the raised track shoe will be idly rotated.

4) Wait until the hydraulic oil temperature rises to the operating range.

5) Measure pump delivery pressure and PC valve output pressure (servo piston inlet pressure) together with the machine set at the following conditions and the engine running at high idling.
   - Working mode: A mode
   - All the control levers of the work equipment, swing and travel are kept in the NEUTRAL position and the travel control lever is kept at half stroke (one side of the track shoes idly rotates).
   - ★ Let the raised track shoe idly rotate, paying enough attention to the surroundings for safety.
   - ★ Judgement method:
     When the ratio between the pump delivery pressure and LS valve output pressure (servo piston output pressure) reaches the following values, both pressures are judged normal.

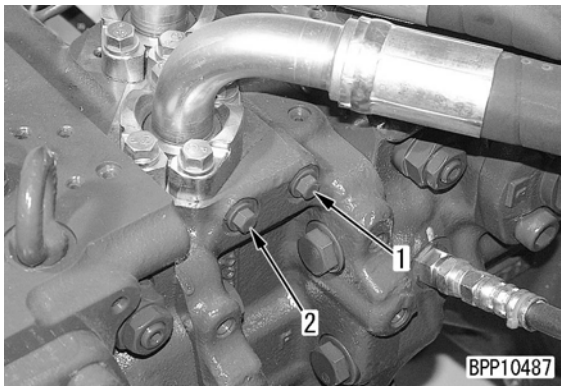
Oil pressure to be measured	Oil pressure ratio	
	All control levers in NEUTRAL	Travel at half stroke
Pump delivery pressure	Nearly equal pressure	1
LS valve delivery pressure		Approx. 3/5

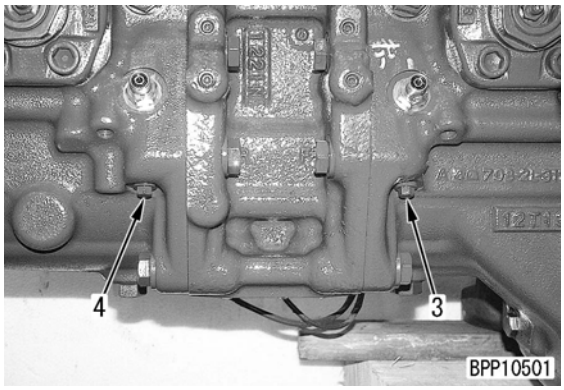
6) Detach all the measurement tools after the measurement and make sure that the machine is back to normal condition.

2. Measurement of LS differential pressure

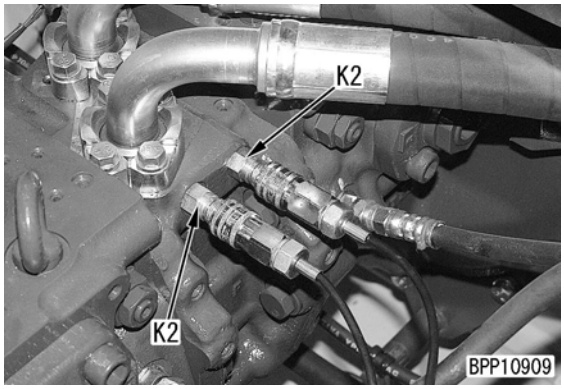
★ LS differential pressure can be obtained by measuring pump delivery pressure and LS pressure (actuator loaded pressure) at the same time and computing the difference of both pressures.

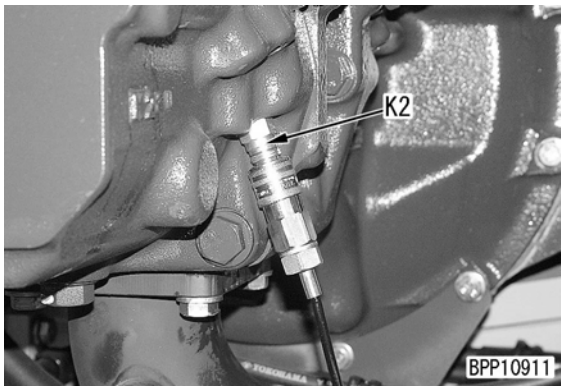
1) Remove oil pressure measurement plugs (1), (2), (3) and (4).
   - Plug (1): For measuring the front pump delivery pressure
   - Plug (2): For measuring the rear pump delivery pressure
   - Plug (3): For measuring the front pump LS pressure
   - Plug (4): For measuring the rear pump LS pressure





2) Fit fitting **K2** and connect it to oil pressure gauge ① of hydraulic tester **K1** or differential pressure gauge **K3**.
   - ★ When using a differential pressure gauge:
     Connect pump delivery pressure to the high pressure side and LS pressure to the low pressure side.
     A differential pressure gauge requires DC 12V power. Connect it with one battery.
   - ★ When using an oil pressure gauge:
     Use an oil pressure gauge with the capacity of 58.5 MPa{600 kg/cm^2}.
     The max. differential pressure is no more than approx. 40 MPa{3.9 kg/cm^2}.
     The same gauge may be used throughout the measurement.





3) Start the engine and raise the track shoe to be measured with the work equipment.
   - For measuring oil pressure in front circuit: Right track shoe
   - For measuring oil pressure in rear circuit: Left track shoe

   k Provide a working area of sufficient space, as the raised track shoe will be idly rotated.
4) Wait until the hydraulic oil temperature rises to the operating range.

5) Measure pump delivery pressure and LS pressure (actuator loaded pressure) together with the machine set at the following conditions and the engine running at high idling.
   - Working mode: A mode
   - Traveling speed: Hi
   - All the control levers of the work equipment, swing and travel are kept in the NEUTRAL position and the travel control lever is kept at half stroke (one side of the track shoes idly rotates).

   ★ Let the raised track shoe idly rotate, paying enough attention to the surroundings for safety.

   ★ Calculation of LS differential pressure: LS differential pressure = Pump delivery pressure – LS pressure

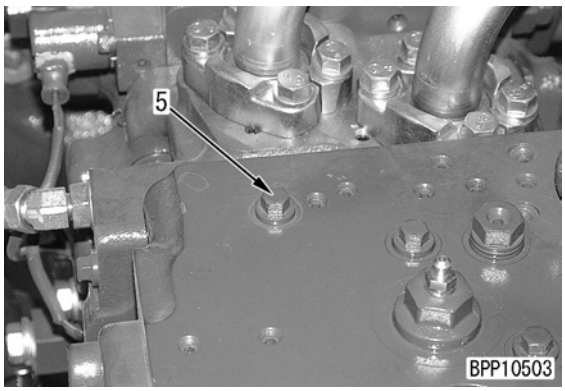
   ★ If LS differential pressure is in the following conditions, it is judged normal.

Control lever position	LS differential pressure
All levers in NEUTRAL	Unload pressure (see standard value table)
Travel lever at half stroke	Max. LS differential pressure (see standard value table)

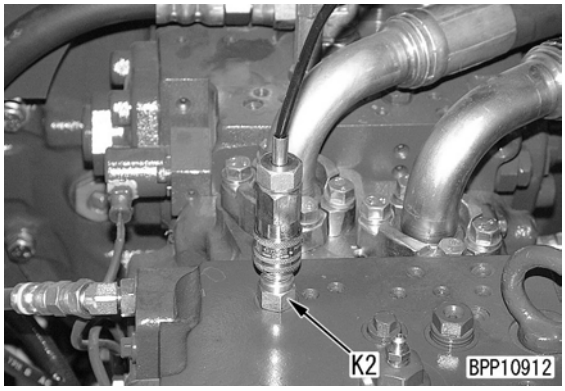
6) Detach all the measurement tools after the measurement, and make sure that the machine is back to normal condition.

3. Measurement of LS-EPC valve output pressure

1) Remove oil pressure measurement plug (5).



2) Fit fitting **K2** and connect it with oil pressure gauge ① of hydraulic tester **K1**.
   ★ Use an oil pressure gauge with the capacity of 5.9 MPa{60 kg/cm^2}.



3) Start the engine and keep it running until the hydraulic oil temperature rises to the operating range.

4) Measure the oil pressure when the engine is running at high idling and the travel speed switch and travel lever are operated.
   ★ If LS-EPC valve output pressure changes to the following values, the pressure is normal.

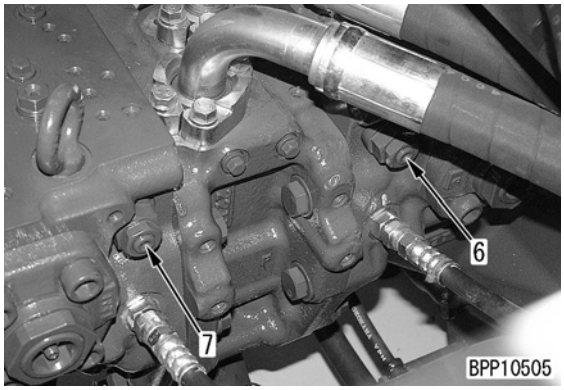
Travel Speed	Travel Control Lever	Hydraulic Pressure
Lo	Neutral	Approx. 2.9 MPa {approx. 30 kg/cm^2}
Hi	Fine control (Note)	0{0}

Note: Operate the travel control lever slightly to the extent that the PPC hydraulic oil pressure is turned ON. (Stop the operation short of starting the machine)

5) Detach all the measurement tools after the measurement, and make sure that the machine is back to normal condition.

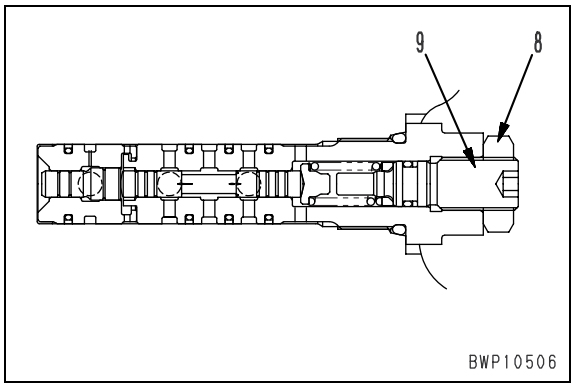
Adjustment

★ When LS differential pressure is not normal, adjust it with LS valves (6) and (7).



1. Loosen lock nut (8) and adjust the pressure by tuning adjusting screw (9).
   ★ If the adjusting screw is turned to the right, the differential pressure rises.
   If the adjusting screw is turned to the left, the differential pressure falls.
   ★ Adjustment amount (LS differential pressure) per turn of adjusting screw:
   1.3 MPa{13.3 kg/cm^2}

3 Lock nut: **49–64 Nm{5–7 kgm}**



2. After the adjustment, confirm that LS differential pressure is normal, following the steps for measurement explained earlier.

MEASUREMENT OF SOLENOID VALVE OUTPUT PRESSURE

★ Solenoid valve output pressure measurement tools

Mark		Part No.	Part Name
L	1	799-101-5002	Hydraulic Tester
		790-261-1203	Digital Type Hydraulic Tester
	2	799-401-2910	Grease Fitting (Size 02)
		07002-*1423	O-ring

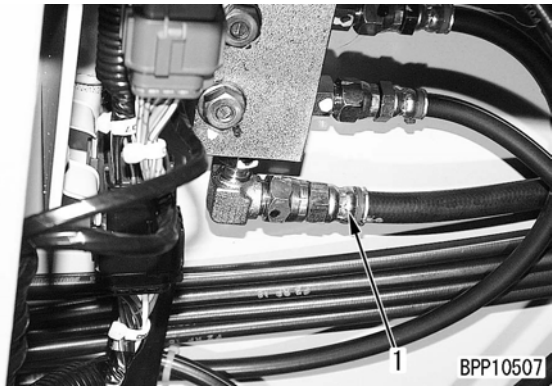
★ Measure solenoid valve output pressure after confirming that control circuit original pressure is normal.

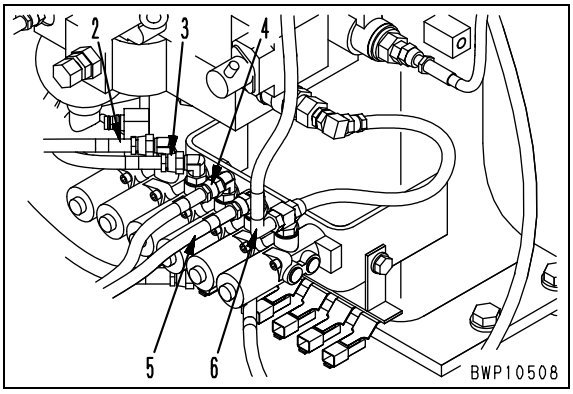
k Lower the work equipment to the ground and stop the engine. After the engine stops, operate the control lever several times to release the remaining pressure in the piping. Then loosen the oil filler cap to release the pressure inside the hydraulic tank.

1. Disconnect the hoses of solenoid valve to be measured at the outlet side.

No.	Solenoid valve to be measured
1	PPC lock solenoid valve
2	Travel interconnection solenoid valve
3	Merge/divide solenoid valve
4	Travel speed shifting solenoid valve
5	Swing and parking brake solenoid valve
6	2-stage relief solenoid valve

★ Hose (1) is installed at the rear of operator's cab, and hoses (2) through (6) are installed at the center of revolving frame.

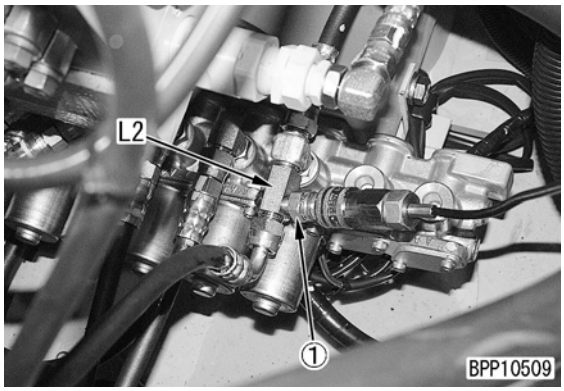




2. Fit fitting **L2** and connect hoses (1) through (6) again.

3. Fit fitting ① of hydraulic tester **L1** and connect it to oil pressure gauge ②.

★ Use an oil pressure gauge with the capacity of 5.9 MPa{60 kg/cm^2}.



4. Start the engine and keep it running until the hydraulic oil temperature rises to the operating range.

5. Run the engine at full throttle, then turn each solenoid valve ON or OFF by operating the control lever switch, and measure the pressure.
- ★ For conditions for turning each solenoid valve ON or OFF, refer to the ensuing "Table for Functioning Conditions" for each solenoid valve.
- ★ How each solenoid valve functions can be confirmed with monitoring function in the monitor panel. (Special Function of Machine Monitor)
- ★ When each output pressure shows the following values, it is judged normal.

Solenoid Valve	Output Pressure
OFF (Demagnetization)	0{0}
ON (Excitation)	3MPa{30kg/cm^2}

6. Detach all the measurement tools after the measurement, and make sure that the machine is back to normal condition.

Table for Functioning Conditions - PPC lock solenoid valve

Functioning Condition		Functioning
Safety lock lever	Locked	OFF
	Released	ON

Table for Functioning Conditions - Swing and parking brake solenoid

Functioning Condition		Functioning
Work equipment, swing, travel, signaling	When all of them is OFF	OFF
	When any of them is ON	ON

Table for Functioning Conditions - Travel interconnection solenoid valve

Functioning Condition			Functioning
When the travel steering signal is ON			ON
When the travel steering signal is OFF	Traveling operation only	If front or rear pump pressure is over 24.5MPa{250kg/cm^2}	ON
	In conditions other than above		OFF

Table for Functioning Conditions - Travel speed shifting solenoid valve

Functioning Condition			Functioning
When overheat setting of the 2nd stage is ON			OFF
When the fuel dial indicates less than 1500 rpm			
When the travel speed switch is at Lo (or ※Mi)			
When the travel speed switch is at Hi	The travel signal is OFF		
	The travel signal is ON	If front or rear pump pressure is 24.5 MPa{250 kg/cm^2}	
		If front or rear pump pressure is 15.3 MPa{150 kg/cm^2}	ON
In conditions other than above			

※: The "Mi" mode is on the multi-monitor specification machine only.

Table for Functioning Conditions - 2-stage relief solenoid valve

Functioning Condition			Functioning
When overheat setting of the 1st stage is ON			OFF
When overheat setting of the 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 switch is ON	If signals other than swing operation only is ON	
		If swing operation only is ON	OFF
In conditions other than above			

Table for Functioning Conditions - Merge/divide solenoid valve

Functioning Condition				Functioning
When working mode is B mode	When service signal is ON			ON
When working mode is ※L mode	When boom RAISE and swing signals are ON			
When travel signal only is ON				
When compound travel marks are ON	When steering signal is OFF	If front or rear pump pressure is over 19.6 MPa (200 kg/cm^2)		
When travel signal is OFF	When swing lock switch is ON			OFF
	When working mode is A mode			
	When swing signal is ON			
	When swing signal is OFF	When service and arm dumping signal are ON	If front or rear pump pressure is over 19.6 MPa{200 kg/cm^2}	ON
In conditions other than above				OFF

※: The "L" mode is on the multi-monitor specification machine only.

MEASUREMENT OF PPC VALVE OUTPUT PRESSURE

★ PPC valve output pressure measurement tools

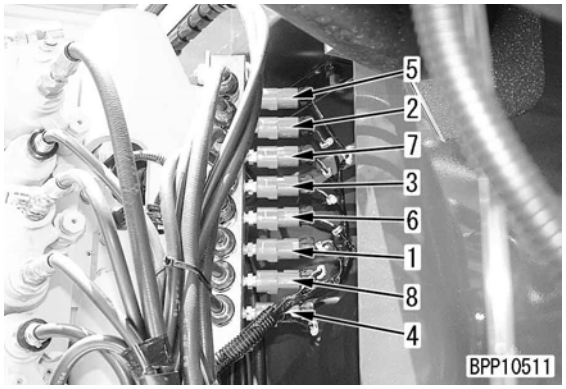
Mark	Part No.	Part Name
M	799-101-5002	Hydraulic Tester
	790-261-1203	Digital Type Hydraulic Tester

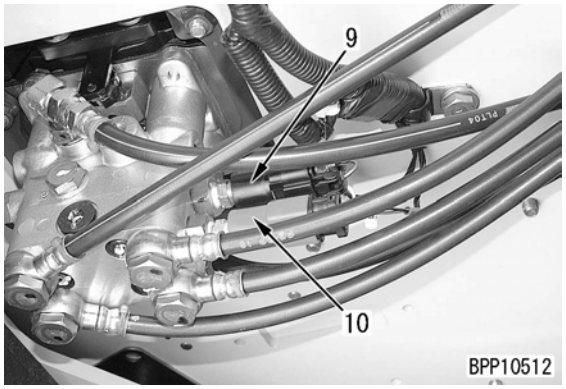
★ Measure PPC valve output pressure after confirming that control circuit original pressure is normal.

1. Remove PPC oil pressure switches (1) through (12) in the hydraulic circuits to be measured.

No.	Circuit to be measured	No.	Circuit to be measured
1	Boom, RAISE	7	Swing, left
2	Boom, LOWER	8	Swing, right
3	Arm, DIGGING	9	Travel (black)
4	Arm, DUMPING	10	Steering (red)
5	Bucket, DIGGING		
6	Bucket, DUMPING		

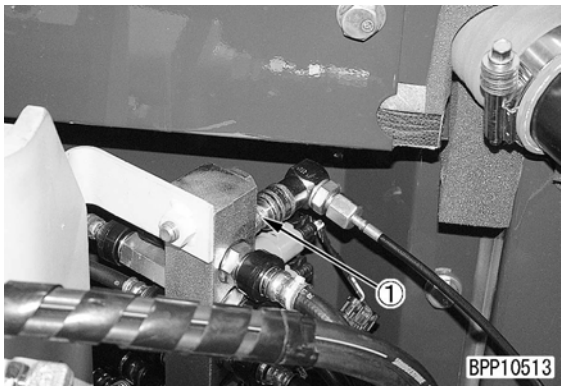
★ Oil pressure switches (1) through (8) are installed in the PPC relay block, and (9) and (10) are installed at the rear of operator's cab.





2. Fit fitting ① of hydraulic tester **M** and connect oil pressure gauge ② .

★ Use an oil pressure gauge with the capacity of 5.9 MPa{60 kg/cm^2}.



3. Start the engine and keep it running until the hydraulic oil temperature rises to the operating range.

4. Measure the pressure when the engine is running at high idling and the control lever of the circuit to be measured is kept in the NEUTRAL position and at the full stroke.

★ If PPC valve output pressure is at the level shown below, it is judged normal.

Lever Control	Hydraulic Pressure
In NEUTRAL	0{0}
At full stroke	Nearly equal to control original pressure (see standard value table)

5. Detach all the measurement tools, and make sure that the machine is back to normal condition.

ADJUSTMENT OF WORK EQUIPMENT AND SWING PPC VALVE

★ If there is excessive play in the work equipment or swing lever, adjust it in the following manner.

1. Remove work equipment and swing PPC valve ass'y.

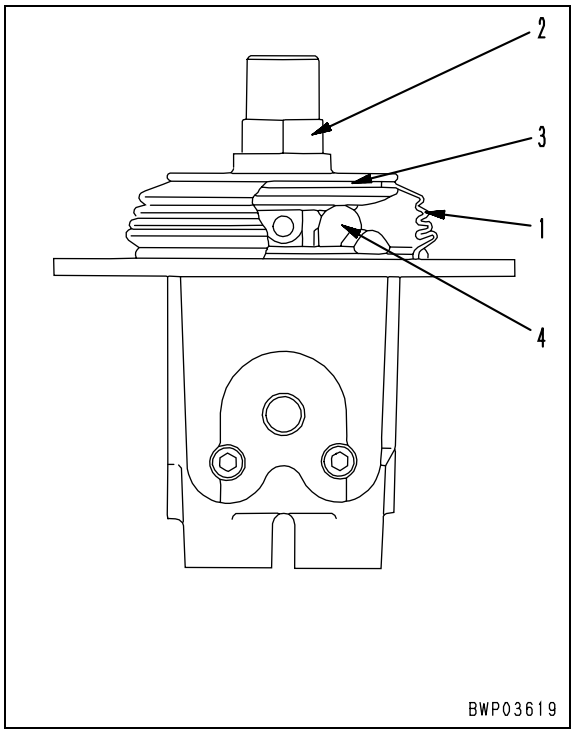
2. Take off boot (1).

3. Loosen lock nut (2) and screw in disc (3) until it contacts the heads of four pistons (4).
★ Do not move the piston while doing this work.

4. Keep disc (3) in place and tighten lock nut (2) to the specified tightening torque.
3 Lock nut: **98–12 7Nm{10–13 kgm}**

5. Install boot (1).

6. Install work equipment and swing PPC valve ass'y.

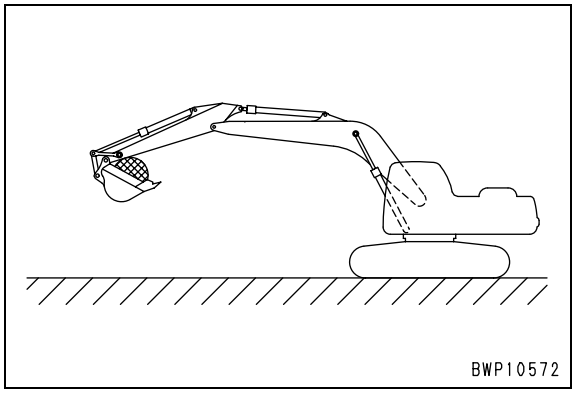


INSPECTION OF LOCATIONS OF HYDRAULIC DRIFT OF WORK EQUIPMENT

★ If there is any hydraulic drift in the work equipment (cylinders), check in the following manner to determine if the cause is in the cylinder packing or in the control valve.

1. Inspection of boom and bucket cylinders

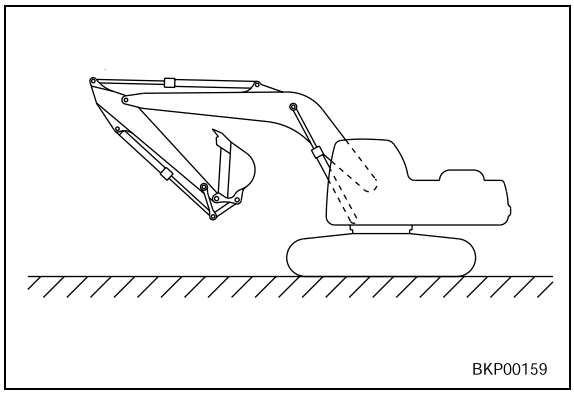
1) Set the work equipment in the same posture as when measuring hydraulic drift, and stop the engine.
   ★ Fill the bucket with earth or apply the rated load to the bucket.



2) Operate the control lever to the RAISE position or the bucket control lever to the CURL position.
   - If the lowering speed increases, the cylinder packing is defective.
   - If there is no change, the control valve is defective.
   ★ Operate the control lever with the engine starting switch in the ON position.
   ★ If pressure in the accumulator has dropped, run the engine for approx. 10 seconds to charge the accumulator again.

2. Inspection of arm cylinder

1) Operate the arm cylinder to move the arm to the position 100 mm before the digging stroke end, and stop the engine.



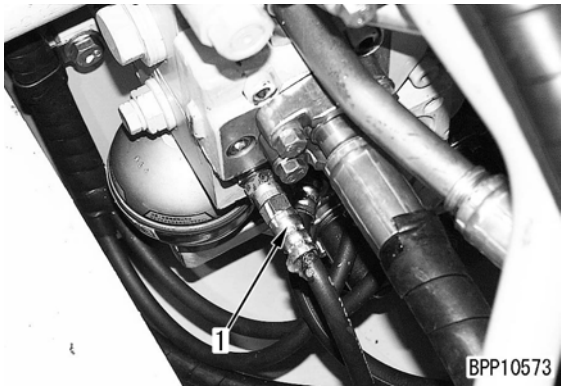
2) Operate the arm control lever to move the arm to the digging side.
   - If the lowering speed increases, the cylinder packing is defective.
   - If there is no change, the control valve is defective.
   ★ Operate the control lever with the engine starting switch in the ON position.
   ★ If pressure in the accumulator has dropped, run the engine for approx. 10 seconds to charge the accumulator again.

[Reference] If the cause of the hydraulic drift is in the defective packing, and the above operation is carried out, downward movement is accelerated for the following reasons.

1) If the work equipment is set to the above posture (holding pressure applied to the bottom end), the oil at the bottom end leaks to the head end. However, the volume at the head end is small than the volume at the bottom end by the volume of the rod end, so the internal pressure at the head end increases because of the oil flowing in from the bottom end.
2) When the internal pressure at the head end increases, the pressure at the bottom end also rises in proportion to this. The balance is maintained at a certain pressure (this differs according to the amount of leakage) by repeating this procedure.
3) When the pressure is balanced, the downward movement becomes slower. If the lever is then operated according to the procedure given above, the circuit at the head end is opened to the drain circuit (the bottom end is closed by the check valve), so the oil at the head end flows to the drain circuit and the downward movement becomes faster.

3. Inspection of boom lock valve

1) Set the work equipment at the maximum reach and the boom top horizontal. Then stop the engine.
   - k Lock the work equipment control levers and release the pressure inside the hydraulic tank.
   - k Do not allow anyone to come under the work equipment during the work.
2) Disconnect drain hose (1) of the control valve, and install a blind plug in the hose.
   - Part No. for the blind hose: 07376-70210
   - ★ Leave the control valve end open.
   - ★ If any oil leaks out from the port that is left open, following hydraulic drift of the work equipment, the boom lock valve is defective (loose contact).



4. Inspection of PPC valve

Measure the amount of hydraulic drift of the work equipment when the accumulator is charged with pressure and the safety lock lever is put to the LOCK and FREE positions.

- ★ Operate the control lever with the engine starting switch in the ON position.
- ★ If pressure in the accumulator has dropped, run the engine for approx. 10 seconds to charge the accumulator again.
- ★ If there is any difference in the hydraulic drift between LOCK and FREE positions, the PPC valve is defective (some internal failure).

RELEASE OF REMAINING PRESSURE IN HYDRAULIC CIRCUIT

- k If the piping between the hydraulic cylinders or the hydraulic motor and control valves is to be disconnected, release the remaining pressure in the following manner.
- ★ There is no pressure remaining in the swing motor circuit and travel motor circuit, but the internal pressure in the hydraulic tank affects them. So open the oil filler cap of the hydraulic tank.

1. Stop the engine, and loosen the oil filler cap gradually to release the pressure inside the tank.

2. Turn the engine starting switch to the ON position and operate the control levers several times.
- ★ There must be power supply to the PPC lock valve. Be sure to operate the control levers with the engine starting switch in the ON position.
- ★ When the levers are operated 2-3 times, the pressure stored in the accumulator is removed.

3. Start the engine, run at low idling for approx. 10 seconds to accumulate pressure in the accumulator, then stop the engine.

4. Repeat the steps in Item 2 to 3 above several times.

MEASUREMENT OF OIL LEAKAGE AMOUNT

1. Measurement of oil leakage amount from boom cylinder

1) Start the engine and keep it running until the hydraulic oil temperature rises to the operating range. Then extend the boom cylinder to the stroke end.

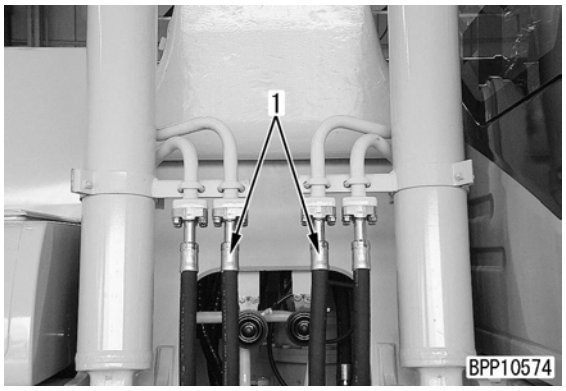
k Release the pressure remaining in the piping, referring to the foregoing section of "Release of Remaining Pressure in Hydraulic Circuit".

2) Disconnect hose (1) at the cylinder head end and block the hose end with a plate.

k Be careful not to disconnect the hose at the cylinder bottom end.

3) Start the engine and apply the relief pressure to the bottom end of the cylinder with the engine running at high idling.

4) Continue this condition for 30 seconds, then measure the oil leakage amount for one minute.



5) After the measurement, make sure that the machine is back to normal condition.

2. Measurement of oil leakage amount from arm cylinder

1) Start the engine and keep it running until the hydraulic oil temperature rises to the operating range. Then extend the arm cylinder to the digging stroke end.

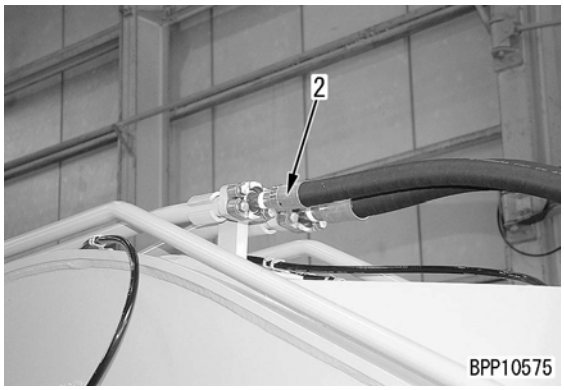
k Release the pressure remaining in the piping, referring to the foregoing section of "Release of Remaining Pressure in Hydraulic Circuit".

2) Disconnect hose (2) on the cylinder head end and block the hose end with a plate.

k Be careful not to disconnect the hose at the cylinder bottom end.

3) Start the engine and apply the relief pressure to the bottom end of the cylinder with the engine running at high idling.

4) Continue this condition for 30 seconds, then measure the oil leakage amount for one minute.



5) After the measurement, make sure that the machine is back to normal condition.

3. Measurement of oil leakage amount from bucket cylinder

1) Start the engine and keep it running until the hydraulic oil temperature rises to the operating range. Then extend the bucket cylinder to the digging stroke end.

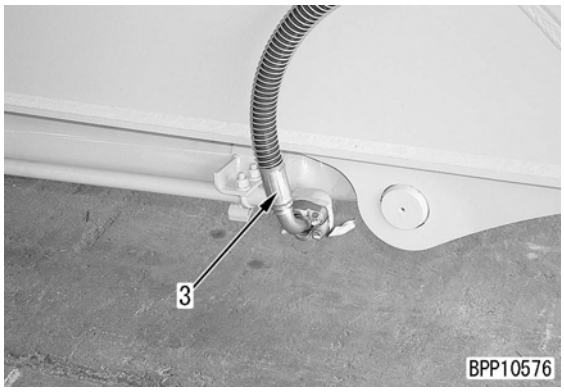
k Release the pressure remaining in the piping, referring to the foregoing section of "Release of Remaining Pressure in Hydraulic Circuit".

2) Disconnect hose (3) at the cylinder head end block the hose end with a plate.

k Be careful not to disconnect the hose at the cylinder bottom end.

3) Start the engine and apply the relief pressure to the bottom end of the cylinder with the engine running at high idling.

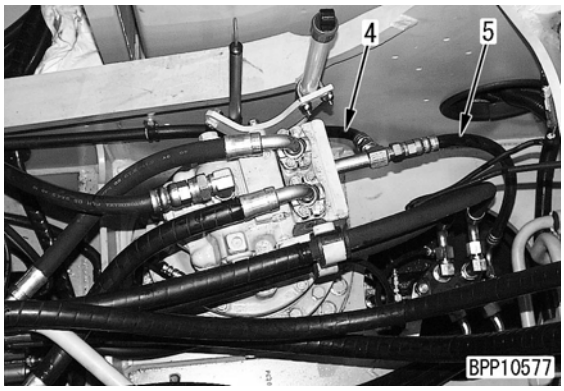
4) Continue this condition for 30 seconds, then measure the oil leakage amount for one minute.



5) After the measurement, make sure that the machine is back to normal condition.

4. Measurement of oil leakage amount from swing motor

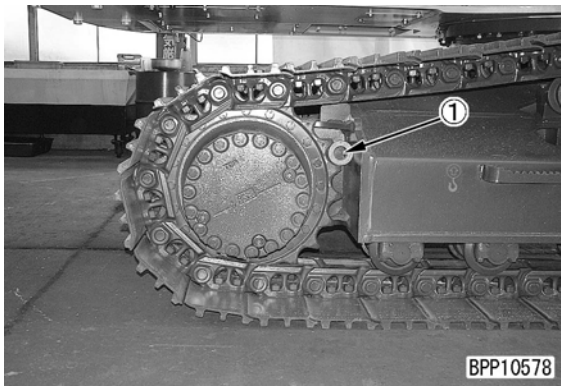
1) Disconnect drain hoses (4) and (5) and fit a blind plug in the hoses.
2) Turn the swing lock switch to the ON position.
3) Start the engine. Apply the swing relief pressure with the engine running at high idling and measure an oil leakage amount under such conditions.
   - ★ After keeping the conditions in 3) above for 30 seconds, measure the oil leakage amount for one minute.
   - ★ After the first measurement, turn the upper structure by 180 degrees and take measurement again in the same way.



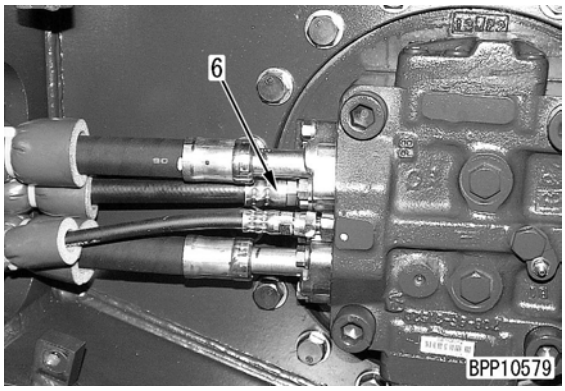
4) After the measurement, make sure that the machine is back to normal condition.

5. Measurement of oil leakage amount from travel motor

1) Take off the travel motor cover.
2) Start the engine and lock the travel.
   - k Put pin ① in between the sprocket and the track frame to block the travel.



3) Disconnect drain hose (6) of the travel motor and fit a blind plug in the hose end.
4) Start the engine and apply the travel relief pressure with the engine running at high idling, then measure an oil leakage amount under such conditions.
   - k In this measurement, an erroneous operation of the control lever will likely lead to a serious accident. Make sure that all the signals and confirmations are followed without fail.
   - ★ After keeping the conditions in 4) above for 30 seconds, measure the oil leakage amount for one minute.
   - ★ Repeat the measurement several times, slightly rotating the motor, i.e. shifting the position of valve plate and cylinder, and the position of cylinder and piston, and take measurement several times.



5) After the measurement, make sure that the machine is back to normal condition.

AIR BLEEDING OF VARIOUS PARTS

Contents of Work \ Air bleeding item	Steps for air bleeding					
	1	2	3	4	5	6
	Hydraulic pump air bleeding	Engine start	Cylinder air bleeding	Swing motor air bleeding	Travel motor air bleeding	Operation start
• Change of hydraulic oil • Cleaning of strainer	○ →	○ →	○ →	○ (Note) →	○ (Note) →	○
• Replacement of return filter element		○ →	→	→	→	○
• Repair or replacement of hydraulic pump • Removing suction pipe	○ →	○ →	○ →	→	→	○
• Repair or replacement of control valve		○ →	○ →	→	→	○
• Replacement of cylinder • Removing cylinder piping		○ →	○ →	→	→	○
• Replacement of swing motor • Removing swing motor piping		○ →	→	○ →	→	○
• Replacement of travel motor swivel • Removing travel motor swivel piping		○ →	→	→	○ →	○

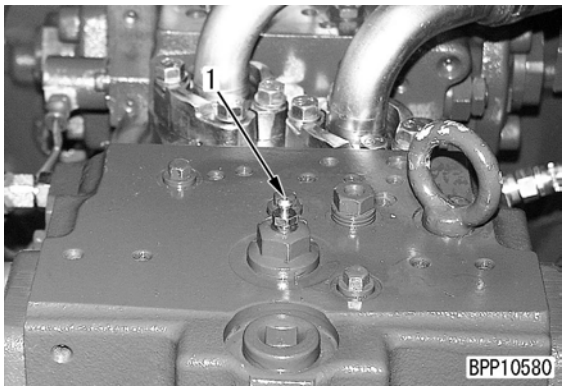
Note: Bleed air from the swing motor and travel motor only when oil in the casing is drained.

1. Air bleeding from hydraulic pump

1) Loosen air bleeding plug (1) and confirm that oil seeps out from the plug.
2) If the oil seepage is confirmed, tighten air bleeding plug (1).

3 Air bleeding plug:
7.8–9.8 Nm{0.8–1.0 kgm}

★ Precautions for starting engine
When starting the engine after the air bleeding work explained above, run the engine at low idling for 10 minutes.
If the engine cooling water temperature is low and an automatic engine warming-up function is relied on, use the fuel dial, when it becomes necessary to cancel it.



2. Air bleeding from hydraulic cylinder

1) Start the engine and kept it running at low idling for 5 minutes.
2) Raise and lower the boom 4 to 5 times with the engine running at low idling.
   ★ Be careful not to apply the relief pressure, stopping the piston rod approx. 100 mm before its stroke end.
3) Repeat the steps in Item 2) above, but this time with the engine running at high idling.
4) Apply the relief pressure by extending the piston rod to its stroke end and with the engine running at low idling.
5) For bleeding air from the arm cylinder and bucket cylinder, follow the same steps explained in Item 2) through 4) above.

★ In case a cylinder is replaced with new one, it is advised to bleed air from the new one before mounting the work equipment. It is especially so with the boom cylinder, because its rod does not extend to the stroke end of LOWER side, after the work equipment is mounted.

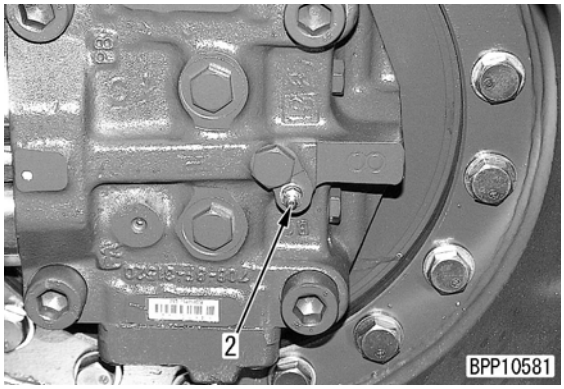
3. Air bleeding from swing motor

1) Start the engine and run it at low idling.
2) Bleed air from the motor by swinging the upper structure slowly.

4. Air bleeding from travel motor

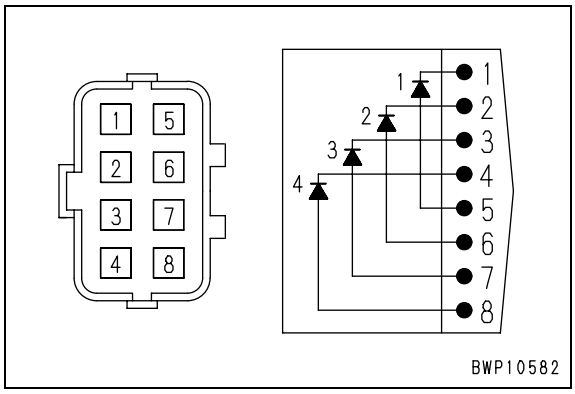
1) Start the engine and run it at low idling.
2) Loosen air bleeding plug (2) and confirm that oil seeps out from the plug.
3) If the oil seepage is confirmed, tighten air bleeding plug (2).

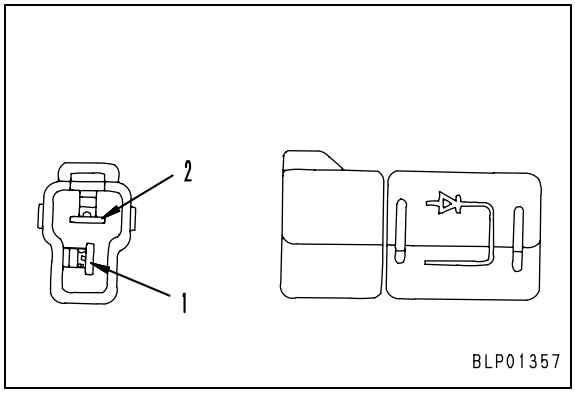
3 Air bleeding plug:
27.5–35.3 Nm{2.8–3.6 kgm}



INSPECTION PROCEDURES FOR DIODE

★ Check an assembled-type diode (8 pins) and single diode (2 pins) in the following manner.
★ The continuity direction of an assembled-type diode is as shown in the diagram below.
★ The continuity direction of a single diode is shown on the diode surface.

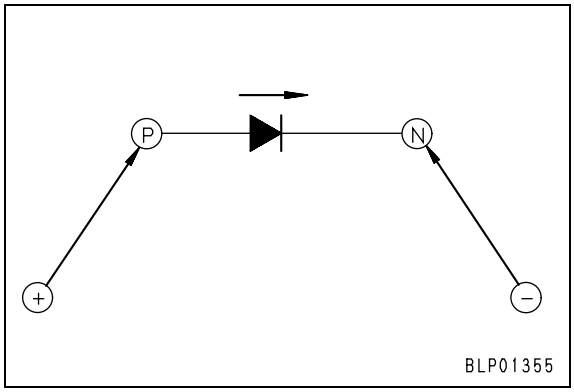




1. When using digital type circuit tester

1) Switch the testing mode to diode range and confirm the indicated value.
   ★ Voltage of the battery inside is displayed with conventional circuit testers.
2) Put the red probe (+) of the test lead to the anode (P) and the black probe (–) to the cathode (N) of diode, and confirm the displayed value.
3) Determine if a specific diode is good or no good with the indicated value.
   • No change in the indicated value: No continuity (defective).
   • Change in the indicated value: Continuity established (normal) (Note)

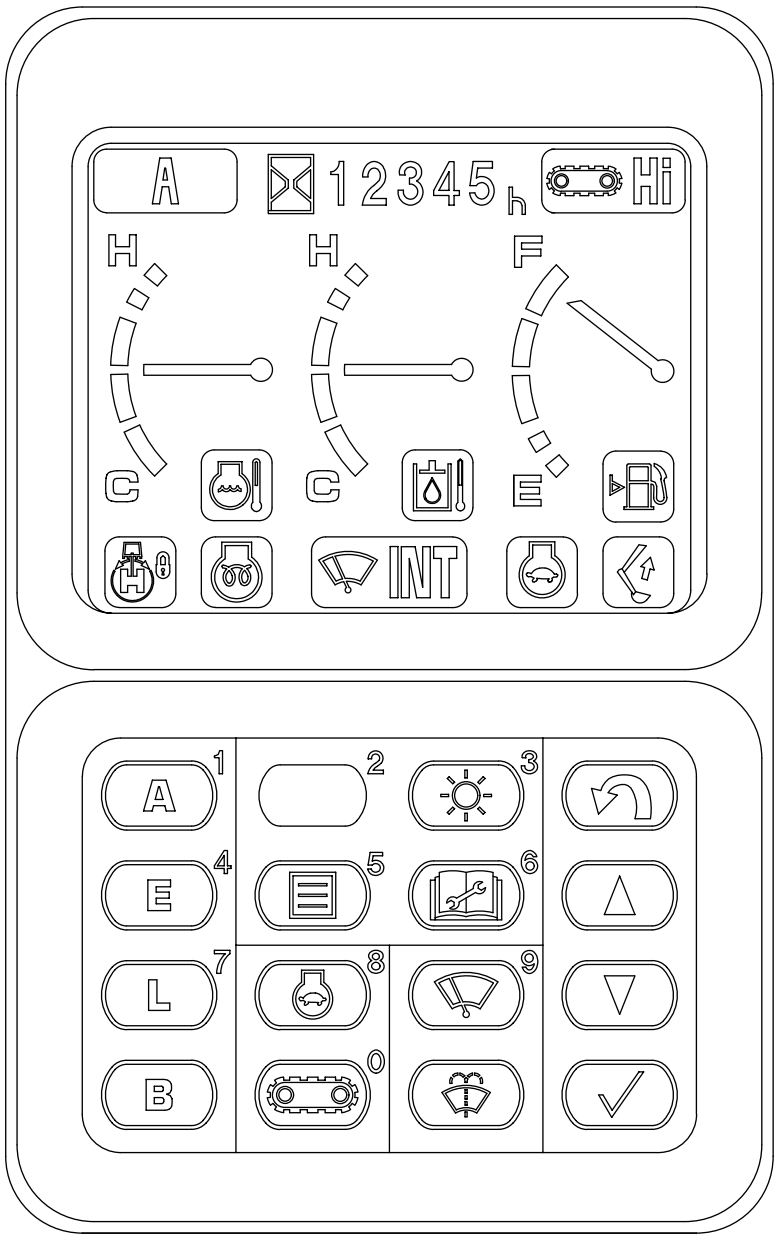
   Note: A silicon diode shows a value between 400 and 600.



2. When using analog type circuit tester

1) Switch the testing mode to resistance range.
2) Check the needle swing in case of the following connections.
   i) Put the red probe (+) of the test lead to the anode (P) and the black probe (–) to the cathode (N) of diode.
   ii) Put the red probe (+) of the test lead to the cathode (N) and the black probe (–) to the anode of diode.
3) Determine if a specific diode is good or no good by the way the needle swings.
   • If the needle does not swing in Case i), but swings in Case ii): Normal (but the breadth of swing (i.e. resistance value) will differ depending on a circuit tester type or a selected measurement range)
   • If the needle swings in either case of i) and ii): Defective (short-circuited internally)
   • If the needle does not swing in any case of i) and ii): Defective (short-circuited internally)

SPECIAL FUNCTION OF MULTI-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
[↩] Return switch
[△] Upward move switch
[▽] Downward move switch
[✓] Input confirmation switch

Monitor panel functions - conventional and special

The monitor panel is provided with conventional and special functions, and various kind of information are shown in the multi-display. Display items consists of automatic display items that are preset in the monitor panel and others that are shown by switch operations.

1. **Conventional function: Operator's Menu**
   This is a function by which an operator can set or show displays by switch operations. The display contents are those which are normally shown.

2. **Special function: Service Menu**
   This is a function by which a service mechanic can set or show displays by special switch operations. The display contents are those which are not normally shown. It is mainly used for inspection, adjustment, trouble-shooting or special setting of machines.

Operator's Menu	
1	Function for inputting and setting password
2	Function for showing Komatsu's logo
3	Function for machine inspection before starting day's work
4	Function for showing machine maintenance
5	Function for showing precaution items
6	Function for confirming working mode and travel speed
7	Function for display of ordinary items
8	Function for adjusting display luminance and contrast
9	Function for adjusting breaker and attachment flow rate
10	Function for confirming maintenance information
11	Function for showing service meter reading
12	Function for checking display LCD
13	Function for showing occurrence of caution item
14	Function for showing users' code No.
15	Function for showing service code No. and failure code No.

Service Menu		
16	Function for monitoring [01]	
17	Function for failure history [02]	Electrical system
		Mechanical system
18	Function for maintenance history [03]	
19	Function for maintenance mode change [04]	
20	Function for recording phone No. [05]	
21	Function for initial value setting and default [06]	Mode with key on
		Language
		Unit
		Attachment installed/No attachment installed
22	Function for adjustment [07]	Adjustment of governor lever stroke
		Fuel pump absorbin torque
		RPM at low idling
		Adjustment of oil flow to attachment

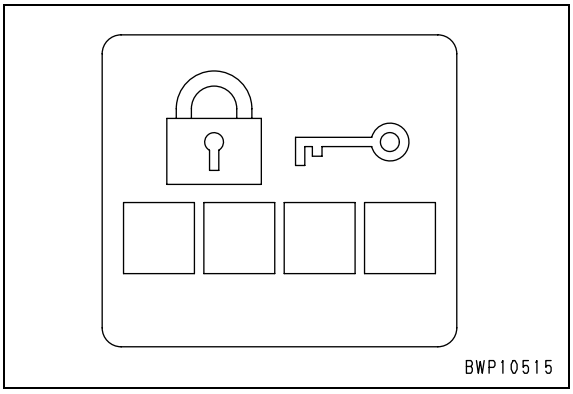
Operation of Operator's Menu and Display (Outline)

★ This section introduces only the outline of the operator's menu. For details on the contents and operation steps of each menu, refer to the operation and maintenance manual or the chapter of "STRUCTURE AND FUNCTION" in this shop manual.

1. Function for inputting and setting password

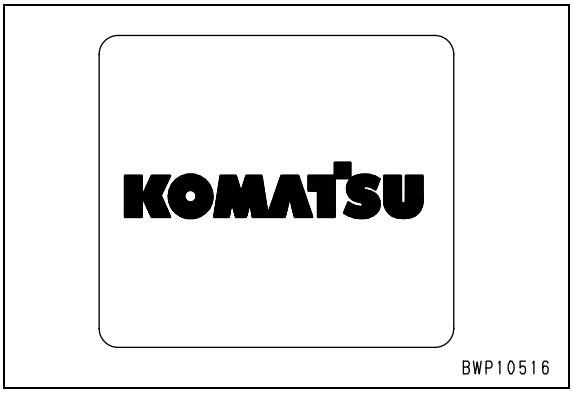
When the engine starting switch is turned ON, the password inputting display is shown.

★ This display is shown only when a password is registered.



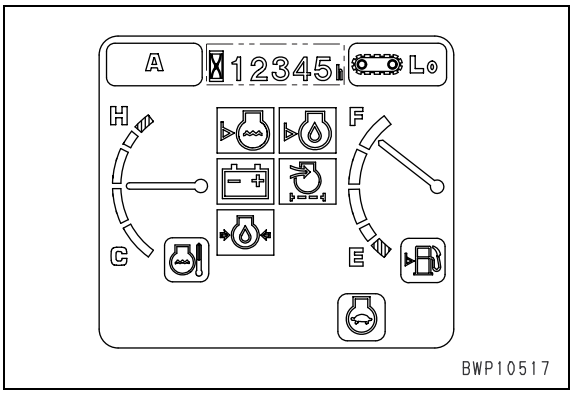
2. Function for showing KOMATSU logo

When a password is inputted, or when the engine starting switch is turned ON, KOMATSU logo is shown for two seconds.



3. Function for machine inspection before starting day's work

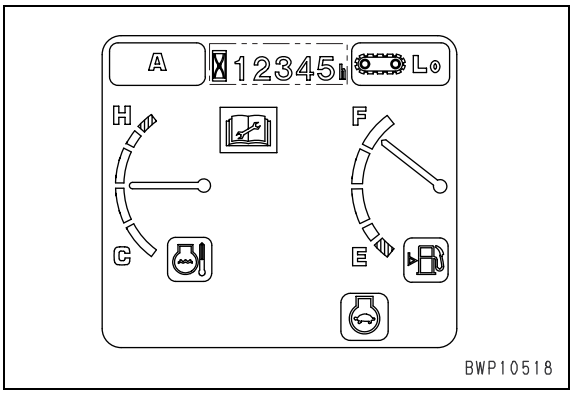
Following the KOMATSU logo, the display of machine inspection before starting day's work is shown for 2 seconds.



4. Function for machine maintenance

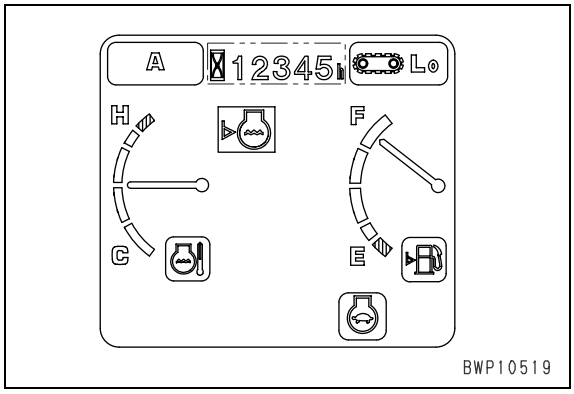
Following the display of machine inspection before starting day's work, the maintenance mark appears for 30 seconds, if there is an oil filter whose maintenance time is approaching or has just passed.

★ This display appears only when the maintenance function is set.



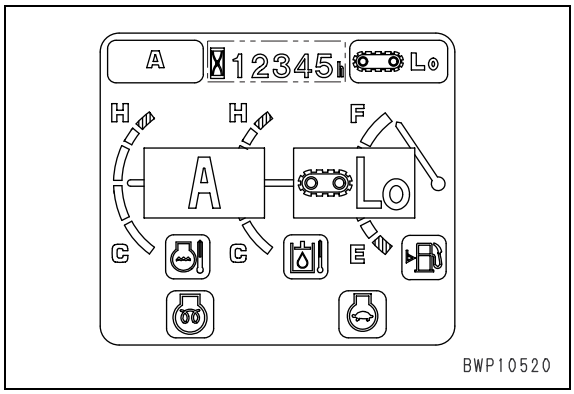
5. Function for showing precaution items

If there is any item of machine inspection before starting day's work that indicates some abnormality, a corresponding symbol mark is shown after the display of machine inspection before starting day's work.



6. Function for confirming working mode and travel speed

After the display of machine inspection before day's work, amplified symbol marks for working mode and travel speed are shown for two seconds to urge an operator to confirm the setting.

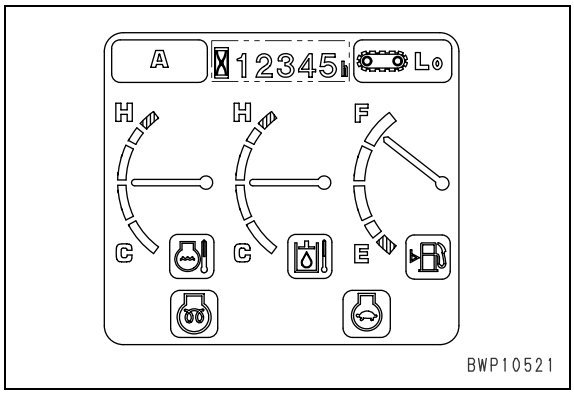


7. Function for display of ordinary items

The display of confirming working mode and travel speed is switched to this display of ordinary items.

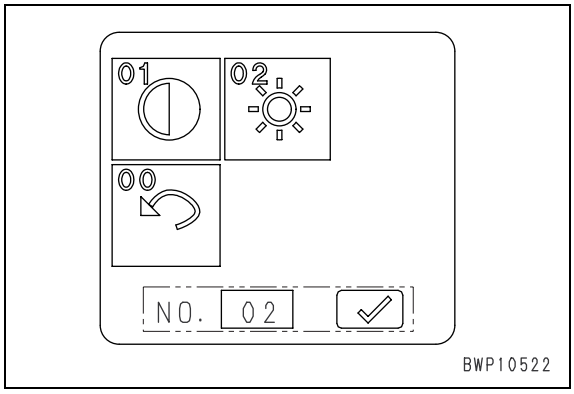
★ If the working mode setting or travel speed setting is changed, or auto-deceleration or windshield wiper setting is activated while this is in display, an amplified corresponding symbol mark is shown for two seconds.

★ In this display, a symbol mark for preheat monitor is shown only when preheating is carried out.



8. Function for adjusting display luminance and contrast

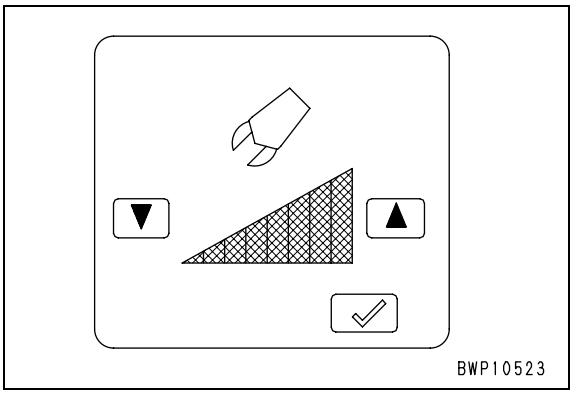
Luminance as well as contrast of the display can be adjusted by operating the display adjusting switch.



9. Function for adjusting breaker and attachment flow rate (For machines equipped with breaker attachment)

When a breaker or other attachments are used, hydraulic pump flow rate can be adjusted by operating the select switch.

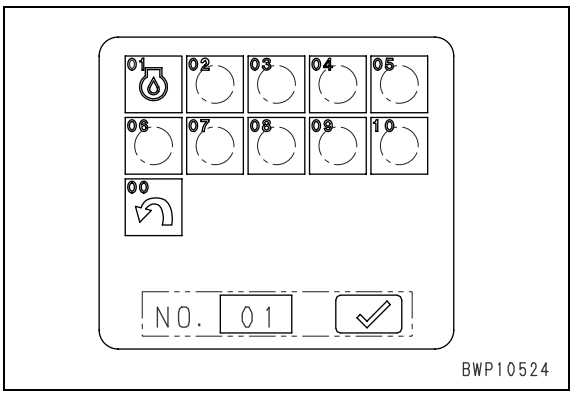
★ Note that the symbol mark and contents of display partially differ between the breaker and the other attachments.



10. Function for confirming maintenance information

Detailed information on maintenance items (set time and elapse of time) can be confirmed and resetting after the confirmation is feasible by operating the maintenance switch.

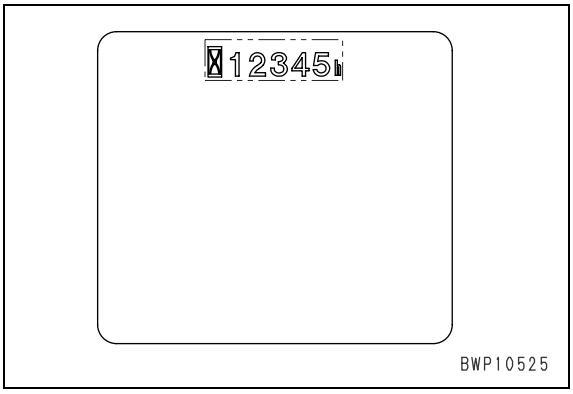
★ Use service Menu for setting or releasing maintenance items and setting maintenance time.



11. Function for showing service meter reading

Only the service meter reading can be shown by the following switching operation, when the engine starting switch is turned OFF.

- Switching operation: [↓] + [△] (synchronized switching operation)



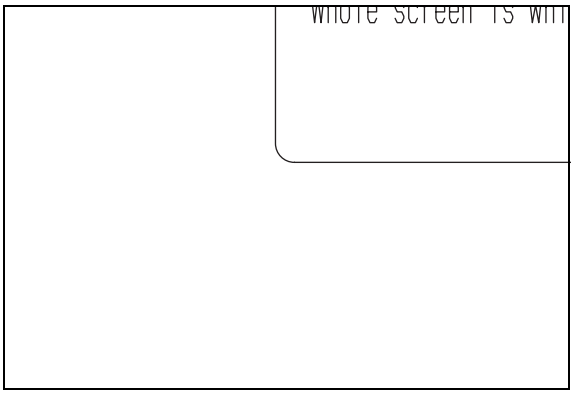
12. Function for checking display LCD

Display of the Display LCD can be confirmed by the following switching operation in the display of inputting and setting password as well as in the display of ordinary items

- Switching operation: [↓] + [A] (synchronized switching operation)

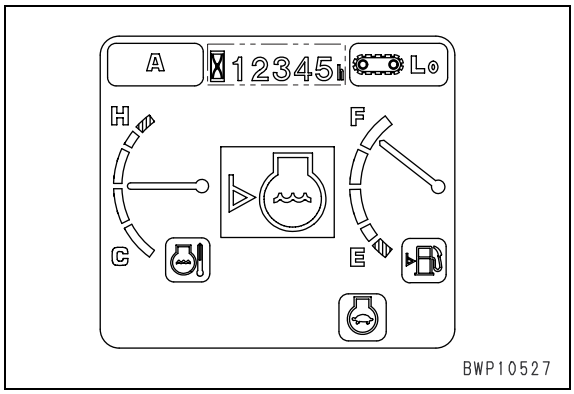
★ All the LCD light up, turning the entire screen white. If there is no showing in black, the display is normal.

★ This display returns to the immediately preceding one, if making any other switching operation.



13. Function for showing occurrence of caution item

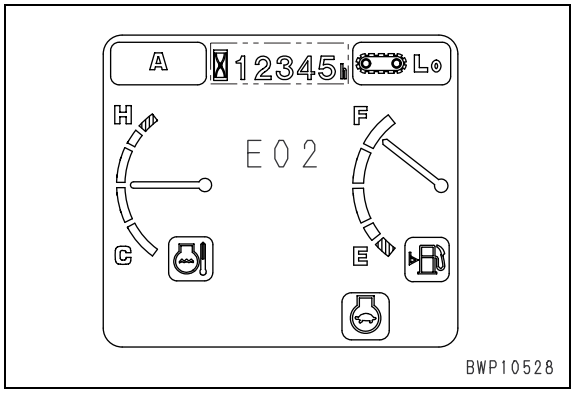
If any of the caution items occurs, the magnified corresponding symbol mark is shown for two seconds and thereafter stays on the display as a small symbol mark until it is dissolved.



14. Function for showing users' code No.

When a trouble occurs on the machine, the user's code is automatically displayed depending on the magnitude of the trouble to call attention of the operator for a proper action.

★ This display turns to the display of service code and failure code, if operating the switch (Refer to Item No. 15)



★ Relation between User Code and Action Directed to Operator

User Code	Failed System	Action Directed to Operator
E02	PC-EPC Valve	Ordinary work may be resumed by turning the emergency pump drive switch ON, but call for the inspection service immediately.
E03	Swing Brake	Release the brake after turning emergency swing and parking brake switch ON. When applying the swing brake, operate the swing lock switch manually. The swing brake may not be released depending on the nature of the trouble. In either case, call for the inspection service immediately.
E05	Governor	The governor control has become inoperable. Operate the governor control lever manually. For fixing the lever at full throttle position, use a fixing bolt provided at the bracket. In this case, call for the inspection service immediately.

15. Function for showing service code No. and failure code No.

If the following switching operation is made while the users' code No. is shown, a phone symbol (if registered), phone numbers (if registered), service code No. and failure code No. are shown in turn.

- Switching operation: [✓] (keep the switch depressed)

★ The following display is repeated in turn, while the switch is depressed.

① Telephone symbol mark

⇩

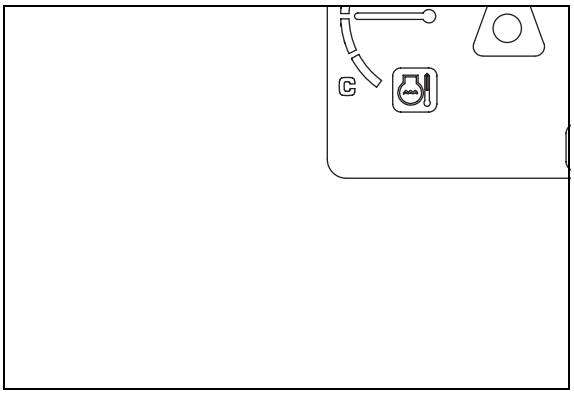
② Telephone No.

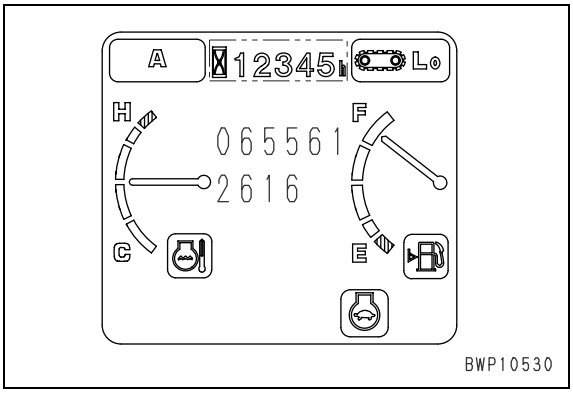
⇩

③ Service code No. and failure code No.

★ The telephone symbol mark and telephone No. are shown only when they are registered in the monitor panel.
For registration, correction and deletion of telephone No., use Service Menu.

★ For details on the displayed service code No. and failure code No., refer to the Table for Service and Failure Code Nos.





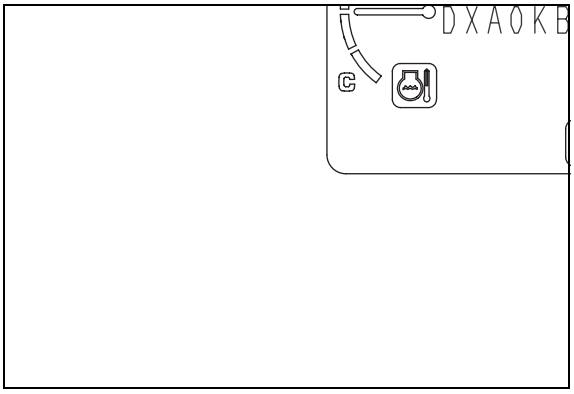


Table for Service and Failure Code Nos.

User Code No.	Service Code		Failure Code			Failure Classification
	Code No.	Content	Code No.	Location	Phenomenon	
–	E101	Abnormal data in error history	DAF0KT	Failure history	Abnormality in data	Electrical system
–	E112	Short circuit in wiper motor drive, normal rotation system	DY2DKB	Windshield wiper motor (normal rotation)	Short circuit	
–	E113	Short circuit in wiper motor drive, reverse rotation system	DY2EKB	Windshield wiper motor (reverse rotation)	Short circuit	
–	E114	Short circuit in windshield washer drive	DY2CKB	Windshield washer motor	Short circuit	
–	E115	Abnormality of windshield wiper in motion	DY20KA	Windshield wiper motor	Disconnection	
–	E116	Abnormality of windshield wiper in retraction	DY20MA	Windshield wiper motor	Malfunctioning	
–	E201	Short circuit in travel interconnection solenoid	DW91KB	Travel interlocking solenoid valve	Short circuit	
E03	E203	Short circuit in swing holding brake solenoid	DW45KB	Swing holding solenoid valve	Short circuit	
–	E204	Short circuit in merge/divide solenoid	DWJ0KB	Merge solenoid valve	Short circuit	
–	E205	Short circuit in 2-stage relief solenoid	DWK0KB	2-stage relief solenoid valve	Short circuit	
–	E206	Short circuit in travel speed shifting solenoid	DW43KB	Travel Hi-Lo shifting solenoid valve	Short circuit	
–	E211	Disconnection in travel interlocking solenoid	DW91KA	Travel interlocking solenoid valve	Disconnection	
E03	E213	Disconnection in swing holding brake solenoid	DW45KA	Swing holding solenoid valve	Disconnection	
–	E214	Disconnection in merge/divide solenoid	DWJ0KA	Merge solenoid valve	Disconnection	
–	E215	Disconnection in 2-stage relief solenoid	DWK0KA	2-stage relief solenoid valve	Disconnection	
–	E216	Disconnection in travel speed shifting solenoid	DW43KA	Travel Hi-Lo shifting solenoid valve	Disconnection	
–	E217	Abnormality in model code input	DA2SKQ	S_NET	Nonconformance in model selecting signal	
–	E218	Disconnection in S_NET signal	DA2SKA	S_NET	Disconnection	
–	E222	Short circuit in LS-EPC solenoid	DXE0KB	LS-EPC solenoid valve	Short circuit	
–	E223	Disconnection in LS-EPC solenoid	DXE0KA	LS-EPC solenoid valve	Disconnection	
–	E224	Abnormality in F pump pressure sensor	DHPAMA	F pump pressure sensor	Malfunctioning	
–	E225	Abnormality in R pump pressure sensor	DHPBMA	R pump pressure sensor	Malfunctioning	
–	E226	Abnormality in pressure sensor power source	DA25KP	Governor pump controller	Lowering in output voltage	
–	E227	Abnormality in engine revolution sensor	DLE2MA	Engine revolution sensor	Malfunctioning	
–	E228	Short circuit in ATT return switching relay	D196KB	ATT switching relay	Short circuit	
E02	E232	Short circuit in PC-EPC solenoid	DXA0KB	TVC solenoid valve	Short circuit	
E02	E233	Disconnection in PC-EPC solenoid	DXA0KA	TVC solenoid valve	Disconnection	
–	E238	Disconnection in ATT return switching relay	D196KA	ATT switching relay	Disconnection	
–	E245	Short circuit in ATT flow rate adjusting EPC	DXE4KB	ATT flow rate throttling EPC valve	Short circuit	
–	E246	Disconnection in ATT flow rate adjusting EPC	DXE4KA	ATT flow rate throttling EPC valve	Disconnection	
–	E256	Incorrect nonvolatile memory data	DA20KT	Nonvolatile memory	Abnormality in data	
–	E306	Abnormality in governor potentiometer	DK54KZ	Governor motor feedback potentiometer	Malfunctioning	
E05	E308	Abnormality in fuel dial	DK10KZ	Throttle potentiometer	Malfunctioning	
–	E315	Short circuit in battery relay output	D110KB	Battery relay	Short circuit	
–	E316	Abnormality in governor motor step-out	DY10K4	Governor motor	Out of control	

User Code No.	Service Code		Failure Code			Failure Classification
	Code No.	Content	Code No.	Location	Phenomenon	
E05	E317	Disconnection in both governor motors A and B	DY10KA	Governor motor	Disconnection	Electrical system
E05	E318	Short circuit in both governor motors A and B	DY10KB	Governor motor	Short circuit	
E50	E501	No setting in model selection	DA2AKM	Governor pump controller	Error in operation or setting	
E50	E502	Malfunction in model selecting signal	DA20KT	Governor pump controller	Abnormality in data	
E50	E511	Abnormality in boom angle sensor (short circuit in power source)	DKA0KB	Boom angle sensor	Short circuit	
–	None	Engine high idling out of rate	A000N1	Engine	Overrunning	Mechanical system
–	None	Engine low idling out of rate	A000N2	Engine	Low idling out of rate	
–	None	Air cleaner clogged	AA10NX	Air cleaner element	Clogging	
–	None	Charging voltage abnormally low	AB00KE	Alternator	Insufficient charging	
–	None	Engine oil pressure abnormally low	B@BAZG	Engine oil	Oil pressure lowered	
–	None	Engine oil level abnormally low	B@BAZK	Engine oil	Oil level lowered	
–	None	Engine cooling water overheated	B@BCNS	Engine cooling water	Overheating	
–	None	Radiator water level abnormally low	B@BCZK	Engine cooling water	Cooling water level lowered	
–	None	Hydraulic oil overheated	B@HANS	Hydraulic oil	Overheating	
–	None	Auto-lubrication system abnormal	DA80MA	Auto-lubrication system controller	Malfunction	

★ This table is arranged in the sequence of Service Code No.
★ In case there is no number assigned in the column of User Code No., or in case "none" is described in the column of Code No. of Service Code, the corresponding service code or failure code is not shown in the display of ordinary items, even if some abnormality occurs. It is recorded only in the failure history (either in electrical system or mechanical system) of Service Menu.
★ History Classification indicates that a specific failure is classified as belonging to either electrical system or mechanical system, when it is recorded in Service Menu.
★ "E" at the head of Code No. of Service Code means the following status of a specific failure.
- With "E": The failure is yet to be dissolved and continues.
- Without "E": The failure has already been dissolved.

Operation and Display of Service Menu

Way of switching to Service Menu

★ When using Service Menu, change the display to Service Menu display through the following special operation.

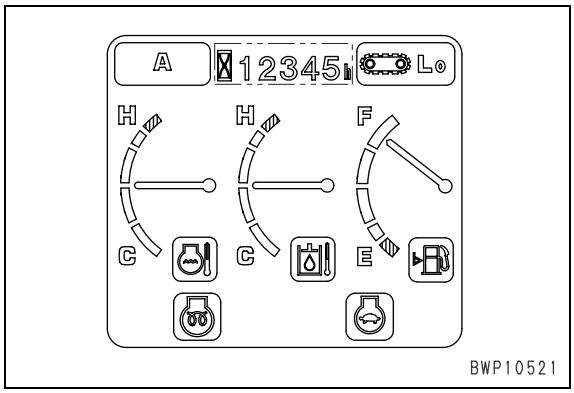
1) Confirmation of display
Confirm that the display of ordinary items is shown.
★ Changing to Service Menu cannot be made from displays other than this.

2) Switch operation
Operate the switch as instructed below.
• Switch operation: [△] + [1] → [2] → [3]
(Enter a figure, depressing [△])

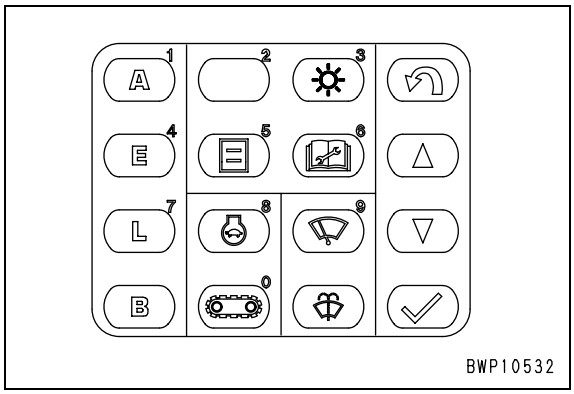
3) Showing Service Menu display
The display is changed to the initial display of Service Menu program. Select an appropriate item from among the menu.

No.	Service Menu
00	Return (Termination of Service Menu)
01	Monitoring
02	Abnormality Record
03	Maintenance Record
04	Maintenance Mode Change
05	Phone Number Entry
06	☆☆☆☆☆ / Default
07	Adjustment
08	–

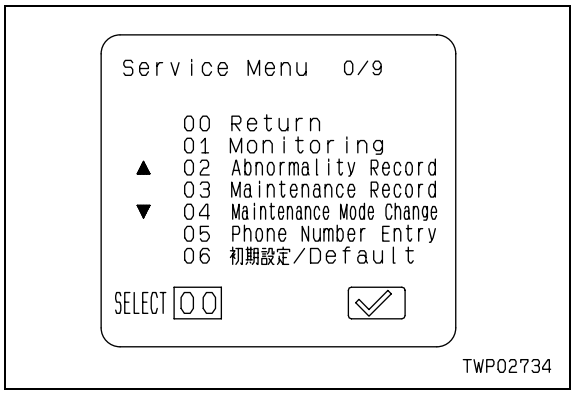
4) Termination of Service Menu function
When terminating the initial display or any subsequent display of Service Menu, do that through any one of the following methods.
① Depress [↩] switch. (This method may be used for terminating any display)
② If "Return" switch is shown, depress it.
③ If "Return" menu is shown, call that menu and depress [✓] switch.



BWP10521



BWP10532



TWP02734

16. Function of monitoring [01]

The monitor panel monitors signals from an assortment of switches, sensors and actuators installed in various parts of the machine. Monitored information can be put in display or confirmed on a real time basis through the following operations.

1) Selection of menu
Select "01 Monitoring" in the initial display of Service Menu and depress [✓] switch.

2) Setting of monitoring item
Select or register an item to be monitored through the following switch operation.

- [△] switch: Selection
- [▽] switch: Selection
- [✓] switch: Registration

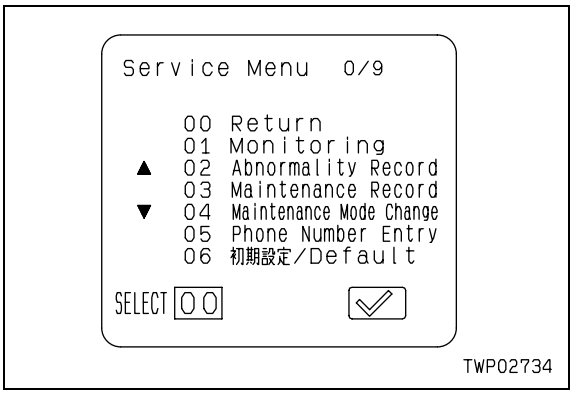
★ A monitoring item can be set in any number between the min. one to the max. four. (Depending upon the selected item, the max. number is less than four)

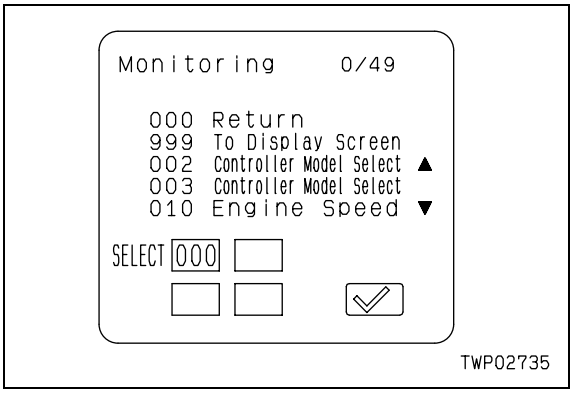
★ In case of monitoring 1 to 3 items, move to the monitored information display through any of the following switch operations, after the registration work has been completed.
  - Keep [✓] switch depressed. (For about 3 seconds)
  - Select Menu 999 and depress [✓] switch.

★ The display automatically moves to the display of monitored information, when all of the registrable items have been duly registered.

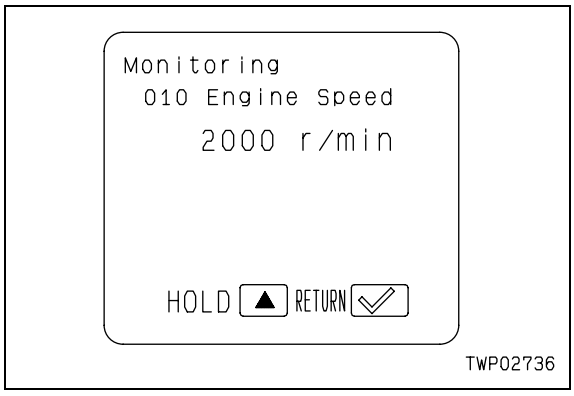
★ Monitored information are transmitted via communication circuits. Thus the number of selected items can impact the communication speed. If truly real time monitoring is required, reduce the selected items to the minimum.

★ For details on the monitoring items, display unit, etc., refer to the Table for Monitoring Items.

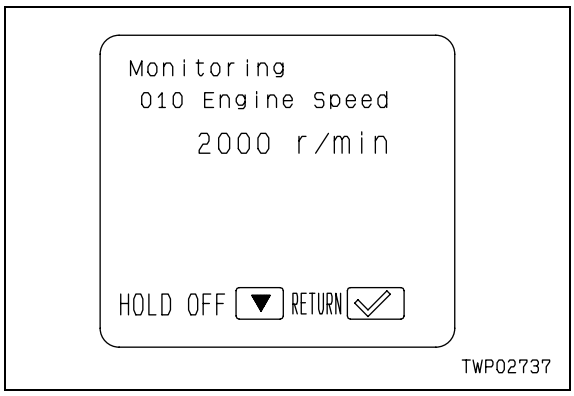




3) Monitoring operation
Call the monitoring information display and confirm the monitored information, while operating the machine.



4) Monitored information holding function
If [△] switch is depressed while monitoring, all the monitored information are put on hold. If [▽] switch is depressed in this condition, information holding is released.



5) Machine setting mode switching function
If it becomes necessary to change settings of working mode, select mode, travel speed and auto-decel while monitoring, depress the corresponding switch, then the mode confirmation display is shown.
★ An illustration at right shows the display in A mode and E mode. Symbol marks are partially different in B mode.
★ When a specific setting is confirmed, depress [✓] switch, then the display returns to that of monitoring.
★ In case a specific setting has been changed while monitoring, the new setting is still maintained when returning from Service Menu to Operator's Menu after the monitoring is finished.

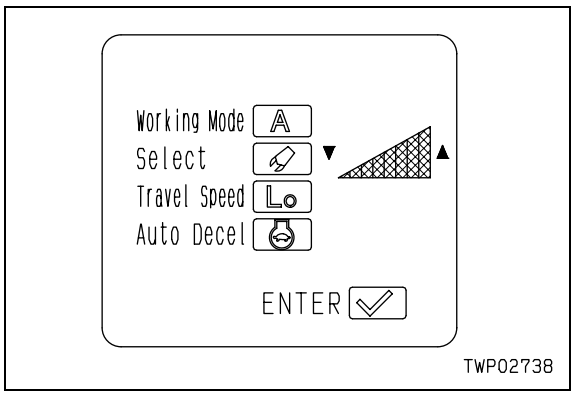


Table for Monitoring Items

Code No.	Item to be monitored		Unit (Default: ISO)			Remark
			ISO	Meter	Inch	
000	Return		(Not displayed)			Termination menu
999	To Display Screen		(Not displayed)			Execute Command menu
002	Controller Model Select		Figure			
003	Controller Model Select		Figure			
010	Engine Speed		r/min	rpm	rpm	
011	F Pump Pressure		MPa	kg/cm^2	psi	
012	R Pump Pressure		MPa	kg/cm^2	psi	
013	PC-EPC Sol. Curr.		mA	mA	mA	
015	LS-EPC Sol. Curr.		mA	mA	mA	
016	2nd Eng. Speed Command		r/min	rpm	rpm	
017	Service Sol. Curr.		mA	mA	mA	
019	Pressure Switch 1	Swing	ON/OFF			
		Travel	ON/OFF			
		Boom Lower	ON/OFF			
		Boom Raise	ON/OFF			
		Arm Curl	ON/OFF			
		Arm Dump	ON/OFF			
021	Pressure Switch 2	Bucket Curl	ON/OFF			
		Bucket Dump	ON/OFF			
		Offset	ON/OFF			(Not used)
		Service	ON/OFF			
		Travel Steering	ON/OFF			
022	Switch Input 1	Lever Sw.	ON/OFF			
		Swing Release Sw.	ON/OFF			
		Swing Brake Sw.	ON/OFF			
023	Solenoid valve 1	Travel Junction	ON/OFF			
		Swing Brake	ON/OFF			
		Merge-divider	ON/OFF			
		2-stage Relief	ON/OFF			
		Travel Speed	ON/OFF			
024	Solenoid valve 2	Service Return	ON/OFF			
027	Switch Input 2	Model Select 1	ON/OFF			
		Model Select 2	ON/OFF			
		Model Select 3	ON/OFF			
		Model Select 4	ON/OFF			
		Model Select 5	ON/OFF			
030	Fuel Dial Vol.		V	V	V	
031	Gov. Motor Potentio Vol.		V	V	V	
032	Battery Voltage		V	V	V	
033	Gov. Motor Phase A Curr.		mA	mA	mA	
034	Gov. Motor Phase B Curr.		mA	mA	mA	
035	Battery Relay O/P Vol.		V	V	V	
036	Switch Input 3	Key Switch	ON/OFF			
037	Controller Output	Batt. Relay Dr.	ON/OFF			
041	Engine Water Temperature		ºC	ºC	ºF	
042	Fuel Lever Sensor Vol.		V	V	V	

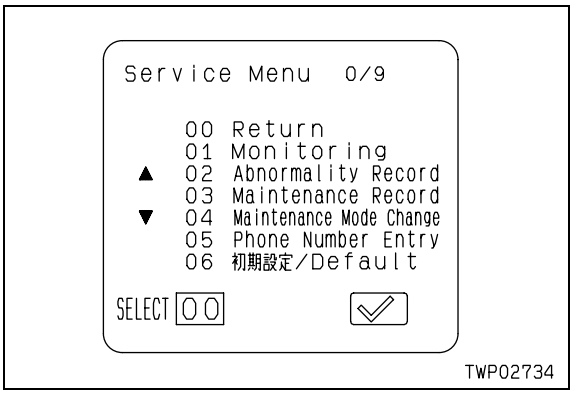
Code No.	Item to be monitored		Unit (Default: ISO)			Remark
			ISO	Meter	Inch	
043	Battery Charge Vol.		V	V	V	
044	Hydr. Oil Temperature		ºC	ºC	ºF	
045	Monitor Input 1	Key Switch	ON/OFF			
		Start	ON/OFF			
		Preheat	ON/OFF			
		Light	ON/OFF			
		Rad. level	ON/OFF			
046	Monitor Input 2	Aircleaner	ON/OFF			
		Eng. Oil Press.	ON/OFF			
		Eng. Oil Level.	ON/OFF			
		Spare	ON/OFF			
		Battery Charge	ABN•NOR			
049	Monitor Input 3	Swing Brake Sw.	ON/OFF			
		Buzzer cancel Sw.	ON/OFF			
		Window Limit Sw.	ON/OFF			
		W Limit Sw.	ON/OFF			
		P Limit Sw.	ON/OFF			
200	Monitor Prog. Version		Figure			
201	Controller Prog. Version		Figure			

★ Select the most favorite display unit from among the prepared three kinds, i.e. ISO, meter and inch. When changing one display unit for another, refer to "Unit" in the initial value setting of Service Menu.
★ Abbreviations, ABN and NOR, stand for the following conditions.
ABN: Abnormal, NOR: Normal

17. Function for Abnormality Record [02]

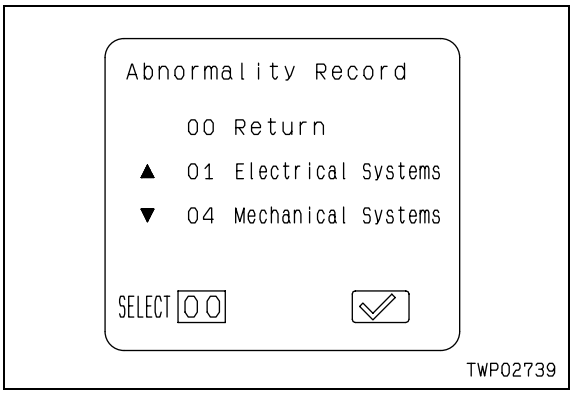
The monitor panel records failures that occurred on the machines in the past after classifying them into failures in the electric system and those in the mechanical system. Information on them can be displayed through the following operation.

1) Selection of menu
Select 02 Abnormality Record in the initial display of Service Menu and depress [✓] switch.

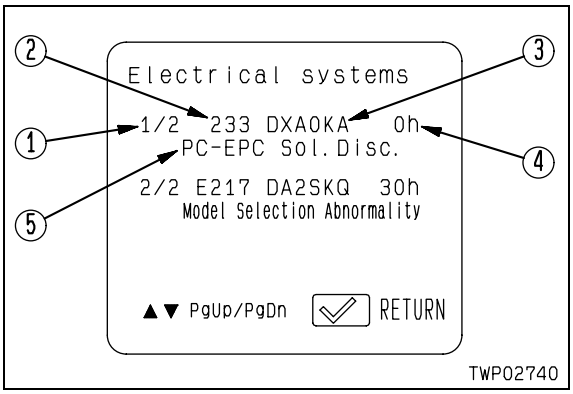


2) Selection of Submenu
Select an appropriate item from Submenu in the Abnormality Record display and depress [✓] switch.

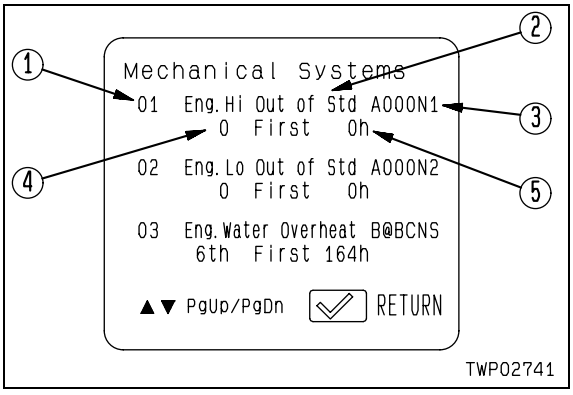
No.	Abnormality Record Submenu
00	Return (termination of Abnormality Record)
01	Electrical System
02	Mechanical Systems



3) Information shown in display of Abnormality Record in the electrical system
   ①: The numerator expresses sequence of failure occurrence, counting from the latest one. The denominator expresses the total number of a specific failure recorded.
   ②: Service Code
   ③: Abnormality Code No. (system in 4 digits and phenomenon in 2 digits)
   ④: Time elapsed since the occurrence of the first failure
   ⑤: Contents of failure
   ★ Refer to "Table for Service Code and Abnormality Code" in Operator's Menu.



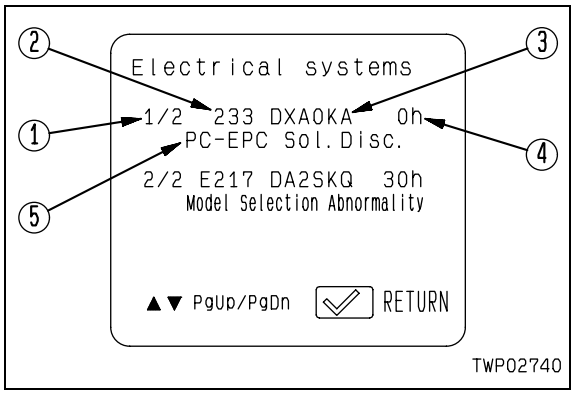
4) Information shown in display of Failure History in the mechanical systems
   ①: Record No.
   ②: Contents of Abnormality
   ③: Abnormality Code No. (system in 4 digits and phenomenon in 2 digits)
   ④: Total number of occurrence
   ⑤: Service meter reading at the initial occurrence
   ★ Refer to "Table for Service Code and Abnormality Code" in Operator's Menu.

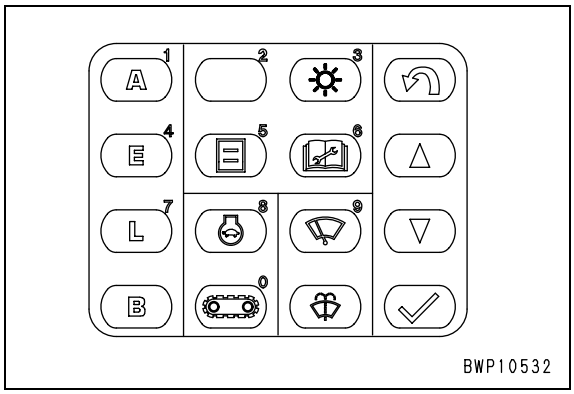


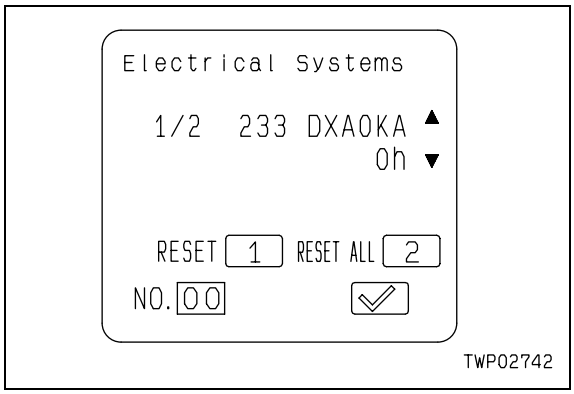
5) Resetting Electrical Systems
   - ★ Resetting Electrical Systems (deletion) is possible only with the electrical system. The failure history in the mechanical system cannot be reset.
   - ★ For resetting any specific or all information in the Electrical Systems, follow the operation explained below.

   i) Through the following switch operation, call the resetting display in the display of Electrical Systems.
      - Switch operation: [△] +[1] → [2] → [3]
      - ★ This is the same switch operation in changing the display to Service Menu.

   ii) Operate the switch, following the instructions shown in the resetting display.
      - ★ When resetting specific information only, call the display of that specific information and reset it with either [△] switch or [▽] switch.
      - ★ When resetting all the information, a display of any information will do.



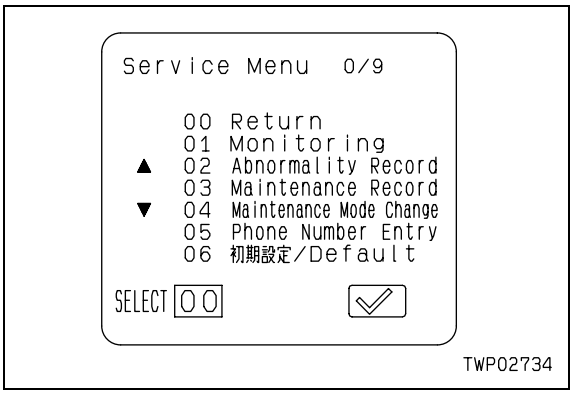




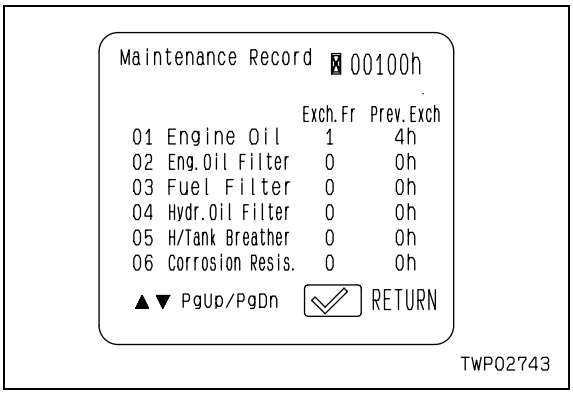
18. Function for Maintenance Record [03]

The monitor panel records information on the maintenance of filters and oils. The stored information can be displayed through the following switch operation.

1) Selection of menu
Select 03 Maintenance Record in Service Menu and depress [✓] switch.



2) Information to be displayed
①: Name of oils and filters
②: Times of replacement to date
③: Service meter reading at the latest replacement

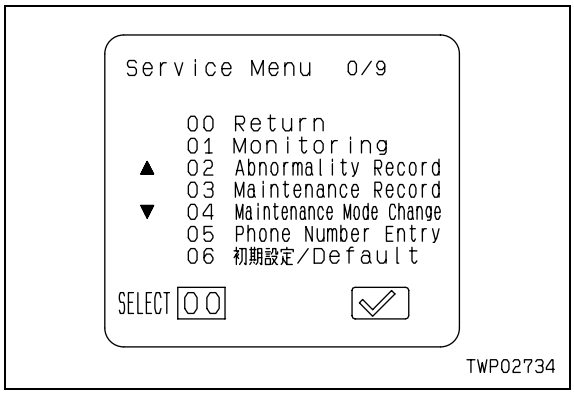


19. Function for Maintenance Mode Change [04]

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

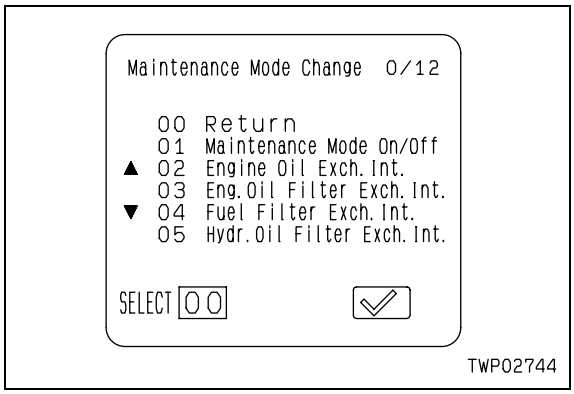
- Turn the function effectual or ineffectual.
- Change the set interval for replacement.

1) Selection of menu
Select 04 Maintenance Mode Change in the initial display of Service Menu, and depress [✓] switch.



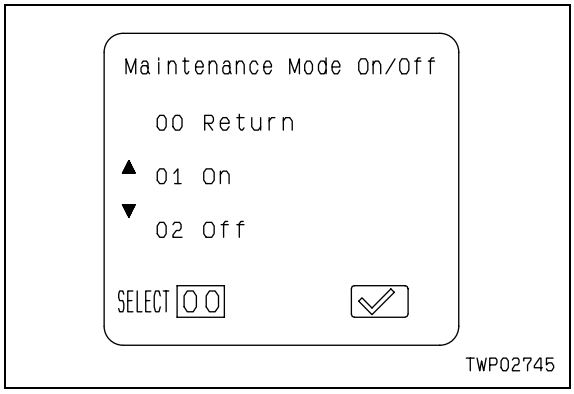
2) Selection of item to be changed
Select an item to be changed in the display of Maintenance Mode Change Selecting Menu.

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	Final Drive Oil Exch. Int.
10	S/Machinery Oil Exch. Int.
11	Hydraulic Oil Exch. Int.
12	Use Default Values



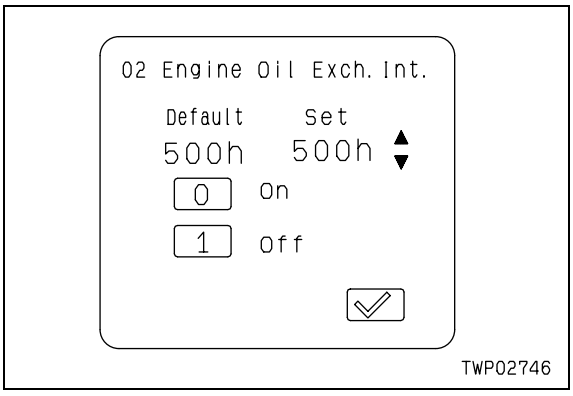
★ 01 and 12 menus are provided for setting the whole maintenance mode, while those from 02 through 11 are for setting individual items.

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)



4) Set contents of individual items
   ①: Default: The maintenance time set in the monitor (recommended by the manufacturer and cannot be changed).
   ②: Set: Maintenance time that can be freely set. The maintenance mode program functions based on this maintenance time. (The maintenance time can be increased or decreased by 50 hours with [△] or [▽] switch)
   ③: On: Maintenance display function with this instruction becomes effectual.
   ④: Off: Maintenance display with this instruction becomes ineffectual.
   ★ The lowest maintenance time is 50 h.

5) Set contents of "Use Default Values"
   When selecting this menu and depressing the switch [✓], all individual time settings are reduced to the initial settings.

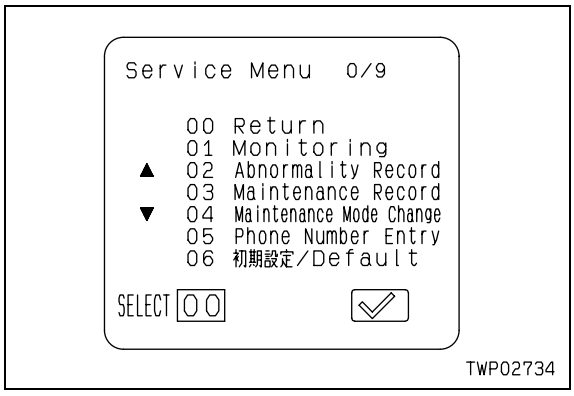


20. Function for Phone Number Entry [05]

In the display of User Code, a telephone number and Service Code are shown alternately. Phone number can be inputted or modified in the following manner.

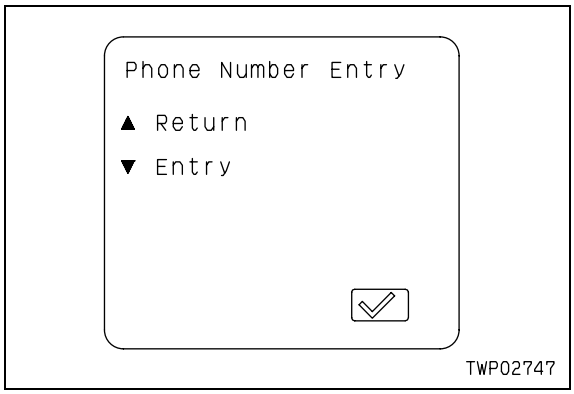
★ If there is no Phone number registered, the display for Phone numbers does not appear.

1) Selection of menu
Select 05 Phone Number Entry menu in the display of Service Menu, and depress [✓] switch.



2) Changing the display
Select Entry next to change the display to the Phone Number Entry display.

★ Even if a Phone number is already inputted, it is deleted, upon switching to the Phone Number Entry display.



3) Entry and setting Phone number
Following the method explained below, Entry a Phone number in the Phone Number Entry display. (Entry automatically begins with a cursor at the left end)

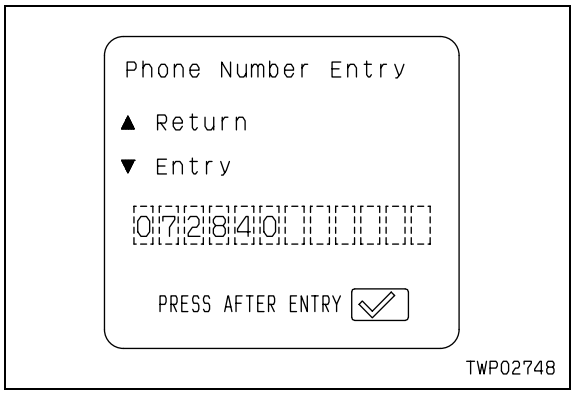
i) Enter a number into a cursor at the left end with a ten-key.

ii) Depress [✓] switch when all the numbers have been entered.

★ Numbers can be entered up to the max. 12 digits, but omit unnecessary digits.

★ When entering a wrong number, depress [B] switch, then the cursor goes back by one digit.

★ When input is finished, the display changes to Entry display shown above. If the inputted Phone number is shown in this display, the input is normal.



21. Function for ☆☆☆☆☆/Default [06]

It is possible to change the following settings for the monitor panel as well as the machine. Make a change as is required.

- Working mode when the engine starting switch is in the ON position.
- Display language in Service Menu
- Display unit in the monitoring function
- With/Without Service Cir.

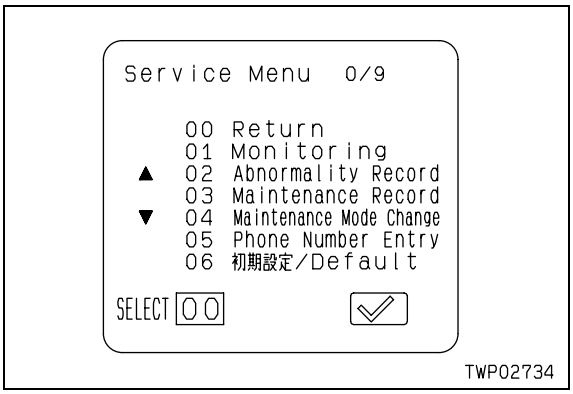
1) Selection of menu
Select 06 "☆☆☆☆☆/Default menu" in the initial display of Service Menu, and depress [✓] switch.

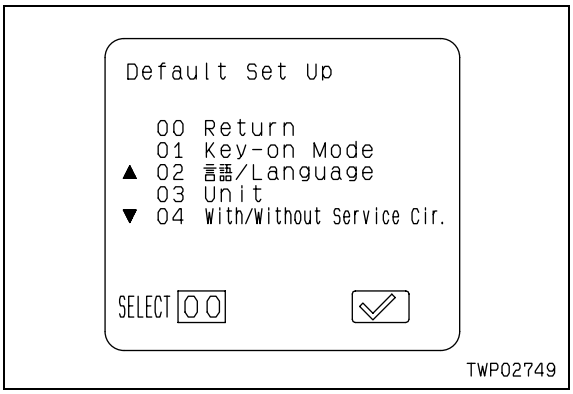
2) Selection of submenu
Select an item to change from the submenu, and depress [✓] switch.

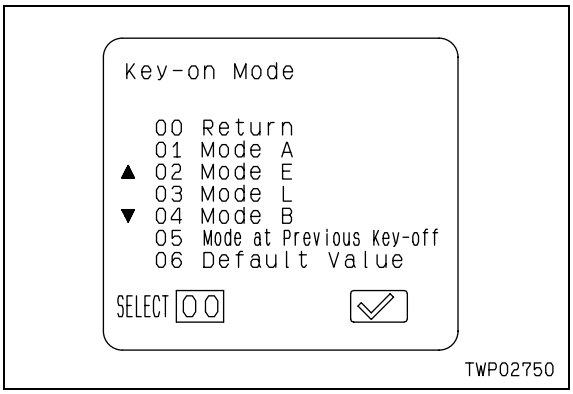
No.	☆☆☆☆☆/Default submenu
00	Return (termination of ☆☆☆☆☆/Default)
01	Key-on Mode
02	☆☆/Language
03	Unit
04	With/Without Service Cir.

3) Function for Key-on Mode
When the engine starting switch is turned ON, a working mode can be set that is shown in the monitor panel.
   - A, E, L and B Modes: If any of them is set, the machine always ramps up with that working mode, when turning the engine starting switch ON.
   - Mode at Previous Key-off: If this mode is set, the machine ramps up with the working mode that was last used in the previous machine operation.
   - Default Value: If this mode is set, the machine ramps up with the default mode (A mode) that was originally set at the time of delivery from the factory.

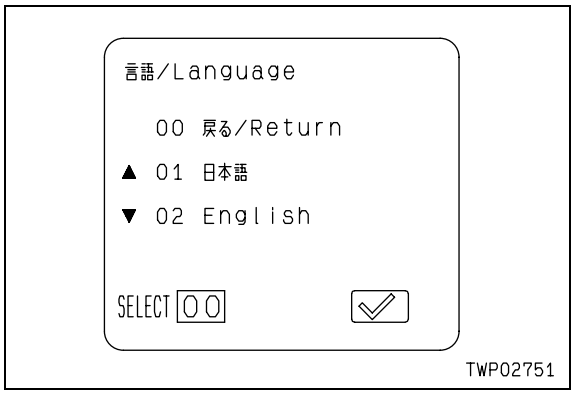
   ★ Irrespective of this setting mode, a machine "With attachment" always ramps up with B mode, when the engine starting switch is turned ON at the subsequent operation, if that was the working mode used in the last machine work.



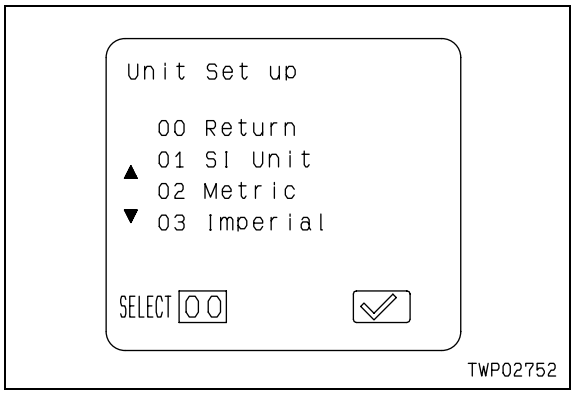




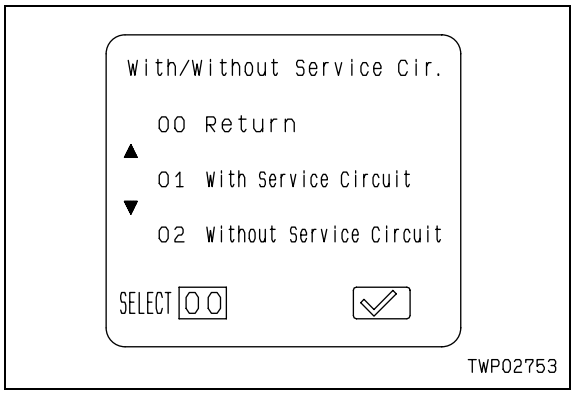
4) Function for ☆☆/Language
In Service Menu, the language in use can be changed between Japanese and English.
★ English is used as the language for default setting in the monitor panel.
★ If the monitor panel for spare parts is to be used in a Japanese-speaking region or organization, change the language from English to Japanese, using this function.



5) Function for unit selection
As the unit to be used in the monitoring function display of Service Menu, three kinds of unit are provided.
★ Unit used for default setting in the monitor panel is SI, i.e. International System of Units.



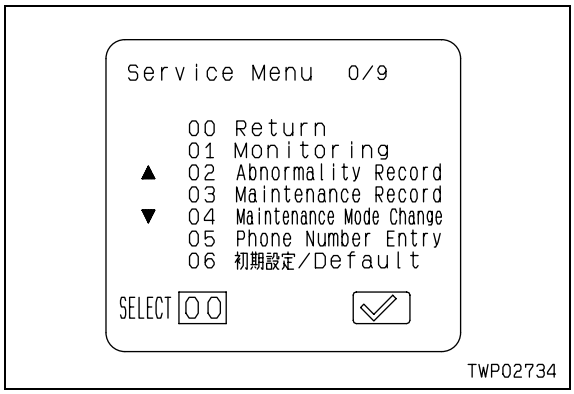
6) Function for selecting distinction of With/Without Service Cir.
It is possible in this function to set a distinction between with or without attachment.
• With Service Circuit: When an attachment is installed.
• Without Service Circuit: When no attachment is installed.
★ If "With Service Circuit" setting is not made in this display, while it is actually installed on a specific machine, SELECT function in Operator's Mode (attachment oil flow rate adjustment) cannot be utilized.



22. Function for Adjustment [07]

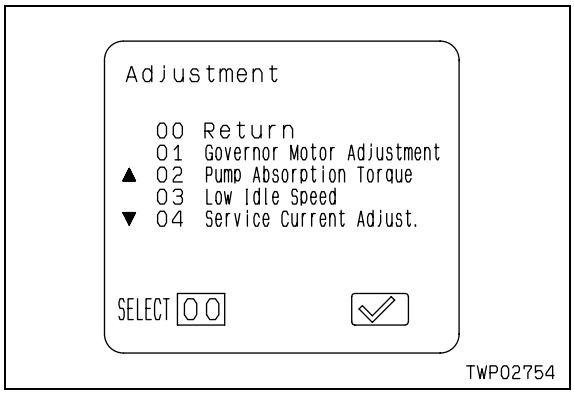
The monitor panel has a function of making various adjustments of the machine.

1) Selection of menu
   Select 07 adjustment in the initial display of Service Menu, and depress [✓] switch.

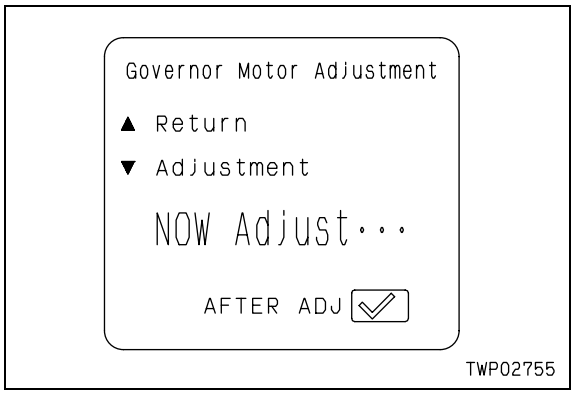


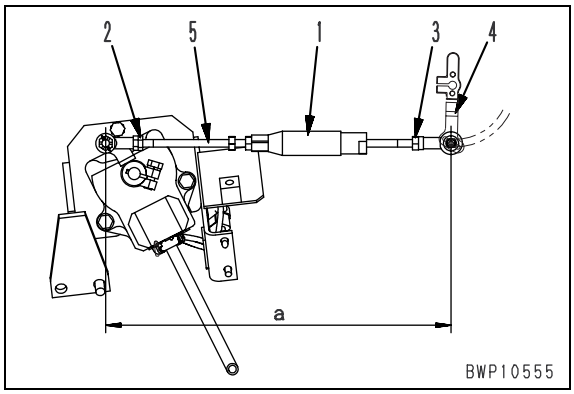
2) Selection of submenu
   Select an item to change from the submenu and depress [✓] switch.

No.	Adjustment submenu
00	Return (termination of adjustment)
01	Governor Motor Adjustment
02	Pump Absorption Torque
03	Low Idle Speed
04	Service Current Adjust.



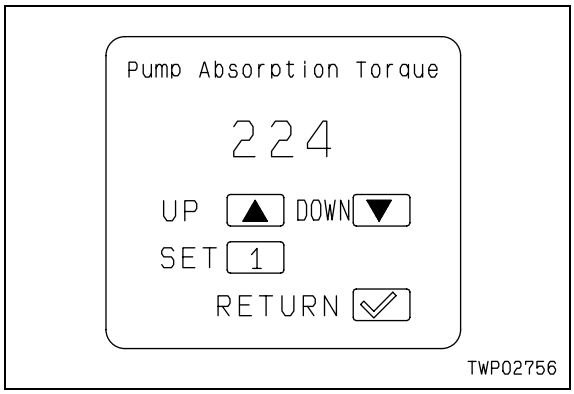
3) Function for Governor Motor Adjustment
   ★ When adjusting the securing position of governor actuator, fuel injection pump and governor spring, call this display and carry out the work in the following manner.
   i) Set the fuel dial at MAX.
      ★ In this condition, the governor actuator lever shifts to the full throttle. Hold this display while in adjustment.
   ii) Loosen nuts (2) and (3) of governor spring (1).
      ★ Nut (2) is of inverse thread (left).
   iii) Turn rod (5) so that governor lever (4) of the fuel injection pump contacts the full stopper.
   iv) Screw in rod (5) by 2 turns from this position to reduce distance **a** between the pin of governor spring (1).
      ★ Distance **a** between the pins is reduced by 5 mm.
   v) Tighten nuts (2) and (3).
      3 Nut:
      11.8–19.6 Nm{1.2–2.0 kgm}
   vi) Confirm that governor spring stretches by 4.0 mm, when the fuel dial is returned to the MIN position and operated to the MAX side again.





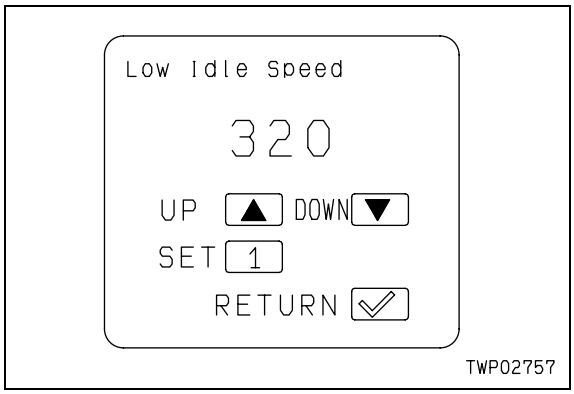
4) Function for Pump Absorption Torque adjustment
The pump absorption torque can be adjusted within the range shown in the table below.

Adjustment value	Torque adjustment value
220	+4.0 kgm
221	+3.0 kgm
222	+2.0 kgm
223	+1.0 kgm
224	0.0 kgm
225	–1.0 kgm
226	–2.0 kgm
227	–3.0 kgm
228	–4.0 kgm



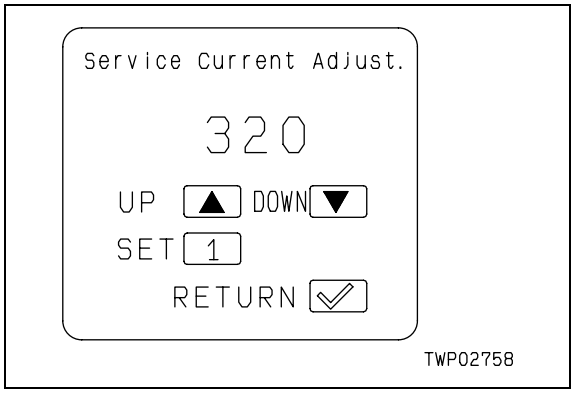
5) Function for Low Idle Speed adjustment
The engine rotation at low idling can be adjusted within the range shown in the table below.

Adjustment value	Low idling rotation
320	1,000 rpm
321	1,100 rpm
322	1,200 rpm
323	1,300 rpm



6) Function for Service Current Adjust.
When a machine is used for a compound operation, distribution of hydraulic pump oil flow can be adjusted within the range shown in the table below.

Adjustment value	Distribution of oil flow to attachment
320	0.5 Time
321	0.7 Time
322	1.0 Time
323	0.4 Time



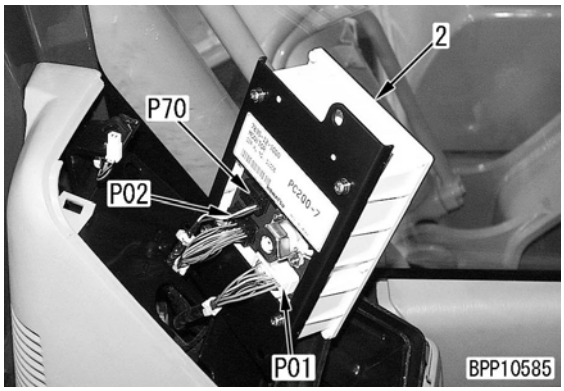
PREPARATIONS FOR TROUBLESHOOTING ELECTRICAL SYSTEM

★ 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) Take off cover (1).
   ★ The cover is fixed with two upper and lower clips. Pull it up for the removal.
   ★ If a sunlight sensor is equipped for an air conditioner, detach **P15** connector at the cover rear side.

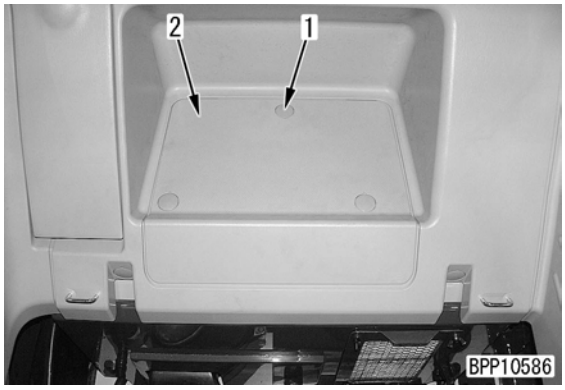
2) Remove three securing screws and take monitor panel (2) off the mount.
   ★ Be careful not to let fall the securing screws inside the console.
3) Insert or connect a T-adaptor for diagnosis with **P01**, **P02** and **P70** (multi-monitor only) connectors.



2. Governor pump controller

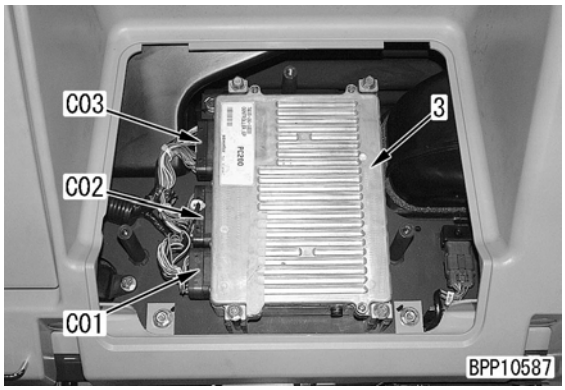
★ The governor pump controller is installed under a cover behind the operator's seat.

1) Remove three caps (1) and then three securing bolts.
   ★ When removing the caps, use of a thin flat-head screw driver is recommended.
2) Take off cover (2).



3) Insert or connect a T-adapter for diagnosis with **C01**, **C02** and **C03** connectors of governor pump controller (3).
   ★ 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.

3	Screw:	**2.82 Nm{0.288 kgm}**



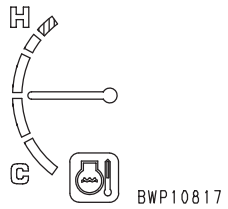
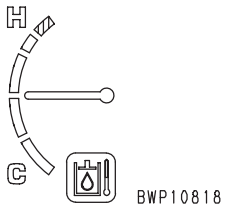
Pm - Tune up Service (PC210, PC210LC, PC210NLC-7)

Model	Serial No.	Service meter reading
☐PC210-7 ☐LC ☐NLC		h

User's name	Implemented on:	Inspected by:
	/ /	

Specifications		
Work equipment	Attachment	Shoe width
Boom ☐ Standard ☐ ( ) Arm ☐ Standard ☐ ( ) Bucket ☐ Standard ☐ ( )	☐ Breaker ☐ ( )	☐ 600 mm ☐ 700 mm ☐ ( )

Oil and cooling water level check		
☐ Radiator water	As required	
☐ Engine oil	☐ Damper case oil	☐ Final drive case oil
☐ Hydraulic oil	☐ Machinery case oil	☐ ( )

Max. range of engine cooling water temperature	Max. range of hydraulic oil temperature	Ambient temperature
		˚C Elevation m

Operator's comment

Result of visual check

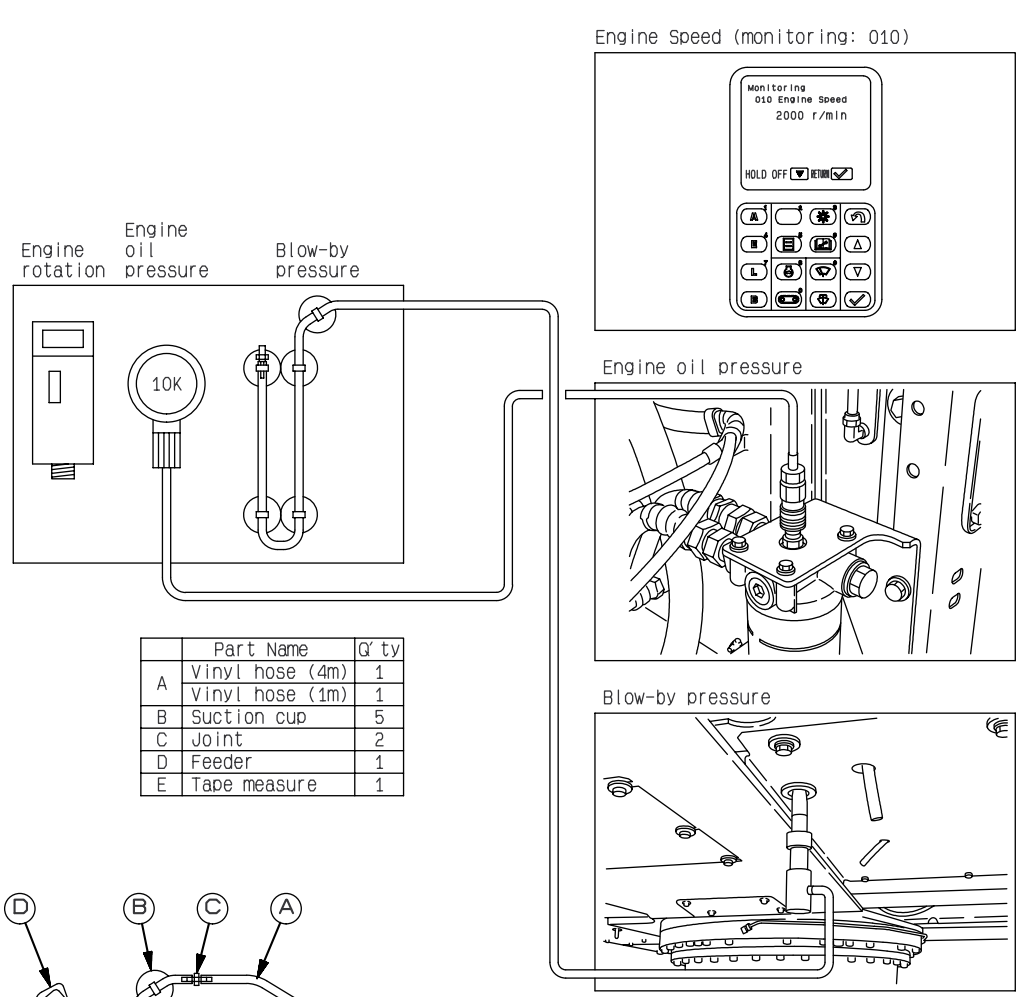
Failure code history	
Electrical system	Mechanical system

Electrical system

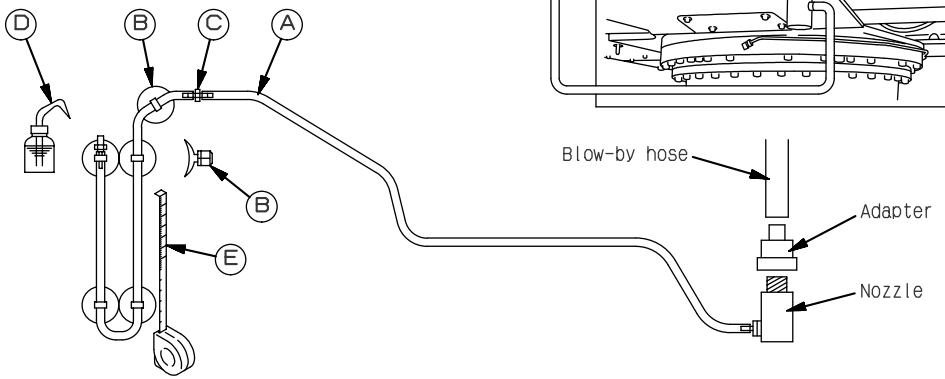
	h
Content:	
	h
Content:	
	h
Content:	
	h
Content:	
	h
Content:	

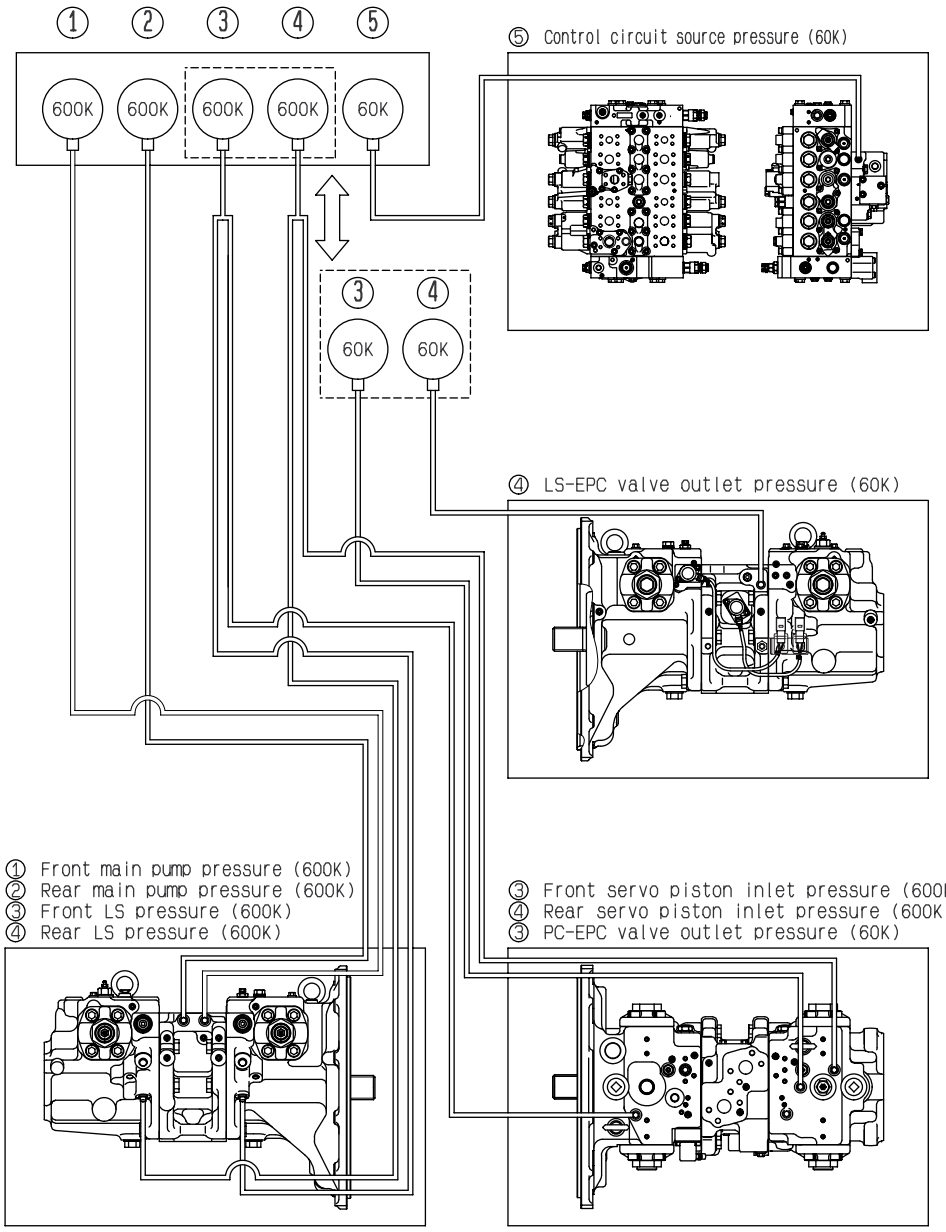
Mechanical system

		Frequency	SMR at initial occurrence
A000N1	Engine rotation at high idling out of rate		
A000N2	Engine rotation at low idling out of rate		
B@BCNS	Engine cooling water overheated		
B@BAZG	Engine oil pressure abnormally low		
B@BAZK	Engine oil level abnormally low		
B@HANS	Hydraulic oil overheated		
B@BCZK	Radiator water level abnormally low		
AA10NX	Air cleaner clogged		
AB00KE	Charging voltage abnormally low		
DA80MA	Auto-lubrication system abnormal		



	Part Name	Q'ty
A	Vinyl hose (4m)	1
	Vinyl hose (1m)	1
B	Suction cup	5
C	Joint	2
D	Feeder	1
E	Tape measure	1





TWP02759

Model	Serial No.	Service meter reading	Client user's name	Implemented on:	Inspected by:

1. Engine (PC210, 210LC, PC210NLC-7)

No.	Condition setting					Measurement item	Unit	Standard value		Measured value	Judgement
	Fuel dial	Working mode	Auto decelerator	One-touch power max. switch	Work equipment operation			New machine	Failure judgement		
1	Full	A	OFF	OFF	Operating travel control lever (Do not travel machine)	Engine rotation	rpm	2,080 – 2,220	—		Good / No good
2						Engine oil pressure	MPa{kg/cm²}	0.39 – 0.64{4.0 – 6.5}	0.25{2.6}		Good / No good
3	Low				All control levers in NEUTRAL	Engine rotation	rpm	980 – 1,080	—		Good / No good
4						Engine oil pressure	MPa{kg/cm²}	Min. 0.15{Min. 1.5}	0.09{2.9}		Good / No good
5	Full			ON	Arm (extended) relief	Engine rotation	rpm	1,800 – 2,000	—		Good / No good
6						Blow-by pressure	kPa{mmH$_2$O}	Max. 1.2{Max. 123}	5.1{520}		Good / No good
7			ON	OFF	All control levers in NEUTRAL	Engine rotation	rpm	1,300 – 1,500	—		Good / No good

2. Work equipment speed (PC210, 210LC, PC210NLC-7)

Hydraulic oil temperature (45 – 55°C)

No.	Condition setting			Measurement item			Unit	Standard value				Measured value	Judgement
								PC210-7		PC210LC,PC210NLC			
	Fuel dial	Working mode	Work equipment posture					New model	Failure judgement	New model	Failure judgement		
1	Full	A	No load, fully extended	Boom RAISE			Sec.	2.9 – 3.7	Max. 4.7	2.9 – 3.7	Max. 4.7		Good / No good
2			Boom held level	Arm DUMPING				2.4 – 3.0	Max. 3.5	2.4 – 3.0	Max. 3.5		Good / No good
3				Arm DIGGING				3.2 – 3.8	Max. 4.5	3.2 – 3.8	Max. 4.5		Good / No good
4		E						3.3 – 3.9	Max. 4.6	3.3 – 3.9	Max. 4.6		Good / No good
5		(※L)						5.8 – 7.0	Max. 7.4	5.8 – 7.0	Max. 7.4		Good / No good
6		A	Boom and arm held level	Bucket DIGGING				2.3 – 2.9	Max. 3.3	2.3 – 2.9	Max. 3.3		Good / No good
7			Fully extended	Swing (5 turns)		Right		21.7 – 26.7	Max. 30	21.7 – 26.7	Max. 30		Good / No good
						Left							Good / No good
8			Track shoe raised at one side	Travel (5 turns)	Lo	Right		46.2 – 56.4	46.2 – 60.4	50.3 – 61.5	50.3 – 65.5		Good / No good
						Left							Good / No good
					(※Mi)	Right		33.7 – 41.3	33.7 – 45.3	36.7 – 44.9	36.7 – 48.9		Good / No good
						Left							Good / No good
					Hi	Right		26.6 – 29.4	26.6 – 31.4	29.0 – 32.0	29.0 – 34.0		Good / No good
						Left							Good / No good

3. Work equipment hydraulic drift amount (PC210, 210LC, PC210NLC-7)

Hydraulic oil temperature (45 – 55°C)

No.	Condition setting			Measurement item	Unit	Standard value				Measured value	Judgement
						PC210-7		PC210LC, PC210NLC-7			
	Fuel dial	Working mode	Work equipment posture			New model	Failure judgement	New model	Failure judgement		
1	Engine stop		Boom and arm held level, Bucket loaded	Hydraulic drift amount at bucket tooth tip (15 min.)	mm	600	Max. 900	600	Max. 900		Good / No good

4. Inspection of hydraulic circuit (PC210, 210LC, PC210NLC-7)

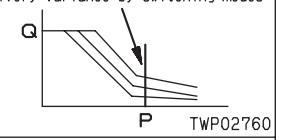
No.	Part to be checked	Condition setting: Fuel dial	Working mode	Auto-decelerator	One-touch power max. switch	Work equipment operation		① 600 kg/cm² F main pump	② 600 kg/cm² R main pump	③ 600 kg/cm² F pump LS	④ 600 kg/cm² R pump LS	⑤ 60 kg/cm² Control circuit pressure	Remarks
1	Self-decompression valve	Full	A	OFF	OFF	Arm dumping relief		■		■	■	►	Circuit pressure 3.2 MPa {33 kg/cm²}
2	Main relief valve											■	34.8 → 37.3 MPa
3	(When power increased)				ON							■	{355 → 380 kg/cm²}
4	LS valve (LS differential pressure valve)				OFF	Neutral						■	Main–LS=3.9 MPa{40 kg/cm²} (LS differential pressure ≒ Unload pressure)
						Travel without load, engine at Hi idling and control lever at half stroke	Right		■		■	■	Main–LS=2.2 MPa{22.0 kg/cm²} (LS pressure)
							Left	■		■		■	
5	Swing safety valve					Swing lock switch ON	(Right relief			■	■	■	30.9 MPa {315 kg/cm²}
							Left relief			■	■	■	
6	Main relief valve, Travel safety valve, Travel interlocking valve					Track shoe locked	Right forward		■	■	■	■	38.2 MPa {390 kg/cm²}
							Right reverse		■	■	■	■	
							Left forward	■		■	■	■	
							Left reverse	■		■	■	■	

■ Connection to be changed to hoses ③ and ④

No.	Part to be checked	Condition setting: Fuel dial	Working mode	Auto-decelerator	One-touch power max. switch	Work equipment operation	① 600 kg/cm² F main pump	② 600 kg/cm² R main pump	③ 600 kg/cm² F pump servo	④ 600 kg/cm² R pump servo	⑤ 60 kg/cm² Control circuit pressure	Remarks
7	Servo	Full	A	OFF	OFF	Arm dumping relief					■	Main servo pressure balance ③ / ① ≒ ④ / ② ≒ 3/5

■ Connection to be changed to hoses ③ and ④, and gauge to be replaced with one with 60 K capacity.

No.	Part to be checked	Condition setting: Fuel dial	Working mode	Auto-decelerator	One-touch power max. switch	Work equipment operation	① 600 kg/cm² F main pump	② 600 kg/cm² R main pump	③ 60 kg/cm² PC EPC	④ 60 kg/cm² LS EPC	⑤ 60 kg/cm² Control circuit pressure	Remarks <Reference value: kg/cm2>
8	PC-EPC valve	Low	A	OFF	OFF	Neutral	■	■		■	■	<34> Delivery variance by switching modes
		Full	A				■	■		■	■	< 3>
			E				■	■		■	■	<14>
			(※L)				■	■		■	■	<21>
			B				■	■		■	■	<16>
9	LS-EPC valve	Full	A	OFF	OFF	Neutral			■		■	At neutral: 2.9MPa {30kg/cm²}
			(※L)			Arm dumping relief			■		■	When 2 pumps relieved: 0MPa {0kg/cm²}
									■		■	When one pump relieved: 1.5MPa {15kg/cm²}



Pm - Tune up Service (PC240LC, PC240NLC-7)

Model	Serial No.	Service meter reading
☐ PC240LC-7 ☐ NLC		h

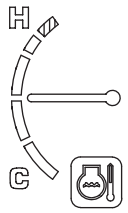
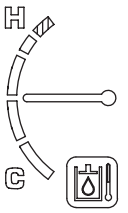
User's name	Implemented on:	Inspected by:
	/ /	

Specifications		
Work equipment	Attachment	Shoe width
Boom ☐ Standard ☐ ( ) Arm ☐ Standard ☐ ( ) Bucket ☐ Standard ☐ ( )	☐ Breaker ☐ ( )	☐ 600 mm ☐ 700 mm ☐ ( )

Oil and cooling water level check

☐ Radiator water
☐ Engine oil
☐ Hydraulic oil

As required
☐ Damper case oil
☐ Machinery case oil
☐ Final drive case oil
☐ ( )

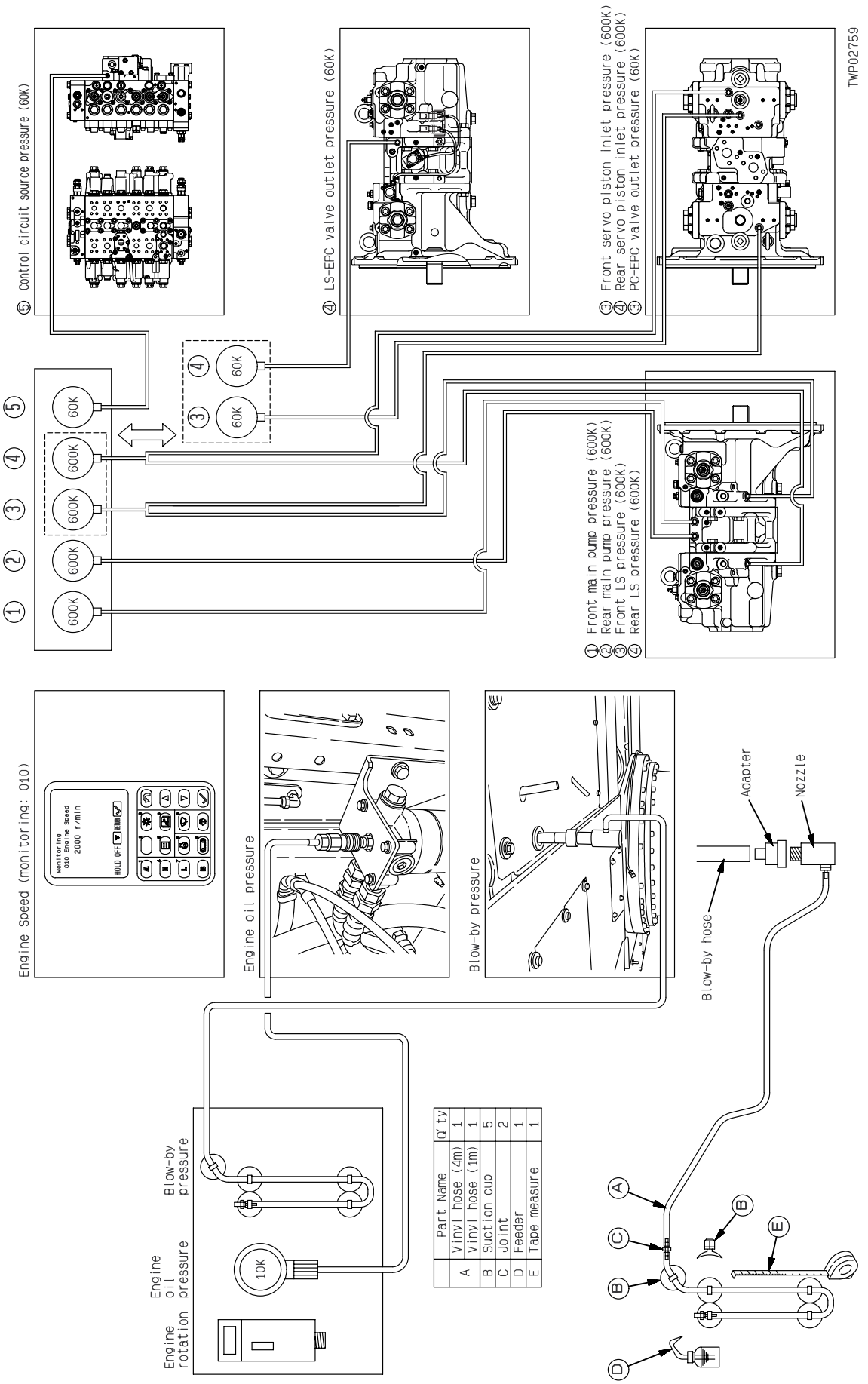
Max. range of engine cooling water temperature	Max. range of hydraulic oil temperature	Ambient temperature
 BWP10817	 BWP10818	˚C **Elevation** m

Operator's comment

Result of visual check

Failure code history

Electrical system	Mechanical system		
		Frequency	SMR at initial occurrence
h Content:	A000N1 Engine rotation at high idling out of rate		
h Content:	A000N2 Engine rotation at low idling out of rate		
h Content:	B@BCNS Engine cooling water overheated		
h Content:	B@BAZG Engine oil pressure abnormally low		
h Content:	B@BAZK Engine oil level abnormally low		
h Content:	B@HANS Hydraulic oil overheated		
	B@BCZK Radiator water level abnormally low		
	AA10NX Air cleaner clogged		
	AB00KE Charging voltage abnormally low		
	DA80MA Auto-lubrication system abnormal		


TWP02759
⑤ Control circuit source pressure (60K)
④ LS-EPC valve outlet pressure (60K)
③ ④ Front servo piston inlet pressure (600K)
Rear servo piston inlet pressure (600K)
③ PC-EPC valve outlet pressure (60K)
① ② ③ ④ ⑤
600K
60K
① ② ③ ④ Front main pump pressure (600K)
Rear main pump pressure (600K)
Front LS pressure (600K)
Rear LS pressure (600K)
Engine Speed (monitoring: 010)
Monitoring
010 Engine Speed
2000 r/min
HOLD OFF
Engine oil pressure
Blow-by pressure
Adapter
Nozzle
Blow-by hose
Engine rotation pressure
Engine oil pressure
Blow-by pressure
10K
Part Name
Q'ty
A Vinyl hose (4m) 1
Vinyl hose (1m) 1
B Suction cup 5
C Joint 2
D Feeder 1
E Tape measure 1
A
B
C
D
E

Model	Serial No.	Service meter reading	Client user's name	Implemented on:	Inspected by:

1. Engine (PC240LC, 240NLC-7)

No.	Condition setting					Measurement item	Unit	Standard value		Measured value	Judgement
	Fuel dial	Working mode	Auto decelerator	One-touch power max. switch	Work equipment operation			New machine	Failure judgement		
1	Full	A	OFF	OFF	Operating travel control lever (Do not travel machine)	Engine rotation	rpm	2,130 – 2,270	—		Good / No good
2						Engine oil pressure	MPa{kg/cm²}	0.39 – 0.64{4.0 – 6.5}	0.25{2.6}		Good / No good
3	Low				All control levers in NEUTRAL	Engine rotation	rpm	980 – 1,080	—		Good / No good
4						Engine oil pressure	MPa{kg/cm²}	Min. 0.15{Min. 1.5}	0.09{2.9}		Good / No good
5	Full			ON	Arm (extended) relief	Engine rotation	rpm	1,850 – 2,050	—		Good / No good
6						Blow-by pressure	kPa{mmH_2O}	Max. 1.2{Max. 123}	5.1{520}		Good / No good
7			ON	OFF	All control levers in NEUTRAL	Engine rotation	rpm	1,300 – 1,500	—		Good / No good

2. Work equipment speed (PC240LC, 240NLC-7)

Hydraulic oil temperature (45 – 55°C)

No.	Condition setting			Measurement item			Unit	Standard value				Measured value	Judgement
	Fuel dial	Working mode	Work equipment posture					PC240LC-7		PC240NLC-7			
								New model	Failure judgement	New model	Failure judgement		
1	Full	A	No load, fully extended	Boom RAISE			Sec.	3.1 – 3.9	Max. 4.9	3.1 – 3.9	Max. 4.9		Good / No good
2			Boom held level	Arm DUMPING				2.7 – 3.3	Max. 3.5	2.7 – 3.3	Max. 3.5		Good / No good
3				Arm DIGGING				3.4 – 4.2	Max. 4.5	3.4 – 4.2	Max. 4.5		Good / No good
4		E						—	—	—	—		Good / No good
5		(※L)						—	—	—	—		Good / No good
6		A	Boom and arm held level	Bucket DIGGING				2.6 – 3.2	Max. 3.3	2.6 – 3.2	Max. 3.3		Good / No good
7			Fully extended	Swing (5 turns)		Right		23.3 – 28.5	Max. 31	23.3 – 28.5	Max. 31		Good / No good
						Left							Good / No good
8			Track shoe raised at one side	Travel (5 turns)	Lo	Right		48.7 – 59.6	48.7 – 63.6	52.8 – 64.6	52.8 – 68.6		Good / No good
						Left							Good / No good
					(※Mi)	Right		35.6 – 43.6	35.6 – 47.6	38.6 – 47.2	38.6 – 51.2		Good / No good
						Left							Good / No good
					Hi	Right		26.7 – 29.5	26.7 – 31.5	28.9 – 31.9	28.9 – 33.9		Good / No good
						Left							Good / No good

※ : The "Mi" and "L" modes are on the multi-monitor specification machine only.

3. Work equipment hydraulic drift amount (PC240LC, 240NLC-7)

Hydraulic oil temperature (45 – 55°C)

No.	Condition setting			Measurement item	Unit	Standard value				Measured value	Judgement
	Fuel dial	Working mode	Work equipment posture			PC240LC-7		PC240NLC-7			
						New model	Failure judgement	New model	Failure judgement		
1	Engine stop		Boom and arm held level, Bucket loaded	Hydraulic drift amount at bucket tooth tip (15 min.)	mm	600	Max. 900	600	Max. 900		Good / No good

4. Inspection of hydraulic circuit (PC240LC, 240NLC-7)

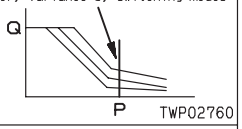
No.	Part to be checked	Condition setting						① 600 kg/cm²	② 600 kg/cm²	③ 600 kg/cm²	④ 600 kg/cm²	⑤ 60 kg/cm²	Remarks
		Fuel dial	Working mode	Auto-decelerator	One-touch power max. switch	Work equipment operation		F main pump	R main pump	F pump LS	R pump LS	Control circuit pressure	
1	Self-decompression valve	Full	A	OFF	OFF	Arm dumping relief		■		■	■		Circuit pressure 3.2 MPa {33 kg/cm²}
2	Main relief valve											■	34.8 → 37.3 MPa
3	(When power increased)				ON							■	{355 → 380 kg/cm²}
4	LS valve (LS differential pressure valve)				OFF	Neutral						■	Main–LS=3.9 MPa{40 kg/cm²} (LS differential pressure ≒ Unload pressure)
						Travel without load, engine at Hi idling and control lever at half stroke	Right		■		■	■	Main–LS=2.2 MPa{22.0 kg/cm²} (LS pressure)
							Left	■		■		■	
5	Swing safety valve					Swing lock switch ON	Right relief			■	■	■	30.9 MPa {315 kg/cm²}
							Left relief			■	■	■	
6	Main relief valve, Travel safety valve, Travel interlocking valve					Track shoe locked	Right forward		■	■	■	■	38.7 MPa {395 kg/cm²}
							Right reverse		■	■	■	■	
							Left forward	■		■	■	■	
							Left reverse	■		■	■	■	

■ Connection to be changed to hoses ③ and ④

No.	Part to be checked	Condition setting					① 600 kg/cm²	② 600 kg/cm²	③ 600 kg/cm²	④ 600 kg/cm²	⑤ 60 kg/cm²	Remarks
		Fuel dial	Working mode	Auto-decelerator	One-touch power max. switch	Work equipment operation	F main pump	R main pump	F pump servo	R pump servo	Control circuit pressure	
7	Servo	Full	A	OFF	OFF	Arm dumping relief					■	Main servo pressure balance ③ / ① ≒ ④ / ② ≒ 3/5

■ Connection to be changed to hoses ③ and ④, and gauge to be replaced with one with 60 K capacity.

No.	Part to be checked	Condition setting					① 600 kg/cm²	② 600 kg/cm²	③ 60 kg/cm²	④ 60 kg/cm²	⑤ 60 kg/cm²	Remarks <Reference value: kg/cm2>
		Fuel dial	Working mode	Auto-decelerator	One-touch power max. switch	Work equipment operation	F main pump	R main pump	PC EPC	LS EPC	Control circuit pressure	
8	PC-EPC valve	Low	A	OFF	OFF	Arm dumping relief	■	■		■	■	<34> Delivery variance by switching modes
		Full	A				■	■		■	■	< 3>
			E				■	■		■	■	<14>
			(※ L)				■	■		■	■	<21>
			B				■	■		■	■	<16>
9	LS-EPC valve	Full	A	OFF	OFF	Neutral			■		■	At neutral: 2.9MPa {30kg/cm²}
						Arm dumping relief			■		■	When 2 pumps relieved: 0MPa {0kg/cm²}
			(※ L)						■		■	When one pump relieved: 1.5MPa {15kg/cm²}



※ : The "L" mode is on the multi-monitor specification machine only.

TROUBLESHOOTING

POINTS TO REMEMBER WHEN TROUBLESHOOTING

- Stop the machine in a level place, and check that the safety pin, blocks, and parking brake are securely fitted.
- When carrying out the operation with two or more workers, keep strictly to the agreed signals, and do not allow any unauthorized person to come near.
- If the radiator cap is removed when the engine is hot, hot water may spurt out and cause burns, so wait for the engine to cool down before starting troubleshooting.
- Be extremely careful not to touch any hot parts or to get caught in any rotating parts.
- When disconnecting wiring, always disconnect the negative (–) terminal of the battery first.
- When removing the plug or cap from a location which is under pressure from oil, water, or air, always release the internal pressure first. When installing measuring equipment, be sure to connect it properly.

The aim of troubleshooting is to pinpoint the basic cause of the failure, to carry out repairs swiftly, and to prevent reoccurrence of the failure.
When carrying out troubleshooting, and important point is of course to understand the structure and function.
However, a short cut to effective troubleshooting is to ask the operator various questions to form some idea of possible causes of the failure that would produce the reported symptoms.

1. When carrying out troubleshooting, do not hurry to disassemble the components.
If components are disassembled immediately any failure occurs:
- Parts that have no connection with the failure or other unnecessary parts will be disassembled.
- It will become impossible to find the cause of the failure.

It will also cause a waste of manhours, parts, or oil or grease, and at the same time, will also lose the confidence of the user or operator.
For this reason, when carrying out troubleshooting, it is necessary to carry out thorough prior investigation and to carry out troubleshooting in accordance with the fixed procedure.

2. Points to ask user or operator
1) Have any other problems occurred apart from the problem that has been reported?
2) Was there anything strange about the machine before the failure occurred?
3) Did the failure occur suddenly, or were there problems with the machine condition before this?
4) Under what conditions did the failure occur?
5) Had any repairs been carried out before the failure?
When were these repairs carried out?
6) Has the same kind of failure occurred before?

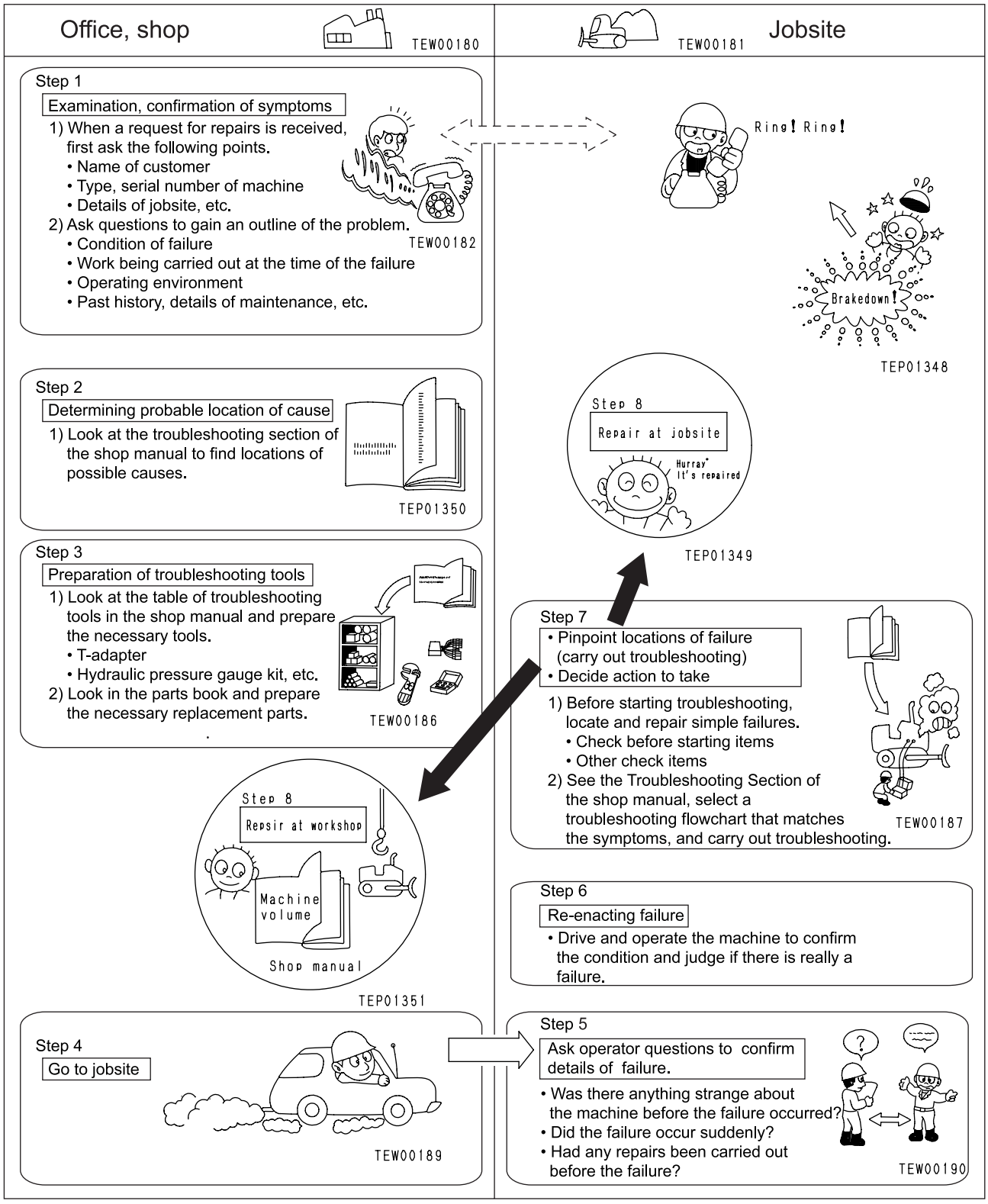
3. Check before troubleshooting
1) Check the oil level
2) Check for any external leakage of oil from the piping or hydraulic equipment.
3) Check the travel of the control levers.
4) Check the stroke of the control valve spool.
5) Other maintenance items can be checked externally, so check any item that is considered to be necessary.

4. Confirming failure
- Confirm the extent of the failure yourself, and judge whether to handle it as a real failure or as a problem with the method of operation, etc.
  - ★ When operating the machine to reenact the troubleshooting symptoms, do not carry out any investigation or measurement that may make the problem worse.

5. Troubleshooting
- Use the results of the investigation and inspection in Items 2 – 4 to narrow down the causes of failure, then use the troubleshooting flowchart to locate the position of the failure exactly.
  - ★ The basic procedure for troubleshooting is as follows.
    1)Start from the simple points.
    2)Start from the most likely points.
    3)Investigate other related parts or information.

6. Measures to remove root cause of failure
- Even if the failure is repaired, if the root cause of the failure is not repaired, the same failure will occur again.
To prevent this, always investigate why the problem occurred. Then, remove the root cause.

SEQUENCE OF EVENTS IN TROUBLESHOOTING



POINTS TO REMEMBER WHEN CARRYING OUT MAINTENANCE

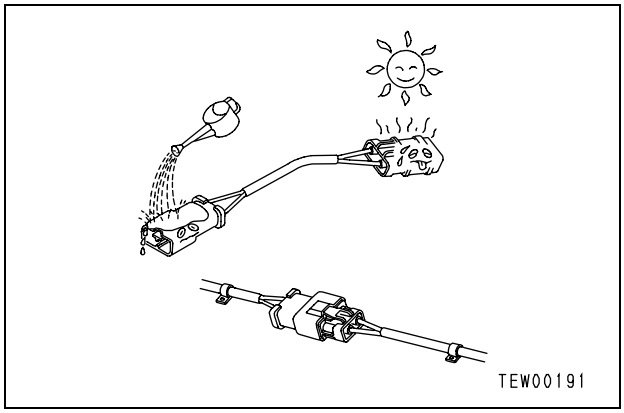
To maintain the performance of the machine over a long period, and to prevent failures or other troubles before they occur, correct operation, maintenance and inspection, troubleshooting, and repairs must be carried out. This section deals particularly with correct repair procedures for mechatronics and is aimed at improving the quality of repairs. For this purpose, it gives sections on "Handling electric equipment" and "Handling hydraulic equipment" (particularly gear oil and hydraulic oil).

1. Points to remember when handling electric equipment

1) Handling wiring harnesses and connectors

Wiring harnesses consist of wiring connecting one component to another component, connectors used for connecting and disconnecting one wire from another wire, and protectors or tubes used for protecting the wiring.

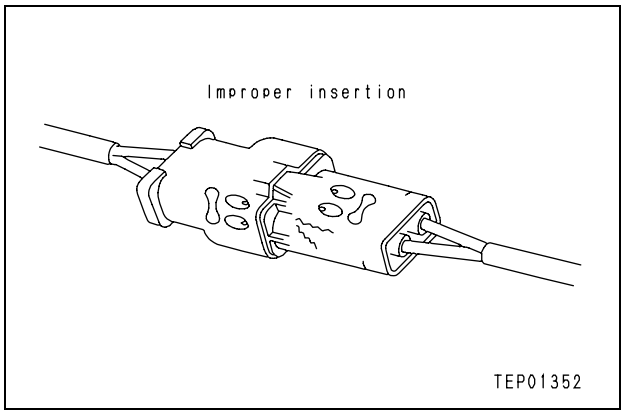
Compared with other electrical components fitted in boxes or cases, wiring harnesses are more likely to be affected by the direct effects of rain, water, heat, or vibration. Furthermore, during inspection and repair operations, they are frequently removed and installed again, so they are likely to suffer deformation or damage. For this reason, it is necessary to be extremely careful when handling wiring harnesses.



Main failures occurring in wiring harness

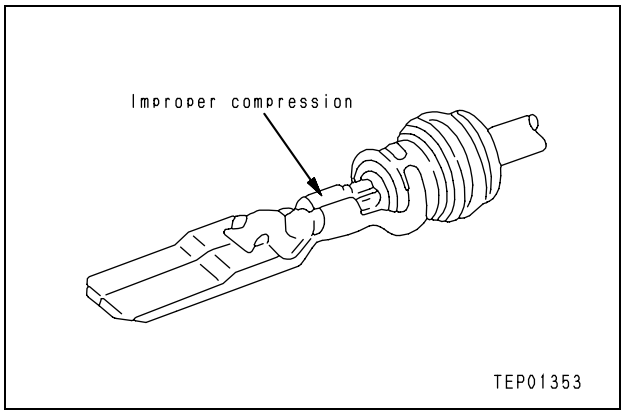
1) Defective contact of connectors (defective contact between male and female)

Problems with defective contact are likely to occur because the male connector is not properly inserted into the female connector, or because one or both of the connectors is deformed or the position is not correctly aligned, or because there is corrosion or oxidization of the contact surfaces.

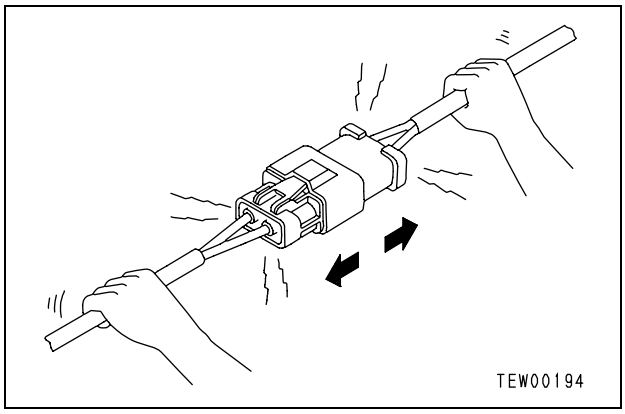


2) Defective crimping or soldering of connectors

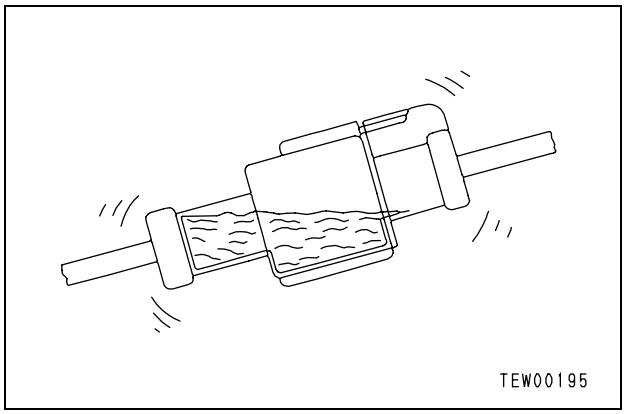
The pins of the male and female connectors are in contact at the crimped terminal or soldered portion, but if there is excessive force brought to bear on the wiring, the plating at the joint will peel and cause improper connection or breakage.



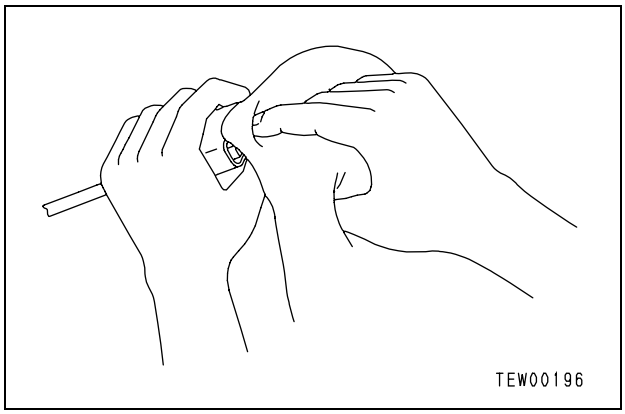
3) Disconnections in wiring
If the wiring is held and the connectors are pulled apart, or components are lifted with a crane with the wiring still connected, or a heavy object hits the wiring, the crimping of the connector may separate, or the soldering may be damaged, or the wiring may be broken.



4) High-pressure water entering connector
The connector is designed to make it difficult for water to enter (drip-proof structure), but if high-pressure water is sprayed directly on the connector, water may enter the connector, depending on the direction of the water jet.
As already said, the connector is designed to prevent water from entering, but at the same time, if water does enter, it is difficult for it to be drained. Therefore, if water should get into the connector, the pins will be short-circuited by the water, so if any water gets in, immediately dry the connector or take other appropriate action before passing electricity through it.

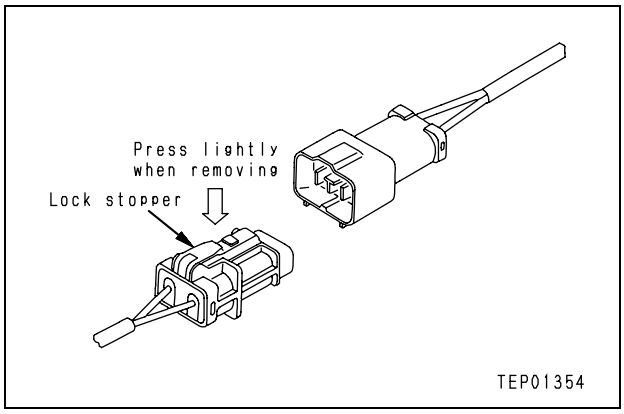


5) Oil or dirt stuck to connector
If oil or grease are stuck to the connector and an oil film is formed on the mating surface between the male and female pins, the oil will not let the electricity pass, so there will be defective contact.
If there is oil or grease stuck to the connector, wipe it off with a dry cloth or blow it dry with compressed air and spray it with a contact restorer.
- ★ When wiping the mating portion of the connector, be careful not to use excessive force or deform the pins.
- ★ If there is oil or water in the compressed air, the contacts will become even dirtier, so remove the oil and water from the compressed air completely before cleaning with compressed air.

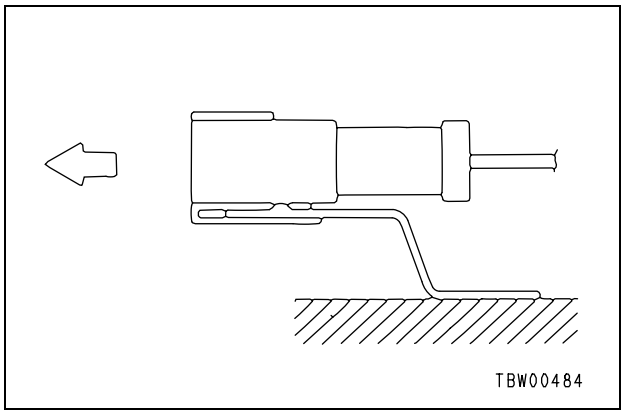


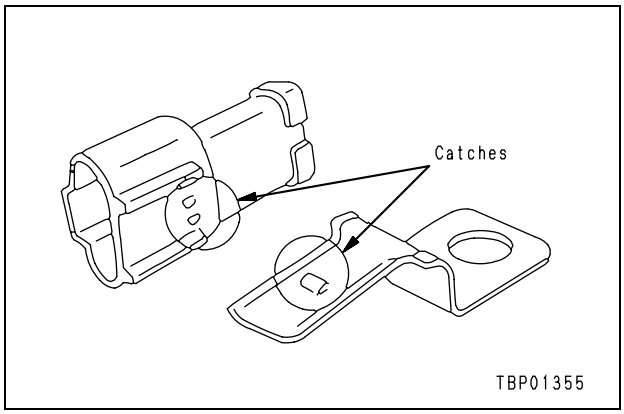
2) Removing, installing, and drying connectors and wiring harnesses

- **Disconnecting connectors**
  1) Hold the connectors when disconnecting.
     When disconnecting the connectors, hold the connectors and not the wires. For connectors held by a screw, loosen the screw fully, then hold the male and female connectors in each hand and pull apart. For connectors which have a lock stopper, press down the stopper with your thumb and pull the connectors apart.
     ★ Never pull with one hand.

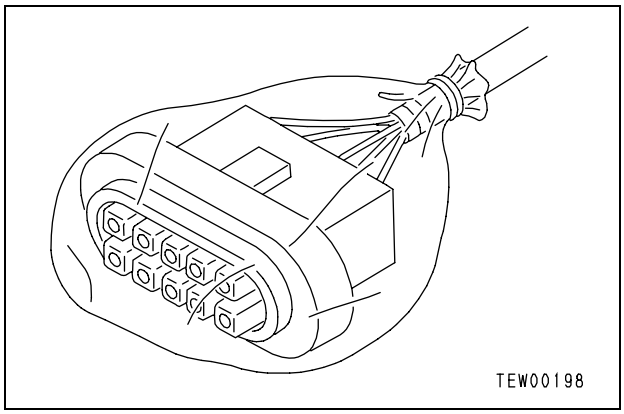


  2) When removing from clips
     When removing a connector from a clip, pull the connector in a parallel direction to the clip.
     ★ If the connector is twisted up and down or to the left or right, the housing may break.





  3) Action to take after removing connectors
     After removing any connector, cover it with a vinyl bag to prevent any dust, dirt, oil, or water from getting in the connector portion.
     ★ If the machine is left disassembled for a long time, it is particularly easy for improper contact to occur, so always cover the connector.



- **Connecting connectors**
  1) Check the connector visually.
     1) Check that there is no oil, dirt, or water stuck to the connector pins (mating portion).
     2) Check that there is no deformation, defective contact, corrosion, or damage to the connector pins.
     3) Check that there is no damage or breakage to the outside of the connector.

     ★ If there is any oil, water, or dirt stuck to the connector, wipe it off with a dry cloth. If any water has got inside the connector, warm the inside of the wiring with a dryer, but be careful not to make it too hot as this will cause short circuits.

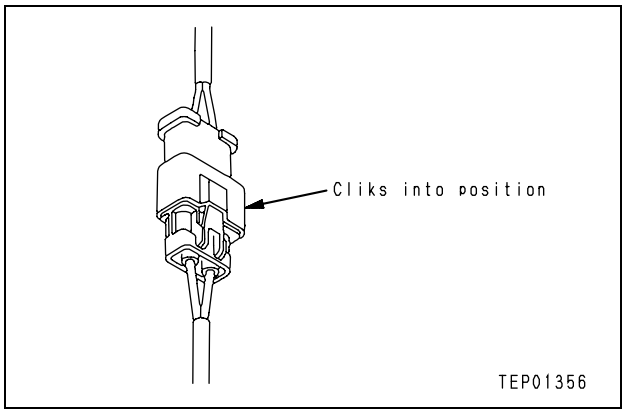
     ★ If there is any damage or breakage, replace the connector.

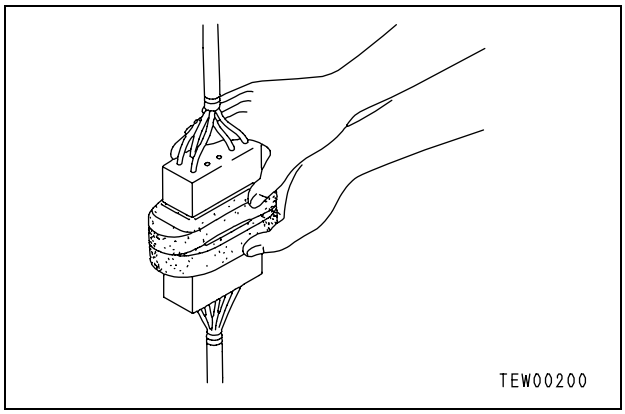
  2) Fix the connector securely.
     Align the position of the connector correctly, then insert it securely.
     For connectors with lock stopper, push in the connector until the stopper clicks into position.

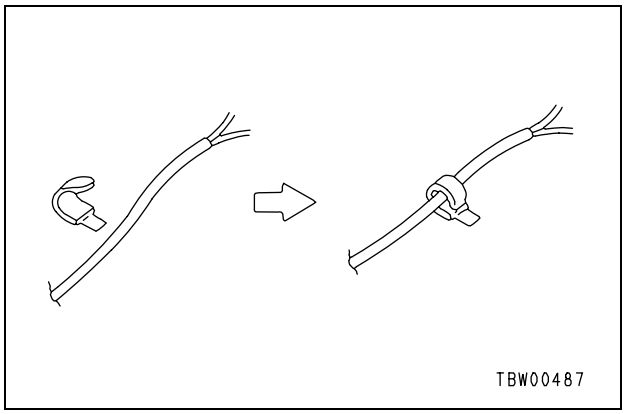
  3) Correct any protrusion of the boot and any misalignment of the wiring harness
     For connectors fitted with boots, correct any protrusion of the boot. In addition, if the wiring harness is misaligned, or the clamp is out of position, adjust it to its correct position.

     ★ If the connector cannot be corrected easily, remove the clamp and adjust the position.

  4) If the connector clamp has been removed, be sure to return it to its original position. Check also that there are no loose clamps.



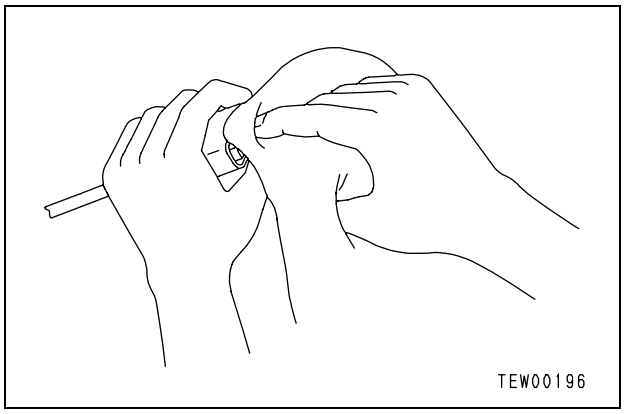




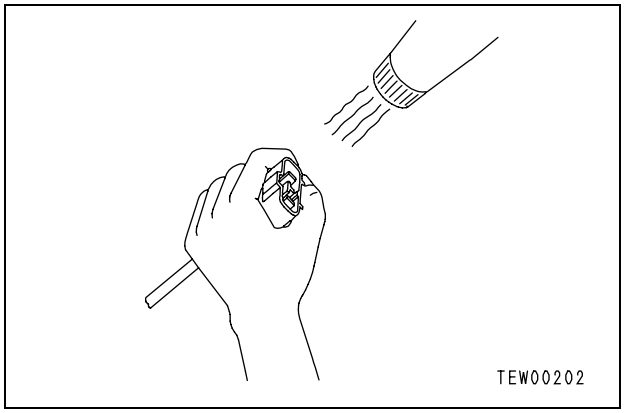
- **Drying wiring harness**
  If there is any oil or dirt on the wiring harness, wipe it off with a dry cloth. Avoid washing it in water or using steam. If the connector must be washed in water, do not use high-pressure water or steam directly on the wiring harness.

  If water gets directly on the connector, do as follows.

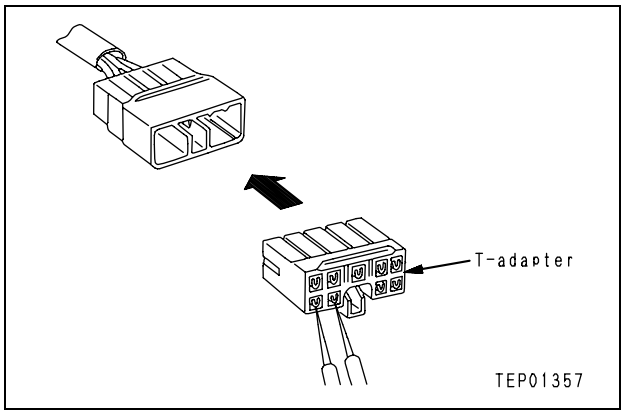
  1) Disconnect the connector and wipe off the water with a dry cloth.
     ★ If the connector is blown dry with compressed air, there is the risk that oil in the air may cause defective contact, so remove all oil and water from the compressed air before blowing with air.



  2) Dry the inside of the connector with a dryer.
     If water gets inside the connector, use a dryer to dry the connector.
     ★ Hot air from the dryer can be used, but regulate the time that the hot air is used in order not to make the connector or related parts too hot, as this will cause deformation or damage to the connector.

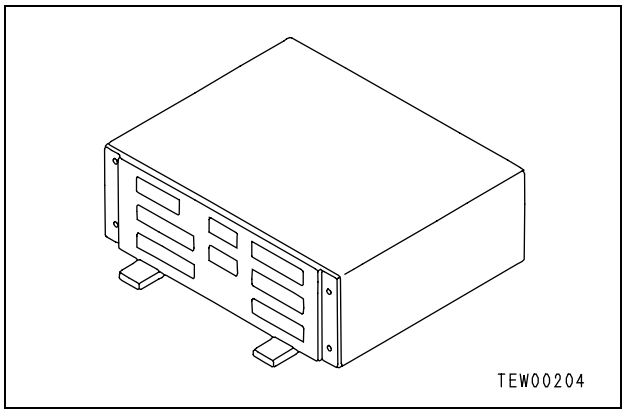


  3) Carry out a continuity test on the connector.
     After drying, leave the wiring harness disconnected and carry out a continuity test to check for any short circuits between pins caused by water.
     ★ After completely drying the connector, blow it with contact restorer and reassemble.

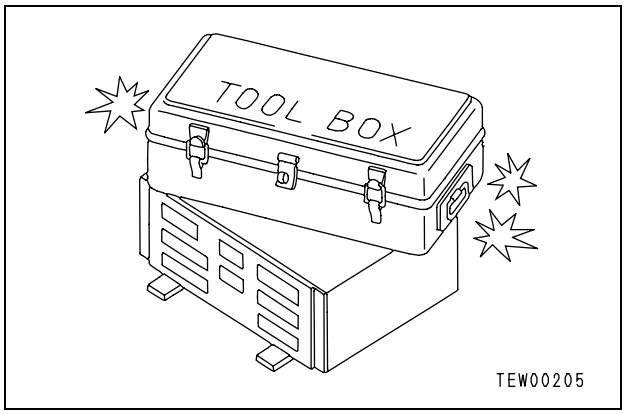


3) Handling control box

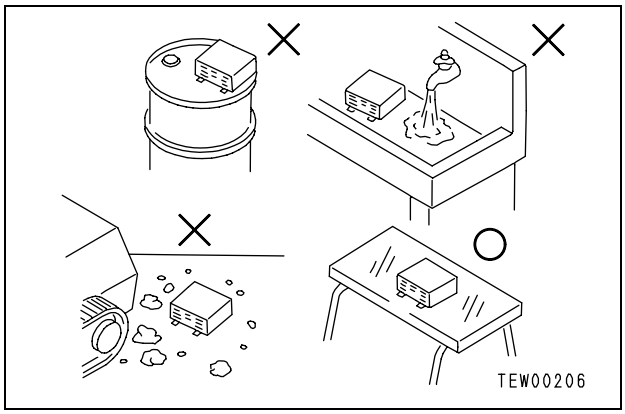
1) The control box contains a microcomputer and electronic control circuits. These control all of the electronic circuits on the machine, so be extremely careful when handling the control box.
2) Do not open the cover of the control box unless necessary.



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

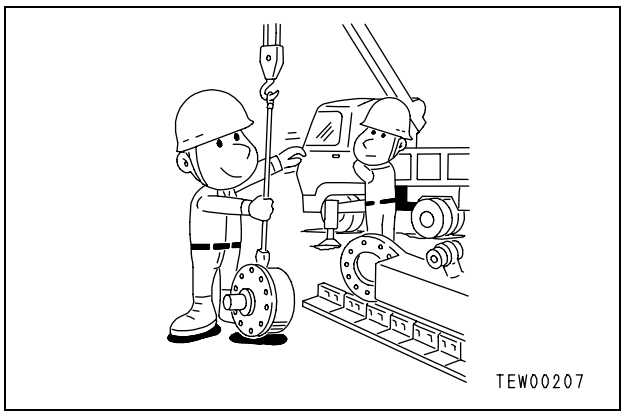
1) Always turn the power OFF before disconnecting or connect connectors.
2) Before carrying out troubleshooting, check that all the related connectors are properly inserted.
   ★ Disconnect and connect the related connectors several times to check.
3) Always connect any disconnected connectors before 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.

3. Points to remember when handling hydraulic equipment

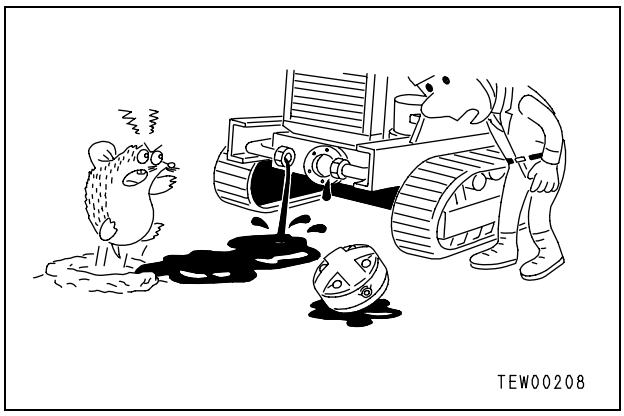
With the increase in pressure and precision of hydraulic equipment, the most common cause of failure is dirt (foreign material) in the hydraulic circuit. When adding hydraulic oil, or when disassembling or assembling hydraulic equipment, it is necessary to be particularly careful.

1) Be careful of the operating environment.
Avoid adding hydraulic oil, replacing filters, or repairing the machine in rain or high winds, or places where there is a lot of dust.

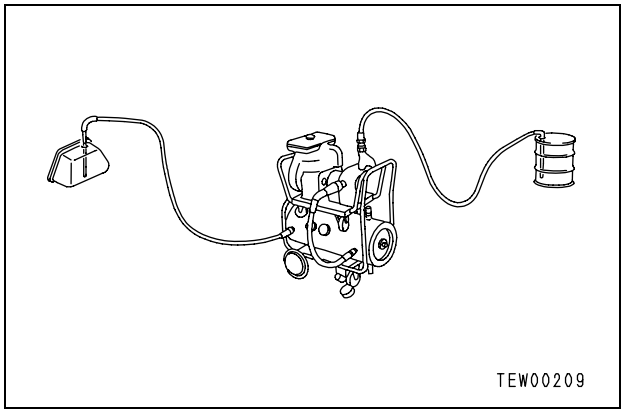
2) Disassembly and maintenance work in the field
If disassembly or maintenance work is carried out on hydraulic equipment in the field, there is danger of dust entering the equipment. It is also difficult to confirm the performance after repairs, so it is desirable to use unit exchange. Disassembly and main-tenance of hydraulic equipment should be carried out in a specially prepared dustproof workshop, and the performance should be confirmed with special test equipment.



3) Sealing openings
After any piping or equipment is removed, the openings should be sealed with caps, tapes, or vinyl bags to prevent any dirt or dust from entering. If the opening is left open or is blocked with a rag, there is danger of dirt entering or of the surrounding area being made dirty by leaking oil so never do this.
Do not simply drain oil out on to the ground, collect it and ask the customer to dispose of it, or take it back with you for disposal.



4) Do not let any dirt or dust get in during refilling operations.
Be careful not to let any dirt or dust get in when refilling with hydraulic oil. Always keep the oil filler and the area around it clean, and also use clean pumps and oil containers. If an oil cleaning device is used, it is possible to filter out the dirt that has collected during storage, so this is an even more effective method.



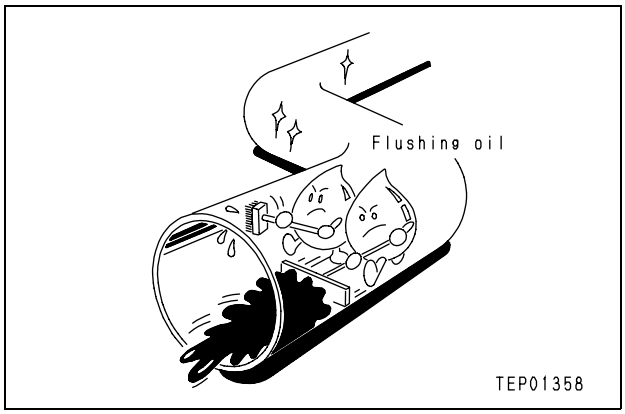
5) Change hydraulic oil when the temperature is high.

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

6) Flushing operations

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

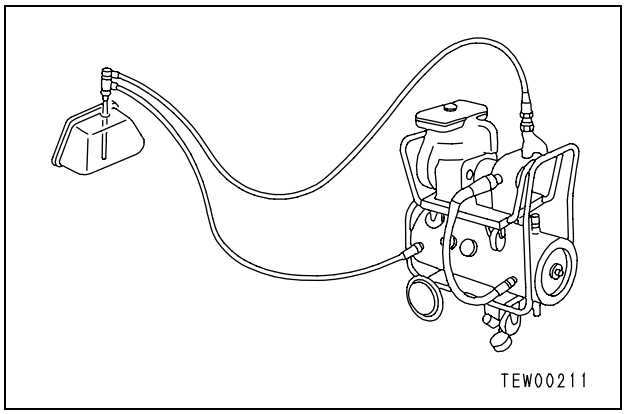
Normally, flushing is carried out twice: primary flushing is carried out with flushing oil, and secondary flushing is carried out with the specified hydraulic oil.



7) Cleaning operations

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

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



CHECKS BEFORE TROUBLESHOOTING

	Item	Judgement value	Action
Lubricating oil, coolant	1. Check fuel level, type of fuel	—	Add fuel
	2. Check for impurities in fuel	—	Clean, drain
	3. Check hydraulic oil level	—	Add oil
	4. Check hydraulic oil strainer	—	Clean, drain
	5. Check swing machinery oil level	—	Add oil
	6. Check engine oil level (oil pan oil level)	—	Add oil
	7. Check coolant level	—	Add water
	8. Check dust indicator for clogging	—	Clean or replace
	9. Check hydraulic filter	—	Replace
	10. Check final drive oil level	—	Add oil
Electrical equipment	1. Check for looseness, corrosion of battery terminal, wiring	—	Tighten or replace
	2. Check for looseness, corrosion of alternator terminal, wiring	—	Tighten or replace
	3. Check for looseness, corrosion of starting motor terminal, wiring	—	Tighten or replace
Hydraulic, mechanical equipment	1. Check for abnormal noise, smell	—	Repair
	2. Check for oil leakage	—	Repair
	3. Carry out air bleeding	—	Bleed air
Electrics, electrical equipment	1. Check battery voltage (engine stopped)	20 – 30V	Replace
	2. Check battery electrolyte level	—	Add or replace
	3. Check for discolored, burnt, exposed wiring	—	Replace
	4. Check for missing wiring clamps, hanging wiring	—	Repair
	5. Check for water leaking on wiring (be particularly careful attention to water leaking on connectors or terminals)	—	Disconnect connector and dry
	6. Check for blown, corroded fuses	—	Replace
	7. Check alternator voltage (engine running at 1/2 throttle or above)	After running for several minutes : 27.5 – 29.5V	Replace
	8. Check operating sound of battery relay (when switch is turned ON/OFF)	—	Replace

CLASSIFICATION AND STEPS FOR TROUBLESHOOTING

Classification of troubleshooting

Mode	Content
Code display	Troubleshooting when Service Code (electrical system) and Failure Code (mechanical system) are displayed.
E mode	Troubleshooting of electrical system
H mode	Troubleshooting of hydraulic and mechanical systems
(Engine)	Troubleshooting of engine assembly (refer to the shop manual for engine in 102 series)

Steps for troubleshooting

If some phenomenon occurs on a machine that looks like a failure, identify the corresponding troubleshooting No. and proceed to the explanations for diagnosis.

1. **Troubleshooting steps when calling User Code display in the monitor panel**
   In the User Code display, select and depress [✓] switch to display Service Code. Following displayed Service Code for the electrical system, carry out the troubleshooting along the corresponding code display.

2. **Troubleshooting steps when the electrical system Service Code or mechanical system Failure Code is recorded in the failure history:**
   If not calling User Code in the monitor panel, check the electrical system Service Code or mechanical system Failure Code, using the failure history function of the monitor panel.
   - ★ If Service Code in the electrical system is recorded, delete the all codes once and revive the code in the display again to check if the same abnormality still persists.
   - ★ Failure Code in the mechanical system cannot be deleted.

3. **Troubleshooting steps without User Code display and no failure history is available**
   If there is no display of User Code nor the failure history in the monitor panel, it is possible that a failure that the monitor panel cannot diagnose by itself may have occurred in any of the electrical, hydraulic or mechanical system. In such a case, reexamine the phenomenon, find out the most similar phenomenon from among "Failure like Phenomena and Troubleshooting No." and carry out E mode or H mode troubleshooting related to the phenomenon in question.

Failure-looking Phenomenon and Troubleshooting No.

No.	Failure-looking phenomenon		Troubleshooting			
			Code display	E mode	H mode	(Engine)
Action to be taken concerning Service Code, User Code and Failure Code						
1	Display User Code in monitor panel		Accord-ing to dis-played code			
2	Display Service Code in electrical system after checking failure history					
3	Display Failure Code in mechanical system after checking failure history					
Engine-related failure						
4	Engine does not start up easily. (It always takes some time to start up the engine)					S-1
5	Engine does not start	Engine does not rotate		E-1		S-2 ①
6		Engine rotates, but there is no exhaust gas				S-2 ②
7		There is exhaust gas, but engine does not start				S-2 ③
8	Engine pickup is poor. (Engine does not follow acceleration)					S-3
9	Engine stops while in operation			E-2	H-2	S-4
10	Engine rotation is irregular. (There is hunting)			E-3		S-5
11	Engine is short of output, or lacks power				H-1	S-6
12	Color of exhaust gas is too dark. (Incomplete combustion)					S-7
13	Excessive engine oil consumption, or color of exhaust gas is blue					S-8
14	Premature engine oil contamination					S-9
15	Excessive fuel consumption					S-10
16	Engine cooling water is mixed with engine oil, spurts out or decreases					S-11
17	Engine oil amount increases. (Water or fuel gets in)					S-13
18	Abnormal noises are heard					S-15
19	Excessive vibrations are caused					S-16
20	Engine does not stop			E-4		
21	Auto-decelerator does not work			E-5	H-5	
22	Engine auto warming-up device does not work			E-6		
23	Engine preheater does not work			E-7		
Failure related to work equipment, swing and travel						
24	Speeds of all work equipment, travel and swing are slow, or they lack power				H-1	S-6
25	Engine rotation drops sharply or stalls				H-2	S-4
26	All work equipment, travel and swing do not move			E-8	H-3	
27	There are abnormal noises from around hydraulic pump				H-4	
28	Fine control mode function works poorly, or shows slow response				H-6	

No.	Failure-looking phenomenon	Troubleshooting			
		Code display	E mode	H mode	(Engine)
Work equipment-related failure					
29	Boom moves slowly or lacks power		E-21, 22	H-7	
30	Arm moves slowly or lacks power		E-23, 24	H-8	
31	Bucket moves slowly or lacks power		E-25, 26	H-9	
32	Boom, arm or bucket does not move			H-10	
33	Natural drift of work equipment is too fast			H-11	
34	Work equipment time lag is too big			H-12	
35	Other work equipment moves, when specific work equipment is relieved			H-13	
36	One-touch power max. switch does not work	E-9, 21–26		H-14	
Compound operation-related failure					
37	In compound operation, work equipment with larger load moves slowly			H-15	
38	In swing + boom RAISE operation, boom moves slowly			H-16	
39	In swing + travel operation, travel speed drops sharply			H-17	
Travel-related failure					
40	Machine tends to swerve while in travel			H-18	
41	Travel speed is slow		E-28	H-19	
42	Machine is difficult to steer, or lacks power		E-28, 29	H-20	
43	Travel speed cannot be shifted or is slow or fast		E-28	H-21	
44	Track shoe does not move (only on one side)			H-22	
Swing-related failure					
45	Machine does not swing		E-27	H-23	
46	Swing acceleration is poor, or swing speed is slow			H-24	
47	Upper structure overruns excessively, when stopping swing			H-25	
48	There is a big shock caused when stopping swing			H-26	
49	There is abnormal noise generated when stopping swing			H-27	
50	There is natural drift while in swing			H-28	
Monitor panel-related failure (Operator's Menu: ordinary display)					
51	No display appears in monitor panel at all		E-10		
52	Part of display is missing in monitor panel		E-11		
53	Descriptions on monitor panel do not apply to the machine model		E-12		
54	In startup inspection, radiator water level monitor lamp lights up red (※)	B@BCZK			
55	In startup inspection, engine oil level monitor lamp lights up red	B@BAZK			

※: The multi-monitor specification machine only.

No.	Failure-looking phenomenon	Troubleshooting			
		Code display	E mode	H mode	(Engine)
56	In startup inspection, maintenance hour monitor lamp lights up red	Refer to Operation and Maintenance Manual			
57	While engine is running, battery charging level monitor lamp lights up red	AB00KE			
58	While engine is running, fuel level monitor lamp lights up red		E-13		
59	While engine is running, air cleaner clogging monitor lamp lights up red	AA10NX			
60	While engine is running, engine cooling water temperature monitor lamp lights up red	B@BCNS			
61	While engine is running, hydraulic oil temperature monitor lamp lights up red (※)	B@HANS			
62	Engine cooling water temperature gauge does not display correctly		E-14		
63	Hydraulic oil temperature gauge does not display correctly (※)		E-15		
64	Fuel gauge does not display correctly		E-16		
65	Swing lock monitor does not display correctly		E-17		
66	When operating monitor switch, no display appears		E-18		
67	Windshield wiper does not work		E-19		
68	Warning buzzer cannot be stopped		E-20		
Monitor panel-related failure (Service Menu: Special Function Display)					
69	In monitoring function, "Boom RAISE" cannot be displayed correctly		E-21		
70	In monitoring function, "Boom LOWER" cannot be displayed correctly		E-22		
71	In monitoring function, "Arm DIGGING" cannot be displayed correctly		E-23		
72	In monitoring function, "Arm DUMPING" cannot be displayed correctly		E-24		
73	In monitoring function, "Bucket DIGGING" cannot be displayed correctly		E-25		
74	In monitoring function, "Bucket DUMPING" cannot be displayed correctly		E-26		
75	In monitoring function, "Swing" cannot be displayed correctly		E-27		
76	In monitoring function, "Travel" cannot be displayed correctly		E-28		
77	In monitoring function, "Travel Differential Pressure" cannot be displayed correctly		E-29		
78	In monitoring function, "Service" cannot be displayed correctly		E-30		
Other failure					
79	Air conditioner does not work		E-31		
80	Travel alarm does not sound		E-32		

CONNECTOR LOCATION CHART AND ELECTRICAL CIRCUIT DIAGRAM BY SYSTEM

Connector table

Connector No.	Type	No. of pin	Name of device	Address			
				Stereo -gram	M circuit	G circuit	P circuit
A01	X	4	Intermediate connector	T-1	H-6	I-5	I-8
A02	X	4	Intermediate connector	T-1	H-6	I-4	
A03	D	12	Intermediate connector	N-1	H-6	I-2	I-8
A04	SWP	12	Intermediate connector	O-1			I-7
A05	SWP	14	Intermediate connector	T-1	H-5		I-6
A06	SWP	14	Intermediate connector	N-1	H-5		I-5
A07	SWP	16	Intermediate connector	S-1	H-3	I-1	I-4
A08	SWP	12	Intermediate connector	N-2			
A09	SWP	8	Intermediate connector	N-2			I-3
A10	Terminal	1	Revolving frame grounding	H-1	H-1	J-5	J-4
A11	Terminal	1	Revolving frame grounding	H-1	I-1		
A12	Terminal	1	Revolving frame grounding	H-2	I-1		
A13	Terminal	1	Revolving frame grounding	I-2	I-1	J-4	J-8
A14	Terminal	1	Revolving frame grounding	K-2	I-1		
A15	Terminal	1	Revolving frame grounding	I-2	I-1		J-4
A16	Terminal	1	Revolving frame grounding	I-2	I-1		J-1
A20	Terminal	1	Battery relay (E terminal)	J-1	I-2	J-4	
A21	Terminal	1	Battery relay (BR terminal)	J-1	I-1	J-4	
A22	Terminal	1	Battery relay (M terminal)	J-1	J-2	K-4	
A23	Terminal	1	Battery relay (B terminal)	J-2	J-1	K-4	
A25	Terminal	1	Heater relay (coil)	L-3		K-6	
A26	Terminal	1	Heater relay (contact)	L-3	K-2		
A27	X	2	Starter safety relay (S and R terminals)	K-2	J-2		
A29	Terminal	1	Starter safety relay (C terminal)	L-3			
A30	YAZAKI	2	Air conditioner outside air temperature sensor	L-4			
A31	D	2	Air cleaner clogging sensor	L-4	K-4		
A33	X	2	Radiator water level sensor	L-4	K-5		
A34	L	2	Fusible link (65A)	A-4	K-6	K-5	
A35	M	2	Fusible link (30A)	A-5	K-6	K-4	
A40	AMP	1	Alarm horn (low tone)	H-1			
A41	AMP	1	Alarm horn (high tone)	H-1			
A42	X	1	Intermediate connector	I-9	J-7		
A43	X	2	Travel alarm	I-2			K-4
A44	M	1	Front right lamp	A-6	K-7		

Connector No.	Type	No. of pin	Name of device	Address			
				Stereo -gram	M circuit	G circuit	P circuit
A50	KES0	2	Window washer monitor (tank)	K-3	K-5		
A51	D	3	F pump hydraulic oil pressure sensor	K-3			K-5
A52	D	3	R pump hydraulic oil pressure sensor	J-9			K-5
A60	X	1	Fuel level sensor	D-9	K-4		
A61	D	2	Hydraulic oil temperature sensor	H-9	K-5		
C01	DRC	24	Governor pump controller	V-9	A-3	A-8	A-8
C02	DRC	40	Governor pump controller	W-9	A-3	A-7	A-7
C03	DRC	40	Governor pump controller	W-9	A-2	A-4	A-4
C09	S	8	Model selection connector	W-6		C-9	
D01	SWP	8	Assembled type diode	W-7	A-9	D-1	G-1
D02	SWP	8	Assembled type diode	W-7	A-8	D-1	
D03	SWP	8	Assembled type diode	P-1			H-1
D04	SWP	8	Assembled type diode	Q-1	A-8	F-1	I-1
E01	Terminal	1	Suction type air heater (electrical intake air heater)	J-9	L-2	L-6	
E02	Terminal	1	Engine hydraulic switch	L-8	K-6		
E03	D	2	Engine oil level switch	L-6	K-5		
E04	D	2	Engine rotation sensor	K-9			K-8
E05	D	2	Engine cooling water temperature sensor	J-9	K-4		
E06	M	3	Fuel dial	K-8			
E06	X	1	Air conditioner compressor electromagnetic switch	O-8			
E08	X	1	Intermediate connector	L-7	J-3	J-5	
E10	D	3	Governor potentiometer	J-9		K-3	
E11	D	4	Governor motor	K-9		K-2	
E12	X	2	Alternator	L-7	K-3	K-5	
F02	YAZAKI	2	Revolving warning lamp	AA-9			
FB1	–	–	Fuse box	W-5	I-9	C-4	F-9
G01	–	–	–	V-2			
G02	–	–	–	V-3			
G03	–	–	–	V-3			
G04	–	–	–	V-2			
G05	–	–	–	V-3			
H08	M	8	Intermediate connector	W-4	K-8		
H09	S	8	Intermediate connector	W-4	J-8		
H10	S	16	Intermediate connector	T-9	D-6	I-8	
H11	S	16	Intermediate connector	S-9	D-5	I-8	B-9
H12	S	12	Intermediate connector	S-9	D-5	I-7	
H15	S090	20	Intermediate connector	N-7	C-2	E-2	C-2

Connector No.	Type	No. of pin	Name of device	Address			
				Stereo -gram	M circuit	G circuit	P circuit
J01	J	20	Junction connector (black)	W-8	C-9	D-9	C-9
J02	J	20	Junction connector (black)	W-8	D-9	D-9	D-9
J03	J	20	Junction connector (green)	W-8	D-9		D-9
J04	J	20	Junction connector (green)	W-7	E-9	E-9	E-9
J05	J	20	Junction connector (pink)	W-6	E-9	E-9	E-9
J06	J	20	Junction connector (orange)	W-6	F-9		H-9
J07	J	20	Junction connector (orange)	U-9	F-9	F-9	H-9
J08	J	20	Junction connector (pink)	U-9			I-9
K19	M	2	Pump resistor (for driving emergency pump)	U-2			E-3
K30	D	3	CAN terminating resistor	T-9	A-2	C-1	
K31	D	3	CAN terminating resistor	N-4	A-4	K-7	
M07	M	3	Lamp switch	P-8	C-2		
M09	M	1	Working lamp (front right)	E-9	K-7		
M13	KES0	2	Speaker (right)	AC-8			
M19	YAZAKI	2	Cigarette lighter	N-3			
M21	PA	9	Radio	U-2			
M22	Y090	2	Horn switch	N-7			
M23	Y090	2	One-touch power max. switch	T-1			
M26	S	12	Air conditioner unit	W-5			
M27	SWP	16	Air conditioner unit	W-5			
M28	SWP	12	Air conditioner unit	W-4			
M29	040	20	Air control panel	W-3			
M30	040	16	Air control panel	W-3			
M31	M	2	Option power source (2)	U-2			
M32	M	2	Option power source (1)	S-9			
M33	M	2	Option power source (3)	–			
M33	SWP	8	Air conditioner unit	S-9			
M34	YAZAKI	2	Air conditioner inside air sensor	W-8			
M40	YAZAKI	2	Working lamp	Z-8	K-8		
M41	YAZAKI	2	Working lamp (additional)	Y-7	K-8		
M42	M	1	Intermediate connector	K-3	J-7		
M43	M	1	Working lamp (rear)	–	K-7		
M45	D	12	Intermediate connector	U-2			
M46	S090	4	RS232C relaying connector	U-9		B-9	
M71	M	2	Room lamp	Z-8			
M72	M	4	DC/AC converter	U-2			
M73	KES0	2	Speaker (left)	AD-8			
M79	YAZAKI	2	12V electrical equipment socket	V-9			

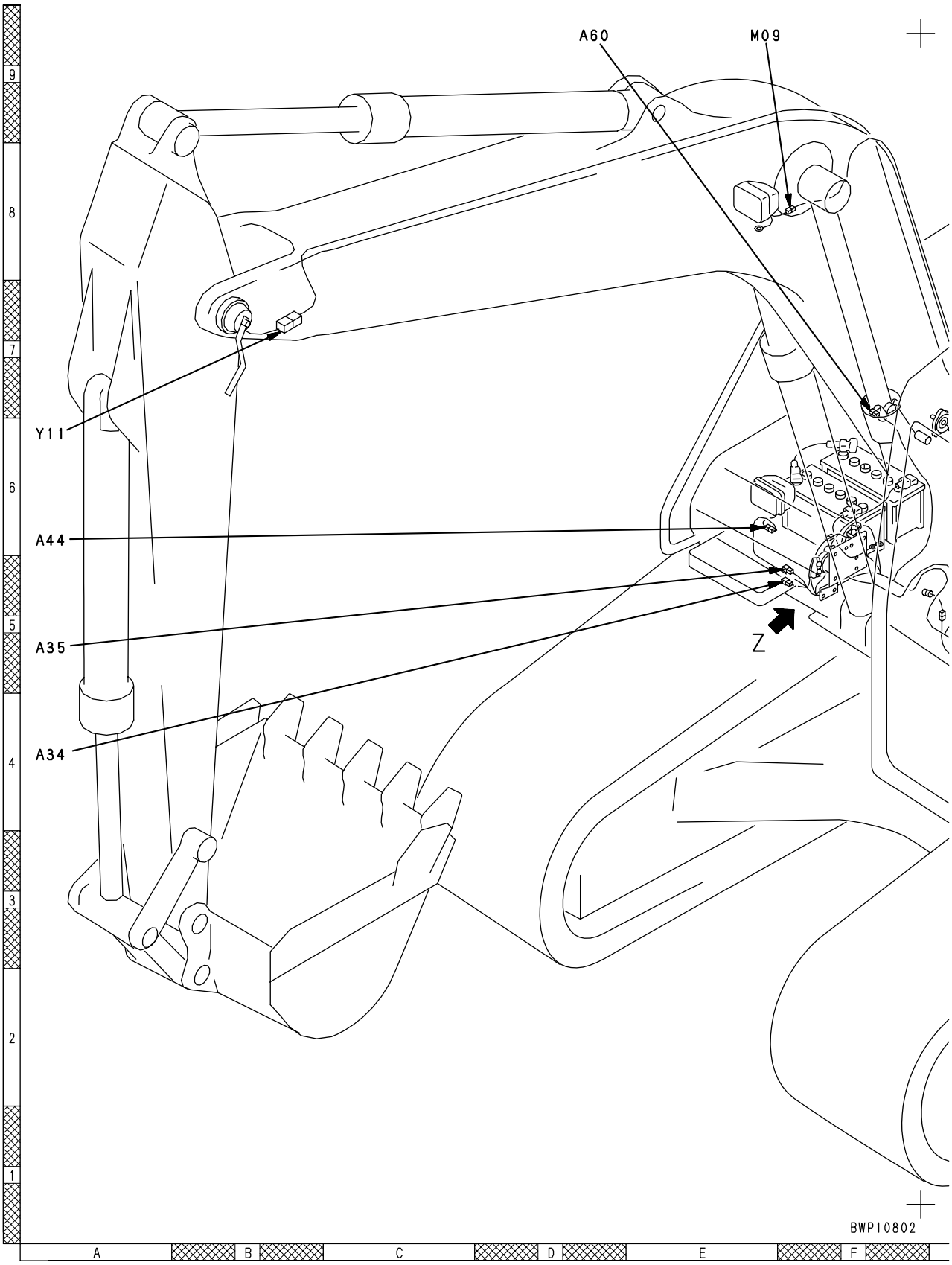
Connector No.	Type	No. of pin	Name of device	Address			
				Stereo-gram	M circuit	G circuit	P circuit
P01	070	12	Monitor panel	N-6	A-7	K-8	
P02	040	20	Monitor panel	N-5	A-6	K-8	A-9
P03	M	2	Buzzer canceling switch	P-9	D-1		
P05	M	2	Revolving warning lamp switch	W-3			
P15	Y050	2	Air conditioner sun light sensor	N-6			
P70	040	16	Monitor panel	N-4	A-5	K-7	
R10	R	5	Lamp relay	O-8	E-1		
R11	R	5	Engine starting motor cutting relay (PPC lock)	P-8	E-1		
R13	R	5	Engine starting motor cutting relay (personal code)	Q-9	F-1		
R20	R	5	Attachment circuit switching relay	W-6			C-9
R21	–	–	–	W-7			
S01	X	2	Bucket digging oil pressure switch	S-8			K-2
S02	X	2	Boom lowering oil pressure switch	L-7			K-3
S03	X	2	Swing oil pressure switch, left	L-7			K-2
S04	X	2	Arm digging oil pressure switch	L-6			K-3
S05	X	2	Bucket dumping oil pressure switch	L-5			K-2
S06	X	2	Boom raise oil pressure switch	L-5			K-3
S07	X	2	Swing oil pressure switch, right	L-5			K-2
S08	X	2	Arm dumping oil pressure switch	L-4			K-3
S09	X	2	Service oil pressure switch (intermediate connector)	K-3			K-1
S10	X	2	Service oil pressure switch, front	–			K-1
S11	X	2	Service oil pressure switch, rear	–			K-1
S14	M	3	Safety lever lock switch	S-1	K-9		F-8
S21	Terminal	6	Pump emergency driving switch	R-9			E-2
S22	Terminal	6	Swing and parking brake emergency releasing switch	R-9			F-2
S25	S090	16	Intermediate connector	Q-9			E-3
S30	X	2	Travel hydraulic switch	O-1			A-1
S31	X	2	Travel steering hydraulic switch	P-1			A-1
SC	Terminal	1	Engine starting motor (C terminal)	K-8			
SSW	Terminal	5	Engine starting switch	N-7			
T05	Terminal	1	Floor frame grounding	W-3	J-8		
T06	Terminal	1	Radio body grounding	–			
T06A	M	1	Intermediate connector	T-2			
T11	Terminal	1	Operator's cab grounding	AD-3			
T13	D	1	Engine starting motor (C terminal)	L-6	J-3		

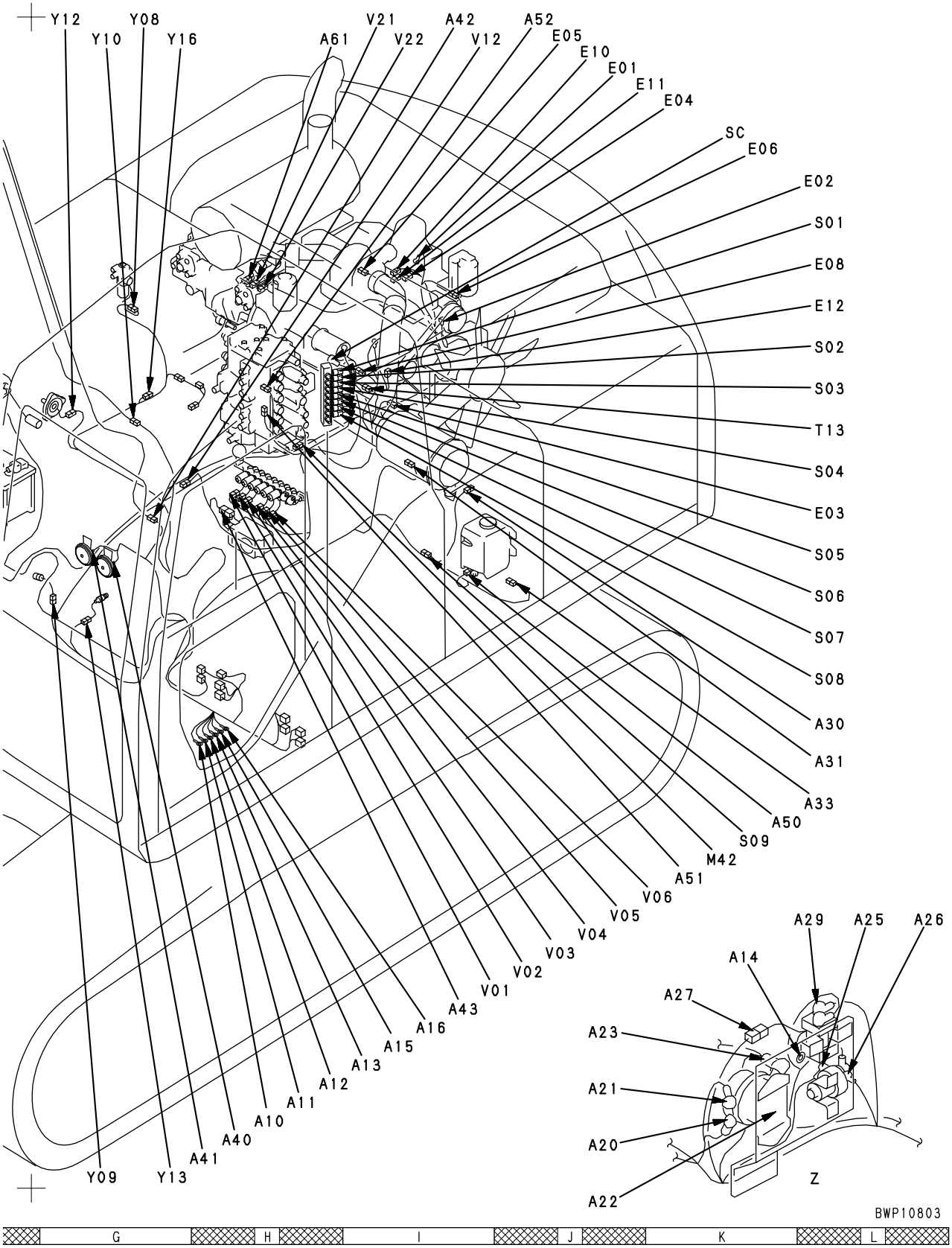
Connector No.	Type	No. of pin	Name of device	Address			
				Stereo -gram	M circuit	G circuit	P circuit
V01	D	2	PPC hydraulic lock solenoid valve	J-2			K-6
V02	D	2	Travel interlocking solenoid valve	J-2			K-6
V03	D	2	Merge/divide valve solenoid valve	J-2			K-6
V04	D	2	Travel speed solenoid valve	J-3			K-5
V05	D	2	Swing and parking brake solenoid valve	J-3			K-5
V06	D	2	2-stage relief solenoid valve	K-3			K-6
V12	D	2	Attachment return switching solenoid valve	I-9			K-4
V21	D	2	PC-EPC solenoid valve	I-9			K-7
V22	D	2	LS-EPC solenoid valve	I-9			K-7
V30	X	2	Attachment oil flow rate adjusting EPC solenoid valve	P-1			A-1
W03	X	2	Rear limit switch (window)	AB-9	L-8		
W04	M	6	Windshield wiper motor	Y-4	B-9		
X05	M	4	Swing lock switch	Q-9	D-2		C-2
Y08	–	–	–	G-9			
Y09	–	–	–	G-1			
Y10	–	–	–	G-9			
Y11	–	–	–	A-6			
Y12	–	–	–	G-9			
Y13	–	–	–	G-1			
Y16	–	–	–	G-9			

Connector No.	Detailed information
D or DT	Japanese and German makes DT type connector (08192-XXXXX)
L	Product of Yazaki Corporation L type connector (08056-2XXXX)
J	Product of Sumitomo Wiring Systems 090 type splice
M	Product of Yazaki M type connector (08056-0XXXX)
R	Product of Ryosei Electro-Circuit Systems* PH166-05020 type connector
S	Product of Yazaki S type connector (08056-1XXXX)
X	Product of Yazaki X type connector (08055-0XXXX)
PA	Product of Yazaki PA type connector
SWP	Product of Yazaki SWP type connector (08055-1XXXX)
DRC	Japanese and German makes DRC type connector
040	Product of Japan AMP 040 type connector
070	Product of Japan AMP 070 type connector
Y050	Product of Yazaki 050 type connector
S090	Product of Sumitomo 090 type connector
Y090	Product of Yazaki 090 type connector
YAZAKI	Yazaki-made connector
KES0	KESO type connector (08027-0XXXX)
Terminal	Round pin type single terminal connector
Terminal	Round terminal

*An affiliated company of Mitsubishi Cable Industries, Ltd.

CONNECTOR LOCATION STEREOGRAM

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Y10
Y16
A61
V21
V22
A42
V12
A52
E05
E10
E01
E11
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SC
E06
E02
S01
E08
E12
S02
S03
T13
S04
E03
S05
S06
S07
S08
A30
A31
A33
A50
S09
M42
A51
V06
V05
V04
V03
V02
V01
A43
A16
A15
A13
A12
A11
A10
A40
A41
Y09
Y13
A29
A25
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A23
A21
A20
A22
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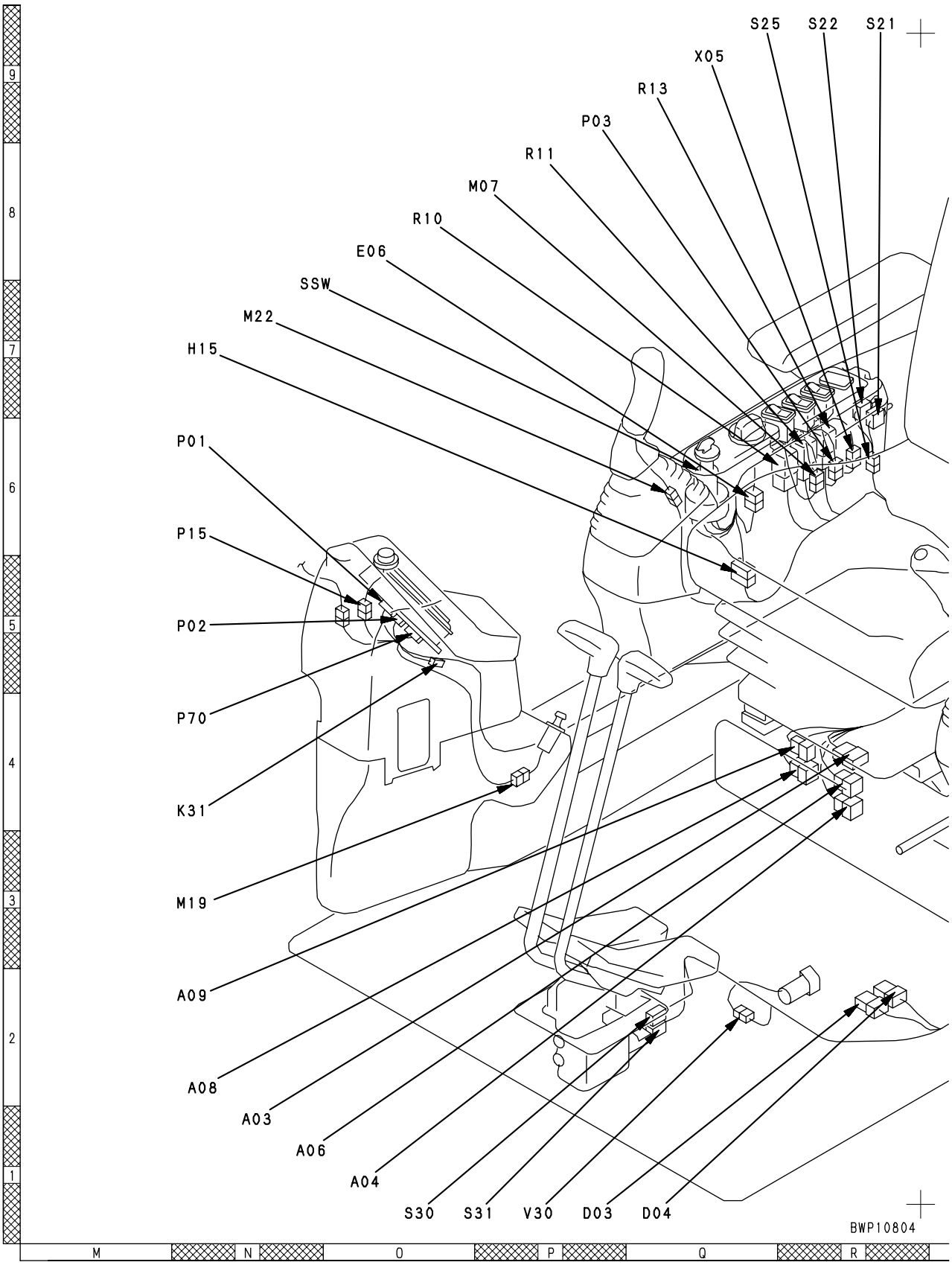
I
J
K
L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S22
S21
X05
R13
P03
R11
M07
R10
E06
SSW
M22
H15
P01
P15
P02
P70
K31
M19
A09
A08
A03
A06
A04
S30
S31
V30
D03
D04
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4
3
2
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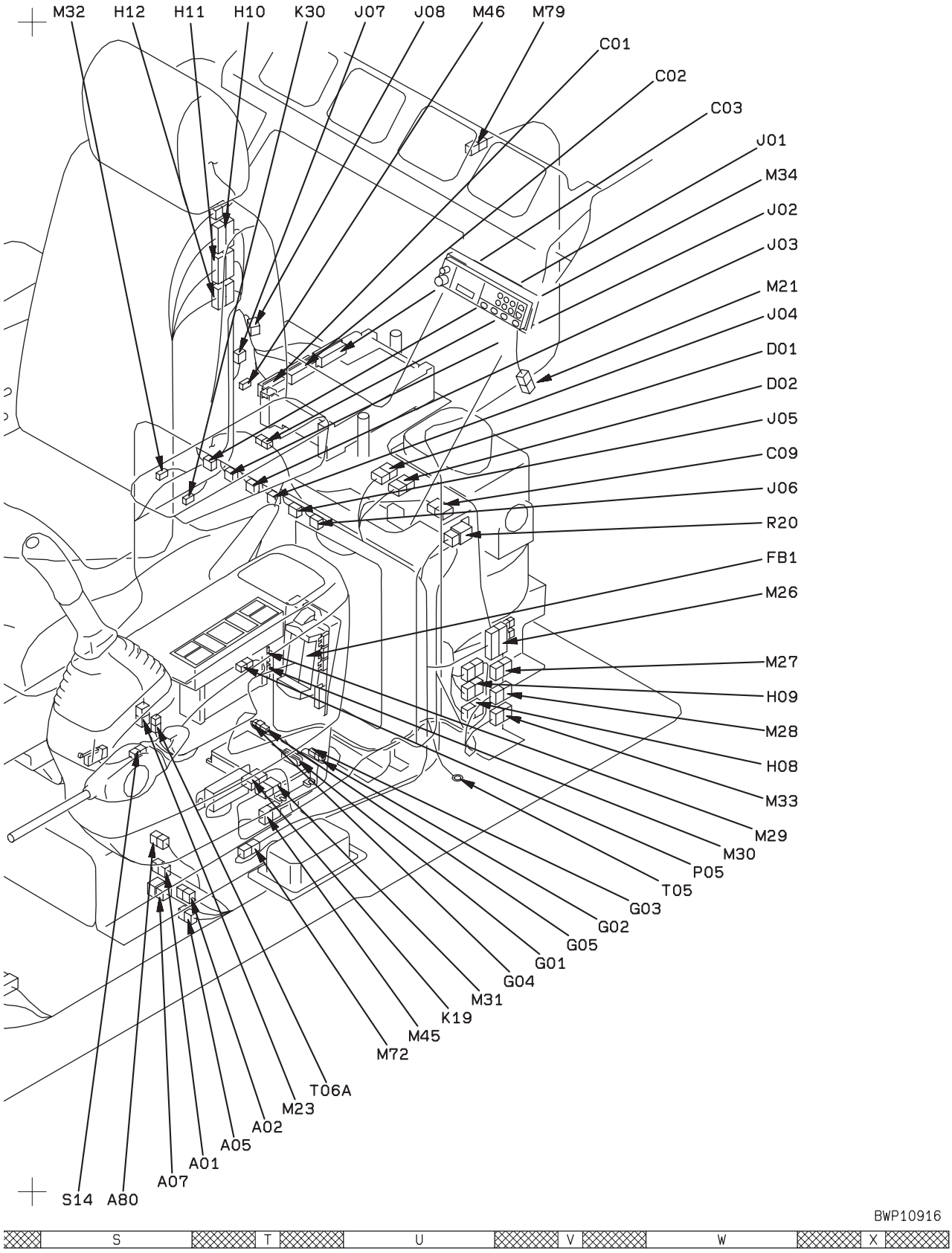
M
N
O
P
Q
R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H12
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H10
K30
J07
J08
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M79
C01
C02
C03
J01
M34
J02
J03
M21
J04
D01
D02
J05
C09
J06
R20
FB1
M26
M27
H09
M28
H08
M33
M29
M30
P05
T05
G03
G02
G05
G01
G04
M31
K19
M45
M72
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A05
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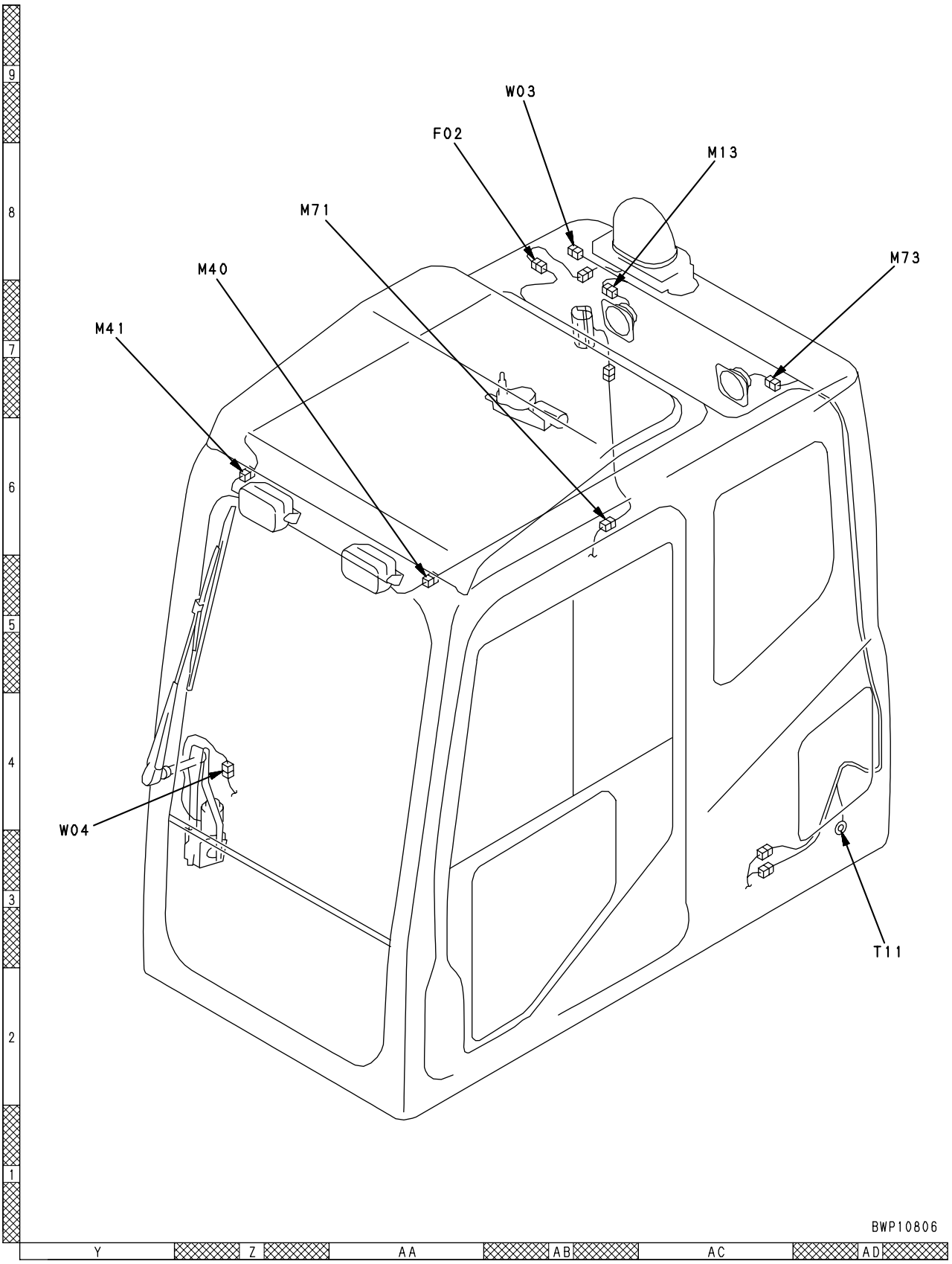
W
X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F02
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M73
M40
M41
W04
T11
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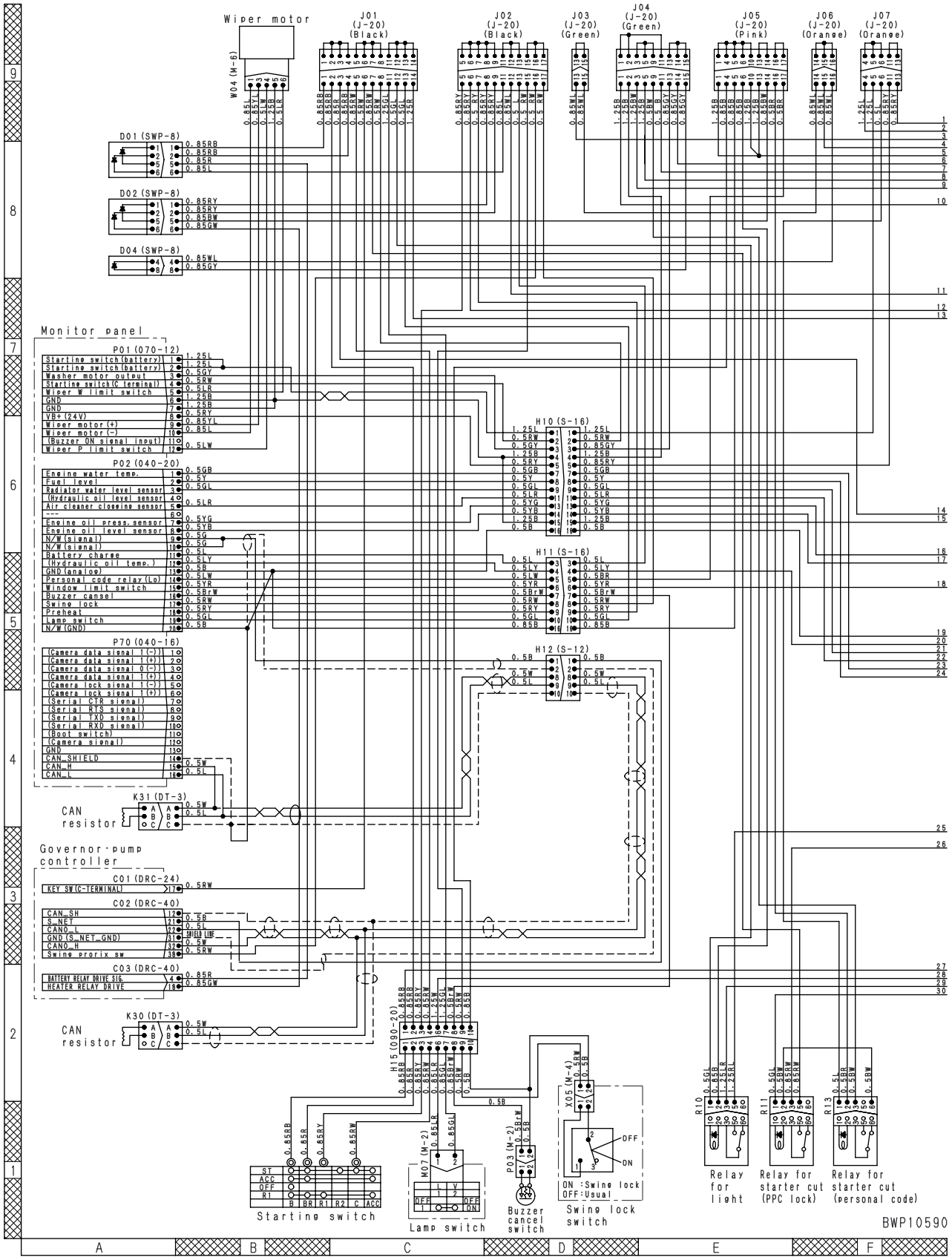
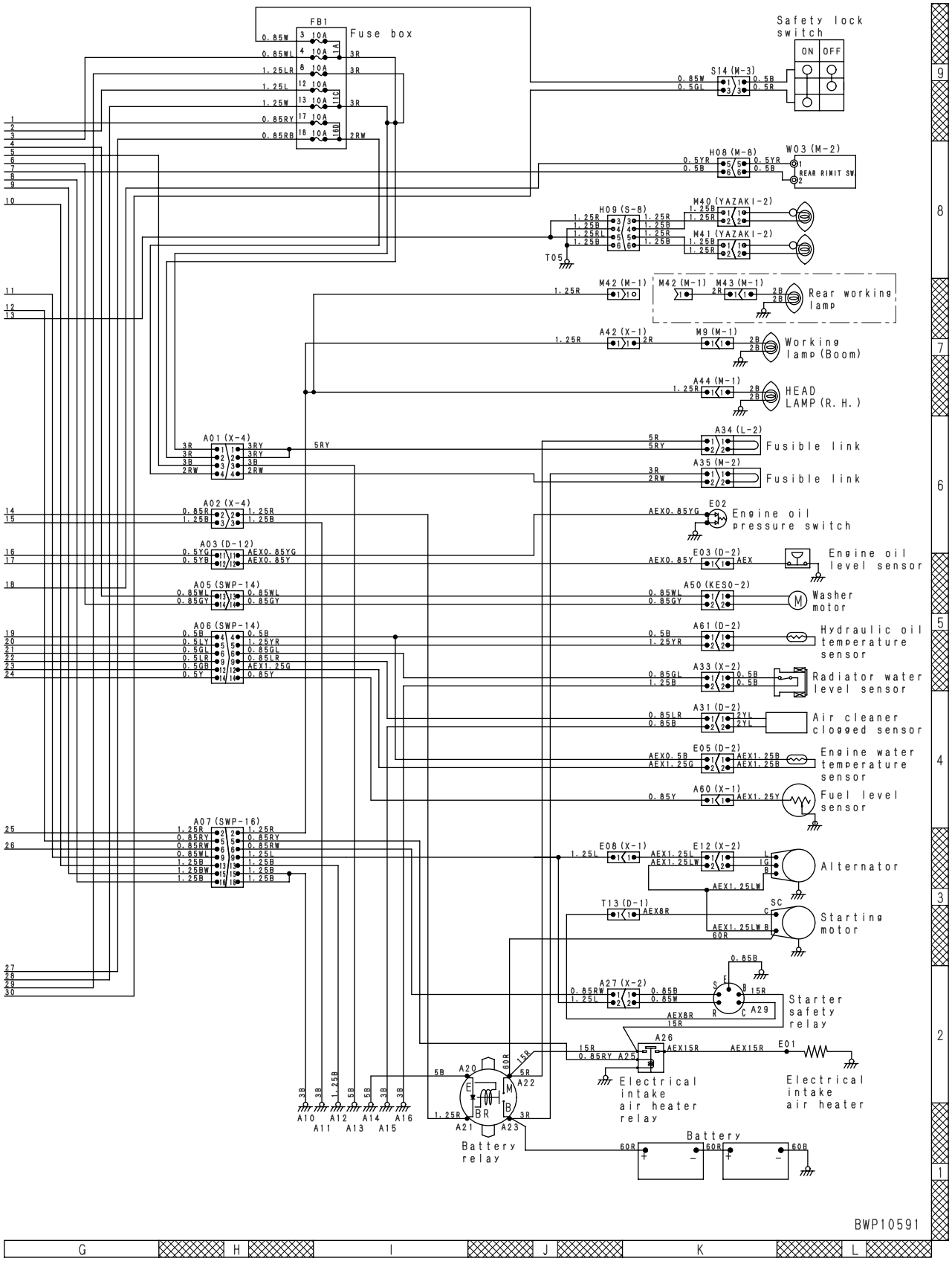
2
1
Y
Z
AA
AB
AC
AD

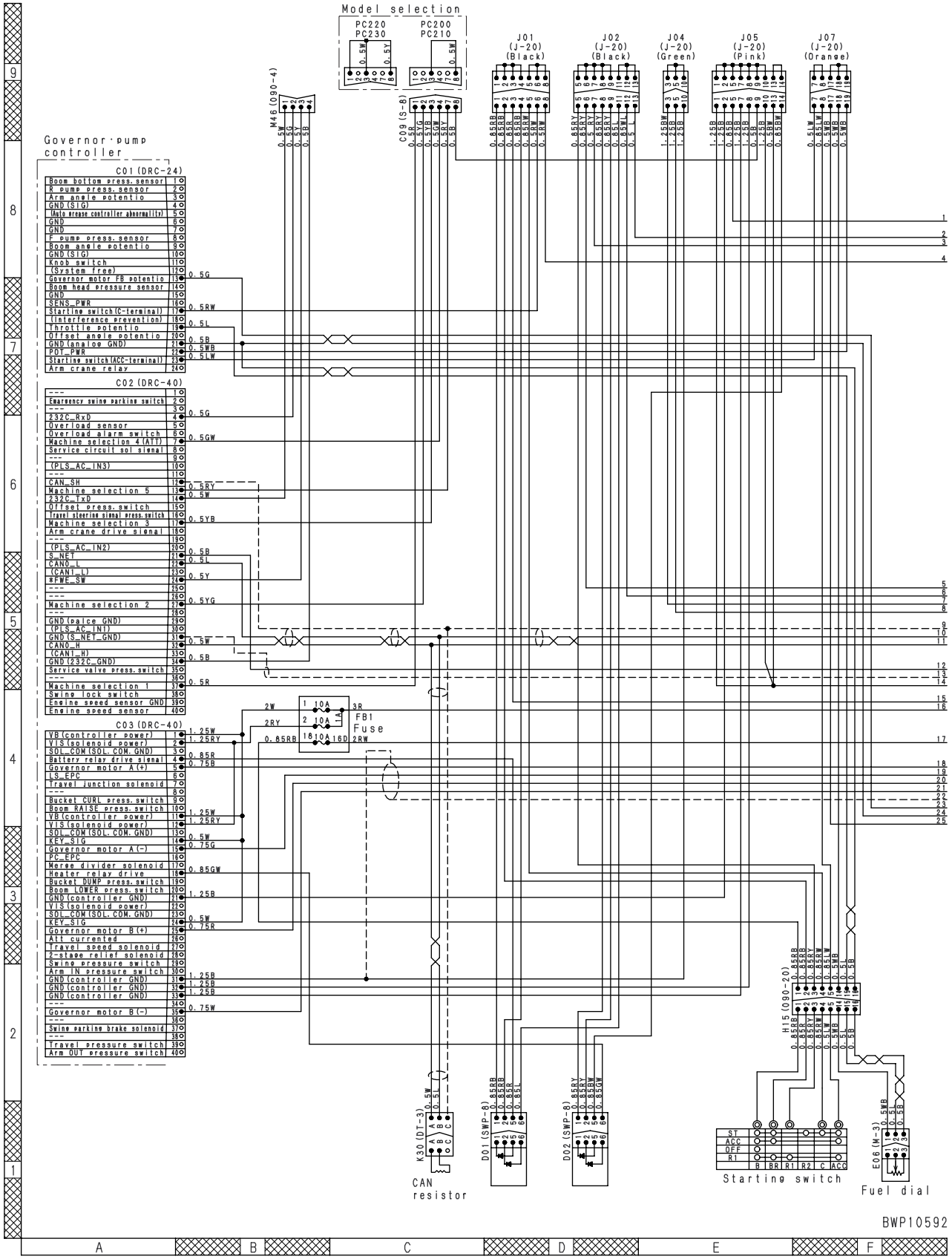
Monitor Panel System Circuit Diagram (M Circuit)



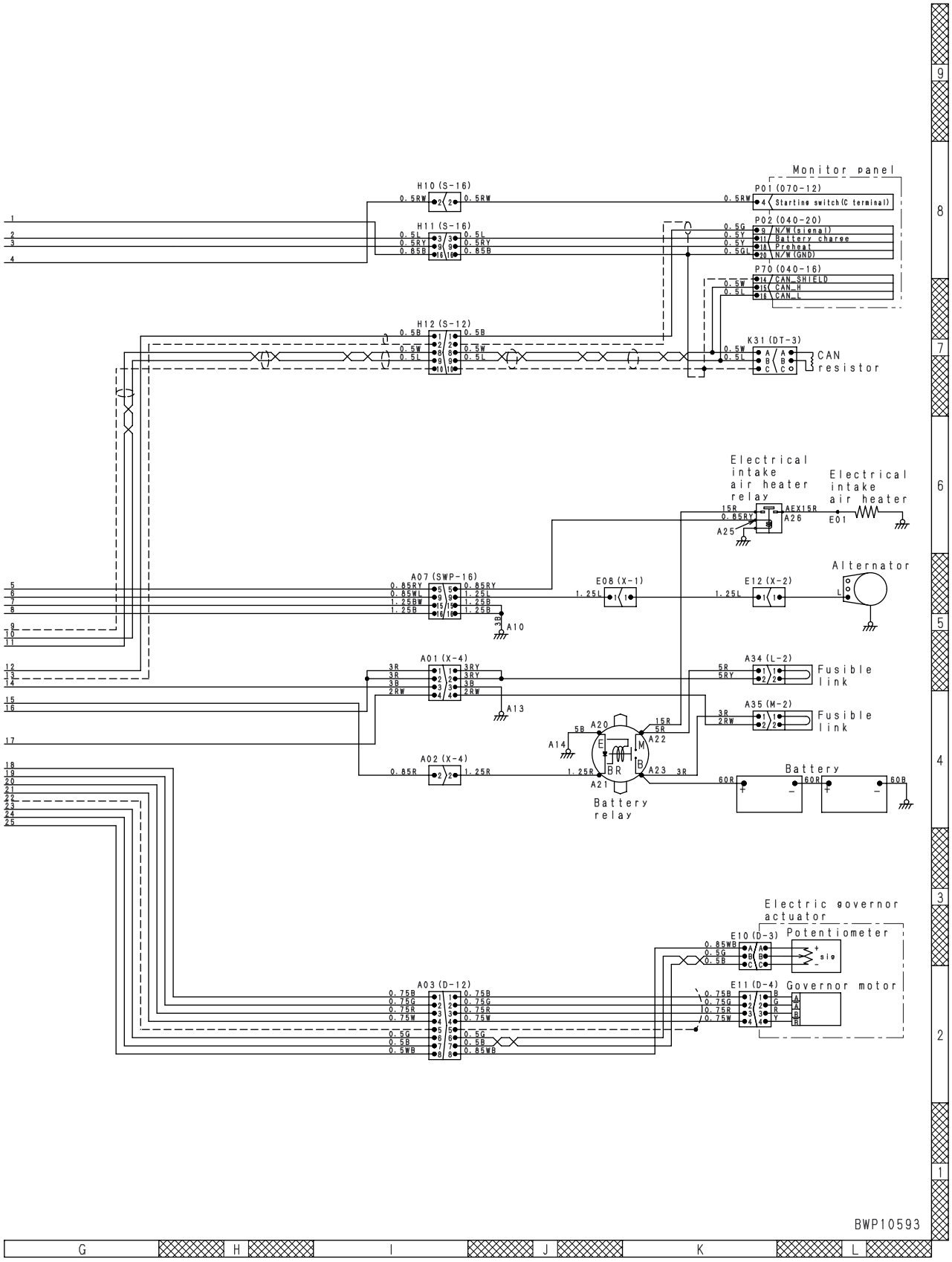
★ This circuit diagram has been compiled by extracting the monitor panel system and engine starting system from the overall electrical circuit diagram.



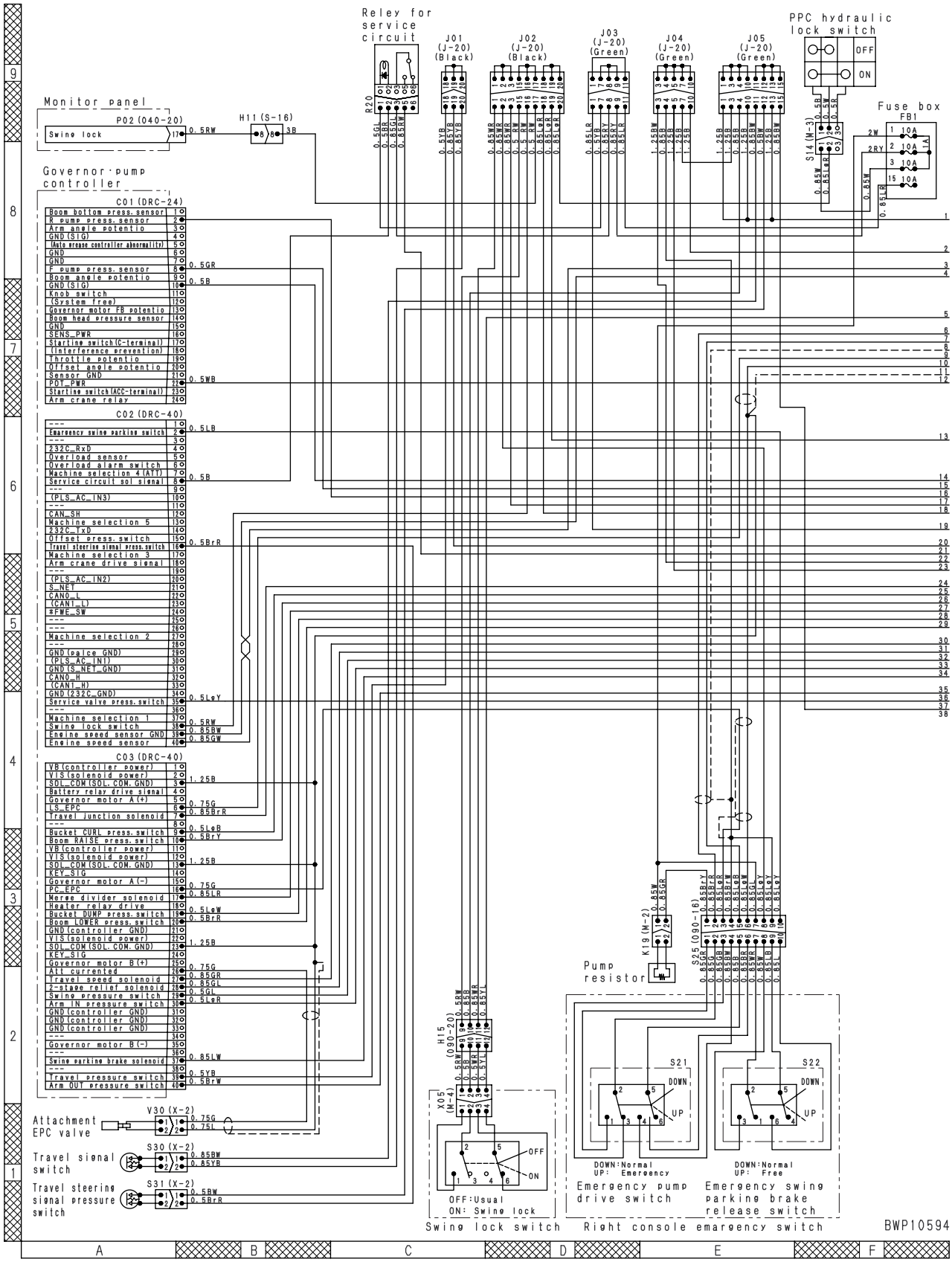
Governor Control System Circuit Diagram (G Circuit) of Governor•Pump Controller



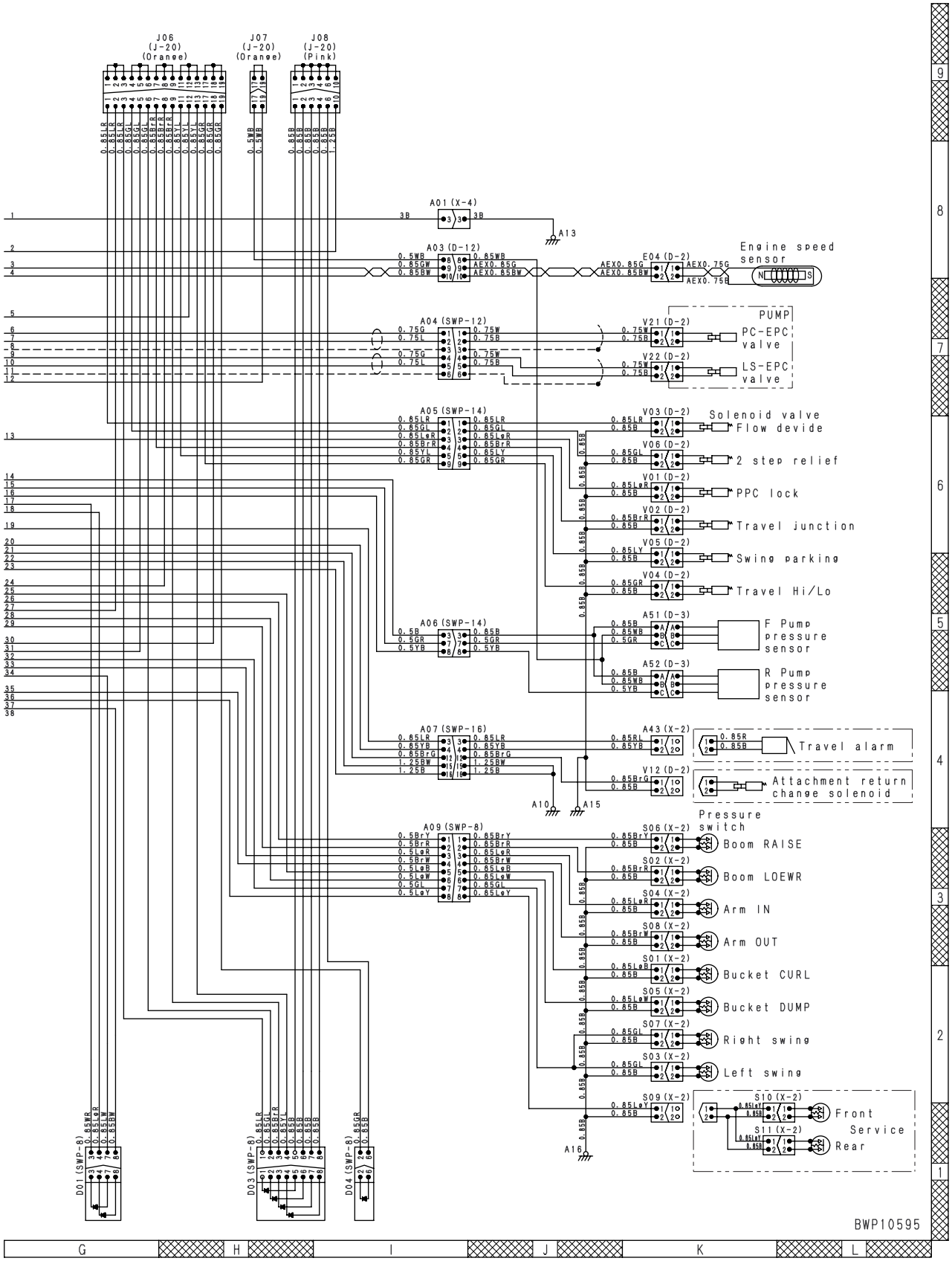
★ This circuit diagram has been compiled by extracting the governor•pump controller system (power source, governor control, model selection and communication) from the overall electrical circuit diagram.



Pump Control System Circuit Diagram (P Circuit) of Governor•Pump Controller

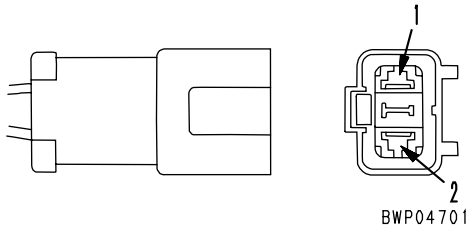
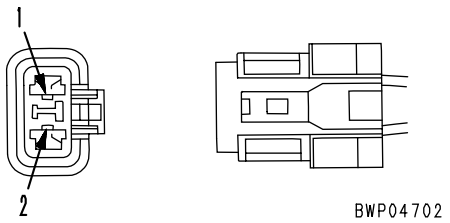


★ This circuit diagram has been compiled by extracting the governor•pump controller system (pump control), PPC lock system and backup alarm system from the overall electrical circuit diagram.



CONNECTION TABLE FOR CONNECTOR PIN NUMBERS

★ The terms male and female refer to the pins, while the terms male housing and female housing refer to the mating portion of the housing.

<table>
<tr><td rowspan="2">No.of pins</td><td colspan="2">X type connector</td><td rowspan="2">T-adapter Part No.</td></tr>
<tr><td>Male (female housing)</td><td>Female (male housing)</td></tr>
<tr><td>1</td><td>Part No.: 08055-00181</td><td>Part No.: 08055-00191</td><td>799-601-7010</td></tr>
<tr><td rowspan="2">2</td><td> 
</td><td> 
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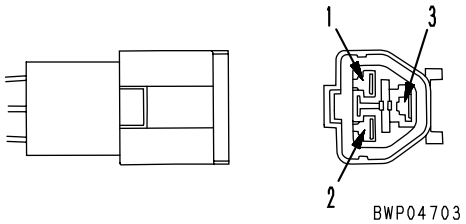
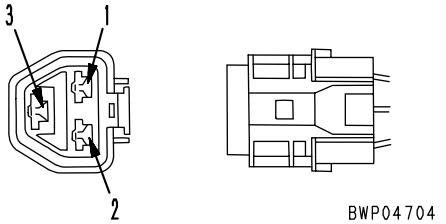
<tr><td rowspan="2">3</td><td> 
</td><td> 
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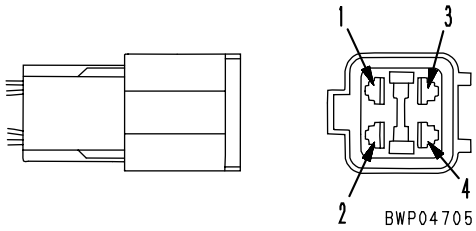
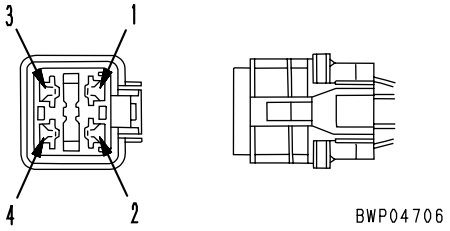
<tr><td>Part No.: 08055-00381</td><td>Part No.: 08055-00391</td></tr>
<tr><td rowspan="2">4</td><td> 
</td><td> 
</td><td rowspan="2">799-601-7040</td></tr>
<tr><td>Part No.: 08055-00481</td><td>Part No.: 08055-00491</td></tr>
<tr><td>—</td><td>Terminal part No.: 79A-222-3370
• Electric wire size: 0.85
• Grommet: Black
• Q’ty: 20</td><td>Terminal part No.: 79A-222-3390
• Electric wire size: 0.85
• Grommet: Black
• Q’ty : 20</td><td>—</td></tr>
<tr><td>—</td><td>Terminal part No.: 79A-222-3380
• Electric wire size: 2.0
• Grommet: Red
• Q’ty: 20</td><td>Terminal part No.: 79A-222-3410
• Electric wire size: 2.0
• Grommet: Red
• Q’ty: 20</td><td>—</td></tr>
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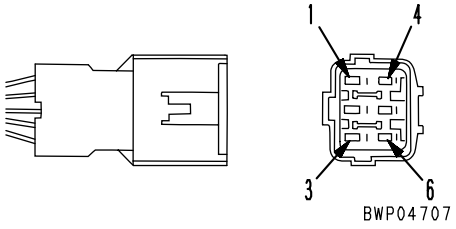
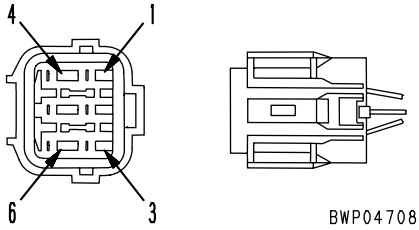
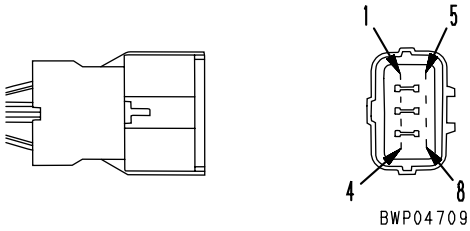
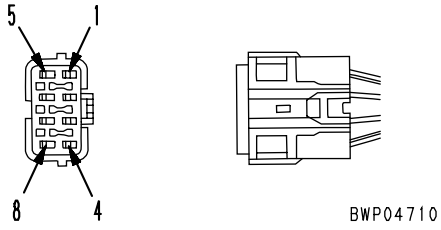
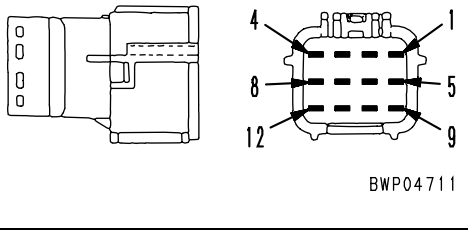
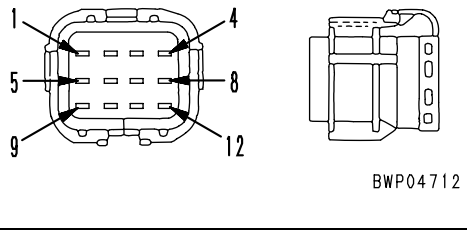
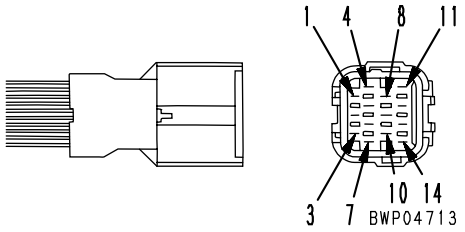
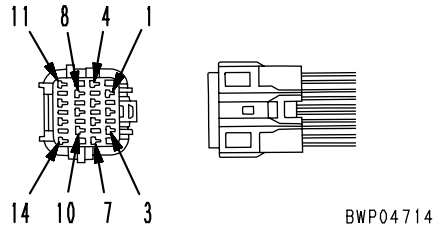
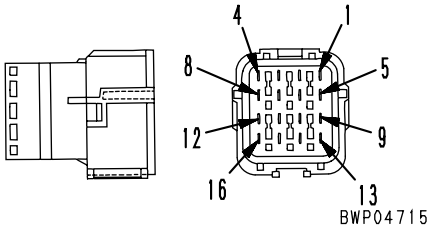
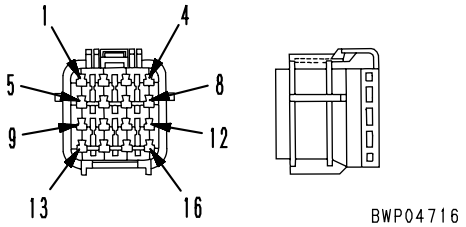
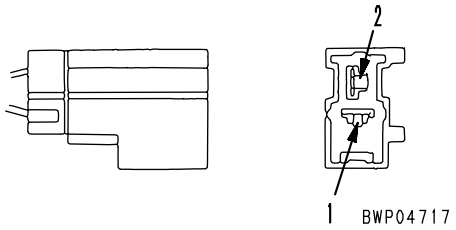
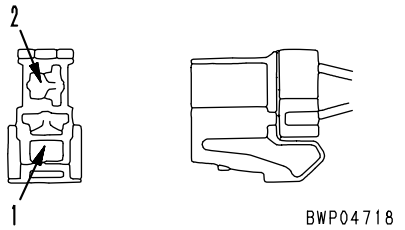
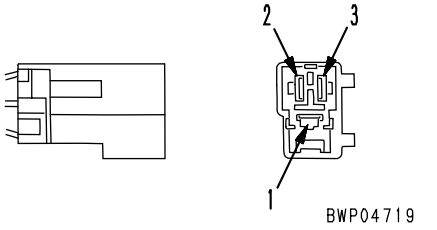
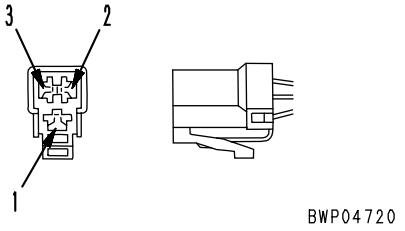
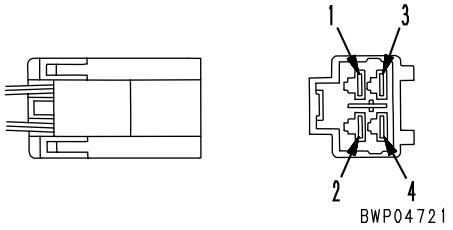
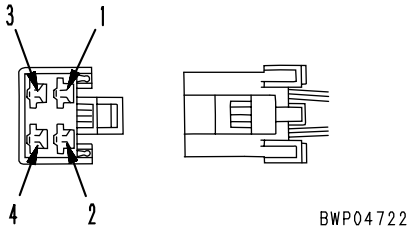
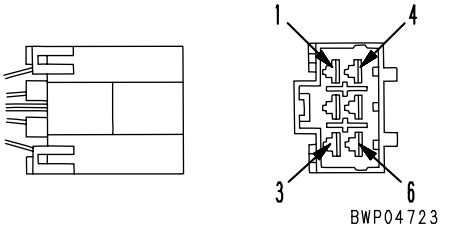
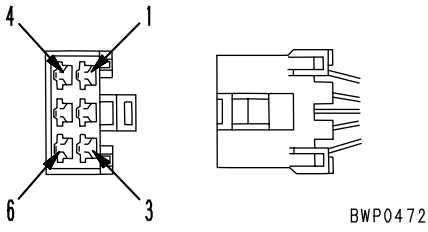
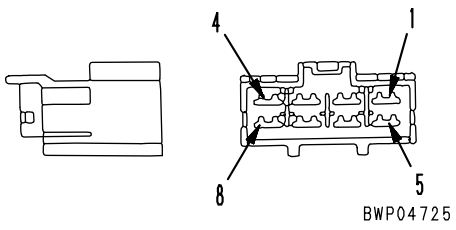
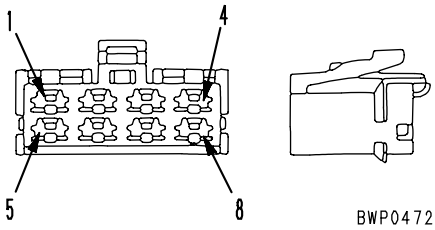
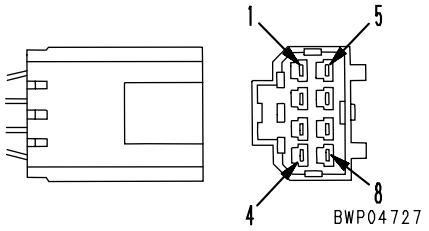
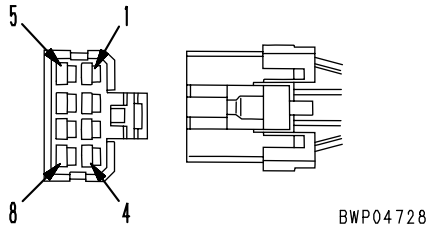
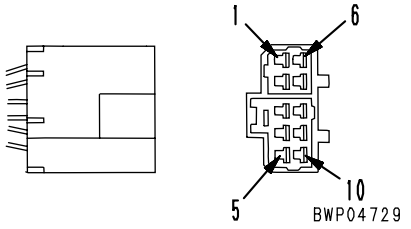
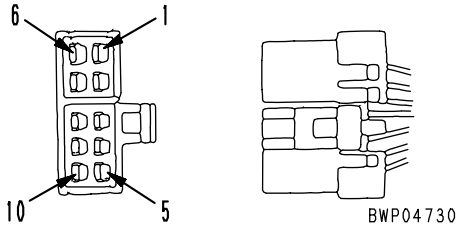
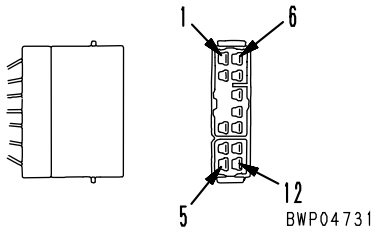
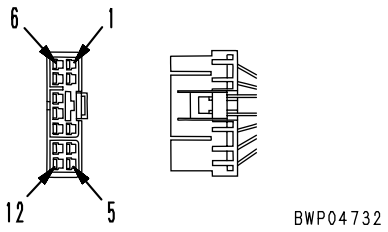
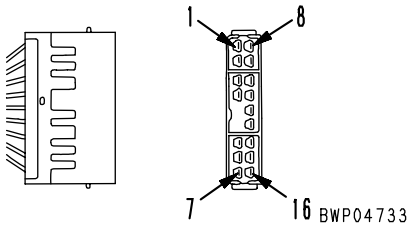
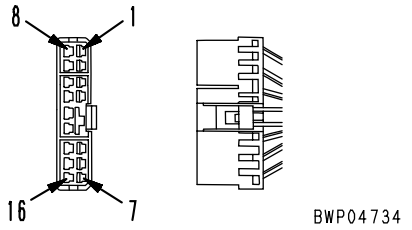
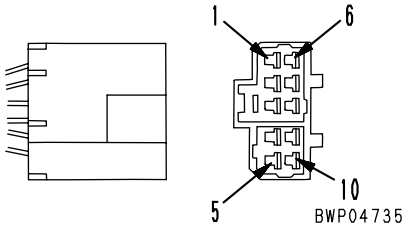
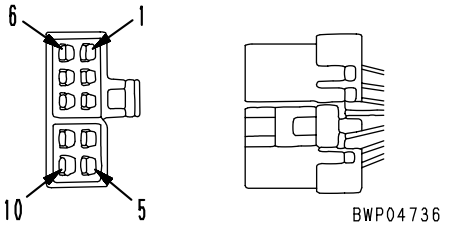
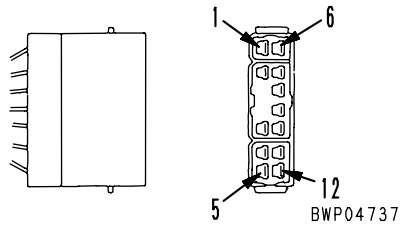
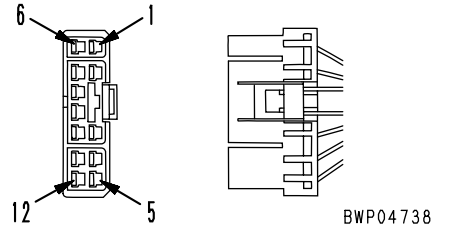
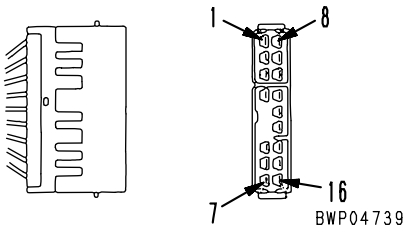
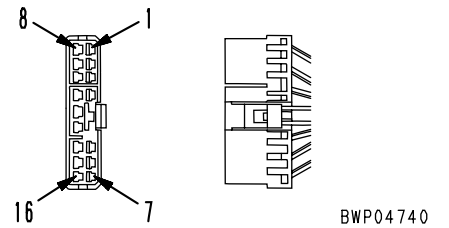
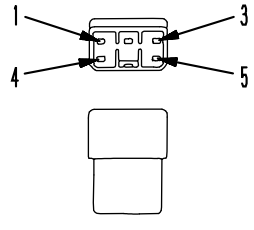
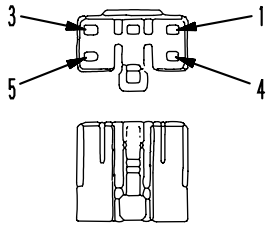
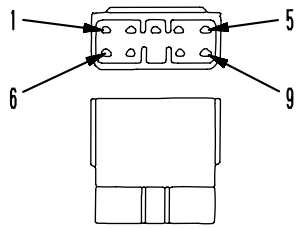
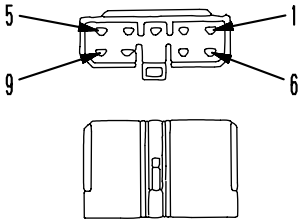
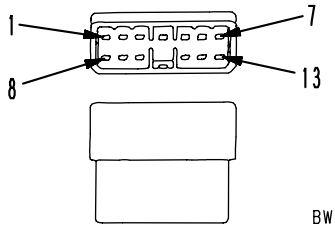
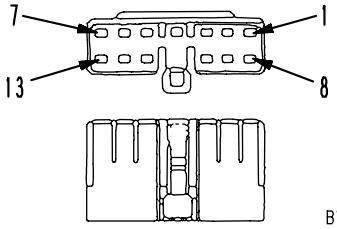
No.of pins	SWP type connector		
	Male (female housing)	Female (male housing)	T-adapter Part No.
6			799-601-7050
	Part No.: 08055-10681	Part No.: 08055-10691	
8			799-601-7060
	Part No.: 08055-10881	Part No.: 08055-10891	
12			799-601-7310
	Part No.: 08055-11281	Part No.: 08055-11291	
14			799-601-7070
	Part No.: 08055-11481	Part No.: 08055-11491	

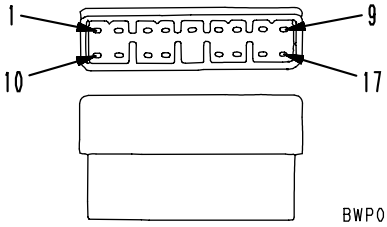
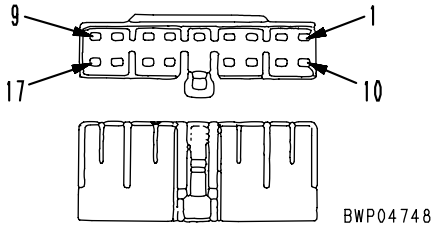
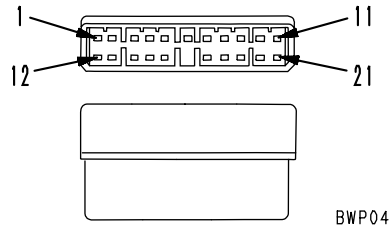
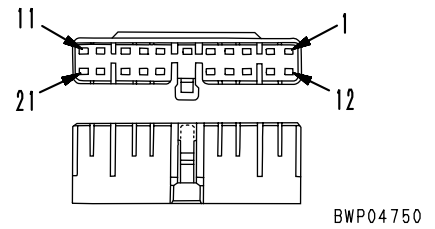
No. of pins	SWP type connector		
	Male (female housing)	Female (male housing)	T-adapter Part No.
16			799-601-7320
	Part No.: 08055-11681	Part No.: 08055-11691	
—	Terminal part No.: • Electric wire size: 0.85 • Grommet: Black • Q'ty: 20	Terminal part No.: • Electric wire size: 0.85 • Grommet: Black • Q'ty: 20	—
—	Terminal part No.: • Electric wire size: 1.25 • Grommet: Red • Q'ty: 20	Terminal part No.: • Electric wire size: 1.25 • Grommet: Red • Q'ty: 20	—

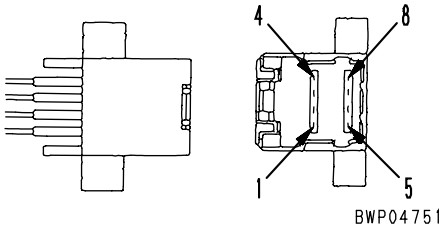
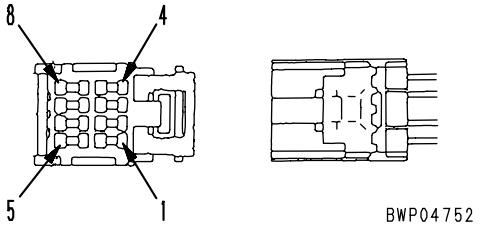
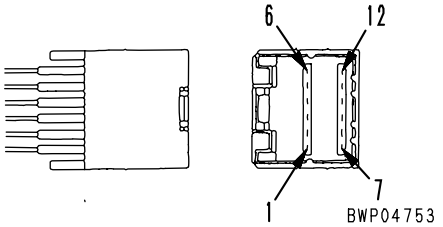
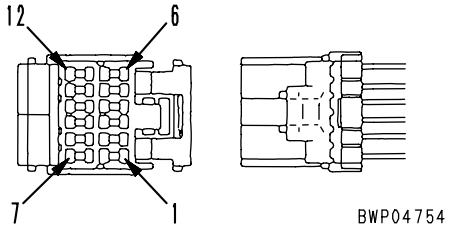
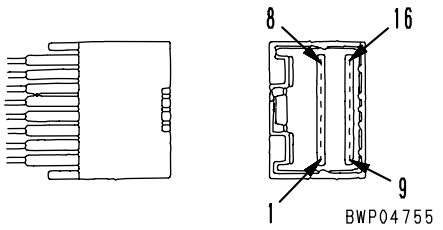
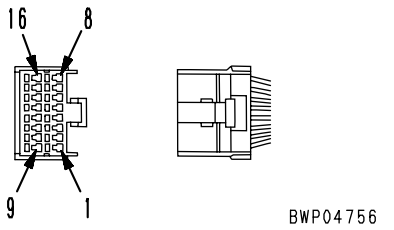
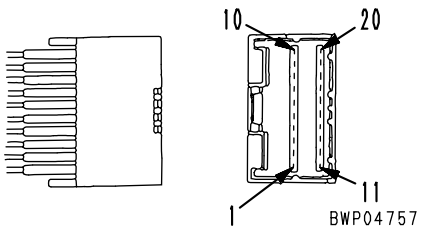
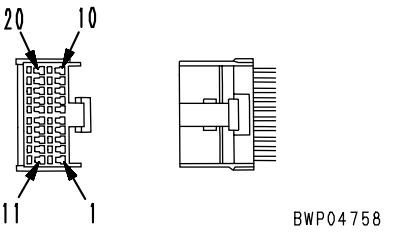
No.of pins	M type connector		
	Male (female housing)	Female (male housing)	T-adapter Part No.
1	Part No.: 08056-00171	Part No.: 08056-00181	799-601-7080
2			799-601-7090
	Part No.: 08056-00271	Part No.: 08056-00281	
3			799-601-7110
	Part No.: 08056-00371	Part No.: 08056-00381	
4			799-601-7120
	Part No.: 08056-00471	Part No.: 08056-00481	
6			799-601-7130
	Part No.: 08056-00671	Part No.: 08056-00681	
8			799-601-7390
	Part No.: 08056-00871	Part No.: 08056-00881	

No.of pins	S type connector		
	Male (female housing)	Female (male housing)	T-adapter Part No.
8			799-601-7140
	Part No.: 08056-10871	Part No.: 08056-10881	
10 (White)			799-601-7150
	Part No.: 08056-11071	Part No.: 08056-11081	
12 (White)			799-601-7350
	Part No.: 08056-11271	Part No.: 08056-11281	
16 (White)			799-601-7330
	Part No.: 08056-11671	Part No.: 08056-11681	

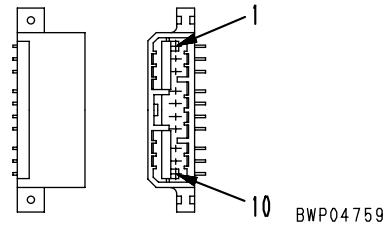
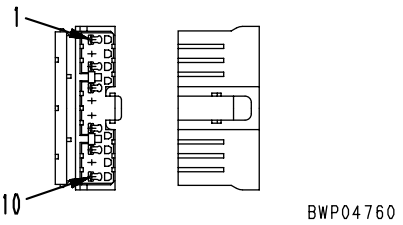
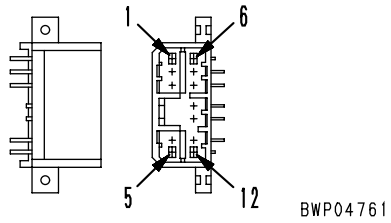
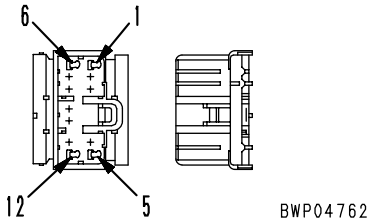
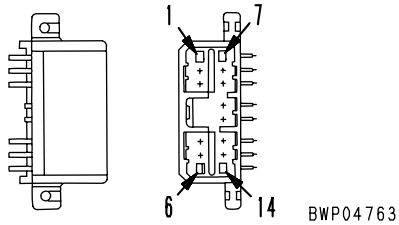
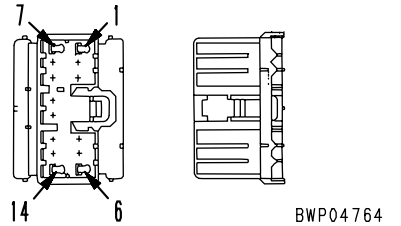
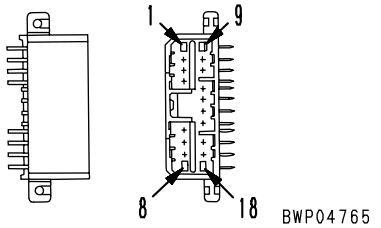
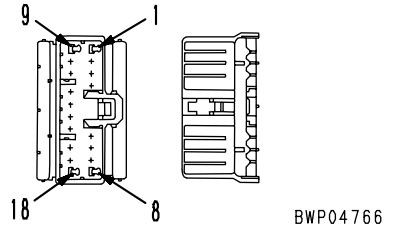
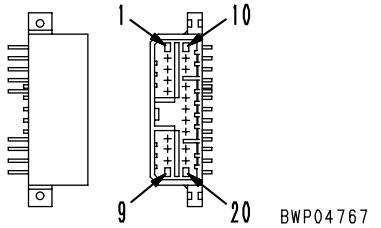
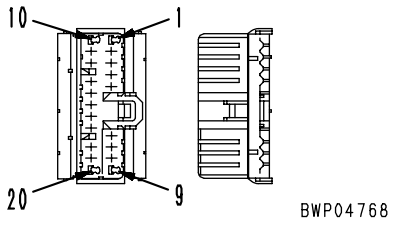
No.of pins	S type connector		
	Male (female housing)	Female (male housing)	T-adapter Part No.
10 (Blue)			—
	—	—	
12 (Blue)			799-601-7160
	Part No.: 08056-11272	Part No.: 08056-11282	
16 (Blue)			799-601-7170
	Part No.: 08056-11672	Part No.: 08056-11682	

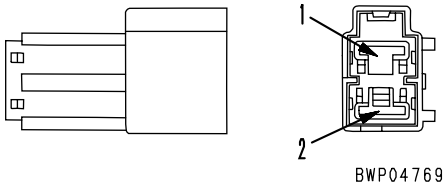
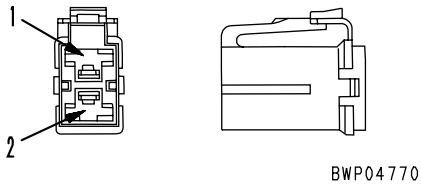
No.of pins	MIC type connector		
	Male (female housing)	Female (male housing)	T-adapter Part No.
7	Body part No.: 79A-222-2640 (Q'ty: 5)	Body part No.: 79A-222-2630 (Q'ty: 5)	—
11	Body part No.: 79A-222-2680 (Q'ty: 5)	Body part No.: 79A-222-2670 (Q'ty: 5)	—
5	 BWP04741	 BWP04742	799-601-2710
	Body part No.: 79A-222-2620 (Q'ty: 5)	Body part No.: 79A-222-2610 (Q'ty: 5)	
9	 BWP04743	 BWP04744	799-601-2950
	Body part No.: 79A-222-2660 (Q'ty: 5)	Body part No.: 79A-222-2650 (Q'ty: 5)	
13	 BWP04745	 BWP04746	799-601-2720
	Body part No.: 79A-222-2710 (Q'ty: 2)	Body part No.: 79A-222-2690 (Q'ty: 2)	

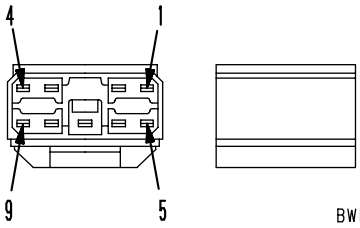
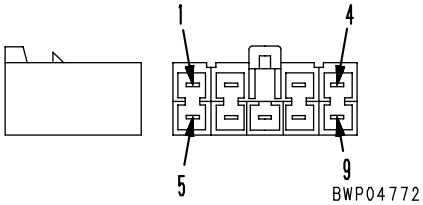
No.of pins	MIC type connector		
	Male (female housing)	Female (male housing)	T-adapter Part No.
17			799-601-2730
	Body part No.: 79A-222-2730 (Q'ty: 2)	Body part No.: 79A-222-2720 (Q'ty: 2)	
21			799-601-2740
	Body part No.: 79A-222-2750 (Q'ty: 2)	Body part No.: 79A-222-2740 (Q'ty: 2)	
	Terminal part No.: 79A-222-2770 (Q'ty: 50)	Terminal part No.: 79A-222-2760 (Q'ty: 50)	—

No.of pins	AMP040 type connector		
	Male (female housing)	Female (male housing)	T-adapter Part No.
8			799-601-7180
	—	Housing part No.: 79A-222-3430 (Q'ty: 5)	
12			799-601-7190
	—	Housing part No.: 79A-222-3440 (Q'ty: 5)	
16			799-601-7210
	—	Housing part No.: 79A-222-3450 (Q'ty: 5)	
20			799-601-7220
	—	Housing part No.: 79A-222-3460 (Q'ty: 5)	

★ Terminal part No.: 79A-222-3470 (No relation with number of pins)

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	

No.of pins	L type connector		
	Male (female housing)	Female (male housing)	T-adapter Part No.
2	 BWP04769	 BWP04770	—
	—	—	

No.of pins	Connector for PA		
	Male (female housing)	Female (male housing)	T-adapter Part No.
9	 BWP04771	 BWP04772	—
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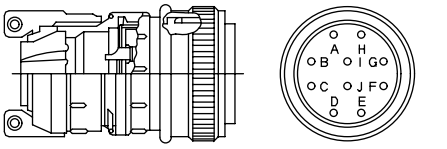
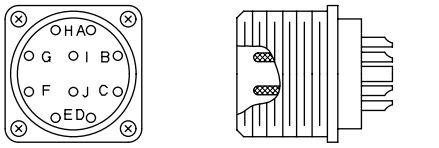
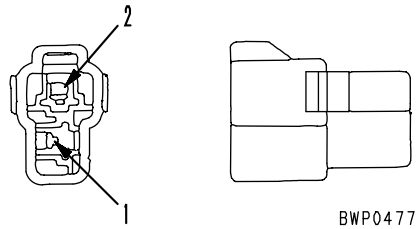
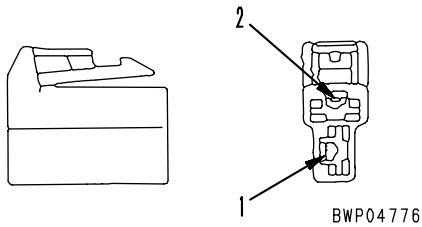
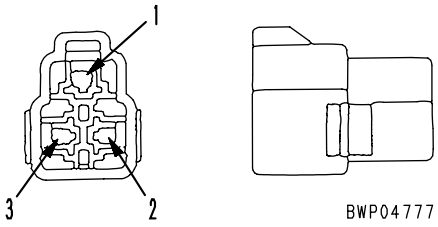
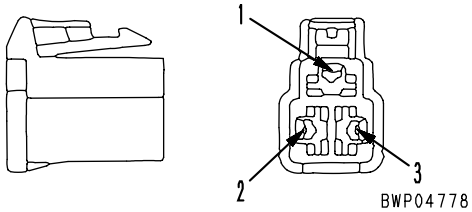
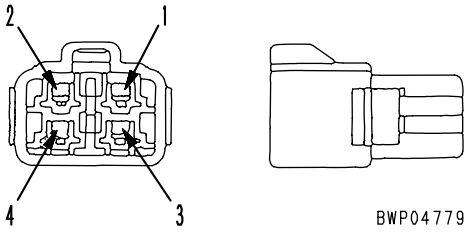
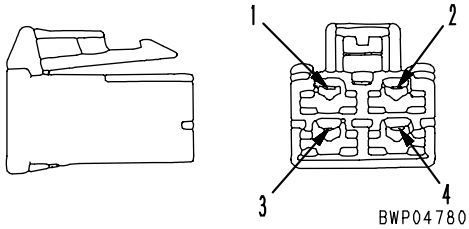
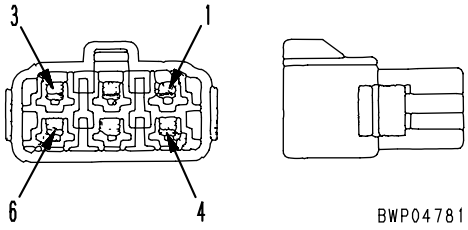
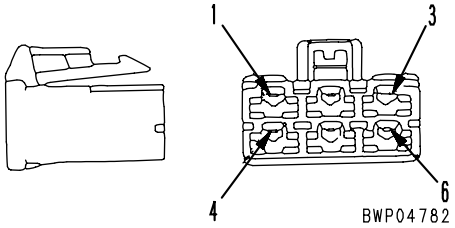
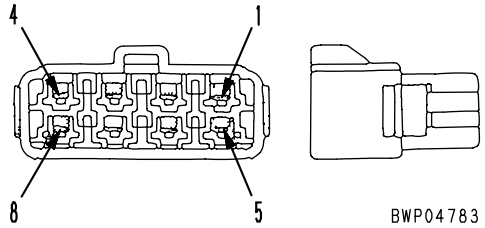
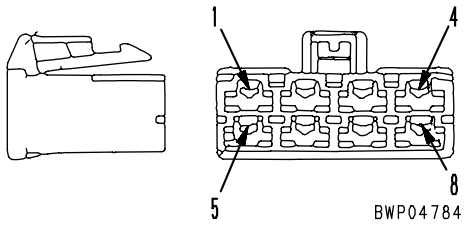
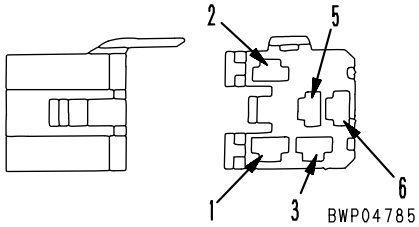
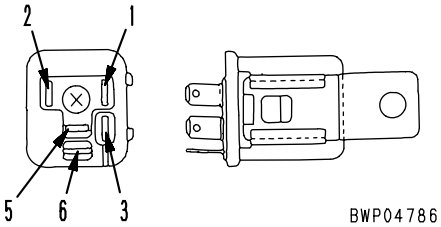
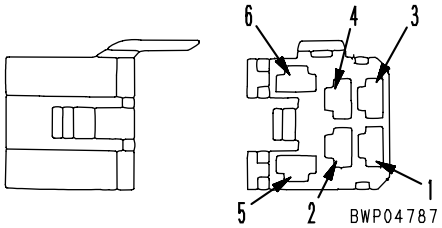
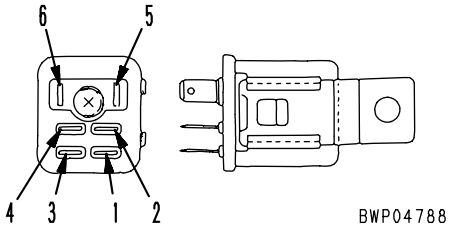
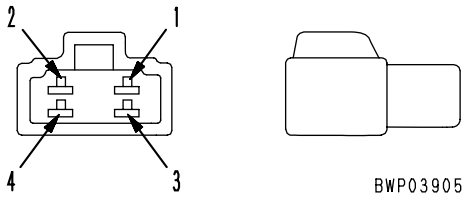
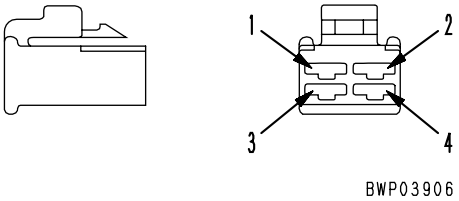
No.of pins	Bendix MS connector		
	Male (female housing)	Female (male housing)	T-adapter Part No.
10	 BWP04773	 BWP04774	799-601-3460
	—	—	

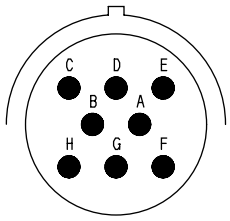
No.of pins	KES 1 (Automobile) connector		
	Male (female housing)	Female (male housing)	T-adapter Part No.
2			—
	Part No.: 08027-10210 (Natural color) 08027-10220 (Black)	Part No.: 08027-10260 (Natural color) 08027-10270 (Black)	
3			—
	Part No.:08027-10310	Part No.:08027-10360	
4			—
	Part No.: 08027-10410 (Natural color) 08027-10420 (Black)	Part No.: 08027-10460 (Natural color) 08027-10470 (Black)	
6			—
	Part No.: 08027-10610 (Natural color) 08027-10620 (Black)	Part No.: 08027-10660 (Natural color) 08027-10670 (Black)	

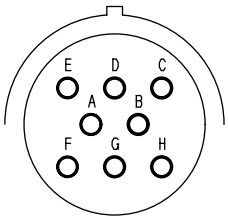
No.of pins	KES 1 (Automobile) connector		
	Male (female housing)	Female (male housing)	T-adapter Part No.
8			—
	Part No.: 08027-10810 (Natural color) 08027-10820 (Black)	Part No.: 08027-10860 (Natural color) 08027-10870 (Black)	

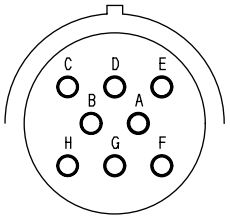
No.of pins	Connector for relay (Socket type)		
	Male (female housing)	Female (male housing)	T-adapter Part No.
5			799-601-7360
	—	—	
6			799-601-7370
	—	—	

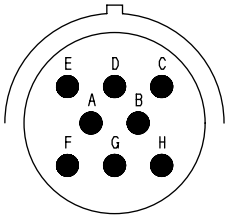
No.of pins	F type connector		
	Male (female housing)	Female (male housing)	T-adapter Part No.
4	 BWP03905	 BWP03906	—
	—	—	

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

<table>
<tr><td rowspan="2">Type (shell size code)</td><td colspan="2">HD30 Series connector</td><td rowspan="2">T-adapter Part No.</td></tr>
<tr><td>Body (plug)</td><td>Body (receptacle)</td></tr>
<tr><td rowspan="4">18-8 (1)</td><td>Pin (male terminal)</td><td>Pin (female termial)</td><td rowspan="3">799-601-9210</td></tr>
<tr><td> 

BWP05001</td><td> 

BWP05002</td></tr>
<tr><td>Part No.: 08191-11201, 08191-11202,
08191-11205, 08191-11206</td><td>Part No.: 08191-14101, 08191-14102,
08191-14105, 08191-14106</td></tr>
<tr><td>Pin (female terminal)</td><td>Pin (male termial)</td><td rowspan="3">799-601-9210</td></tr>
<tr><td> 

BWP05003</td><td> 

BWP05004</td></tr>
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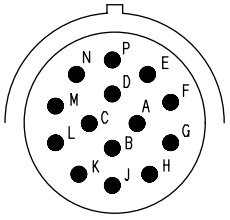
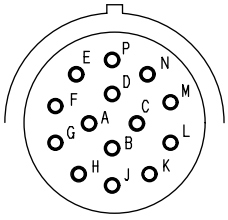
08191-12205, 08191-12206</td><td>Part No.: 08191-13101, 08191-13102,
08191-13105, 08191-13106</td></tr>
<tr><td rowspan="4">18-14 (2)</td><td>Pin (male terminal)</td><td>Pin (female termial)</td><td rowspan="3">799-601-9220</td></tr>
<tr><td> 

BWP05005</td><td> 

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08191-21205, 08191-12206</td><td>Part No.: 08191-24101, 08191-24102,
08191-24105, 08191-24106</td></tr>
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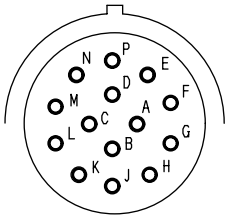
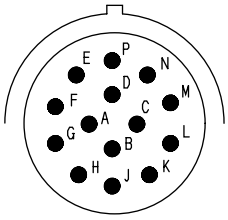
<tr><td> 

BWP05007</td><td> 

BWP05008</td></tr>
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08191-22205, 08191-22206</td><td>Part No.: 08191-23101, 08191-23102,
08191-23105, 08191-23106</td></tr>
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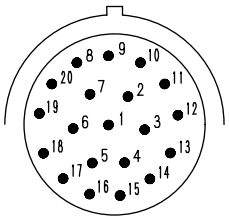
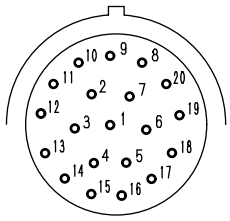
[The pin No. is also marked on the connector (electric wire insertion end)]

<table>
<tr><td rowspan="2">Type (shell size code)</td><td colspan="3">HD30 Series connector</td></tr>
<tr><td>Body (plug)</td><td>Body (receptacle)</td><td>T-adapter Part No.</td></tr>
<tr><td rowspan="4">18-20 (3)</td><td>Pin (male terminal)</td><td>Pin (female termial)</td><td rowspan="2">799-601-9230</td></tr>
<tr><td> 
BWP05009</td><td> 
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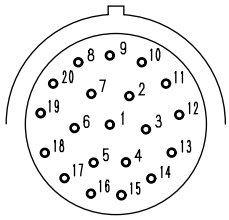
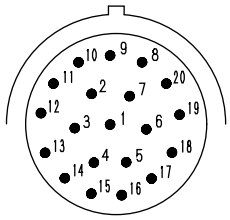
<tr><td>Part No.:08191-31201, 08191-31202</td><td>Part No.:08191-34101, 08191-34102</td><td rowspan="3">799-601-9230</td></tr>
<tr><td>Pin (female terminal)</td><td>Pin (male termial)</td></tr>
<tr><td> 
BWP05011</td><td> 
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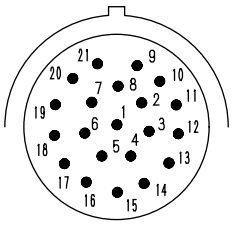
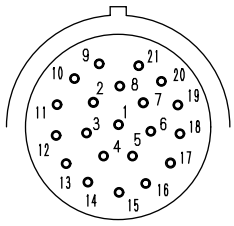
<tr><td> 
BWP05013</td><td> 
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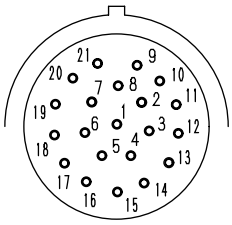
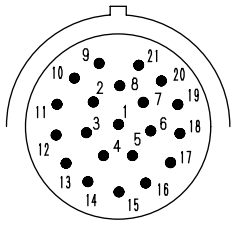
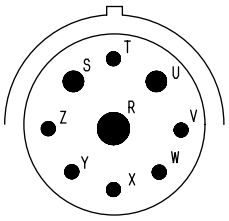
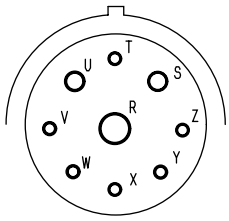
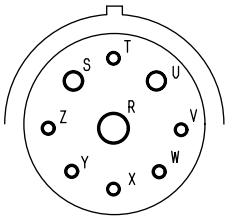
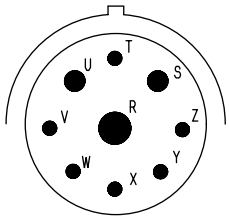
<tr><td>Pin (female terminal)</td><td>Pin (male termial)</td></tr>
<tr><td> 
BWP05015</td><td> 
BWP05016</td></tr>
<tr><td>Part No.:08191-42201, 08191-42202</td><td>Part No.:08191-43101, 08191-43102</td></tr>
</table>

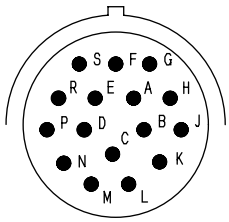
[The pin No. is also marked on the connector (electric wire insertion end)]

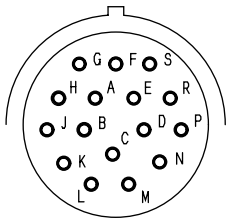
<table>
<tr><td rowspan="2">Type (shell size code)</td><td colspan="3">HD30 Series connector</td></tr>
<tr><td>Body (plug)</td><td>Body (receptacle)</td><td>T-adapter Part No.</td></tr>
<tr><td rowspan="6">24-9 (5)</td><td>Pin (male terminal)</td><td>Pin (female termial)</td><td rowspan="3">799-601-9250</td></tr>
<tr><td> 

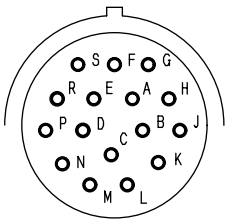
BWP05017</td><td> 

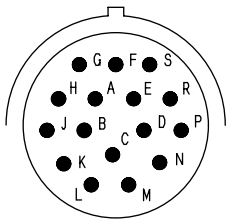
BWP05018</td></tr>
<tr><td>Part No.:08191-51201, 08191-51202</td><td>Part No.:08191-54101, 08191-54102</td></tr>
<tr><td>Pin (female terminal)</td><td>Pin (male termial)</td><td rowspan="3">799-601-9250</td></tr>
<tr><td> 

BWP05019</td><td> 

BWP05020</td></tr>
<tr><td>Part No.:08191-52201, 08191-52202</td><td>Part No.:08191-53101, 08191-53102</td></tr>
<tr><td rowspan="6">24-16 (6)</td><td>Pin (male terminal)</td><td>Pin (female termial)</td><td rowspan="3">799-601-9260</td></tr>
<tr><td> 

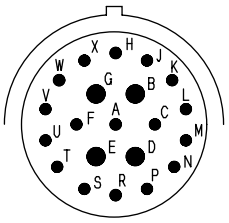
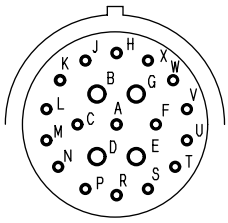
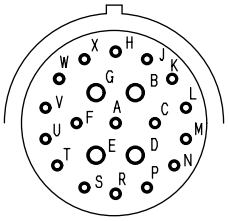
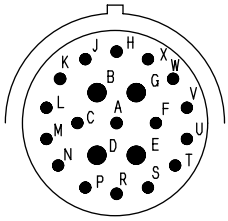
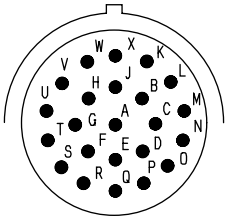
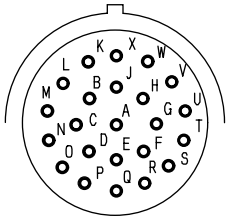
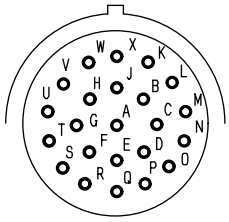
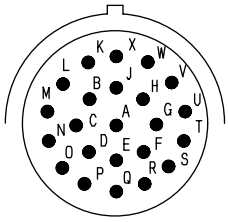
BWP05021</td><td> 

BWP05022</td></tr>
<tr><td>Part No.: 08191-61201, 08191-62202,
08191-61205, 08191-62206</td><td>Part No.: 08191-64101, 08191-64102,
08191-64105, 08191-64106</td></tr>
<tr><td>Pin (female terminal)</td><td>Pin (male termial)</td><td rowspan="3">799-601-9260</td></tr>
<tr><td> 

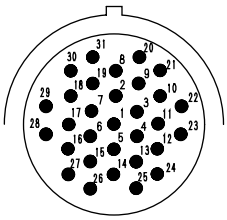
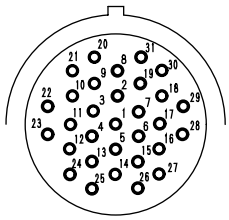
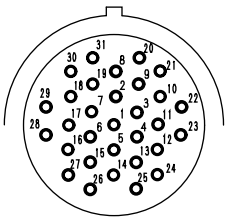
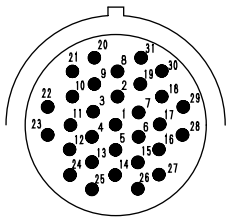
BWP05023</td><td> 

BWP05024</td></tr>
<tr><td>Part No.: 08191-62201, 08191-62202,
08191-62205, 08191-62206</td><td>Part No.: 08191-63101, 08191-63102,
08191-63105, 08191-63106</td></tr>
</table>

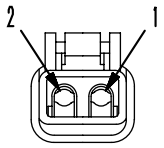
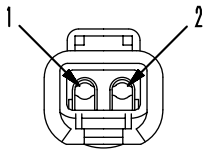
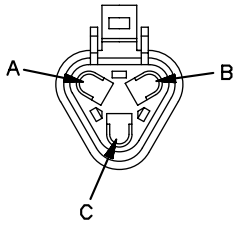
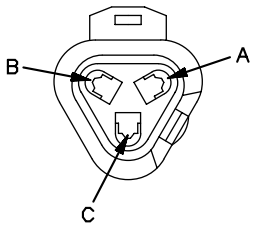
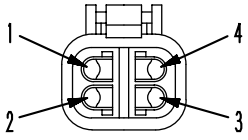
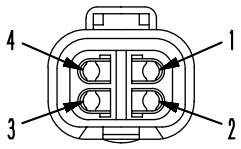
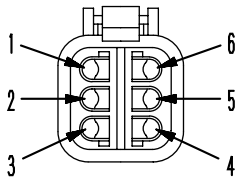
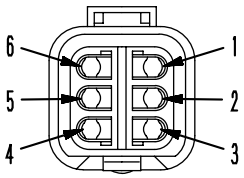
[The pin No. is also marked on the connector (electric wire insertion end)]

<table>
<tr><td rowspan="2">Type (shell size code)</td><td colspan="3">HD30 Series connector</td></tr>
<tr><td>Body (plug)</td><td>Body (receptacle)</td><td>T-adapter Part No.</td></tr>
<tr><td rowspan="4">24-21 (7)</td><td>Pin (male terminal)</td><td>Pin (female termial)</td><td rowspan="2">799-601-9270</td></tr>
<tr><td> 
BWP05025</td><td> 
BWP05026</td></tr>
<tr><td>Part No.: 08191-71201, 08191-71202,
08191-71205, 08191-71206</td><td>Part No.: 08191-74101, 08191-74102,
08191-74105, 08191-74106</td><td rowspan="3">799-601-9270</td></tr>
<tr><td>Pin (female terminal)</td><td>Pin (male termial)</td></tr>
<tr><td> 
BWP05027</td><td> 
BWP05028</td></tr>
<tr><td>Part No.: 08191-72201, 08191-72202,
08191-72205, 08191-72206</td><td>Part No.: 08191-73101, 08191-73102,
08191-73105, 08191-73106</td></tr>
<tr><td rowspan="4">24-22 (8)</td><td>Pin (male terminal)</td><td>Pin (female termial)</td><td rowspan="2">799-601-9280</td></tr>
<tr><td> 
BWP05029</td><td> 
BWP05030</td></tr>
<tr><td>Part No.: 08191-81201, 08191-81202
08191-81203, 08191-81204
08191-81205, 08191-80206</td><td>Part No.: 08191-84101, 08191-84102
08191-84103, 08191-84104
08191-84105, 08191-84106</td><td rowspan="3">799-601-9280</td></tr>
<tr><td>Pin (female terminal)</td><td>Pin (male termial)</td></tr>
<tr><td> 
BWP05031</td><td> 
BWP05032</td></tr>
<tr><td>Part No.: 08191-82201, 08191-82202
08191-82203, 08191-82204
08191-82205, 08191-82206</td><td>Part No.: 08191-83101, 08191-83102
08191-83103, 08191-83104
08191-83105, 08191-83106</td></tr>
</table>

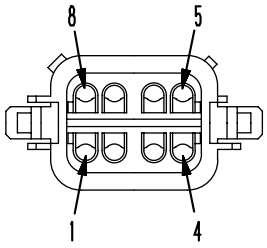
[The pin No. is also marked on the connector (electric wire insertion end)]

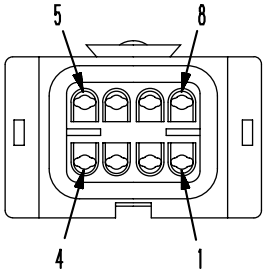
<table>
<tr><td rowspan="2">Type (shell size code)</td><td colspan="3">HD30 Series connector</td></tr>
<tr><td>Body (plug)</td><td>Body (receptacle)</td><td>T-adapter Part No.</td></tr>
<tr><td rowspan="4">24-31 (9)</td><td>Pin (male termial)</td><td>Pin (female terminal)</td><td rowspan="2">799-601-9290</td></tr>
<tr><td> 
BWP05033</td><td> 
BWP05034</td></tr>
<tr><td>Part No.: 08191-91203, 08191-91204, 08191-91205, 08191-91206</td><td>Part No.: 08191-94103, 08191-94104, 08191-94105, 08191-94106</td></tr>
<tr><td>Pin (female terminal)</td><td>Pin (male termial)</td><td rowspan="2">799-601-9290</td></tr>
<tr><td> 
BWP05035</td><td> 
BWP05036</td></tr>
<tr><td>Part No.: 08191-92203, 08191-92204, 08191-92205, 08191-92206</td><td>Part No.: 08191-93103, 08191-93104, 08191-93105, 08191-93106</td></tr>
</table>

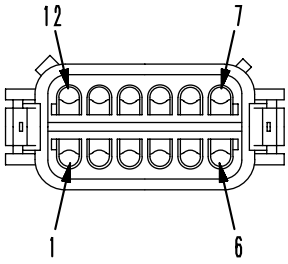
[The pin No. is also marked on the connector (electric wire insertion end)]

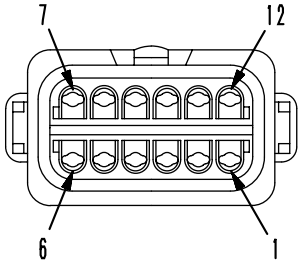
No.of pins	DT Series connector		
	Body (plug)	Body (receptacle)	T-adapter Part No.
2	 BWP05037	 BWP05038	799-601-9020
	Part No.: 08192-12200 (normal type) 08192-22200 (fine wire type)	Part No.: 08192-12100 (normal type) 08192-22100 (fine wire type)	
3	 BWP05039	 BWP05040	799-601-9030
	Part No.: 08192-13200 (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)	

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

<table>
<tr><th rowspan="2">No.of pins</th><th colspan="3">DT Series connector</th></tr>
<tr><th>Body (plug)</th><th>Body (receptacle)</th><th>T-adapter Part No.</th></tr>
<tr><td rowspan="2">8</td><td> 

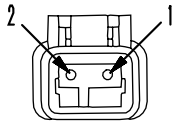
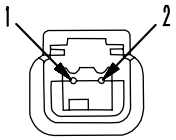
BWP05045</td><td> 

BWP05046</td><td rowspan="2">8GR: 799-601-9060
8B: 799-601-9070
8G: 799-601-9080
8BR: 799-601-9090</td></tr>
<tr><td>Part No.: 08192-1820☐ (normal type)
08192-2820☐ (fine wire type)</td><td>Part No.: 08192-1810☐ (normal type)
08192-2810☐ (fine wire type)</td></tr>
<tr><td rowspan="2">10</td><td> 

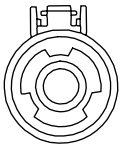
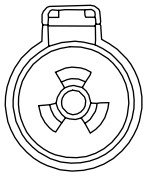
BWP05047</td><td> 

BWP05048</td><td rowspan="2">12GR: 799-601-9110
12B: 799-601-9120
12G: 799-601-9130
12BR: 799-601-9140</td></tr>
<tr><td>Part No.: 08192-1920☐ (normal type)
08192-2920☐ (fine wire type)</td><td>Part No.: 08192-1910☐ (normal type)
08192-2910☐ (fine wire type)</td></tr>
</table>

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

No.of pins	DTM Series connector		
	Body (plug)	Body (receptacle)	T-adapter Part No.
2	 BWP05049	 BWP05050	799-601-9010
	Part No.: 08192-02200	Part No.: 08192-02100	

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

No.of pins	DTHD Series connector		
	Body (plug)	Body (receptacle)	T-adapter Part No.
2	 BWP05051	 BWP05052	—
	Part No.: 08192-31200 (Contact size#12) 08192-41200 (Contact size #8) 08192-51200 (Contact size #4)	Part No.: 08192-31100 (Contact size#12) 08192-41100 (Contact size #8) 08192-51100 (Contact size #4)	

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

INFORMATION CONTAINED IN TROUBLESHOOTING TABLE

★ The troubleshooting table and the related circuit diagrams contain the following information. Grasp their contents fully before proceeding to actual troubleshooting work.

User Code	Service Code	Failure Code	Failure phenomenon	Title of failure phenomenon shown in failure history
Display in monitor panel	Display in monitor panel	Display in monitor panel		
Failure content	Failure status as detected by monitor panel or controller			
Response from monitor panel or controller	Action taken by the monitor panel or controller to protect an affected system or equipment, when they detect some failure.			
Phenomenon occurring on machine	Phenomenon that occurs on the machine, resulting from the above action taken by the monitor panel or controller			
Relative information	Information on the failure occurred as well as the troubleshooting			

Presumed cause and standard value in normalcy	Cause		Standard value in normalcy and references for troubleshooting
	1	Cause that presumably triggered failure in question (The assigned No. is for filing purpose only. It does not stand for any priority)	<Content Included> • Standard value in normalcy by which to pass "Good" or "No good" judgement over the presumed cause • Reference for passing the above "Good" or "No Good" judgement <Phenomenon of Wiring Harness Failure> • Disconnection There is a faulty contact at the connector or disconnection of wiring harness occurred. • Defective grounding A wiring harness that is not connected with a grounding circuit has a contact with the grounding circuit. • Short-circuiting A wiring harness that is not connected with a 24 V electric circuit has a contact with the electric circuit. <Precaution for Troubleshooting> 1) Connector No. display method and handling of T-adapter Insert or connect T-adapters in the following manner before starting troubleshooting unless otherwise instructed. • If there is no indication of "male" or "female" in a specific connector No., disconnect the connector and insert the T-adapter into both male and female sides. • If there is an indication of "male" or "female" in a specific connector No., disconnect the connector and connect the T-adepter with only one side of either "male" or "female". 2) Entry sequence of pin No. and handling of circuit tester lead Connect the positive (+) lead and the negative (–) lead OFF a circuit tester in the following manner unless otherwise instructed. • Connect the positive (+) lead with the pin No. indicated at the front or the wiring harness. • Connect the negative (–) lead with the pin No. indicated at the front or the wiring harness.
	2		
	3		
	4		
	5		

Relative Electrical Circuit Diagram

This is part of the electrical circuit diagram which shows the portion where the failure occurred.

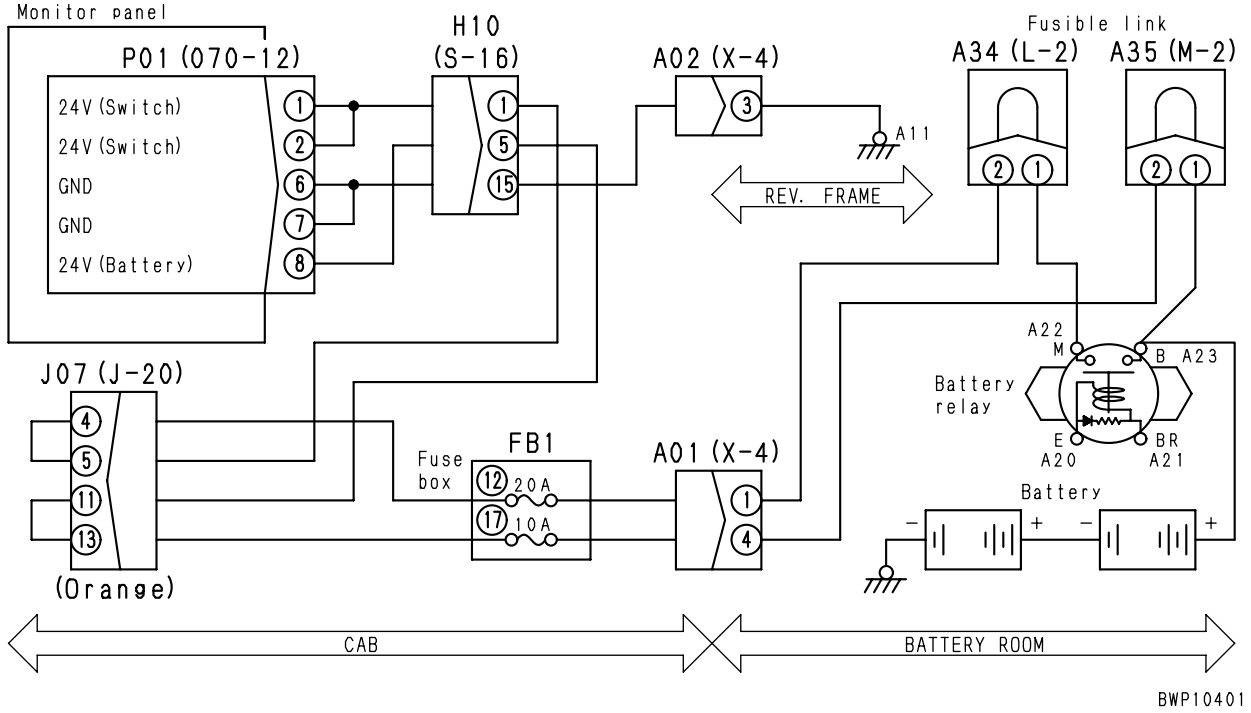
- Connector No.: Indicates (Type - numbers of a pin) (color)
- Arrow: Roughly indicates the location in the machine where it is installed.

Service Code in Electrical System E101 (Abnormal data in Error History)

User Code	Service Code	Failure Code	Failure phenomenon	Abnormal data in the error history (in Monitor Panel system)
—	**E101**	**DAF0KT**		
Failure content	• The voltage in the firm power source circuit for Monitor Panel (battery) has dropped below 12 V or exceeded 36 V.			
Response from Monitor Panel	• None in particular			
Phenomenon occurring on machine	• A display for information on the failure history (in the electrical system) cannot be called.			

Presumed cause and standard value in normalcy		Cause	Standard value in normalcy and references for troubleshooting		
	1	Fuse No. 12 defective	If the fuse is blown, there is a big possibility that the circuit has a grounding fault.		
	2	Fusible link No. A35 defective	If the fusible link is blown, there is a big possibility that the circuit has a grounding fault.		
	3	Disconnection of wiring harness (Disconnection or connector contact fault)	★Turn the engine starting switch OFF for the preparations, and hold it in the OFF position for the troubleshooting.		
			Wiring harness from P01 (female) ⑧ to J07 to FB1-17 outlet	Resistance value	Above 1 Ω
			Wiring harness between FB1-17 inlet and A35 (male) ②	Resistance value	Above 1 Ω
			Wiring harness between A35 (male) ① and A23 (B terminal)	Resistance value	Above 1 Ω
	4	Grounding fault of wiring harness (Contact with grounding circuit)	★Turn the engine starting switch OFF for the preparations, and hold it in the OFF position for the troubleshooting.		
			Between wiring harness between P01 (female) ⑧ to J07 and FB1-17 outlet and grounding	Resistance value	Above 1 MΩ
			Between wiring harness between FB1-17 inlet and A35 (male) ② and grounding	Resistance value	Above 1 MΩ
			Between wiring harness between A35 (male) ① and A23 (B terminal) and grounding	Resistance value	Above 1 MΩ
	5	Monitor Panel defective	★Turn the engine starting switch OFF for the preparations, and hold it in the OFF position for the troubleshooting.		
			C03	Voltage	
			Between ⑧ and ⑥ ⑦	20 – 30 V	

Monitor Panel Power Source Electric Circuit Diagram

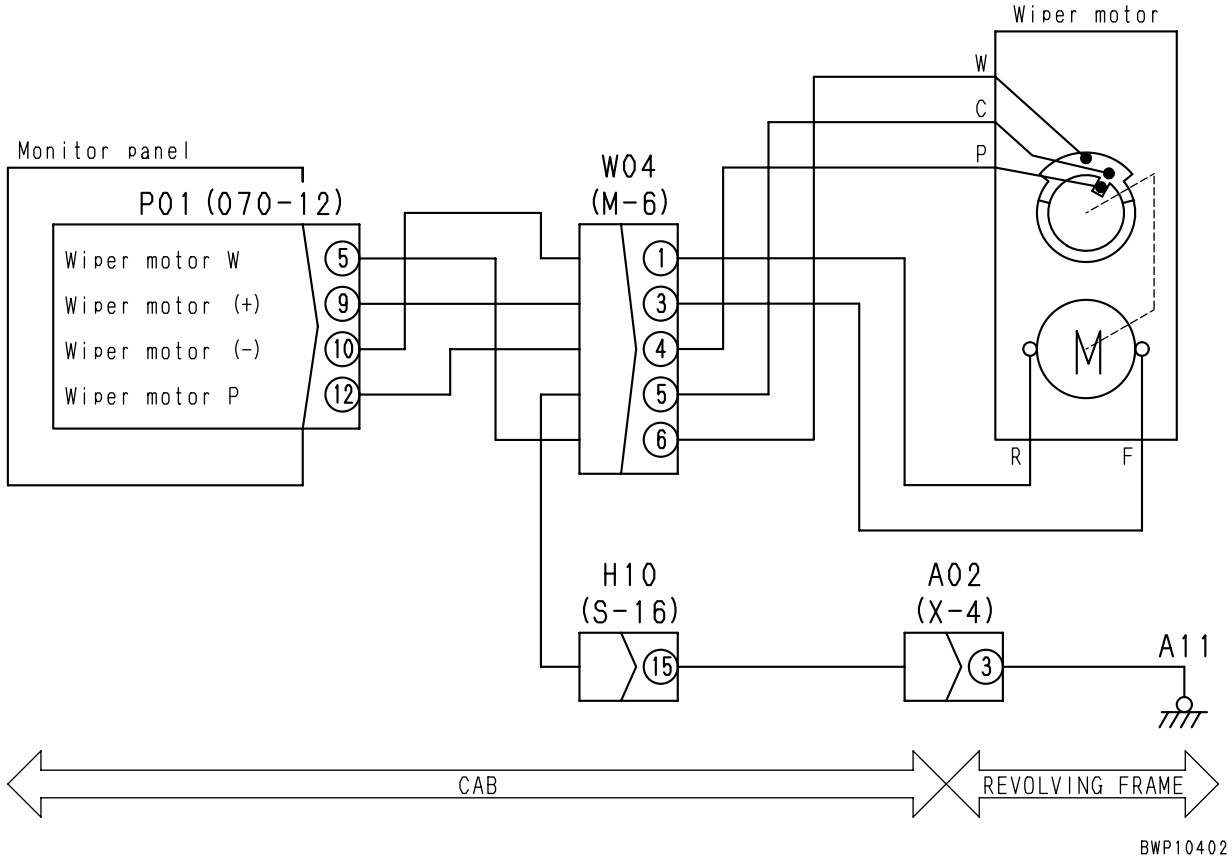


Service Code in Electrical System E112
(Short-circuiting in normal rotation system of windshield wiper motor drive)

User Code	Service Code	Failure Code	Failure phenomenon	Short-circuiting in normal rotation system of windshield wiper motor drive (in monitor panel system)
—	**E112**	**DY2DKB**		
Failure content	• Abnormal current flew to the windshield wiper motor normal rotation circuit, when power is provided.			
Response from Monitor Panel	• Power supply to the windshield wiper motor normal rotation circuit is turned OFF.			
Phenomenon occurring on machine	• The windshield wiper stops moving.			

Presumed cause and standard value in normalcy		Cause	Standard value in normalcy and references for troubleshooting			
	1	Windshield wiper motor defective (Internal short-circuiting or grounding fault)	★Turn the engine starting switch OFF for the preparations, and hold it in the OFF position for the troubleshooting.			
			W04 (female)		Continuity and resistance value	
			Between ③ and ①		Continued	
			Between ③ and grounding		Above 1 MΩ	
	2	Grounding fault of wiring harness (Contact with grounding circuit)	★Turn the engine starting switch OFF for the preparations, and hold it in the OFF position for the troubleshooting.			
			Between wiring harness between P01 (female) ⑨ and W04 (male) ③ and grounding		Resistance value	Above 1 MΩ
	3	Monitor panel defective	★Turn the engine starting switch OFF for the preparations, and hold it in the ON position for the troubleshooting.			
			P01	Windshield wiper switch	Voltage	
			Between ⑨ and grounding	OFF	Below 3 V	
				ON	Below 3 V⇔20 – 30 V (at constant cycle)	

Electric Circuit Diagram for Monitor Panel Windshield Wiper Motor

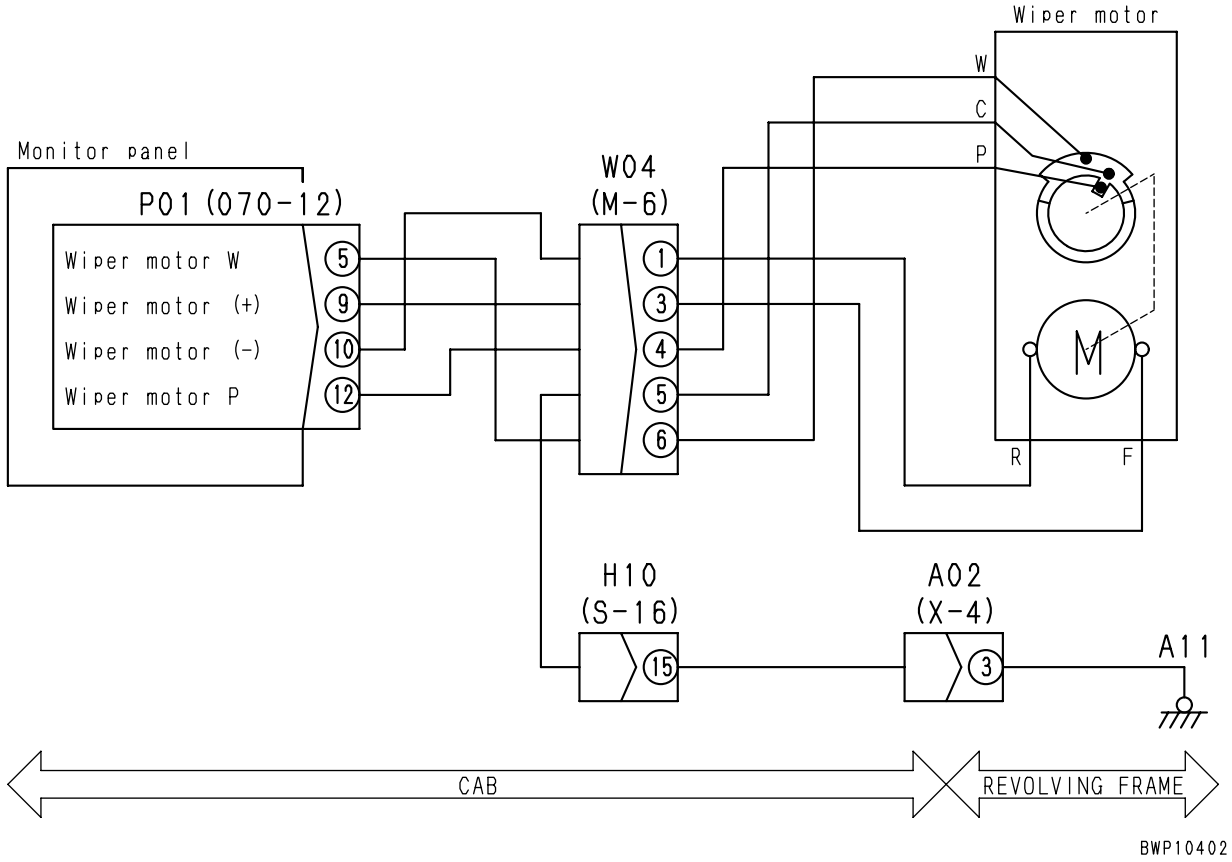


Service Code in Electrical System E113
(Short-circuiting in reverse rotation system of windshield wiper motor drive)

User Code	Service Code	Failure Code	Failure phenomenon	Short-circuiting in reverse rotation system of windshield wiper motor drive (in Monitor Panel system)
—	**E113**	**DY2EKB**		
Failure content	• Abnormal current flew to the reverse rotation circuit of the windshield wiper motor drive, when the windshield wiper was set in motion.			
Response from Monitor Panel	• Power supply to the reverse rotation circuit of the windshield wiper motor drive was switched OFF.			
Phenomenon occurring on machine	• The windshield wiper stopped moving.			

Presumed cause and standard value in normalcy		Cause	Standard value in normalcy and references for troubleshooting			
	1	Windshield wiper motor defective (Internal short-circuiting or grounding fault)	★Turn the engine starting switch OFF for the preparations, and hold it in the OFF position for the troubleshooting.			
			W04 (female)		Continuity and resistance value	
			Between ① and ③		Continued	
			Between ① and grounding		Above 1 MΩ	
	2	Grounding fault of wiring harness (Contact with grounding circuit)	★Turn the engine starting switch OFF for the preparations, and hold it in the OFF position for the troubleshooting.			
			Between wiring harness between P01 (female) ⑩ and W04 (male) ① and grounding		Resistance value	Above 1 MΩ
	3	Monitor panel defective	★Turn the engine starting switch OFF for the preparations, and hold it in the ON position for the troubleshooting.			
			P01	Windshield wiper switch		Voltage
			Between ⑩ and grounding	OFF		Below 3 V
				ON		Below 3 V⇔20 – 30 V (at constant cycle)

Electric Circuit Diagram for Monitor Panel Windshield Wiper Motor

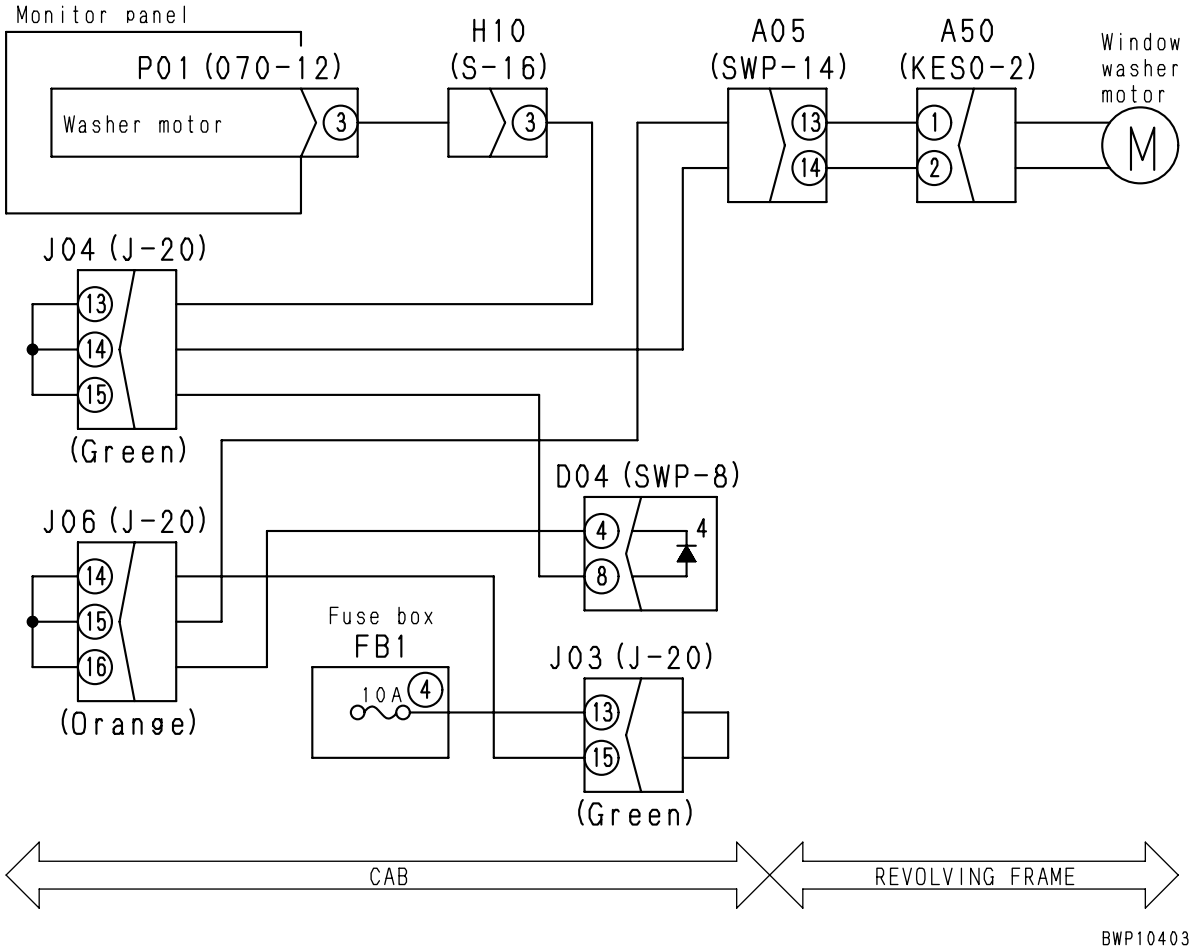


Service Code in Electrical System E114
(Short-circuiting in window washer drive system)

User Code	Service Code	Failure Code	Failure phenomenon	Short-circuiting in window washer drive system (in Monitor Panel system)
—	**E114**	**DY2CKB**		
Failure content	• Abnormal current flew to the window washer drive circuit, when the circuit was grounded and power was switched ON.			
Response from Monitor Panel	• Power supply to the grounding in the window washer motor circuit was switched OFF.			
Phenomenon occurring on machine	• The window washer stopped moving.			

Presumed cause and standard value in normalcy		Cause	Standard value in normalcy and references for troubleshooting			
	1	Window washer drive motor defective (Internal short-circuiting)	★Turn the engine starting switch OFF for the preparations, and hold it in the OFF position for the troubleshooting.			
			A50 (male)		Resistance value	
			Between ① and ②		5 – 20 Ω	
	2	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 for the troubleshooting.			
			Between wiring harness from P01 (female) ③ to J04 to A50 (female) ② and grounding, or between wiring harness between P01 (female) ③ and D04 (female) ⑧ and grounding		Voltage	Below 1 V
	3	Monitor panel defective	★Turn the engine starting switch OFF for the preparations, and hold it in the ON position for the troubleshooting.			
			P01	Window washer switch	Voltage	
			Between ③ and grounding	OFF	20 – 30 V	
				ON	Below 1 V	

Monitor Panel Window Washer Motor Electrical Circuit Diagram

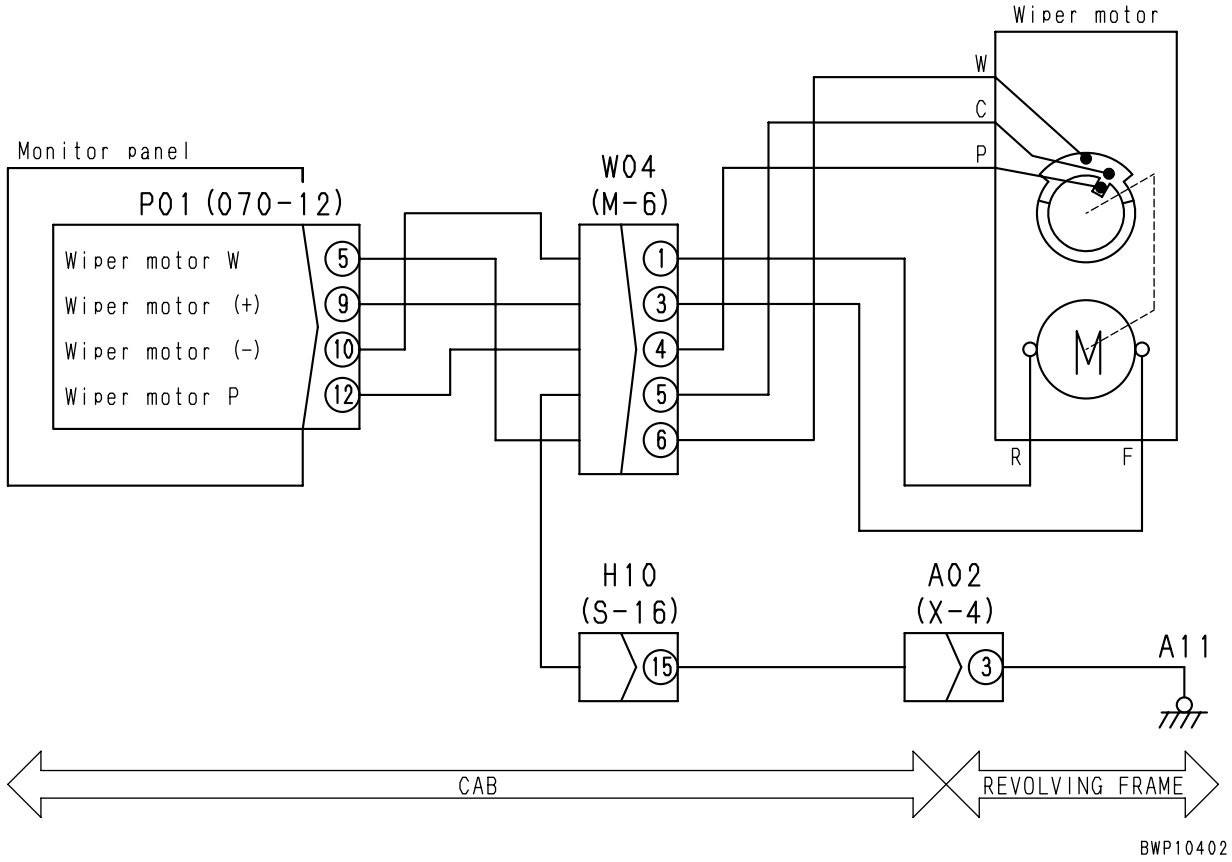


Service Code in Electrical System E115 (Abnormal Windshield Wiper Motion)

User Code	Service Code	Failure Code	Failure phenomenon	Abnormal operation of windshield wiper (in Monitor Panel system)
—	**E115**	**DY20KA**		
Failure content	• A W signal is not inputted at both ends of movement, when it is in motion.			
Response from Monitor Panel	• Power to the windshield wiper motor is turned OFF.			
Phenomenon occurring on machine	• The windshield wiper motor does not work.			
Relative information	• Input of W signal at both ends of movement (ON or OFF) can be confirmed in the monitor function. (Code No. 049: Monitor input 3)			

Presumed cause and standard value in normalcy		Cause	Standard value in normalcy and references for troubleshooting			
	1	Windshield wiper motor defective (Internal disconnection)	★Turn the engine starting switch OFF for the preparations, and hold it in the OFF position for the troubleshooting.			
			W04 (female)	Windshield wiper blade	Resistance value	
			Between ⑥ and ⑤	At upper end of operation range	Below 1 Ω	
				Outside upper end of operation range	Above 1 MΩ	
	2	Disconnection of wiring harness (Disconnection or faulty contact with connector)	★Turn the engine starting switch OFF for the preparations, and hold it in the OFF position for the troubleshooting.			
			Wiring harness between P01 (female) ⑤ and W04 (male) ⑥		Resistance value	Below 1 Ω
			Wiring harness between W04 (male) ⑤ and grounding		Resistance value	Below 1 Ω
	3	Monitor panel defective	★Turn the engine starting switch OFF for the preparations, and hold it in the ON position for the troubleshooting.			
			P01	Windshield wiper blade	Voltage	
			Between ⑤ and grounding	At upper end of operation range	Below 1 V	
				Outside upper end of operation range	20 – 30 V	

Monitor Panel Windshield Wiper Motor Electrical Circuit Diagram

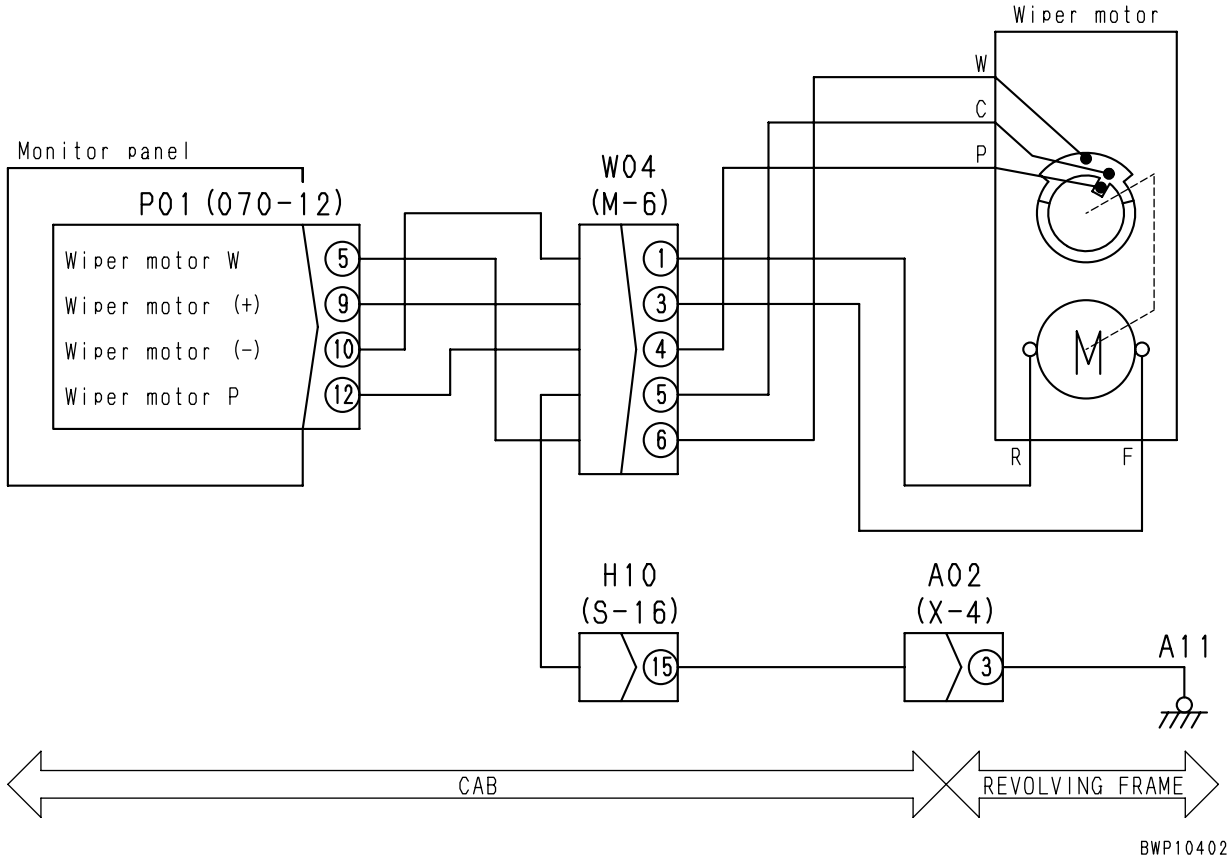


Service Code in Electrical System E116 (Abnormality in retracting windshield wiper)

User Code	Service Code	Failure Code	Failure phenomenon	Abnormal operation of retracting windshield wiper (in Monitor Panel system)
—	**E116**	**DY20MA**		
Failure content	• P signal in the retraction range is not inputted, when the wiper is retracted.			
Response from Monitor Panel	• Power supply to the windshield wiper motor is switched OFF, when the wiper is retracted.			
Phenomenon occurring on machine	• The windshield wiper cannot be retracted completely.			
Relative information	• It can be checked in the monitoring function whether P signal (ON or OFF) in the retraction operation range is inputted or not. (Code No. 049: Monitor Input 3)			

Presumed cause and standard value in normalcy	Cause		Standard value in normalcy and references for troubleshooting			
	1	Windshield wiper motor defective (Internal disconnection)	★Turn the engine starting switch OFF for the preparations, and hold it in the OFF position for the troubleshooting.			
			W04 (female)	Windshield wiper blade	Resistance value	
			Between ④ and ⑤	Retraction range	Below 1 Ω	
				Operation range	Above 1 MΩ	
	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 P01 (female) ⑫ and W04 (male) ④		Resistance value	Below 1 Ω
			Between wiring harness W04 (male) ⑤ and grounding		Resistance value	Below 1 Ω
	3	Monitor panel defective	★Turn the engine starting switch OFF for the preparations, and hold it in the ON position during the troubleshooting.			
			P01	Windshield wiper blade	Voltage	
			Between ⑫ and grounding	Retraction range	Below 1V	
				Operation range	20 – 30 V	

Monitor Panel Windshield Wiper Motor Electrical Circuit Diagram



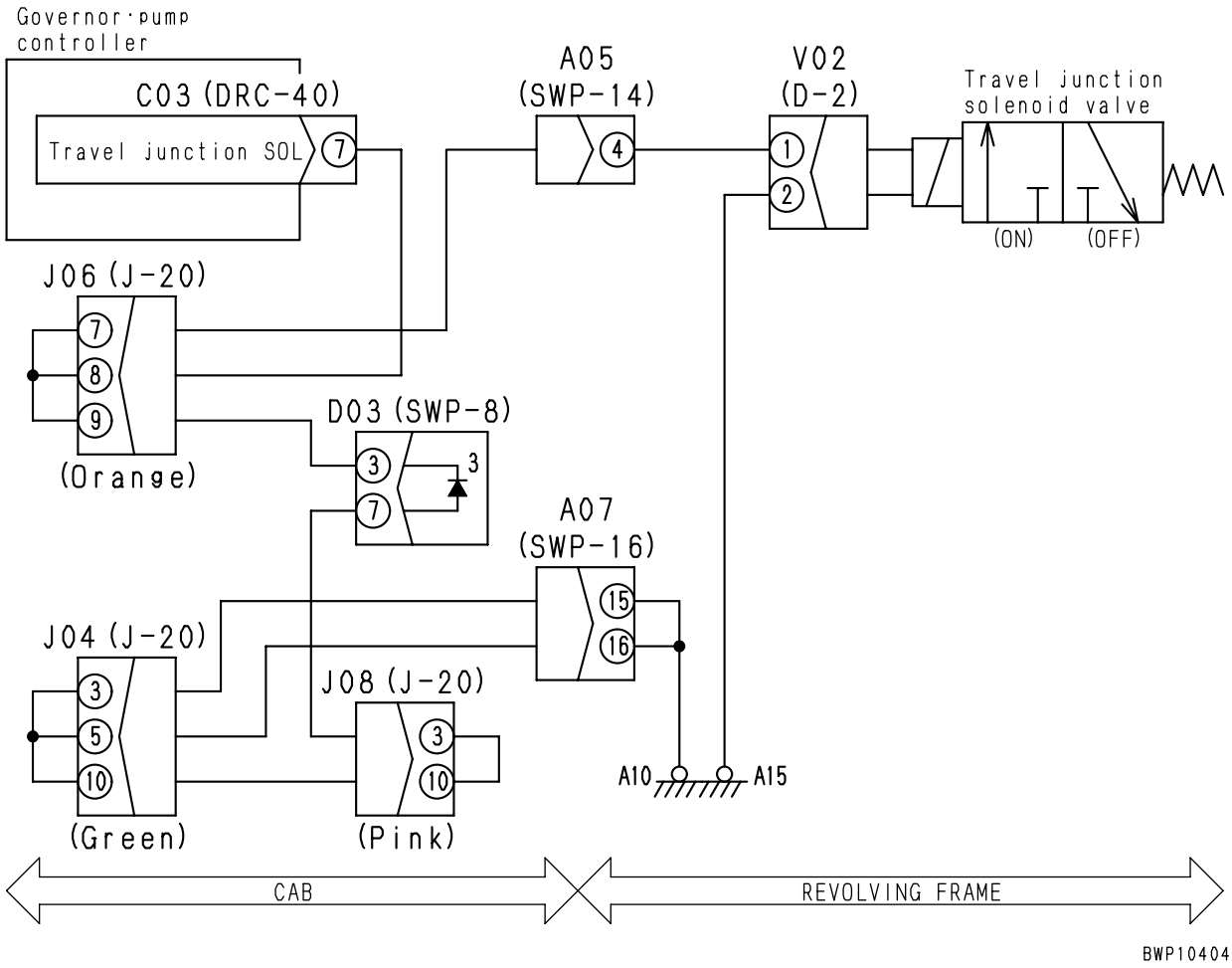
Service Code in Electrical System E201 (Short-circuiting in travel interlocking solenoid)

User Code	Service Code	Failure Code	Failure phenomenon	Short-circuiting in travel interlocking solenoid (in governor • pump controller system)
—	**E201**	**DW91KB**		
Failure content	• Abnormal current flew to the travel interlocking circuit, when power was supplied to the circuit.			
Response from controller	• Power supply to the travel interlocking circuit is switched OFF. • Even if the failure cause disappears of itself, the solenoid circuit does not return to normalcy, unless the engine starting switch is once turned OFF.			
Phenomenon occurring on machine	• It is difficult to steer the machine at turns.			
Relative information	• Operation of the travel interlocking solenoid (ON or OFF) can be checked in the monitoring function. (Code No. 023: Solenoid)			

Presumed cause and standard value in normalcy

	Cause	Standard value in normalcy and references for troubleshooting			
1	Travel interlocking solenoid defective (Internal short-circuiting or grounding fault)	★Turn the engine starting switch OFF for the preparations, and hold it in the OFF position during the troubleshooting.			
		V02 (male)	Resistance value		
		Between ① and ②	20 – 60 Ω		
		Between ① and grounding	Above 1 MΩ		
2	Assembled-type diode D03 defective (Internal short-circuiting)	★Turn the engine starting switch OFF for the preparations, and hold it in the OFF position during the troubleshooting.			
		D03 (male)	Resistance value		
		Between ③ and ⑦	Above 1 MΩ		
3	Grounding fault of wiring harness (Contact with grounding circuit)	★Turn the engine starting switch OFF for the preparations, and hold it in the OFF position during the troubleshooting.			
		Between wiring harness from C03 (female) ⑦ to J06 to V02 (female) ① and grounding, or between wiring harness between C03 (female) ⑦ and D03 (female) ③ and grounding	Resistance value	Above 1 MΩ	
4	Governor • pump controller defective	★Turn the engine starting switch OFF for the preparations, and hold it running during the troubleshooting.			
		C03	Travel control lever	Voltage	
		Between ⑦ and grounding	Straight forward	Below 1 V	
			Steering	20 – 30 V	

Electrical Circuit for Travel Interlocking Solenoid in Governor • Pump Controller



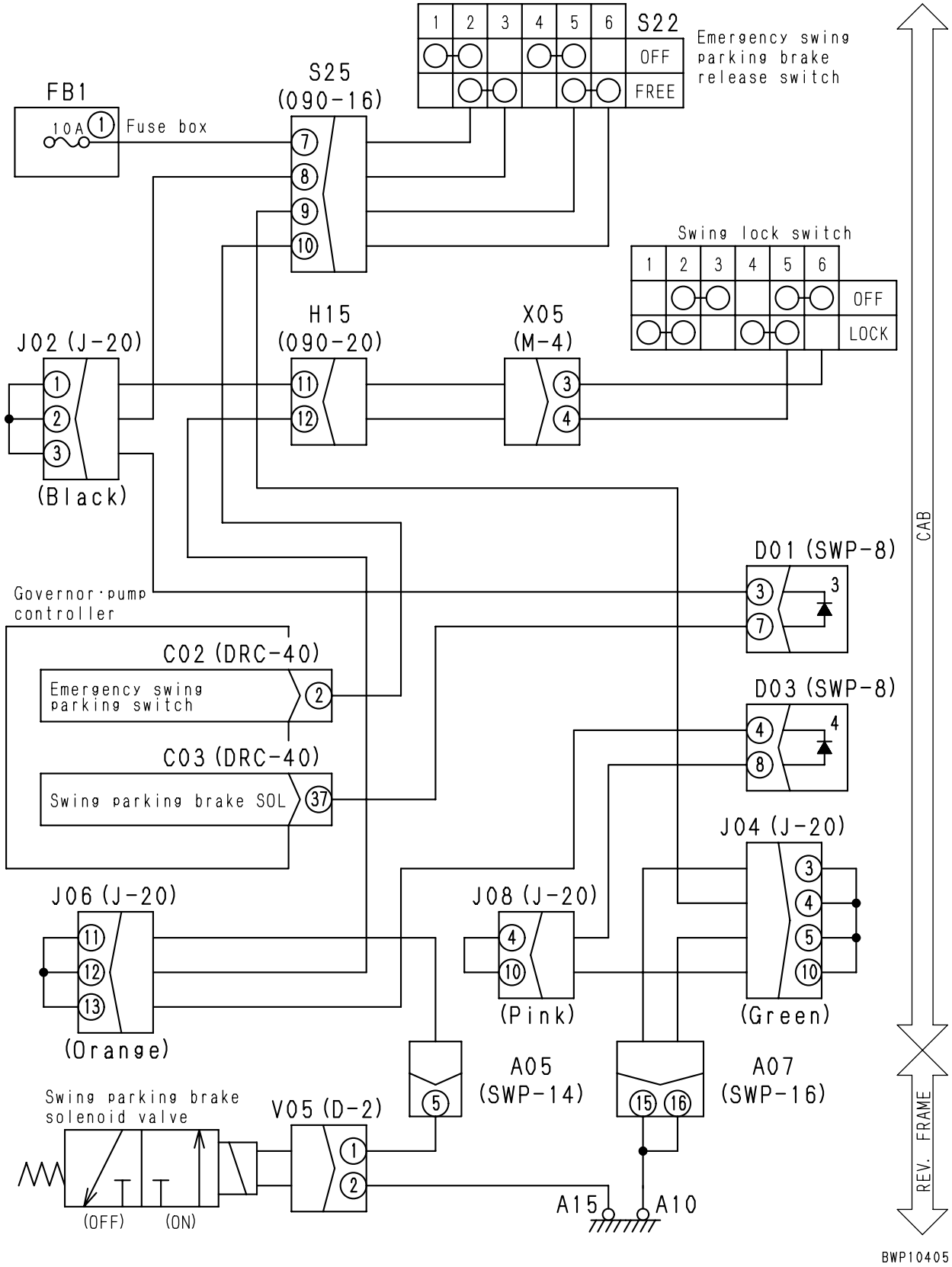
Service Code in Electrical System E203
(Short-circuiting in swing and parking brake solenoid - in governor • pump controller system)

User Code	Service Code	Failure Code	Failure phenomenon	Short-circuiting in swing and parking brake solenoid (in governor • pump controller system)
E03	**E203**	**DW45KB**		
Failure content	• Abnormal current flew to the swing and parking brake solenoid circuit, when power was supplied to the circuit.			
Response from controller	• Power supply to the swing and parking brake solenoid circuit is switched OFF. • Even after the failure cause disappears of itself, the swing and steering brake does not return to normalcy, unless the engine starting switch is once turned OFF.			
Phenomenon occurring on machine	• The upper structure cannot swing.			
Relative information	• Operation of the swing and parking brake solenoid (ON or OFF) can be checked in the monitoring function. (Code No. 023: Solenoid 1) • If there is no abnormality with the solenoid or wiring harness, the upper structure can swing by turning the emergency swing brake releasing switch to the FREE position. (In this case, however, the parking brake does not work, when stopping the machine)			

Presumed cause and standard value in normalcy

	Cause	Standard value in normalcy and references for troubleshooting			
1	Swing and parking brake solenoid defective (Internal short-circuiting or grounding fault)	★Turn the engine starting switch OFF for the preparations, and hold it in the OFF position during the troubleshooting.			
		V05 (male)		Resistance value	
		Between ① and ②		20 – 60 Ω	
		Between ① and grounding		Above 1 MΩ	
2	Assembled-type diode D03 defective (Internal short-circuiting)	★Turn the engine starting switch OFF for the preparations, and hold it in the OFF position during the troubleshooting.			
		D03 (male)		Resistance value	
		Between ④ and ⑧		Above 1 MΩ	
3	Grounding fault of wiring harness (Contact with grounding circuit)	★Turn the engine starting switch OFF for the preparations, and hold it in the OFF position during the troubleshooting.			
		Wiring harness from C03 (female) ㊲ to D01 to J02 to X05 to J06 to V05 (female) ①, or between wiring harness between C03 (female) ㊲ and D03 (female) ④ and grounding		Resistance value	Above 1 MΩ
4	Governor • pump controller defective	★Turn the engine starting switch OFF for the preparations, and hold it running during the troubleshooting.			
		C03	Swing control lever	Voltage	
		Between ㊲ and grounding	NEUTRAL	Below 1 V	
			Swing	20 – 30 V	

Electrical Circuit Diagram for Swing and Parking Brake of Governor • Pump Controller

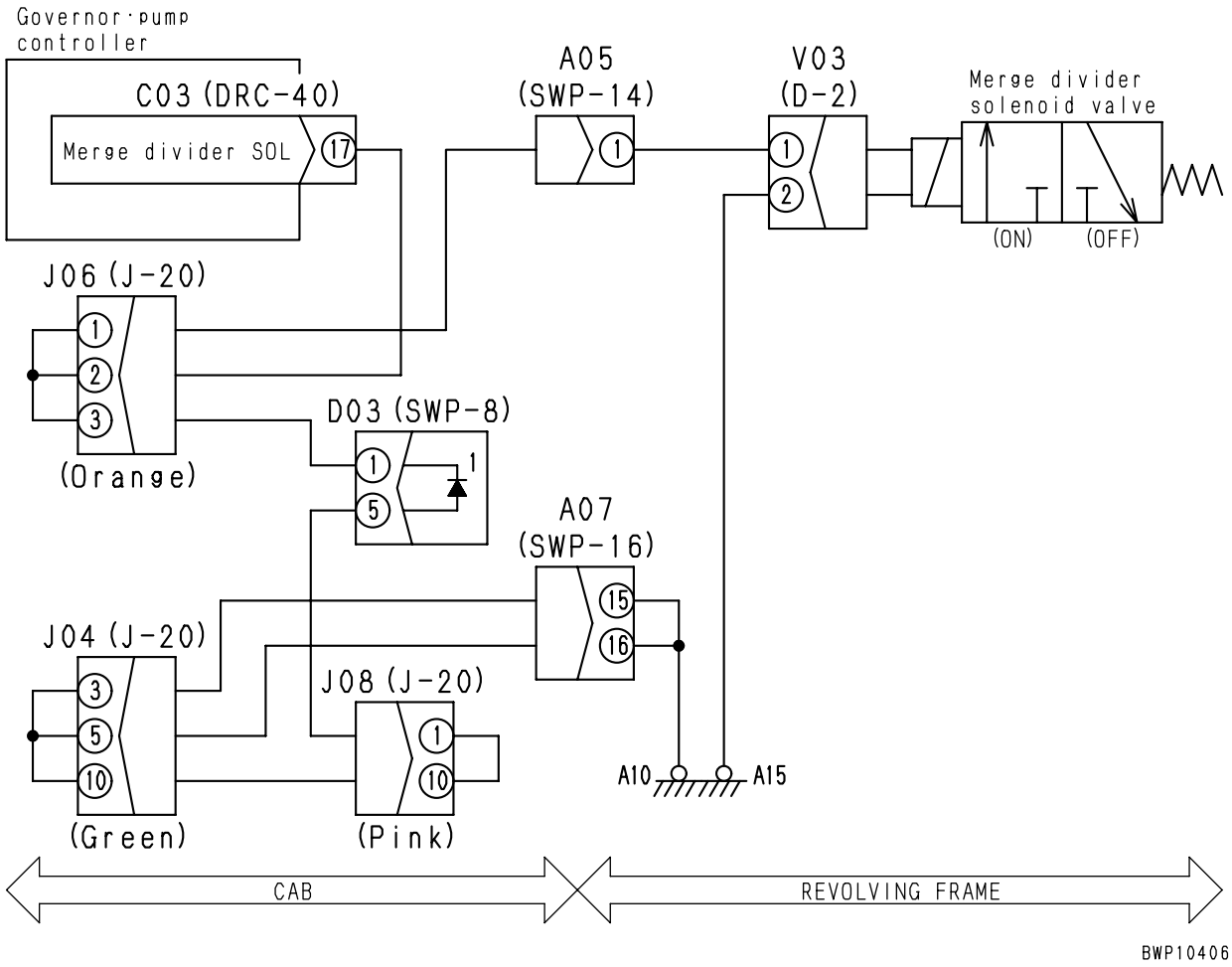


Service Code in Electrical System E204 (Short-circuiting in merge/divide solenoid)

User Code	Service Code	Failure Code	Failure phenomenon	Short-circuiting in merge/divide solenoid (in governor • pump controller system)
—	**E204**	**DWJ0KB**		
Failure content	• Abnormal current flew to the merge/divide solenoid circuit, when power was supplied to the circuit.			
Response from controller	• Power supply to the merge/divide solenoid circuit is switched OFF. • Even after the failure cause disappears of itself, the machine operation does not return to normalcy, unless the engine starting switch is once turned OFF.			
Phenomenon occurring on machine	• In L mode, the work equipment moves slowly, or the swing speed is slow in its single operation.			
Relative information	• Operation of the merge/divide solenoid (ON or OFF) can be checked in the monitoring function. (Code No. 023: Solenoid 1)			

Presumed cause and standard value in normalcy		Cause	Standard value in normalcy and references for troubleshooting			
	1	Merge/divide solenoid defective (Internal short-circuiting or grounding fault)	★Turn the engine starting switch OFF for the preparations, and hold it in the OFF position during the troubleshooting.			
			V03 (male)	Resistance value		
			Between ① and ②	20 – 60 Ω		
			Between ① and grounding	Above 1 MΩ		
	2	Assembled-type diode D03 defective (Internal short-circuiting)	★Turn the engine starting switch OFF for the preparations, and hold it in the OFF position during the troubleshooting.			
			D03 (male)	Resistance value		
			Between ① and ⑤	Above 1 MΩ		
	3	Grounding fault of wiring harness (Contact with grounding circuit)	★Turn the engine starting switch OFF for the preparations, and hold it in the OFF position during the troubleshooting.			
			Wiring harness from C03 (female) ⑰ to J06 to V03 (female) ①, or between wiring harness between C03 (female) ⑰ and D03 (female) ① and grounding	Resistance value	Above 1 MΩ	
	4	Governor • pump controller defective	★Turn the engine starting switch OFF for the preparations, and hold it running during the troubleshooting.			
			C03	Travel control lever	Voltage	
			Between ⑰ and grounding	NEUTRAL	Below 1 V	
				When operating one side only	20 – 30 V	

Electrical Circuit Diagram for Merge/Divide Solenoid in Governor • Pump Controller

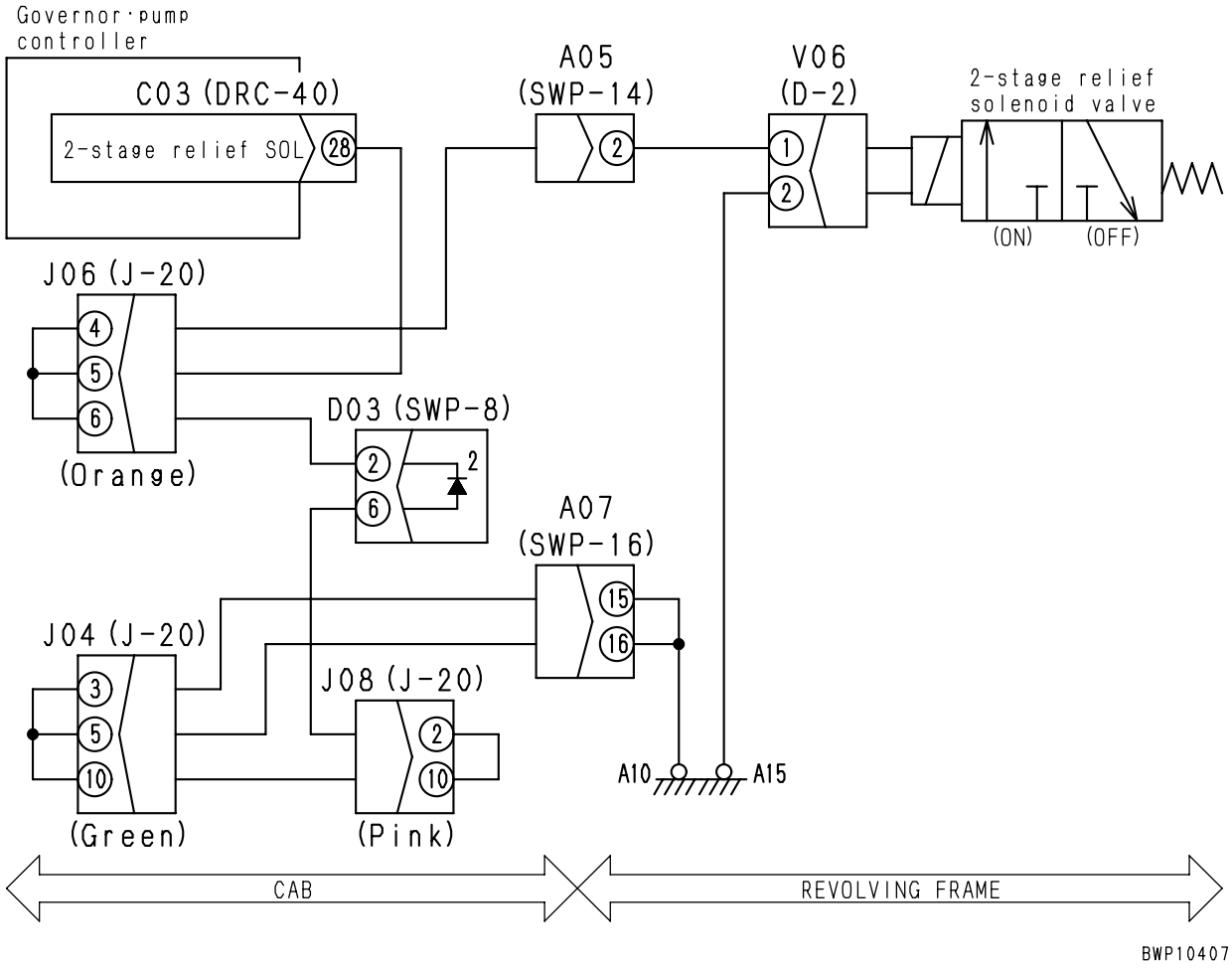


Service Code in Electrical System E205 (Short-circuiting in 2-stage relief solenoid)

User Code	Service Code	Failure Code	Failure phenomenon	Short-circuiting in 2-stage relief solenoid (in governor • pump controller system)
—	**E205**	**DWK0KB**		
Failure content	• Abnormal current flew to the 2-stage relief solenoid circuit, when power was supplied to the circuit.			
Response from controller	• Power supply to the 2-stage relief solenoid circuit is switched OFF. • Even after the failure cause disappears of itself, the machine operation does not return to normalcy, unless the engine starting switch is once turned OFF.			
Phenomenon occurring on machine	• The one-touch power max. switch does not work.			
Relative information	• Operation of the 2-stage relief solenoid (ON or OFF) can be checked in the monitoring function. (Code No. 023: Solenoid 1)			

Presumed cause and standard value in normalcy		Cause	Standard value in normalcy and references for troubleshooting			
	1	2-stage relief solenoid defective (Internal short-circuiting or grounding fault)	★Turn the engine starting switch OFF for the preparations, and hold it in the OFF position during the troubleshooting.			
			V06 (male)	Resistance value		
			Between ① and ②	20 – 60 Ω		
			Between ① and grounding	Above 1 MΩ		
	2	Assembled-type diode D03 defective (Internal short-circuiting)	★Turn the engine starting switch OFF for the preparations, and hold it in the OFF position during the troubleshooting.			
			D03 (male)	Resistance value		
			Between ② and ⑥	Above 1 MΩ		
	3	Grounding fault of wiring harness (Contact with grounding circuit)	★Turn the engine starting switch OFF for the preparations, and hold it in the OFF position during the troubleshooting.			
			Wiring harness from C03 (female) ㉘ to J06 to V06 (female) ①, or between wiring harness between C03 (female) ㉘ and D03 (female) ② and grounding	Resistance value	Above 1 MΩ	
	4	Governor • pump controller defective	★Turn the engine starting switch OFF for the preparations, and hold it in the ON position during the troubleshooting.			
			C03	Working mode	Voltage	
			Between ㉘ and grounding	Other than L mode	Below 1 V	
				L mode	20 – 30 V	

Electric Circuit Diagram for 2-stage Relief Solenoid in Governor • Pump Controller

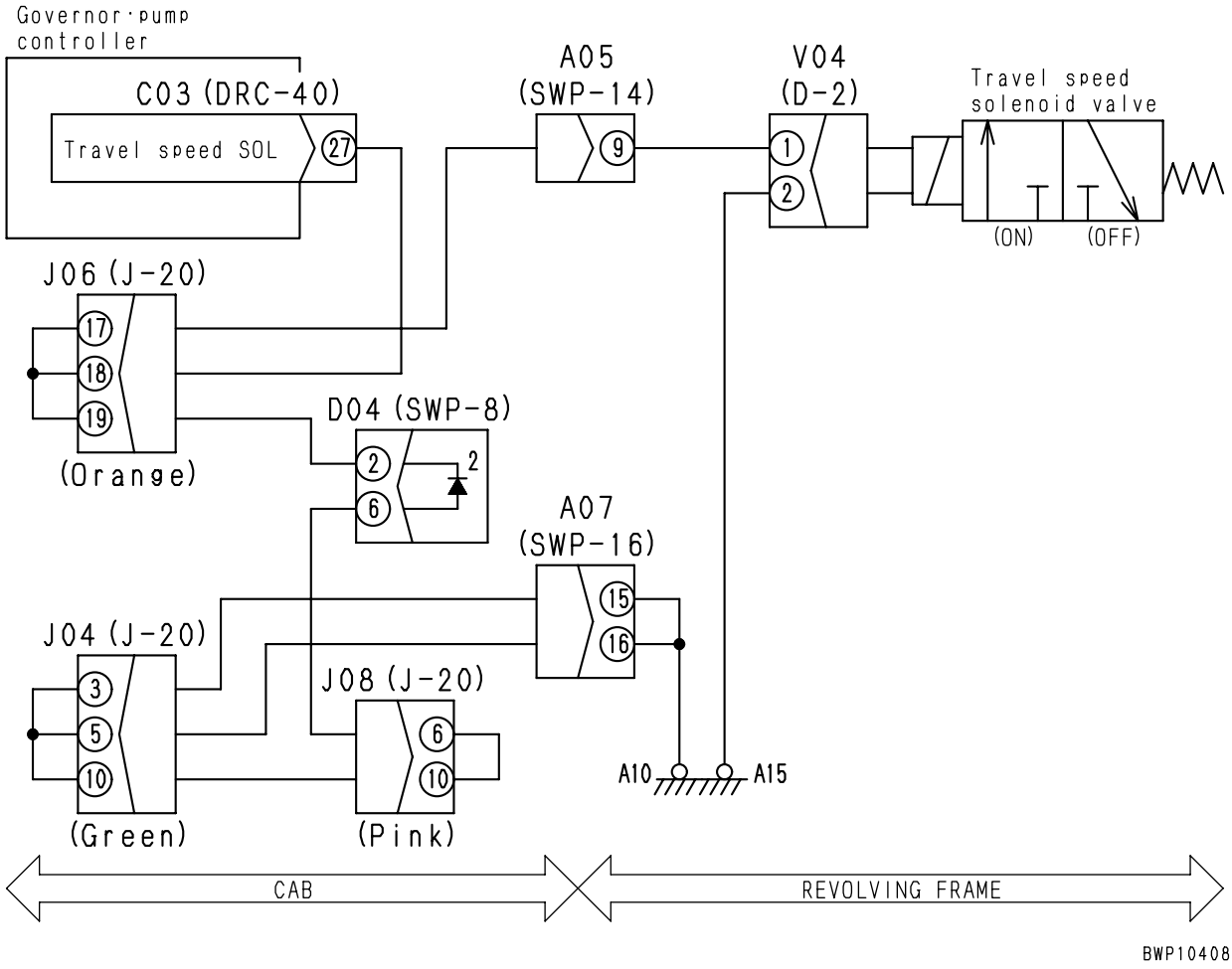


Service Code in Electrical System E206
(Short-circuiting in travel speed shifting solenoid)

User Code	Service Code	Failure Code	Failure phenomenon	Short-circuiting in travel speed shifting solenoid (in governor • pump controller system)
—	**E206**	**DW43KB**		
Failure content	• Abnormal current flew to the travel speed shifting solenoid, when power was supplied to the circuit.			
Response from controller	• Power supply to the travel speed shifting solenoid circuit is switched OFF. • Even after the failure cause disappears of itself, the machine operation does not return to normalcy, unless the engine starting switch is once turned OFF.			
Phenomenon occurring on machine	• The travel speed does not turn to Hi. (The display in the monitor panel changes correctly)			
Relative information	• Operation of the travel speed shifting solenoid (ON or OFF) can be checked in the monitoring function. (Code No. 023: Solenoid 1)			

Presumed cause and standard value in normalcy		Cause	Standard value in normalcy and references for troubleshooting			
	1	Travel speed shifting solenoid defective (Internal short-circuiting or grounding fault)	★Turn the engine starting switch OFF for the preparations, and hold it in the OFF position during the troubleshooting.			
			V04 (male)	Resistance value		
			Between ① and ②	20 – 60 Ω		
			Between ① and grounding	Above 1 MΩ		
	2	Assembled-type diode D04 defective (Internal short-circuiting)	★Turn the engine starting switch OFF for the preparations, and hold it in the OFF position during the troubleshooting.			
			D04 (male)	Resistance value		
			Between ② and ⑥	Above 1 MΩ		
	3	Grounding fault of wiring harness (Contact with grounding circuit)	★Turn the engine starting switch OFF for the preparations, and hold it in the OFF position during the troubleshooting.			
			Wiring harness from C03 (female) ㉗ to J06 to V04 (female) ①, or between wiring harness between C03 (female) ㉗ and D04 (female) ② and grounding	Resistance value	Above 1 MΩ	
	4	Governor • pump controller defective	★Turn the engine starting switch OFF for the preparations, and hold it running during the troubleshooting.			
			C03	Travel speed	Voltage	
			Between ㉗ and grounding	Lo	Below 1 V	
				Hi + Travel operation	20 – 30 V	

Electrical Circuit Diagram for Travel Speed Shifting Solenoid in Governor • Pump Controller

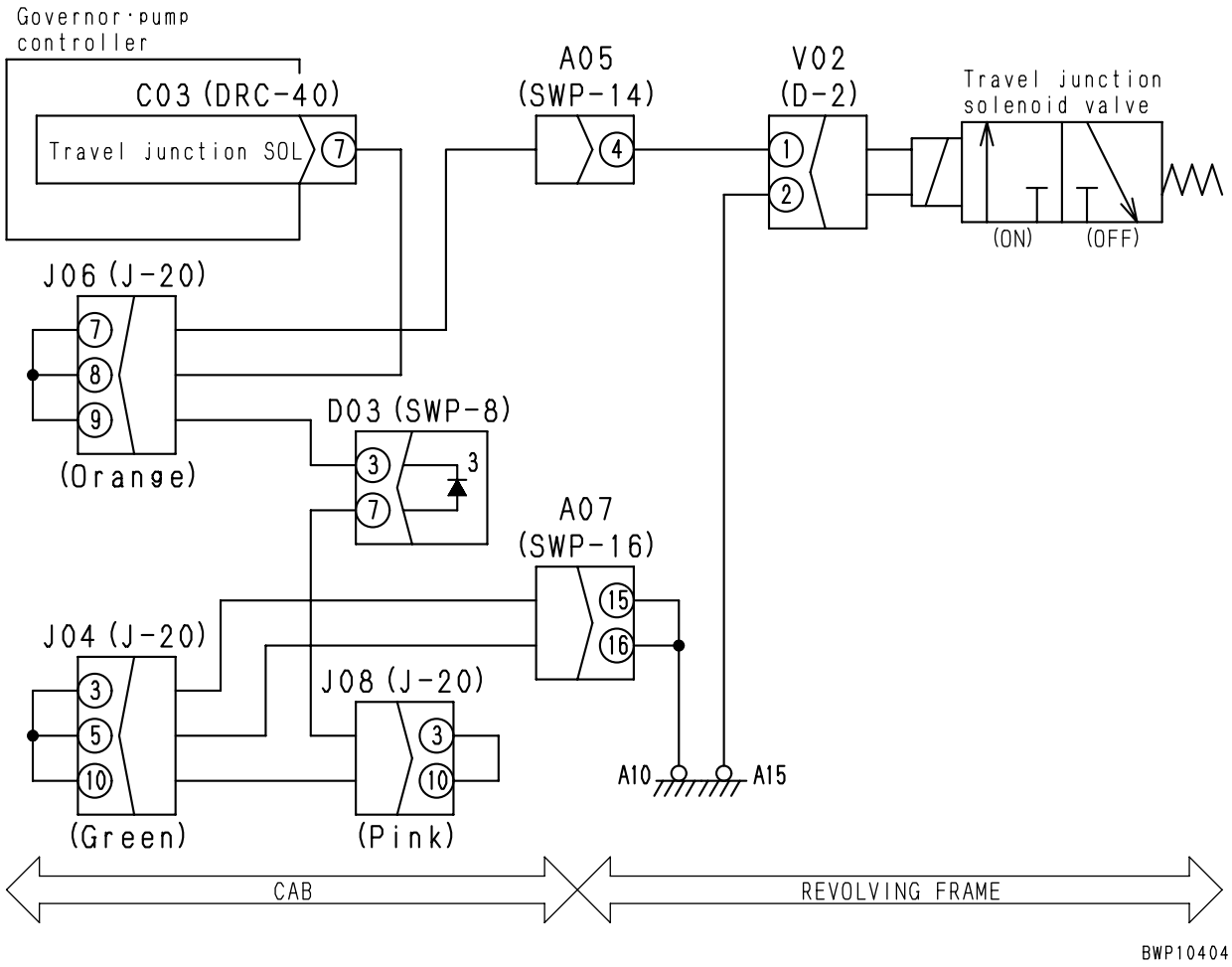


Service Code in Electrical System E211 (Disconnection in travel interlocking solenoid)

User Code	Service Code	Failure Code	Failure phenomenon	Disconnection in travel interlocking solenoid (in governor • pump controller system)
—	**E211**	**DW91KA**		
Failure content	• No current flows to the travel interlocking solenoid circuit, when power is supplied to the circuit.			
Response from controller	• None in particular (The solenoid does not function as there is current flowing to it) • When the failure cause disappears of itself, the machine operation returns to normalcy.			
Phenomenon occurring on machine	• It is difficult to steer the machine while traveling.			
Relative information	• Operation of the travel interlocking solenoid (ON or OFF) can be checked in the monitoring function. (Code No. 023: Solenoid 1) ★The solenoid detects disconnection, when power is ON. Hence be sure to check it with power ON after the repairs. (For how to turn power ON or OFF, refer to the troubleshooting under Service Code [E201].)			

Presumed cause and standard value in normalcy		Cause	Standard value in normalcy and references for troubleshooting			
	1	Travel interlocking solenoid defective (Internal disconnection)	★Turn the engine starting switch OFF for the preparations, and hold it in the OFF position during the troubleshooting.			
			V02 (male)	Resistance value		
			Between ① and ②	20 – 60 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 from C03 (female) ⑦ to J06 to V02 (female) ①	Resistance value	Below 1 Ω	
			Wiring harness between V02 (female) ② and grounding	Resistance value	Below 1 Ω	
	3	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 from C03 (female) ⑦ to J06 to V02 (female) ①, or between wiring harness C03 (female) ⑦ and D03 (female) ③ and grounding	Voltage	Below 1 V	
	4	Governor • pump controller defective	★Turn the engine starting switch OFF for the preparations, and hold it in the OFF position during the troubleshooting.			
			C03 (female)	Resistance value		
			Between ⑦ and grounding	20 – 60 Ω		

Electrical Circuit Diagram for Travel Interlocking Solenoid in Governor • Pump Controller

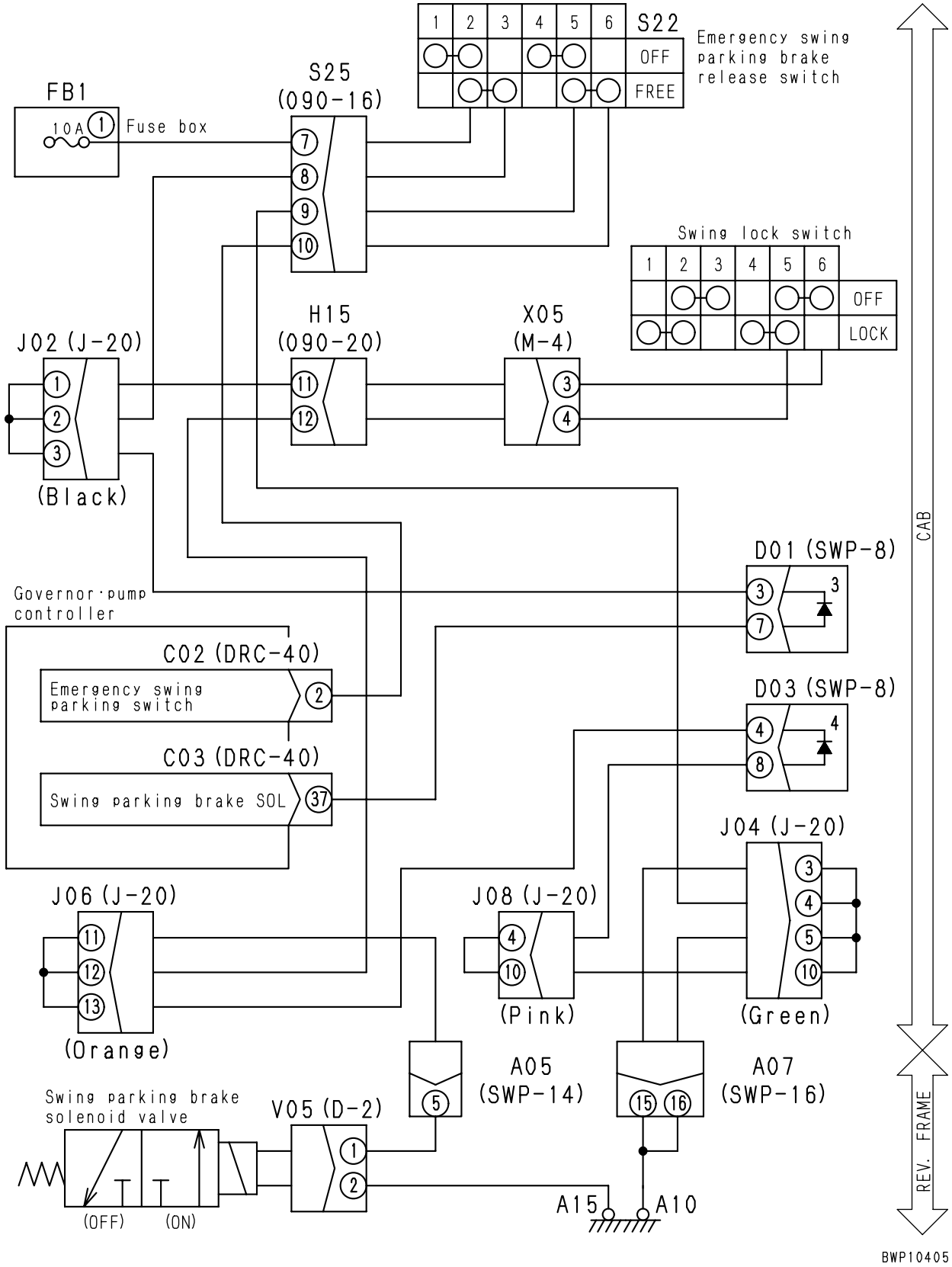


Service Code in Electrical System E213 (Disconnection in Swing Parking Brake Solenoid)

User Code	Service Code	Failure Code	Failure phenomenon	Disconnection in swing and parking brake solenoid (in governor • pump controller system)
E03	**E213**	**DW45KA**		
Failure content	• No current flows to the swing parking brake solenoid circuit, when power is supplied to the circuit.			
Response from controller	• None in particular (The solenoid does not function as there is no current flowing to it) • When the failure cause disappears of itself, the machine operation returns to normalcy.			
Phenomenon occurring on machine	• The machine's upper structure does not swing.			
Relative information	• Operation of the swing parking brake solenoid (ON or OFF) can be checked in the monitoring function. (Code No. 023: Solenoid 1) • If there is abnormality neither with the solenoid nor with wiring harnesses, the upper structure can swing by moving the emergency swing brake release switch to the FREE position. (In this case, however, the parking brake does not work, when stopping the machine) ★While in troubleshooting, hold both the swing lock switch and the emergency swing release switch in the OFF position. ★The solenoid detects disconnection, when power is ON. Hence be sure to check it with power ON after the repairs. (For how to turn power ON or OFF, refer to the troubleshooting under Service Code [E203].)			

Presumed cause and standard value in normalcy		Cause	Standard value in normalcy and references for troubleshooting			
	1	Swing parking brake solenoid defective (Internal disconnection)	★Turn the engine starting switch OFF for the preparations, and hold it in the OFF position during the troubleshooting.			
			V05 (male)		Resistance value	
			Between ① and ②		20 – 60 Ω	
	2	Swing lock switch defective (Internal disconnection)	★Turn the engine starting switch OFF for the preparations, and hold it in the OFF position during the troubleshooting.			
			X05 (female)	Swing lock switch	Resistance value	
			Between ③ and ④	OFF	Below 1 Ω	
				LOCK	Above 1 MΩ	
	3	Assembled-type diode D01 defective (Internal disconnection)	★Turn the engine starting switch OFF for the preparations, and hold it in the OFF position during the troubleshooting.			
			D01 (male)	Digital type circuit tester	Continuity	
			Between ⑦ and ③	Diode mode	Continued	
	4	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 C03 (female) ㊲ and D01 (female) ⑦		Resistance value	Below 1 Ω
			Wiring harness from D01 (female) ③ to J02 to X05 (male) ③		Resistance value	Below 1 Ω
			Wiring harness from X05 (male) ④ to J06 to V05 (female) ①		Resistance value	Below 1 Ω
			Wiring harness between V05 (female) ② and grounding		Resistance value	Below 1 Ω
	5	Short-circuiting of Wiring harness (Contact with 24V circuit)	★Turn the engine starting switch OFF for the preparations, and hold it in the ON position during the troubleshooting.			
			Between wiring harness between C03 (female) ㊲ and D01 (female) ⑦ and grounding		Voltage	Below 1 V
	6	Governor • pump controller defective	★Turn the engine starting switch OFF for the preparations, and hold it in the OFF position during the troubleshooting.			
			C03 (female)	Disconnect D01 and connect pins ③ and ⑦ of the male side.	Resistance value	
			Between ㊲ and grounding		20 – 60 Ω	

Electrical Circuit Diagram for Swing and Parking Brake Solenoid in Governor • Pump Controller

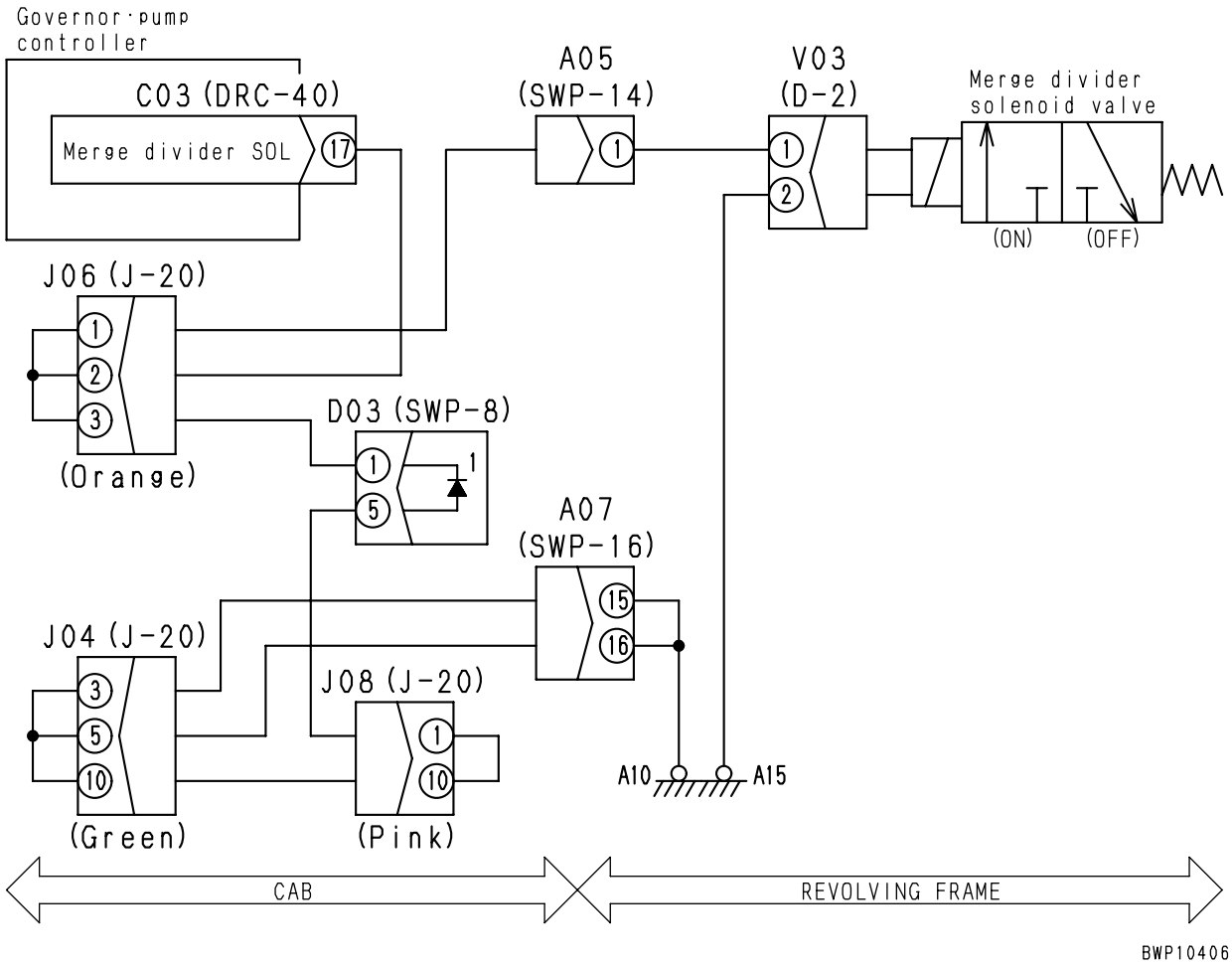


Service Code in Electrical System E214 (Disconnection of merge/divide solenoid)

User Code	Service Code	Failure Code	Failure phenomenon	Disconnection in merge/divide solenoid (in governor • pump controller system)
—	**E214**	**DWJ0KA**		
Failure content	• No current flows to the merge/divide solenoid circuit, when power is supplied to the circuit.			
Response from controller	• None in particular (The solenoid does not function as there is no current flowing to it) • When the failure cause disappears of itself, the machine operation returns to normalcy.			
Phenomenon occurring on machine	• In L mode, speeds of the work equipment and swing in its single operation are too fast			
Relative information	• Operation of the merge/divide solenoid (ON or OFF) can be checked in the monitoring function. (Code No. 023: Solenoid 1) ★The solenoid detects disconnection, when power is ON. Hence be sure to check it with power ON after the repairs. (For how to turn power ON or OFF, refer to the troubleshooting under Service Code [E204].)			

Presumed cause and standard value in normalcy	Cause		Standard value in normalcy and references for troubleshooting			
	1	Merge/divide solenoid defective (Internal disconnection)	★Turn the engine starting switch OFF for the preparations, and hold it in the OFF position during the troubleshooting.			
			V03 (male)	Resistance value		
			Between ① and ②	20 – 60 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 from C03 (female) ⑰ to J06 to V03 (female) ①	Resistance value	Below 1 Ω	
			Wiring harness between V03 (female) ② and grounding	Resistance value	Below 1 Ω	
	3	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 from C03 (female) ⑰ to J06 to V03 (female) ①, or between wiring harness between C03 (female) ⑰ and D03 (female) ① and grounding	Voltage	Below 1 V	
	4	Governor • pump controller defective	★Turn the engine starting switch OFF for the preparations, and hold it in the OFF position during the troubleshooting.			
			C03 (female)	Resistance value		
			Between ⑰ and grounding	20 – 60 Ω		

Electrical Circuit Diagram for Merge/Divide Solenoid in Governor • Pump Controller

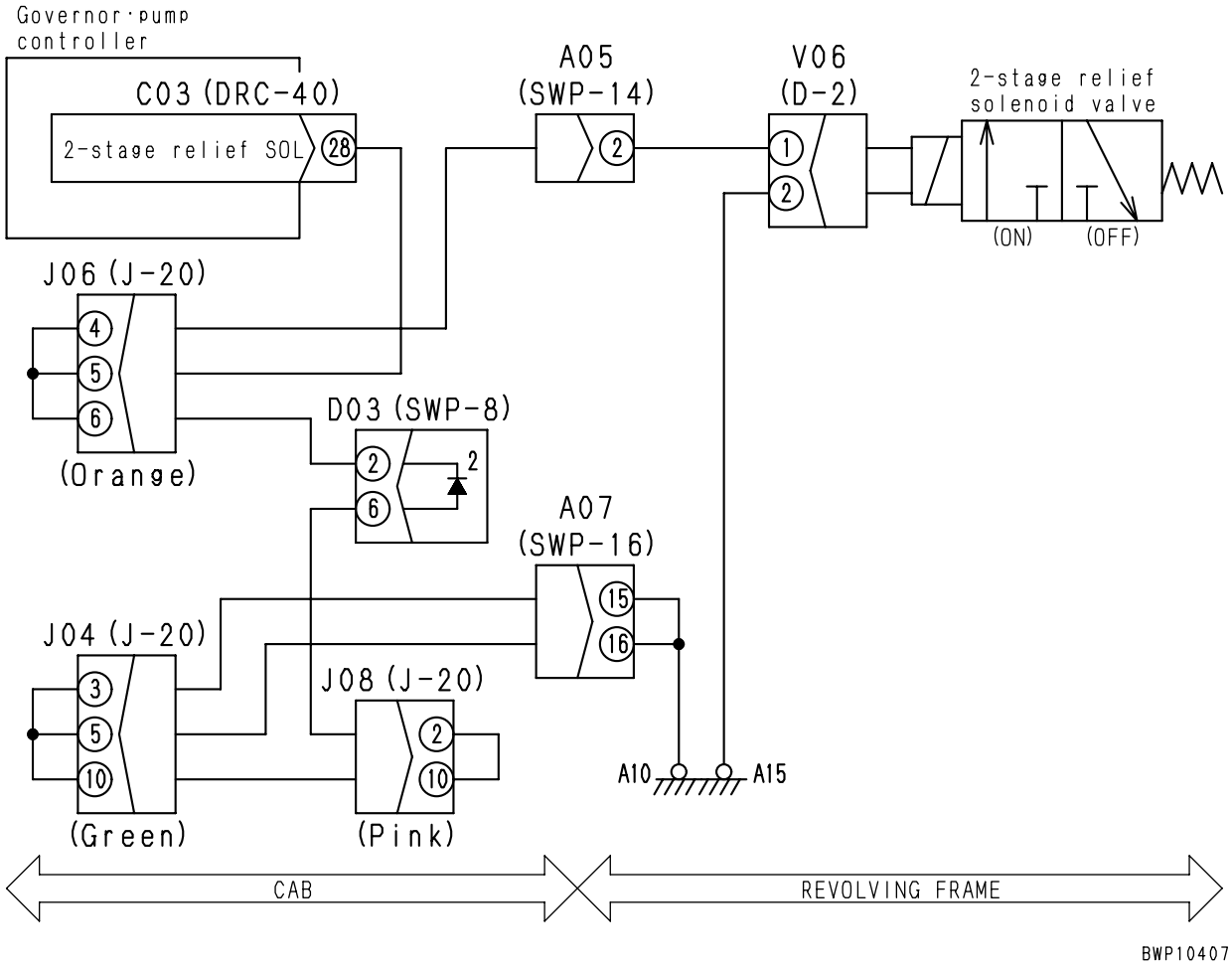


Service Code in Electrical System E215 (Disconnection in 2-stage relief solenoid)

User Code	Service Code	Failure Code	Failure phenomenon	Disconnection in 2-stage relief solenoid (in governor • pump controller system)
—	**E215**	**DWK0KA**		
Failure content	• No current flows to the 2-stage relief solenoid circuit, when power is supplied to the circuit.			
Response from controller	• None in particular (The solenoid does not function as there is no current flowing to it) • When the failure cause disappears of itself, the machine operation returns to normalcy.			
Phenomenon occurring on machine	• The one-touch power max. switch does not work.			
Relative information	• Operation of the 2-stage relief solenoid (ON or OFF) can be checked in the monitoring function. (Code No. 023: Solenoid 1) ★The solenoid detects disconnection, when power is ON. Hence be sure to check it with power ON after the repairs. (For how to turn power ON or OFF, refer to the troubleshooting under Service Code [E205].)			

Presumed cause and standard value in normalcy		Cause	Standard value in normalcy and references for troubleshooting			
	1	2-stage relief solenoid defective (Internal disconnection)	★Turn the engine starting switch OFF for the preparations, and hold it in the OFF position during the troubleshooting.			
			V06 (male)	Resistance value		
			Between ① and ②	20 – 60 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 from C03 (female) ㉘ to J06 to V06 (female) ①	Resistance value	Below 1 Ω	
			Wiring harness between V06 (female) ② and grounding	Resistance value	Below 1 Ω	
	3	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 from C03 (female) ㉘ to J06 to V06 (female) ①, or between wiring harness between C03 (female) ㉘ and D03 (female) ② and grounding	Voltage	Below 1 V	
	4	Governor • pump controller defective	★Turn the engine starting switch OFF for the preparations, and hold it in the OFF position during the troubleshooting.			
			C03 (female)	Resistance value		
			Between ㉘ and grounding	20 – 60 Ω		

Electrical Circuit Diagram for 2-stage Relief Solenoid in Governor • Pump Controller

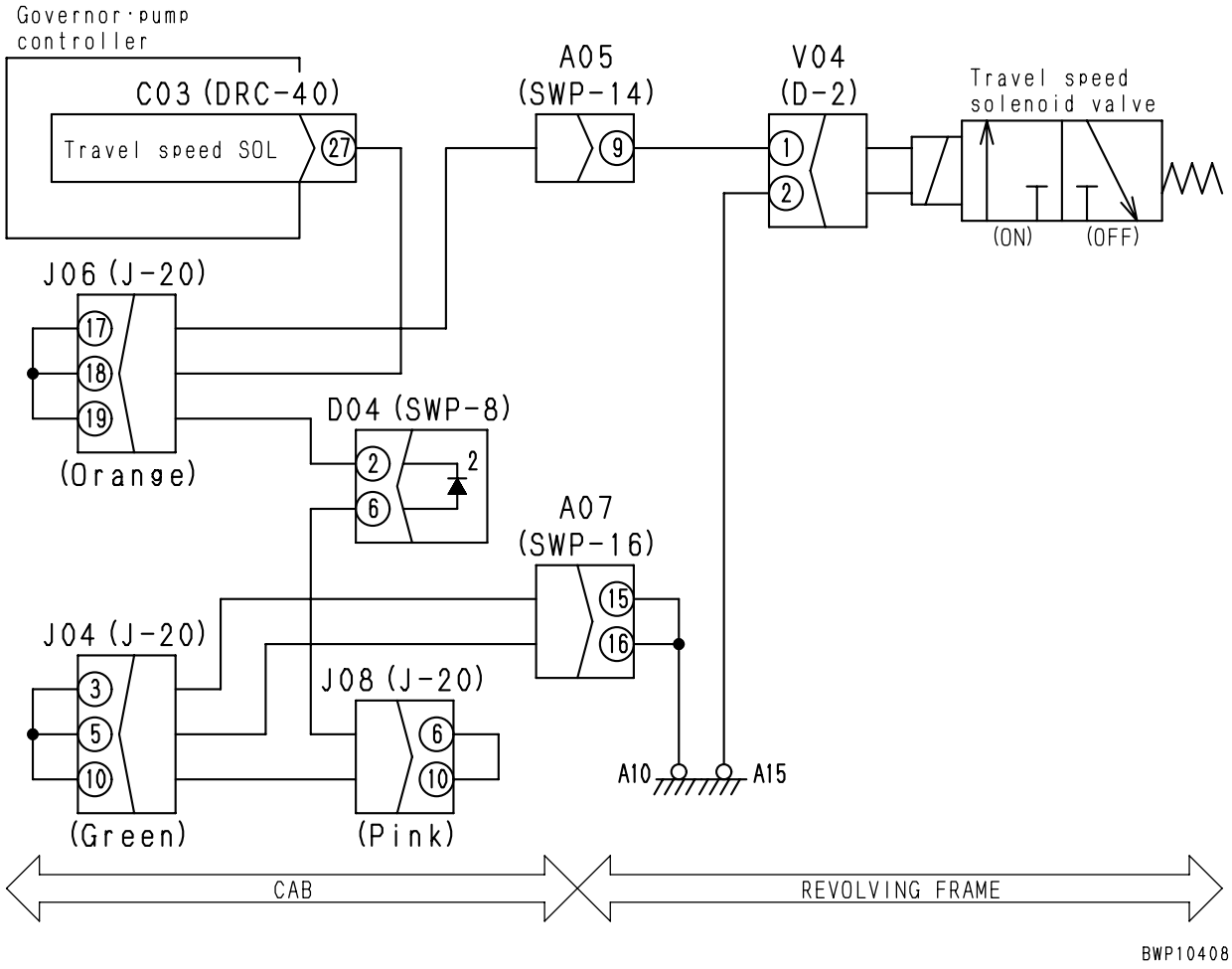


Service Code in Electrical System E216 (Disconnection in travel speed shifting solenoid)

User Code	Service Code	Failure Code	Failure phenomenon	Disconnection in travel speed shifting solenoid (in governor • pump controller system)
—	**E216**	**DW43KA**		
Failure content	• No current flows to the travel speed shifting solenoid circuit, when power is supplied to the circuit.			
Response from controller	• None in particular (The solenoid does not function as there is no current flowing to it) • When the failure cause disappears of itself, the machine operation returns to normalcy.			
Phenomenon occurring on machine	• The travel speed does not shift to Hi. (The display changes normally in the monitor panel)			
Relative information	• Operation of the travel speed shifting solenoid (ON or OFF) can be checked in the monitoring function. (Code No. 023: Solenoid 1) ★The solenoid detects disconnection, when power is ON. Hence be sure to check it with power ON after the repairs. (For how to turn power ON or OFF, refer to the troubleshooting under Service Code [E206].)			

Presumed cause and standard value in normalcy		Cause	Standard value in normalcy and references for troubleshooting			
	1	Travel speed shifting solenoid defective (Internal disconnection)	★Turn the engine starting switch OFF for the preparations, and hold it in the OFF position during the troubleshooting.			
			V04 (male)	Resistance value		
			Between ① and ②	20 – 60 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 from C03 (female) ㉗ to J06 to V04 (female) ①	Resistance value	Below 1 Ω	
			Wiring harness between V06 (female) ② and grounding	Resistance value	Below 1 Ω	
	3	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 from C03 (female) ㉗ to J06 to V04 (female) ①, or between wiring harness between C03 (female) ㉗ and D04 (female) ② and grounding	Voltage	Below 1 V	
	4	Governor • pump controller defective	★Turn the engine starting switch OFF for the preparations, and hold it in the OFF position during the troubleshooting.			
			C03 (female)	Resistance value		
			Between ㉗ and grounding	20 – 60 Ω		

Electrical Circuit Diagram for Travel Speed Shifting Solenoid in Governor • Pump Controller



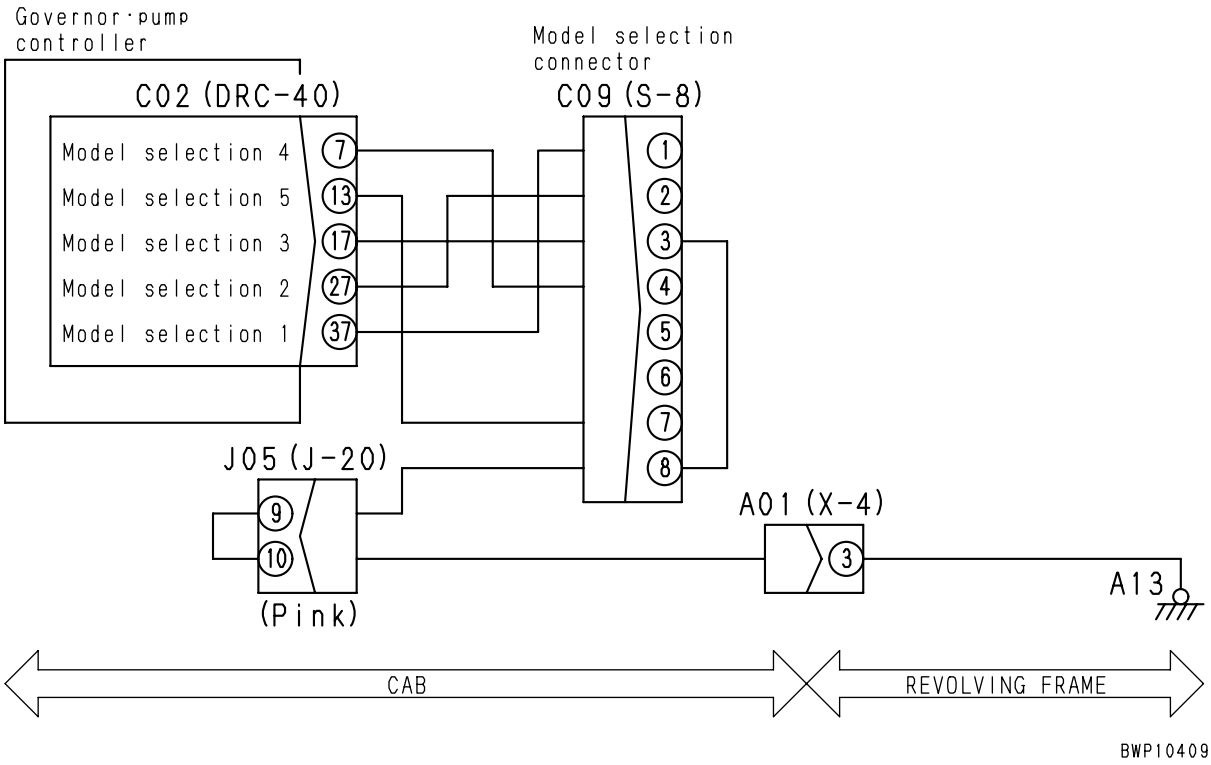
Service Code in Electrical System E217 (Abnormality in inputting model code)

PC210-7K

User Code	Service Code	Failure Code	Failure phenomenon	Abnormality in inputting model code (in governor • pump controller system)
—	**E217**	**DA2SKQ**		
Failure content	• A model code signal was inputted which indicates another model that is not registered in the controller.			
Response from controller	• The controller treats it as a default-set model (PC210). • Even if the failure cause disappears of itself, the machine operation does not return to normalcy, unless the engine starting switch is once turned OFF.			
Phenomenon occurring on machine	• None in particular with PC210 model			
Relative information	• Model names (expressed in number) that the controller recognizes can be confirmed in the monitoring function. (Code No. 002 and 003: Controller Model Code) ★Input of model selecting signals (ON or OFF) can be confirmed in the monitoring function.(Code No. 027:Switch Input 2)			

Presumed cause and standard value in normalcy		Cause	Standard value in normalcy and references for troubleshooting			
	1	Model selecting connector defective (Internal disconnection or short-circuiting)	★Turn the engine starting switch OFF for the preparations, and hold it in the OFF position during the troubleshooting.			
			C09 (female)	Resistance value		
			Between ③ and ⑧	Below 1 Ω		
			Between ①, ②, ④ or ⑦ and ⑧	Above 1 MΩ		
	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 C03 (female) ⑰ and C09 (male) ③	Resistance value	Below 1 Ω	
			Between wiring harness between C09 (male) ⑧ and J05 and grounding	Resistance value	Below 1 Ω	
	3	Grounding fault of wiring harness (Contact with grounding circuit)	★Turn the engine starting switch OFF for the preparations, and hold it in the OFF position during the troubleshooting.			
			Between wiring harness between C03 (female) ⑦ and C09 (male) ④ and grounding	Resistance value	Above 1 MΩ	
			Between wiring harness between C03 (female) ⑬ and C09 (male) ⑦ and grounding	Resistance value	Above 1 MΩ	
			Between wiring harness between C03 (female) ㉗ and C09 (male) ② and grounding	Resistance value	Above 1 MΩ	
			Between wiring harness between C03 (female) ㊲ and C09 (male) ① and grounding	Resistance value	Above 1 MΩ	
	4	Governor • pump controller defective	★Turn the engine starting switch OFF for the preparations, and hold it in the ON position during the troubleshooting.			
			C03	Voltage		
			Between ⑦, ⑬, ㉗ or ㊲ and grounding	20 – 30 V		
			Between ⑰ and grounding	Below 1 V		

Electrical Circuit Diagram for Model Selecting Connector in Governor • Pump Controller
PC210-7K

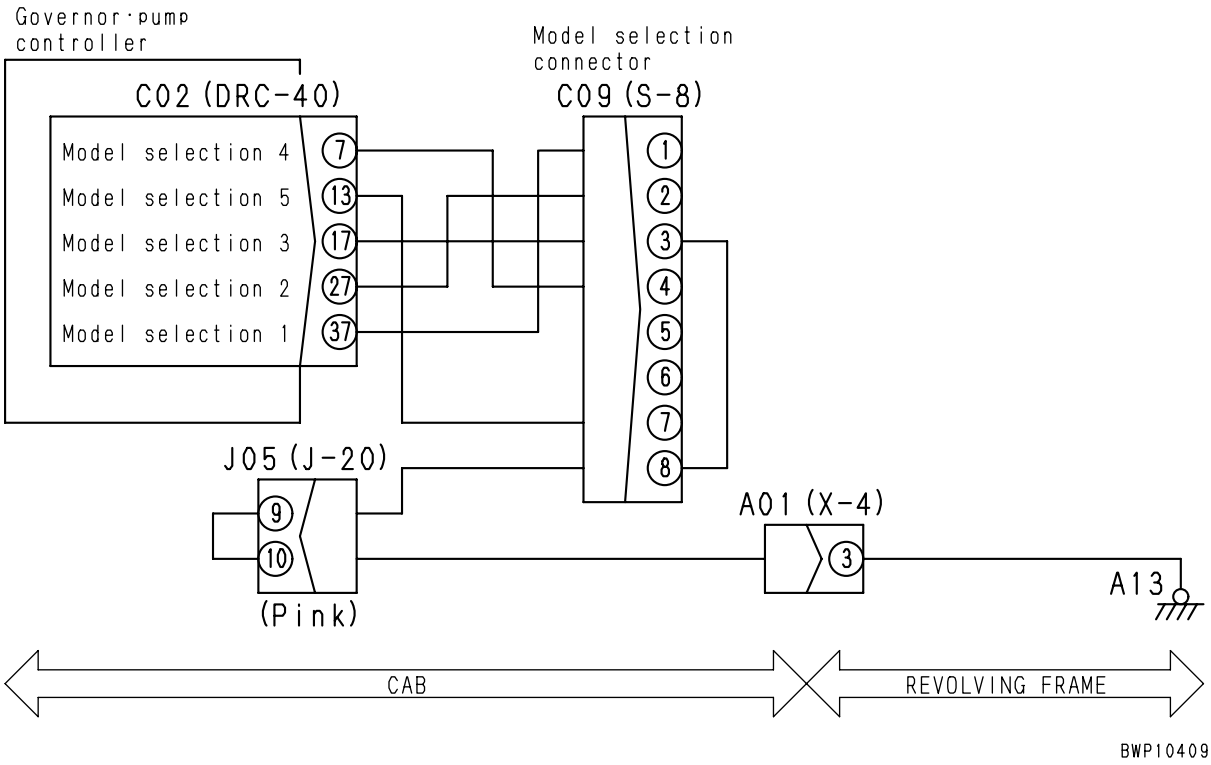


PC240-7K

User Code	Service Code	Failure Code	Failure phenomenon	Abnormality in inputting model code (in governor • pump controller system)
—	**E217**	**DA2SKQ**		
Failure content	• A model code signal was inputted which indicates another model that is not registered in the controller.			
Response from controller	• The controller treats it as a default-set model (PC210). • Even if the failure cause disappears of itself, the machine operation does not return to normalcy, unless the engine starting switch is once turned OFF.			
Phenomenon occurring on machine	• None in particular with PC210 model			
Relative information	• Model names (expressed in number) that the controller recognizes can be confirmed in the monitoring function. (Code No. 002 and 003: Controller Model Code) ★Input of model selecting signals (ON or OFF) can be confirmed in the monitoring function.(Code No. 027:Switch Input 2)			

Presumed cause and standard value in normalcy		Cause	Standard value in normalcy and references for troubleshooting			
	1	Model selecting connector defective (Internal disconnection or short-circuiting)	★Turn the engine starting switch OFF for the preparations, and hold it in the OFF position during the troubleshooting.			
			C09 (female)	Resistance value		
			Between ①, ③ and ⑧	Below 1 Ω		
			Between ②, ④ or ⑦ and ⑧	Above 1 MΩ		
	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 C03 (female) ㊲ and C09 (male) ①	Resistance value	Below 1 Ω	
			Wiring harness between C03 (female) ⑰ and C09 (male) ③	Resistance value	Below 1 Ω	
			Between wiring harness between C09 (male) ⑧ and J05 and grounding	Resistance value	Below 1 Ω	
	3	Grounding fault of wiring harness (Contact with grounding circuit)	★Turn the engine starting switch OFF for the preparations, and hold it in the OFF position during the troubleshooting.			
			Between wiring harness between C03 (female) ⑦ and C09 (male) ④ and grounding	Resistance value	Above 1 MΩ	
			Between wiring harness between C03 (female) ⑬ and C09 (male) ⑦ and grounding	Resistance value	Above 1 MΩ	
			Between wiring harness between C03 (female) ㉗ and C09 (male) ② and grounding	Resistance value	Above 1 MΩ	
	4	Governor • pump controller defective	★Turn the engine starting switch OFF for the preparations, and hold it in the ON position during the troubleshooting.			
			C03	Voltage		
			Between ⑦, ⑬ or ㉗ and grounding	20 – 30 V		
			Between ㊲, ⑰ and grounding	Below 1 V		

Electrical Circuit Diagram for Model Selecting Connector in Governor • Pump Controller
PC240-7K



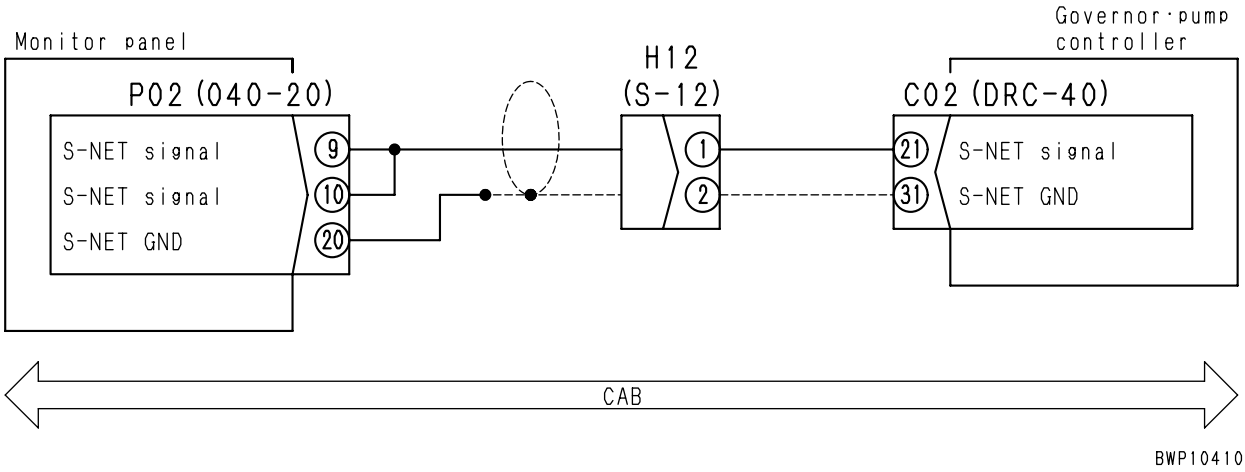
Service Code in Electrical System E218 Disconnection of S-NET signal)

User Code	Service Code	Failure Code	Failure phenomenon	Disconnection in S-NET signal (in governor • pump controller system)
—	**E218**	**DA2SKA**		
Failure content	• A failure occurred in S-NET communication between the monitor and controller in the past. (The machine operation returned to normalcy, when the display was resumed)			
Response from controller	• While the failure is still continuing, the machine operation is controlled by the following default setting. 1) Working mode: E mode 2) Travel speed: Lo 3) Auto-decelerator: ON 4) Attachment oil flow rate: Minimum (※) • When the failure cause disappears of itself, the machine operation returns to normalcy.			
Phenomenon occurring on machine	• The working mode cannot be changed. (The display changes normally in the monitor panel) • The travel speed cannot be shifted. (The display changes normally in the monitor panel) • The auto-decelerator cannot be released. (The display changes normally in the monitor panel) • The attachment oil flow rate cannot be changed. (The display changes normally in the monitor panel) (※)			
Relative information	• This Service Code No. is displayed to inform that there was a failure occurred in the past, when S-NET communication between the monitor panel and the governor • pump controller is returned to normalcy. • The communication has already returned to normalcy by the time this Service Code No. is displayed. But thoroughly diagnose all the related equipment and circuits, and remove all potential causes for a failure in order to prevent recurrence of failures.			

※: The multi-monitor specification machine only.

Presumed cause and standard value in normalcy		Cause	Standard value in normalcy and references for troubleshooting		
	1	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 P02 (female) ⑨ ⑩ and C02 (female) ㉑	Resistance value	Below 1 Ω
			Wiring harness between P02 (female) ⑳ and C02 (female) ㉛	Resistance value	Below 1 Ω
	2	Grounding fault of wiring harness (Contact with grounding circuit)	★Turn the engine starting switch OFF for the preparations, and hold it in the OFF position during the troubleshooting.		
			Between wiring harness between P02 (female) ⑨ ⑩ and C02 (female) ㉑ and grounding	Resistance value	Above 1 MΩ
	3	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.		
			Between wiring harness between P02 (female) ⑨ ⑩ and C02 (female) ㉑ and grounding	Voltage	Below 1 V
	4	Monitor panel defective	★Turn the engine starting switch OFF for the preparations, and hold it in the ON position during the troubleshooting.		
			P02 (male)	Voltage	
			Between ⑨ ⑩ and ⑳	6 – 9 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 (male)	Voltage	
			Between ㉑ and ㉛	6 – 9 V	

Electrical Circuit Diagram for S-NET Communication between Monitor Panel and Governor • Pump Controller

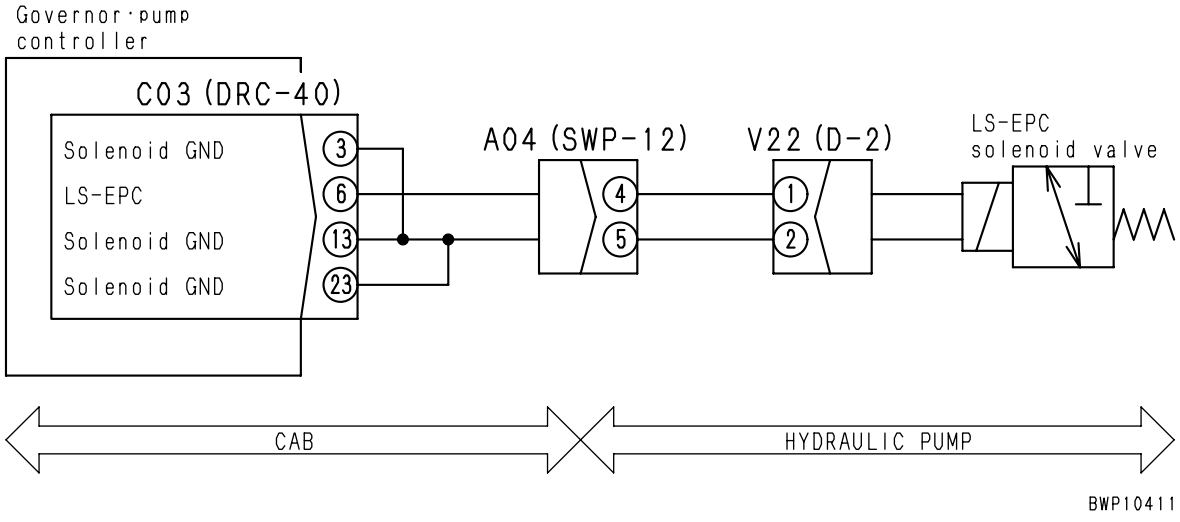


Service Code in Electrical System E222 (Short-circuiting in LS-EPC solenoid)

User Code	Service Code	Failure Code	Failure phenomenon	Disconnection in LS-EPC solenoid (in governor • pump controller system)
—	**E222**	**DXE0KB**		
Failure content	• Abnormal current flew to the LS-EPC solenoid circuit.			
Response from controller	• The controller reduces the output to the LS-EPC solenoid circuit to 0. • Even if the failure cause disappears, the current does not return to normalcy, unless the engine starting switch is once turned OFF.			
Phenomenon occurring on machine	• The travel speed is slow at Mi and Lo. • In L mode, speeds of the work equipment and swing are too fast.			
Relative information	• Output to LS-EPC solenoid (ampere) can be confirmed in the monitor function. (Code No. 015: LS-EPC solenoid current)			

Presumed cause and standard value in normalcy	Cause		Standard value in normalcy and references for troubleshooting			
	1	LS-EPC solenoid defective (Internal short-circuiting or grounding fault)	★Turn the engine starting switch OFF for the preparations, and hold it in the OFF position during the troubleshooting.			
			V22 (male)	Resistance value		
			Between ① and ②	7 – 14 Ω		
			Between ① and grounding	Above 1 MΩ		
	2	Grounding fault of wiring harness (Contact with grounding circuit)	★Turn the engine starting switch OFF for the preparations, and hold it in the OFF position during the troubleshooting.			
			Between wiring harness between C03 (female) ⑥ and V22 (female) ① and grounding	Resistance value	Above 1 MΩ	
	3	Governor • pump controller defective	★Turn the engine starting switch OFF for the preparations, and hold it in the OFF position during the troubleshooting.			
			C03 (female)	Resistance value		
			Between ⑥ and ③ ⑬ ㉓	7 – 14 Ω		
			Between ⑥ and grounding	Above 1 MΩ		

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

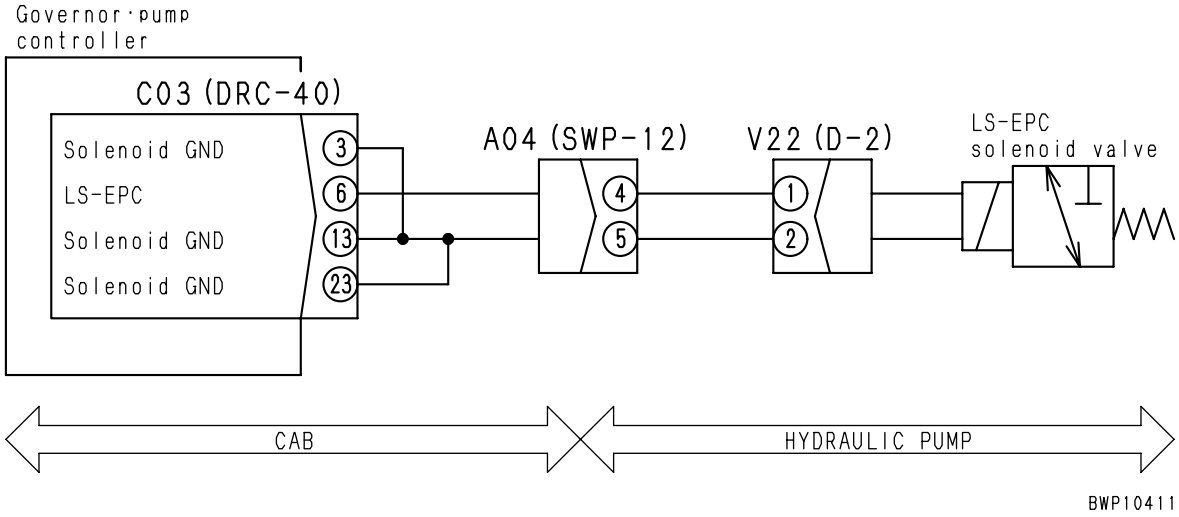


Service Code in Electrical System E223 (Disconnection in LS-EPC solenoid system)

User Code	Service Code	Failure Code	Failure phenomenon	Disconnection in LS-EPC solenoid (in governor • pump controller system)
—	**E223**	**DXE0KA**		
Failure content	• No current flows to the LS-EPC solenoid circuit.			
Response from controller	• None in particular (The solenoid does not function as there is no current flowing to it) • When the failure cause disappears of itself, the machine operation returns to normalcy.			
Phenomenon occurring on machine	• The travel speed is slow at Mi and Lo. • In L mode, speeds of the work equipment and swing are too fast.			
Relative information	• Output to LS-EPC solenoid (ampere) can be confirmed in the monitor function. (Code No. 015: LS-EPC solenoid current)			

Presumed cause and standard value in normalcy		Cause	Standard value in normalcy and references for troubleshooting			
	1	LS-EPC solenoid defective (Internal short-circuiting)	★Turn the engine starting switch OFF for the preparations, and hold it in the OFF position during the troubleshooting.			
			V22 (male)	Resistance value		
			Between ① and ②	7 – 14 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.			
			Between wiring harness between C03 (female) ⑥ and V22 (female) ① and grounding	Resistance value	Below 1 Ω	
			Wiring harness between C03 (female) ③ ⑬ ㉓ and V22 (female) ②	Resistance value	Below 1 Ω	
	3	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.			
			Between wiring harness between C03 (female) ⑥ and V22 (female) ① and grounding	Voltage	Below 1 V	
	4	Governor • pump controller defective	★Turn the engine starting switch OFF for the preparations, and hold it in the OFF position during the troubleshooting.			
			C03 (female)	Resistance value		
			Between ⑥ and ③ ⑬ ㉓	7 – 14 Ω		

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



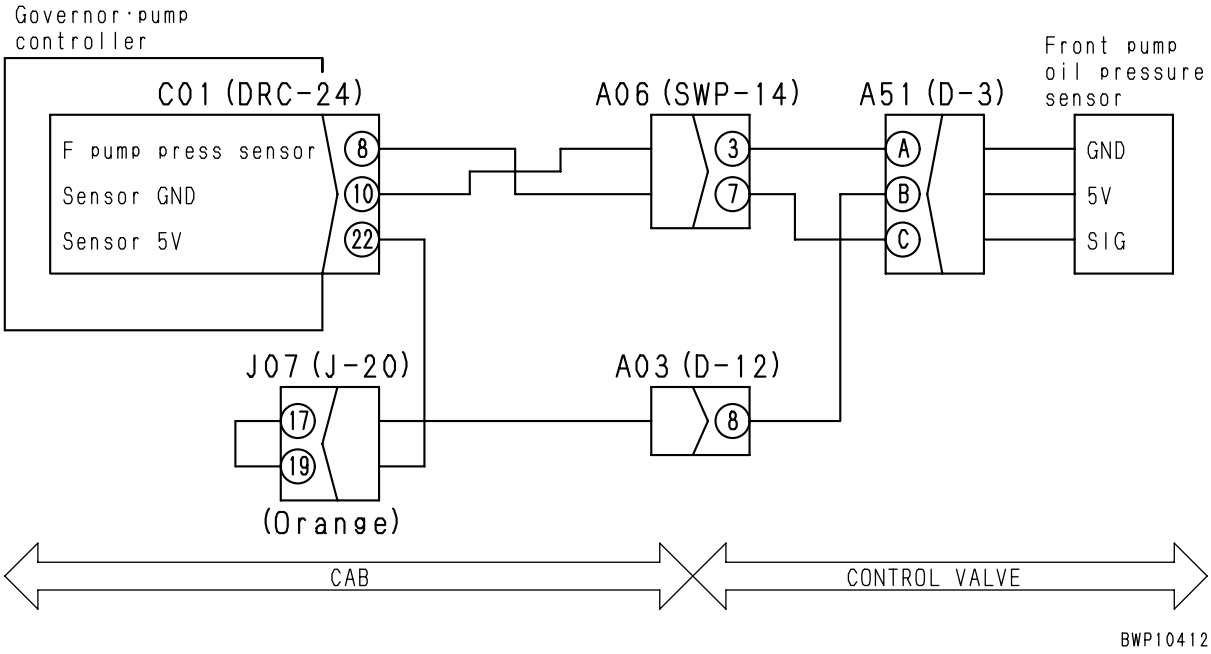
Service Code in Electrical System E224 (Abnormality in F pump pressure sensor)

User Code	Service Code	Failure Code	Failure phenomenon	Abnormality in F pump pressure sensor (in governor • pump controller system)
—	**E224**	**DHPAMA**		
Failure content	• Signal voltage from the F pump pressure sensor dropped below 0.3 V or exceeded 4.72 V.			
Response from controller	• The controller controls the F pump pressure at 0 MPa{0 kg/cm^2}. • If the failure cause disappears, the sensor returns to normalcy of itself.			
Phenomenon occurring on machine	• The travel speed does not shift automatically.			
Relative information	• Input from the F pump pressure sensor (pressure) can be confirmed in the monitor function. (Code No. 011: F pump pressure)			

Presumed cause and standard value in normalcy

	Cause	Standard value in normalcy and references for troubleshooting			
1	Sensor power source fault	If the Service Code No. [E226] is displayed, troubleshoot the failure first.			
2	F pump pressure sensor defective (Internal failure)	★Turn the engine starting switch OFF for the preparations, and keep the engine running during the troubleshooting.			
		A51	Voltage		
		Between Ⓑ and Ⓐ	4.5 – 5.5 V		
		Between Ⓒ and Ⓐ	0.5 – 4.5 V		
3	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 from C01 (female) ㉒ to J07 to A51 (female) Ⓑ	Resistance value	Below 1 Ω	
		Wiring harness between C01 (female) ⑩ and A51 (female) Ⓐ	Resistance value	Below 1 Ω	
		Wiring harness between C01 (female) ⑧ and A51 (female) Ⓒ	Resistance value	Below 1 Ω	
4	Grounding fault of wiring harness (Contact with grounding circuit)	★Turn the engine starting switch OFF for the preparations, and hold it in the OFF position during the troubleshooting.			
		Between wiring harness between C01 (female) ⑧ and A51 (female) Ⓒ and grounding	Resistance value	Above 1 MΩ	
5	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.			
		Between wiring harness between C01 (female) ㉒, J07 and A51 (female) Ⓑ and grounding	Voltage	Below 1 V	
		Between wiring harness between C01 (female) ⑧ and A51 (female) Ⓒ ang grounding	Voltage	Below 1 V	
6	Governor • pump controller defective	★Turn the engine starting switch OFF for the preparations, and keep the engine running during the troubleshooting.			
		C01	Voltage		
		Between ㉒ and ⑩	4.5 – 5.5 V		
		Between ⑧ and ⑩	0.5 – 4.5 V		

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



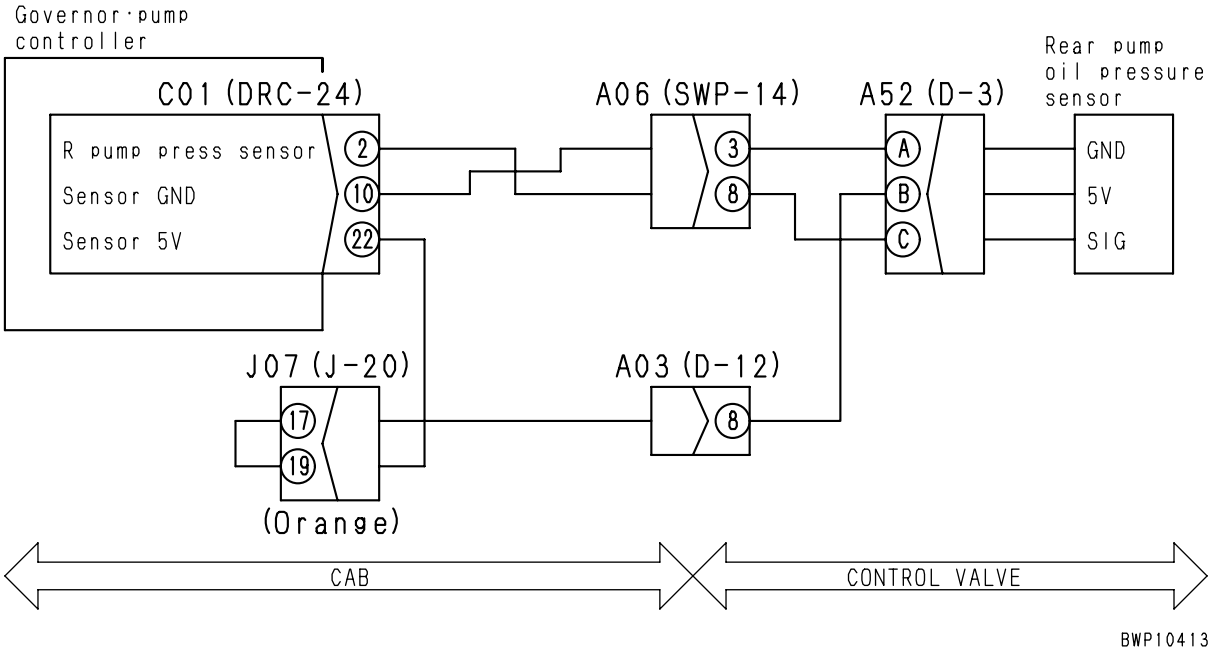
Service Code in Electrical System E225 (Abnormality in R pump pressure sensor)

User Code	Service Code	Failure Code	Failure phenomenon	Abnormality in R pump pressure sensor (in governor • pump controller system)
—	**E225**	**DHPBMA**		
Failure content	• Signal voltage from the R pump pressure sensor dropped below 0.3 V or exceeded 4.42 V.			
Response from controller	• The controller controls the R pump pressure as 0 MPa {0 kg/cm^2}. • If the failure cause disappears, the sensor returns to normalcy of itself.			
Phenomenon occurring on machine	• The travel speed does not shift automatically.			
Relative information	• Input from the R pump pressure sensor (pressure) can be confirmed in the monitor function. (Code No. 012: R pump pressure)			

Presumed cause and standard value in normalcy

	Cause	Standard value in normalcy and references for troubleshooting			
1	Sensor power source fault	If the Service Code No. [E226] is displayed, troubleshoot the failure first.			
2	R pump pressure sensor defective (Internal failure)	★Turn the engine starting switch OFF for the preparations, and keep the engine running during the troubleshooting.			
		A52	Voltage		
		Between Ⓑ and Ⓐ	4.5 – 5.5 V		
		Between Ⓒ and Ⓐ	0.5 – 4.5 V		
3	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 from C01 (female) ㉒ to J07 to A52 (female) Ⓑ	Resistance value	Below 1 Ω	
		Wiring harness between C01 (female) ⑩ and A52 (female) Ⓐ	Resistance value	Below 1 Ω	
		Wiring harness between C01 (female) ② and A52 (female) Ⓒ	Resistance value	Below 1 Ω	
4	Grounding fault of wiring harness (Contact with grounding circuit)	★Turn the engine starting switch OFF for the preparations, and hold it in the OFF position during the troubleshooting.			
		Between wiring harness between C01 (female) ② and A52 (female) Ⓒ and grounding	Resistance value	Above 1 MΩ	
5	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.			
		Between wiring harness between C01 (female) ㉒, J07 and A52 (female) Ⓑ and grounding	Voltage	Below 1 V	
		Between wiring harness between C01 (female) ② and A52 (female) Ⓒ and grounding	Voltage	Below 1 V	
6	Governor • pump controller defective	★Turn the engine starting switch OFF for the preparations, and keep the engine running during the troubleshooting.			
		C01	Voltage		
		Between ㉒ and ⑩	4.5 – 5.5 V		
		Between ② and ⑩	0.5 – 4.5 V		

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

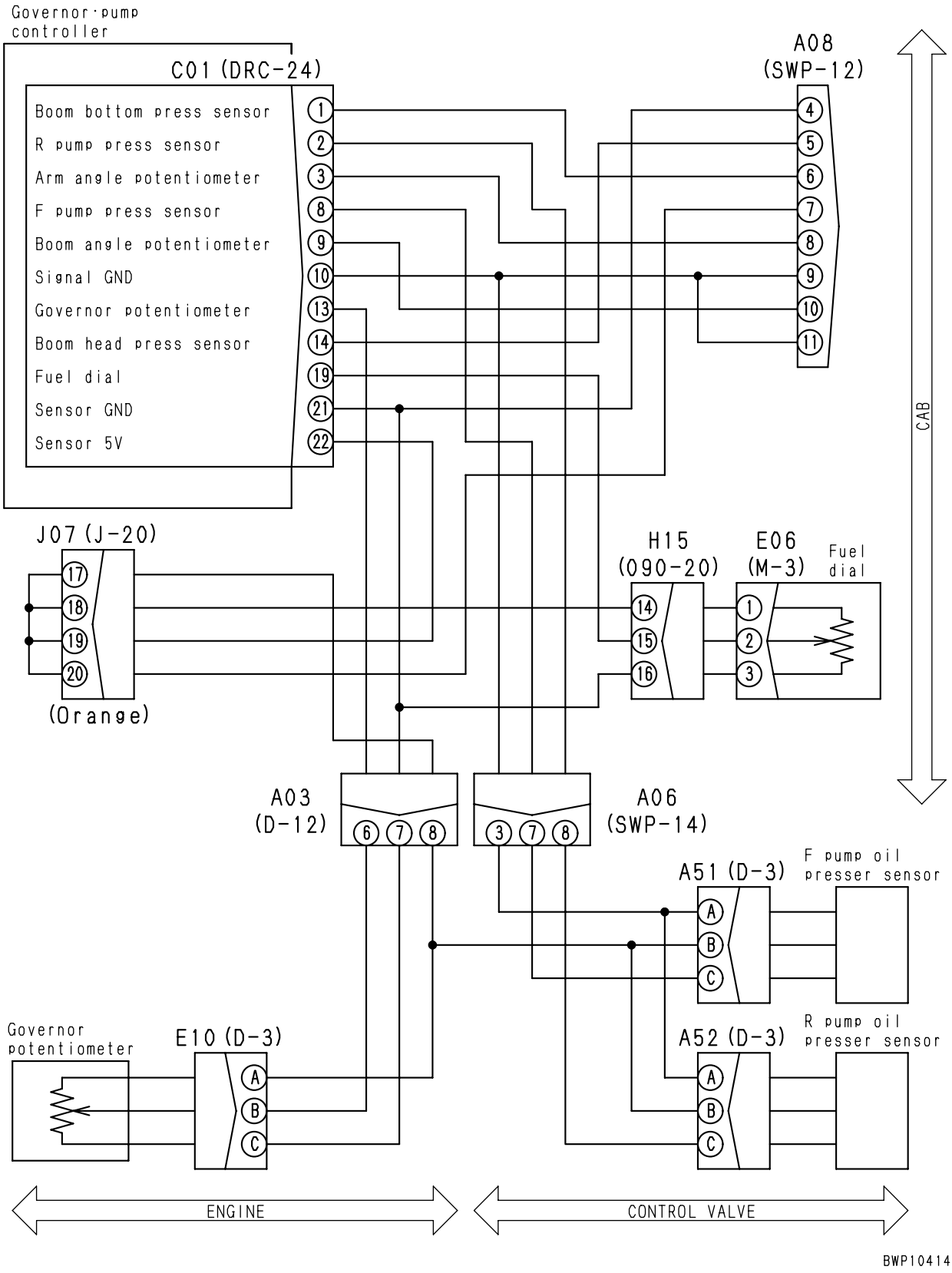


Service Code in Electrical System E226 (Abnormality in Pressure sensor power source)

User Code	Service Code	Failure Code	Failure phenomenon	Abnormality in pressure sensor power source (in governor • pump controller system)
—	**E226**	**DA25KP**		
Failure content	• Abnormal current flew to the power source circuit (5 V) for the pressure sensors and potentiometer.			
Response from controller	• The controller turns OFF power supply to the power source circuit (5 V). • Even when the failure cause disappears of itself, the current does not return to normalcy, unless the engine starting switch is once turned OFF.			
Phenomenon occurring on machine	• Signals from the pressure sensors and potentiometer are not inputted correctly. • The Service Code of "pressure sensor abnormal" and that of "potentiometer abnormal" are displayed at the same time.			

Presumed cause and standard value in normalcy		Cause	Standard value in normalcy and references for troubleshooting		
	1	Pressure sensor or potentiometer defective (Internal short-circuit)	Disconnect the following equipment one by one. Equipment that shows no service code is defective, having an internal failure. ★Turn the engine starting switch OFF for the preparations, and hold it in the ON position during the troubleshooting.		
			Fuel dial	E06 Connector	
			Governor motor potentiometer	E10 Connector	
			F pump pressure sensor	A51 Connector	
			R pump pressure sensor	A52 Connector	
	2	Grounding fault of wiring harness (Contact with grounding circuit)	★Turn the engine starting switch OFF for the preparations, and hold it in the OFF position during the troubleshooting.		
			Between wiring harness from C01 (female) ㉒ to J07 to E06 (female) ① and grounding [Fuel dial system]	Resistance value	Above 1 MΩ
			Between wiring harness from C01 (female) ㉒ to J07 to E10 (female) Ⓐ and grounding [Governor potentiometer system]	Resistance value	Above 1 MΩ
			Between wiring harness from C01 (female) ㉒ to J07 to A51 (female) Ⓑ and grounding [F pump pressure sensor system]	Resistance value	Above 1 MΩ
			Between wiring harness from C01 (female) ㉒ to J07 to A52 (female) Ⓑ and grounding [R pump pressure sensor system]	Resistance value	Above 1 MΩ
			Between wiring harness from C01 (female) ㉒ to J07 to A08 (male) ⑦ and grounding [Attachment system]	Resistance value	Above 1 MΩ
	3	Governor • pump controller defective	★Turn the engine starting switch OFF for the preparations, and hold it in the ON position during the troubleshooting.		
			C01	Voltage	
			Between ㉒ and ⑩ ㉑	4.5 – 5.5 V	

Electrical Circuit Diagram for Sensor Power Source in Governor • Pump Controller

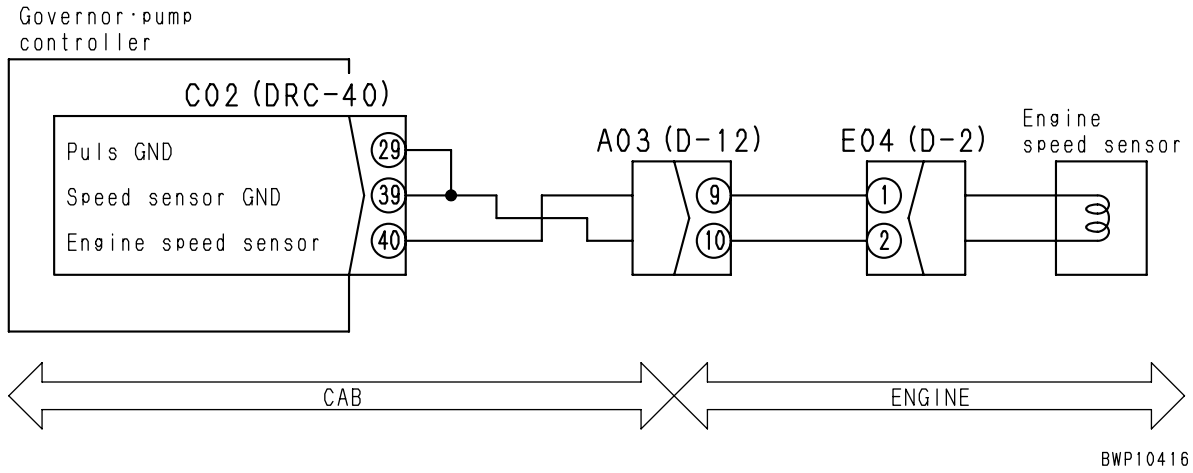


Service Code in Electrical System E227
(Abnormality in engine rotation sensor in governor • pump controller system)

User Code	Service Code	Failure Code	Failure phenomenon	Abnormality in engine rotation sensor (in governor • pump controller system)
—	**E227**	**DLE2MA**		
Failure content	• A normal pulse signal is not inputted to the signal circuit in the engine rotation sensor.			
Response from controller	• The controller exercises a control equivalent to E mode. • If the failure cause disappears of itself, the signal input returns to normalcy.			
Phenomenon occurring on machine	• The machine lacks power a bit.			
Relative information	• Input from the engine rotation sensor (rpm) can be confirmed in the monitor function. (Code No. 010: Engine RPM)			

Presumed cause and standard value in normalcy		Cause	Standard value in normalcy and references for troubleshooting			
	1	Engine rotation sensor fault (Internal short-circuiting or disconnection)	★Turn the engine starting switch OFF for the preparations, and hold it in the OFF position during the troubleshooting.			
			E04 (male)	Resistance value		
			Between ① and ②	500 – 1,000 Ω		
			Between ① and grounding	Above 1 MΩ		
	2	Engine rotation sensor adjustment improper	For the inspection and adjustment, refer to the section of "Adjusting Engine Rotation Sensor" in this manual.			
	3	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) ㊵ and E04 (female) ①	Resistance value	Below 1 Ω	
			Wiring harness between C02 (female) ㉙ ㊴ and E04 (female) ②	Resistance value	Below 1 Ω	
	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.			
			Between wiring harness between C02 (female) ㊵ and E04 (female) ① 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 (female)	Resistance value		
			Between ㊵ and ㉙ ㊴	500 – 1,000 Ω		
			Between ㊵ and grounding	Above 1 MΩ		

Electrical Circuit Diagram for Monitor Panel Power Source

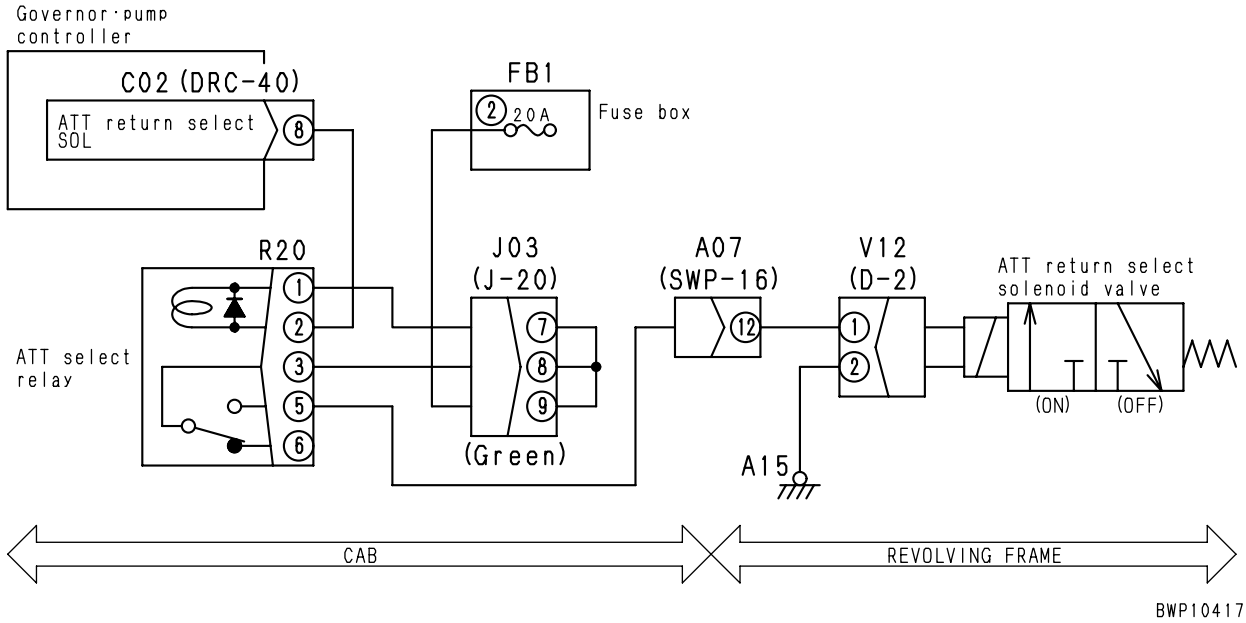


Service Code in Electrical System E228 (Short-circuiting in attachment return switching relay)

User Code	Service Code	Failure Code	Failure phenomenon	Short-circuiting in attachment return switching relay (in governor • pump controller system)
—	**E228**	**D196KB**		
Failure content	• Abnormal current flew to the attachment return switching relay circuit , when it was grounded (power ON).			
Response from controller	• The controller turned OFF power to the attachment return switching relay circuit. • Even when the failure cause disappears of itself, the current does not return to normalcy.			
Phenomenon occurring on machine	• The hydraulic circuit for attachments is not switched to the single operation circuit.			
Relative information	• It can be confirmed in the monitor function how the attachment return switching relay circuit works (ON or OFF). (Code No. 024:Solenoid 2)			

Presumed cause and standard value in normalcy		Cause	Standard value in normalcy and references for troubleshooting		
	1	Attachment return switching relay defective (Internal short-circuiting)	★Turn the engine starting switch OFF for the preparations, and hold it in the OFF position during the troubleshooting.		
			R20 (male)	Resistance value	
			Between ① and ②	100 – 500 Ω	
	2	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.		
			Between wiring harness between C02 (female) ⑧ and R20 (female) ② and grounding	Voltage	Below 1 V
	3	Governor • pump controller defective	★Turn the engine starting switch OFF for the preparations, and hold it in the ON position during the troubleshooting.		
			C03	Working mode	Voltage
			Between ⑧ and grounding	Other than B mode	20 – 30 V
				B mode	Below 1 V

Electrical Circuit Diagram for Attachment Return Switching Relay and Solenoid

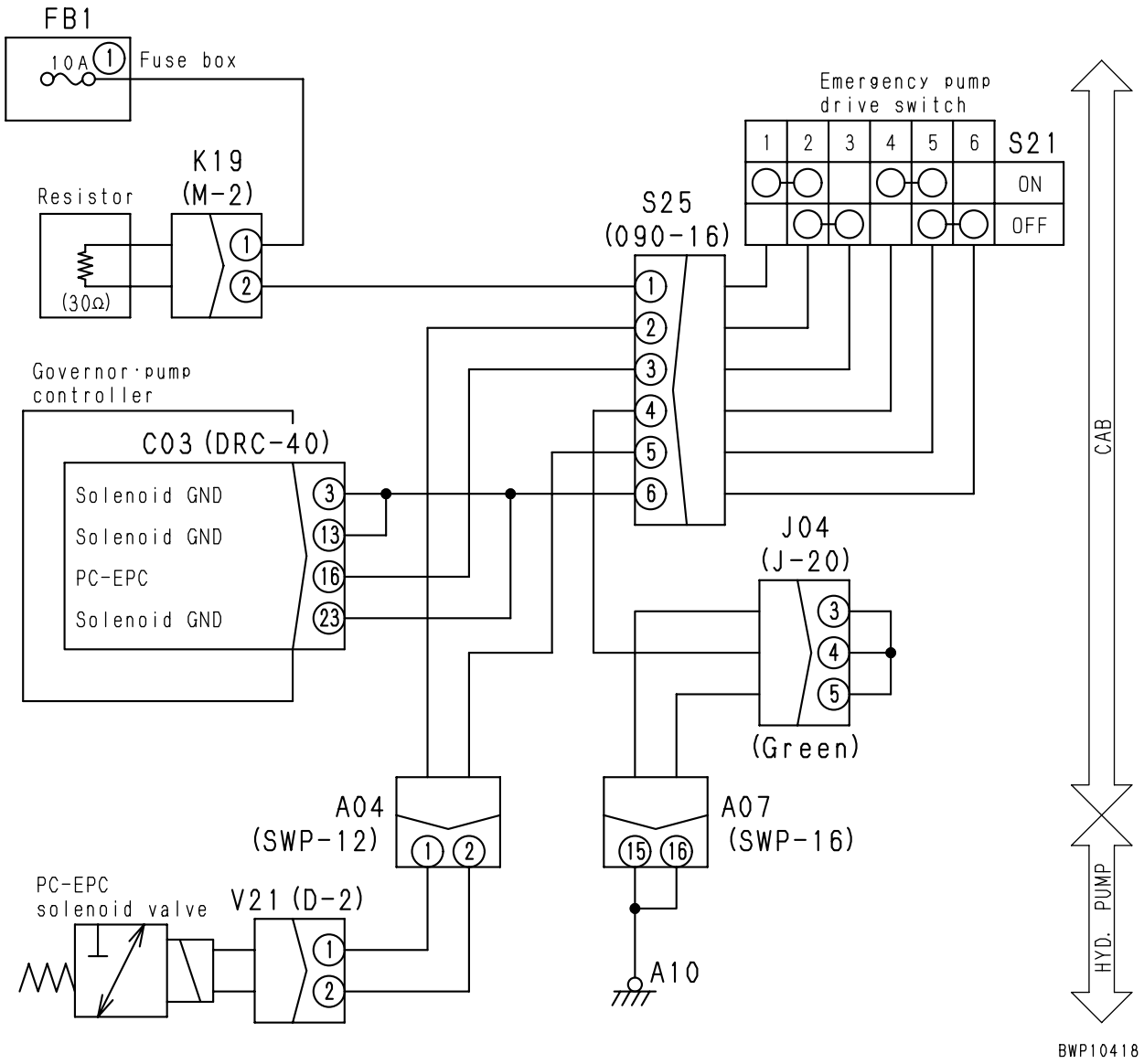


Service Code in Electrical System E232 (Short-circuiting in PC-EPC Solenoid

User Code	Service Code	Failure Code	Failure phenomenon	Disconnection in PC-EPC solenoid (in governor • pump controller system)
E02	**E232**	**DXA0KB**		
Failure content	• Abnormal current flew to the PC-EPC solenoid circuit.			
Response from controller	• The controller reduces the output to the PC-EPC solenoid circuit to 0. • Even if the failure cause disappears, the current does not return to normalcy, unless the engine starting switch is once turned OFF.			
Phenomenon occurring on machine	• As load to the pump increases, the engine rotation drops sharply and sometimes the engine stalls.			
Relative information	• Output to PC-EPC solenoid (ampere) can be confirmed in the monitor function. (Code No. 013: PC-EPC solenoid current) • If there is no abnormality with the solenoid or any of the wiring harnesses, the machine can be operated in a working mode equivalent to E mode by turning the emergency drive switch ON. (At that time the monitor panel continues to display service code No. [E232], but this is not abnormal) ★Turn the emergency driving switch ON during the troubleshooting.			

Presumed cause and standard value in normalcy		Cause	Standard value in normalcy and references for troubleshooting			
	1	PC-EPC solenoid defective (Internal short-circuiting or grounding fault)	★Turn the engine starting switch OFF for the preparations, and hold it in the OFF position during the troubleshooting.			
			V21 (male)	Resistance value		
			Between ① and ②	7 – 14 Ω		
			Between ① and grounding	Above 1 MΩ		
	2	Grounding fault of wiring harness (Contact with grounding circuit)	★Turn the engine starting switch OFF for the preparations, and hold it in the OFF position during the troubleshooting.			
			Between wiring harness from C03 (female) ⑱ to S21 to V21 (female) ① and grounding	Resistance value	Above 1 MΩ	
	3	Governor • pump controller defective	★Turn the engine starting switch OFF for the preparations, and hold it in the OFF position during the troubleshooting.			
			C03 (female)	Resistance value		
			Between ⑯ and ③ ⑬ ㉓	7 – 14 Ω		
			Between ⑯ and grounding	Above 1 MΩ		

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



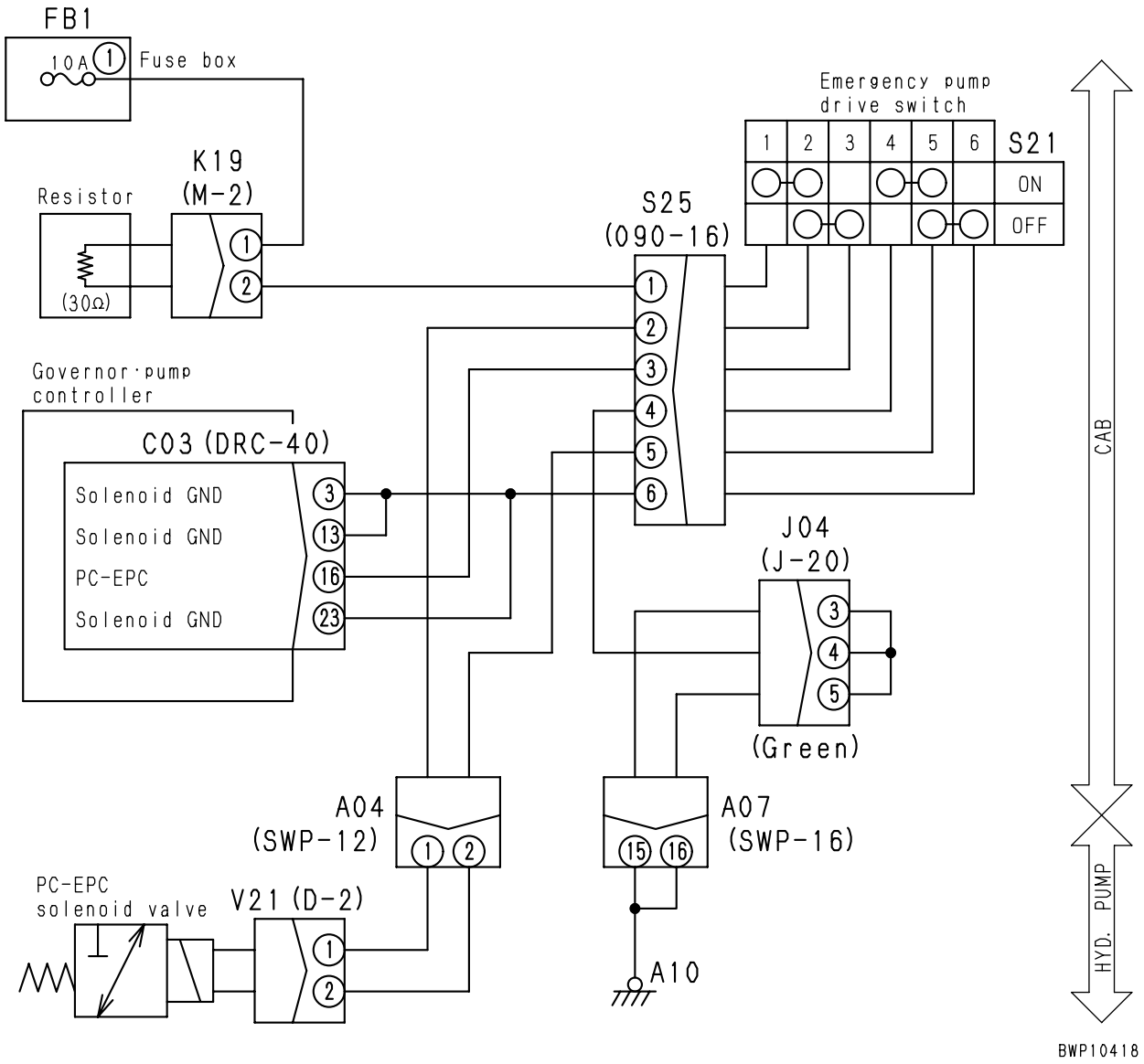
Service Code in Electrical System E233 (Disconnection in PC-EPC solenoid system)

User Code	Service Code	Failure Code	Failure phenomenon	Disconnection in PC-EPC solenoid (in governor • pump controller system)
E02	**E233**	**DXA0KA**		
Failure content	• No current flows to the PC-EPC solenoid circuit.			
Response from controller	• None in particular (The solenoid does not function as there is no current flowing to it) • When the failure cause disappears of itself, the current returns to normalcy.			
Phenomenon occurring on machine	• As load to the pump increases, the engine rotation drops sharply and sometimes the engine stalls.			
Relative information	• Output to PC-EPC solenoid (ampere) can be confirmed in the monitor function. (Code No. 013: PC-EPC solenoid current) • If there is no abnormality with the solenoid or any of the wiring harnesses, the machine can be operated in a working mode equivalent to E mode by turning the emergency driving switch ON. (At that time the monitor panel continues to display Service Code No. [E233], but this is not abnormal)			

Presumed cause and standard value in normalcy

	Cause	Standard value in normalcy and references for troubleshooting			
1	PC-EPC solenoid defective (Internal short-circuiting)	★Turn the engine starting switch OFF for the preparations, and hold it in the OFF position during the troubleshooting.			
		V21 (male)	Resistance value		
		Between ① and ②	7 – 14 Ω		
2	Emergency pump driving switch defective (Internal disconnection)	★Turn the engine starting switch OFF for the preparations, and hold it in the OFF position during the troubleshooting.			
		S21	Switch	Resistance value	
		Between ② and ③	OFF	Below 1 Ω	
			ON	Above 1 MΩ	
		Between ⑤ and ⑥	OFF	Below 1 Ω	
			ON	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 in the OFF position during the troubleshooting.			
		Wiring harness between C03 (female) ⑯ and S21 ③	Resistance value	Below 1 Ω	
		Wiring harness between S21 ② and V21 (female) ①	Resistance value	Below 1 Ω	
		Wiring harness between C03 (female) ③ ⑬ ㉓ and S21 ⑥	Resistance value	Below 1 Ω	
		Wiring harness between S21 ⑤ and V21 (female) ②	Resistance value	Below 1 Ω	
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.			
		Between wiring harness between C03 (female) ⑯ and S21 ③ and grounding	Voltage	Below 1 V	
		Between wiring harness between S21 ② and V21 (female) ① 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 OFF position during the troubleshooting.			
		C03 (female)	Resistance value		
		Between ⑯ and ③ ⑬ ㉓	7 – 14 Ω		

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



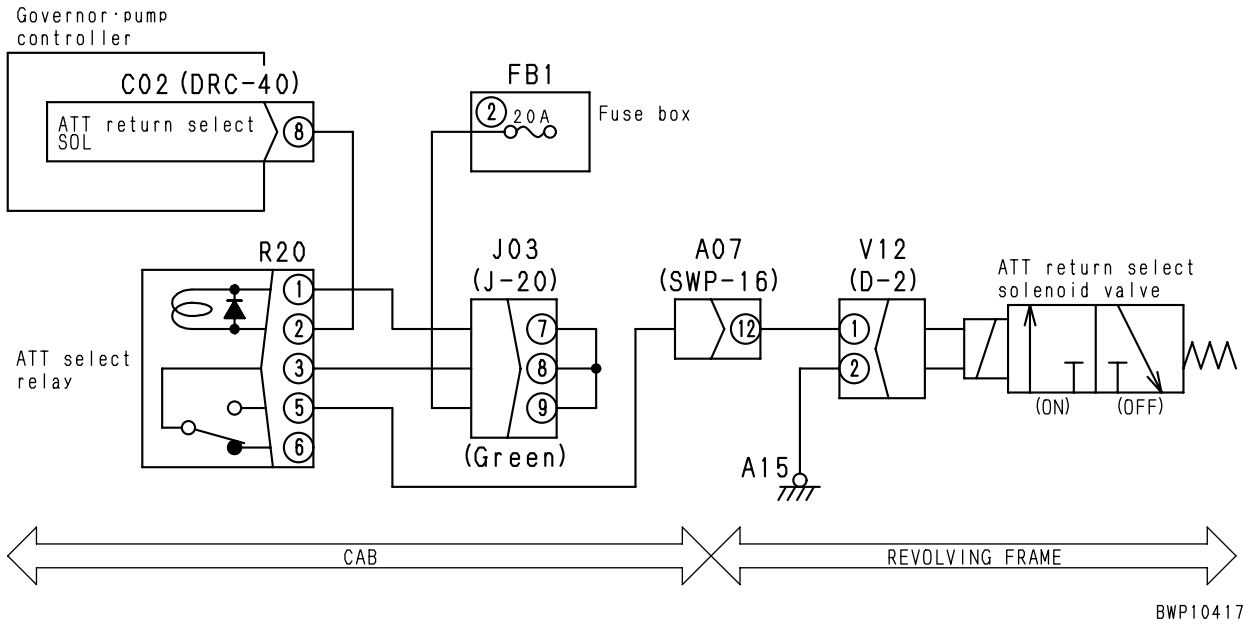
Service Code in Electrical System E238 (Disconnection in attachment return switching relay)

User Code	Service Code	Failure Code	Failure phenomenon	Disconnection in attachment return switching relay (in governor • pump controller system)
—	**E238**	**D196KA**		
Failure content	• When the attachment switching relay circuit is disconnected from grounding (power OFF), 24 V voltage is not generated.			
Response from controller	• None in particular • If the failure cause disappears, the governor returns to normalcy.			
Phenomenon occurring on machine	• The hydraulic circuit for attachments cannot be switched to the single operation			
Relative information	• It can be confirmed in the monitor function how the attachment return switching relay circuit works (ON or OFF). (Code No. 024:Solenoid 2)			

Presumed cause and standard value in normalcy

	Cause	Standard value in normalcy and references for troubleshooting			
1	Fuse No. 2 fault	If the fuse has been blown, there is a big possibility that grounding fault occurred in the relay circuit.			
2	Attachment return switching relay defective (Internal disconnection)	★Turn the engine starting switch OFF for the preparations, and hold it in the OFF position during the troubleshooting.			
		R20 (male)	Resistance value		
		Between ① and ②	100 – 500 Ω		
3	Emergency pump driving switch defective (Internal disconnection)	★Turn the engine starting switch OFF for the preparations, and hold it in the OFF position during the troubleshooting.			
		Wiring harness between C02 (female) ⑧ and R20 (female) ②	Resistance value	Below 1 Ω	
		Wiring harness from R20 (female) ① to J03 to FB1-2 outlet	Resistance value	Below 1 Ω	
4	Grounding fault of wiring harness (Contact with grounding circuit)	★Turn the engine starting switch OFF for the preparations, and hold it in the OFF position during the troubleshooting.			
		Between wiring harness between C02 (female) ⑧ and R20 (female) ② and grounding	Resistance value	Above 1 MΩ	
		Between wiring harness from R20 (female) ① to J03 to FB1-2 outlet and grounding	Resistance value	Above 1 MΩ	
5	Governor • pump controller defective	★Turn the engine starting switch OFF for the preparations, and hold it in the ON position during the troubleshooting.			
		C03	Working mode	Voltage	
		Between ⑧ and grounding	Other than B mode	20 – 30 V	
			B mode	Below 1 V	

Electrical Circuit Diagram for Attachment Return Switching Relay and Solenoid in Governor • Pump Controller

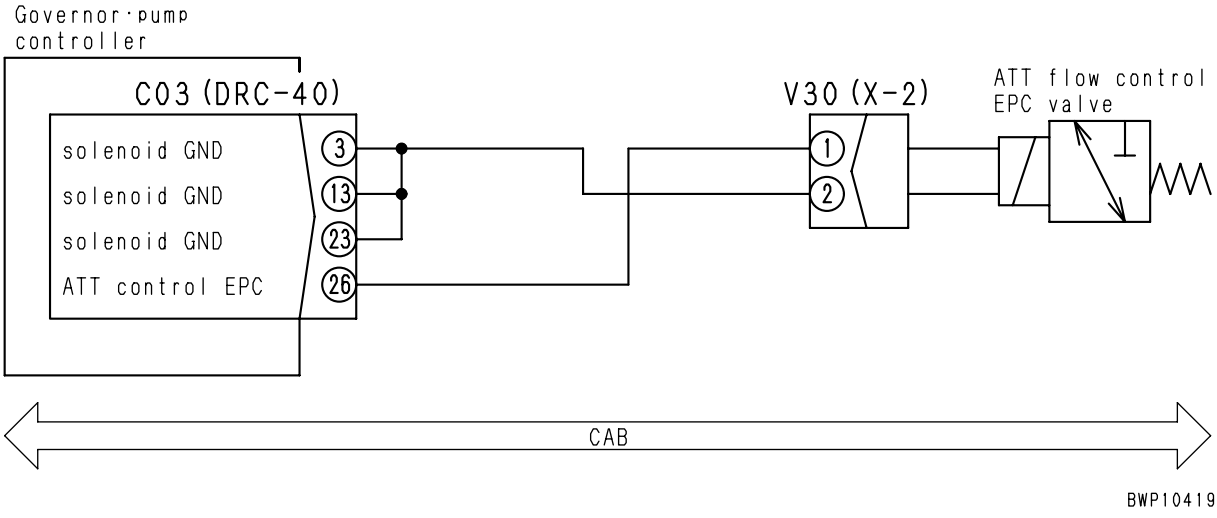


Service Code in Electrical Equipment E245 (Short-circuiting in attachment oil flow rate adjusting EPC) (Multi-monitor only)

User Code	Service Code	Failure Code	Failure phenomenon	Short-circuiting in attachment oil flow rate adjusting EPC (in governor • pump controller system)
—	**E245**	**DXE4KB**		
Failure content	• Abnormal current flew to the attachment oil flow rate adjusting EPC solenoid circuit.			
Response from controller	• The controller reduces to zero (0) power to the attachment oil flow rate adjusting EPC solenoid circuit. • Even when the failure cause disappears, the EPC solenoid circuit does not return to normalcy, unless the engine starting switch is once turned OFF.			
Phenomenon occurring on machine	• The attachments do not move.			
Relative information	• It can be confirmed in the monitor function how power (ampere) is supplied to the attachment oil flow rate adjusting EPC solenoid circuit. (Code No. 017: Service solenoid current)			

Presumed cause and standard value in normalcy		Cause	Standard value in normalcy and references for troubleshooting			
	1	Attachment oil flow rate adjusting EPC defective (Internal short-circuiting or grounding fault)	★Turn the engine starting switch OFF for the preparations, and hold it in the OFF position during the troubleshooting.			
			V30 (male)	Resistance value		
			Between ① and ②	7 – 14 Ω		
			Between ① and grounding	Above 1 MΩ		
	2	Grounding fault of wiring harness (Contact with grounding circuit)	★Turn the engine starting switch OFF for the preparations, and hold it in the OFF position during the troubleshooting.			
			Between wiring harness between C03 (female) ㉖ and V30 (female) ① and grounding	Resistance value	Above 1 MΩ	
	3	Governor • pump controller defective	★Turn the engine starting switch OFF for the preparations, and hold it in the OFF position during the troubleshooting.			
			C03 (female)	Resistance value		
			Between ㉖ and ③ ⑬ ㉓	7 – 14 Ω		
			Between ㉖ and grounding	Above 1 MΩ		

Electrical Circuit Diagram for Attachment Oil Flow Rate Adjusting EPC Solenoid in Governor • Pump Controller

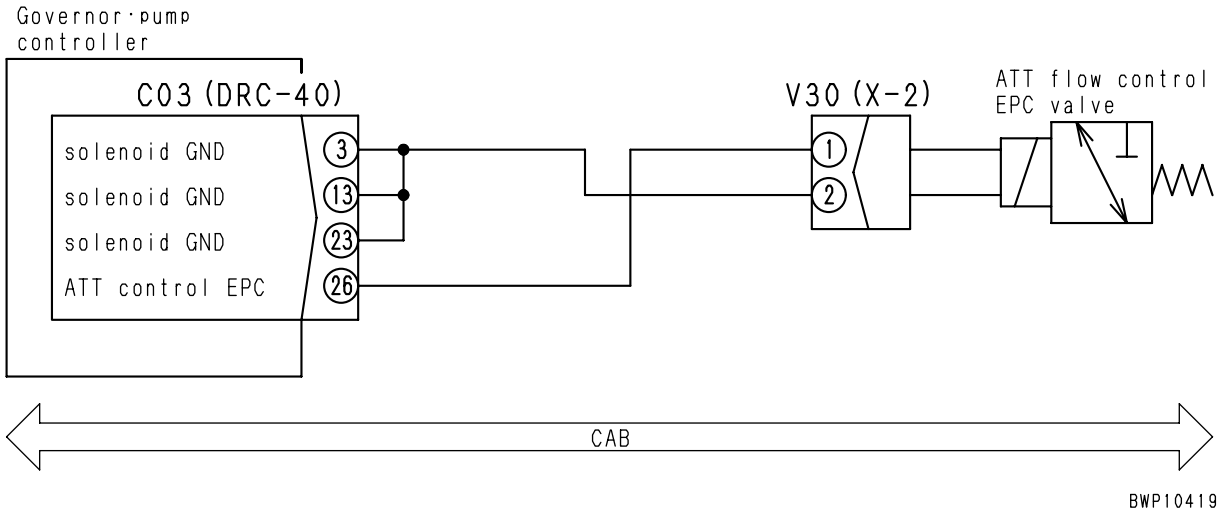


Service Code in Electrical System E246
(Disconnection in attachment oil flow rate adjusting EPC) (Multi-monitor only)

User Code	Service Code	Failure Code	Failure phenomenon	Disconnection in attachment oil flow rate adjusting EPC (in governor • pump controller system)
—	**E246**	**DXE4KA**		
Failure content	• No current flew to the attachment oil flow rate adjusting EPC solenoid circuit.			
Response from controller	• None in particular (The solenoid does not work, as there is no current flowing to it) • If the failure cause disappears, the EPC solenoid circuit returns to normalcy of itself.			
Phenomenon occurring on machine	• The attachments do not move.			
Relative information	• It can be confirmed in the monitor function how power (ampere) is supplied to the attachment oil flow rate adjusting EPC solenoid circuit. (Code No. 017: Service solenoid current)			

Presumed cause and standard value in normalcy	Cause		Standard value in normalcy and references for troubleshooting			
	1	Attachment oil flow rate adjusting EPC defective (Internal short-circuiting or grounding fault)	★Turn the engine starting switch OFF for the preparations, and hold it in the OFF position during the troubleshooting.			
			V30 (male)	Resistance value		
			Between ① and ②	7 – 14 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.			
			Between wiring harness between C03 (female) ㉖ and V30 (male) ① and grounding	Resistance value	Below 1 Ω	
			Between wiring harness between C03 (female) ③ ⑬ ㉓ and V30 (male) ② and grounding	Resistance value	Below 1 Ω	
	3	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.			
			Between wiring harness between C03 (female) ㉖ and V30 (female) ① and grounding	Voltage	Below 1 V	
	4	Governor • pump controller defective	★Turn the engine starting switch OFF for the preparations, and hold it in the OFF position during the troubleshooting.			
			C03 (female)	Resistance value		
			Between ㉖ and ③ ⑬ ㉓	7 – 14 Ω		

Electrical Circuit Diagram for Attachment Oil Flow Rate Adjusting EPC Solenoid in Governor • Pump Controller



Service Code in Electrical System E256 (Incorrect nonvolatile memory data)

User Code	Service Code	Failure Code	Failure phenomenon	Incorrect nonvolatile memory data (in governor • pump controller)
—	**E256**	**DA20KT**		
Failure content	• The data in the nonvolatile memory in the controller cannot be updated.			
Response from controller	• None in particular • Even if the failure cause disappears, the nonvolatile memory does not return to normalcy, unless the engine starting switch is once turned OFF.			
Phenomenon occurring on machine	• In some cases control parameters of the machines change, resulting in increase or decrease of the machine's power.			
Relative information	• Recorded in the nonvolatile memory are part of the machine control parameters			

Presumed cause and standard value in normalcy		Cause	Standard value in normalcy and references for troubleshooting
	1	Governor • pump controller defective	As it is an internal failure, troubleshooting is impossible. (There is no problem with continuing with use of the controller, so long as no failure is visually evident)

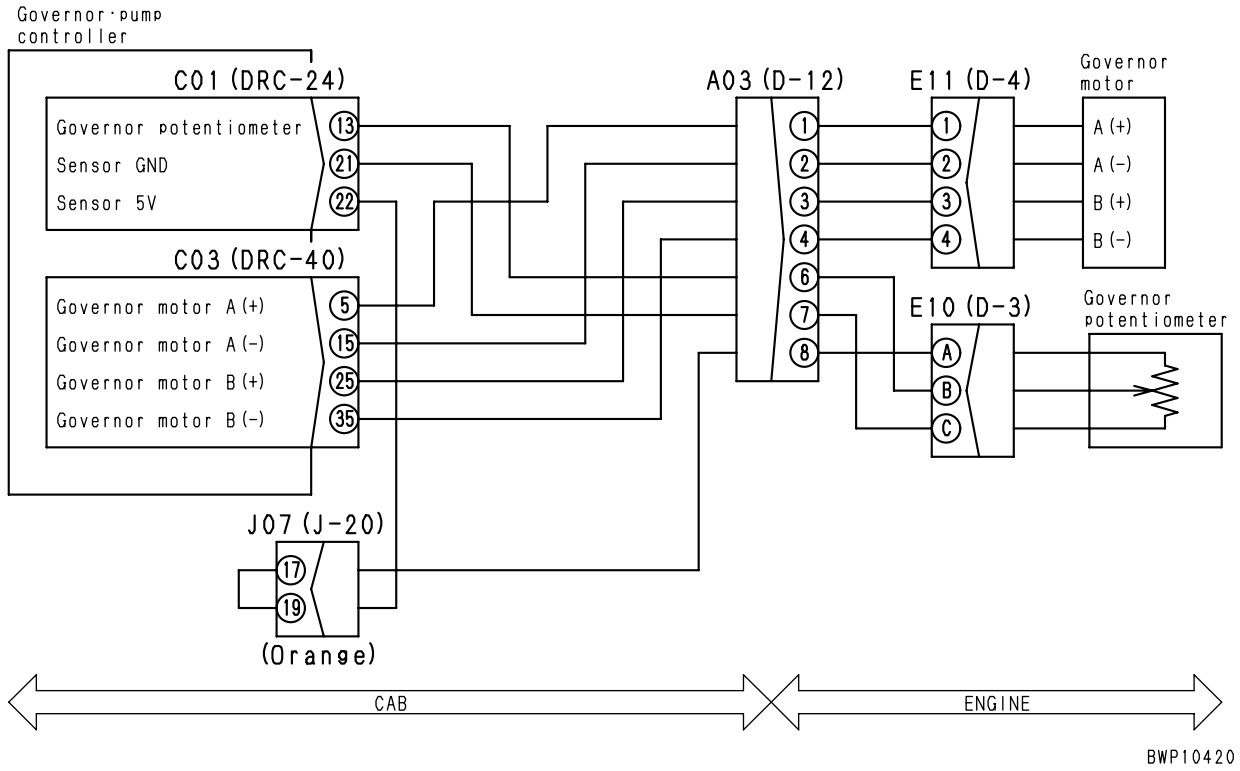
Service Code in Electrical System E306 (Abnormality in governor potentiometer)

User Code	Service Code	Failure Code	Failure phenomenon	Abnormality in governor potentiometer (in governor • pump controller)
—	**E306**	**DK54KZ**		
Failure content	• Signal voltage from the governor potentiometer dropped below 0.4 V or exceeded 4.6 V.			
Response from controller	• The controller exercises control by computing the motor position through voltage right before a failure occurred. • Even if the failure cause disappears of itself, the governor potentiometer does not return to normalcy, unless the engine starting switch is once turned OFF.			
Phenomenon occurring on machine	• The engine cannot attain the specified rotation at high idling. (A bit lower) • The engine cannot attain the specified rotation at low idling (A bit higher) • The auto-decelerator or automatic warming-up function does not work. • There is hunting while the engine is running. • The engine stalls. • The engine does not stop.			
Relative information	• Input from the governor potentiometer (voltage) can be confirmed in the monitor function. (Code No. 031: Governor potentiometer voltage)			

Presumed cause and standard value in normalcy

	Cause	Standard value in normalcy and references for troubleshooting		
1	Sensor power source defective	If Service Code No. [E226] is displayed, troubleshoot the failure first.		
2	Governor potentiometer defective (Internal failure)	★Turn the engine starting switch OFF for the preparations, and hold it in the OFF position during the troubleshooting.		
		E10 (male)	Resistance value	
		Between Ⓐ and Ⓒ	4.0 – 6.0 kΩ	
		Between Ⓑ and Ⓐ	0.25 – 5.0 kΩ	
		Between Ⓑ and Ⓒ	0.25 – 5.0 kΩ	
3	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 from C01 (female) ㉒ to J07 to E10 (female) Ⓐ	Resistance value	Below 1 Ω
		Wiring harness between C01 (female) ㉑ and E10 (female) Ⓒ	Resistance value	Below 1 Ω
		Wiring harness between C01 (female) ⑬ and E10 (female) Ⓑ	Resistance value	Below 1 Ω
4	Grounding fault of wiring harness (Contact with grounding circuit)	★Turn the engine starting switch OFF for the preparations, and hold it in the OFF position during the troubleshooting.		
		Between wiring harness between C01 (female) ⑬ and E10 (female) Ⓑ and grounding	Resistance value	Above 1 MΩ
5	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.		
		Between wiring harness from C01 (female) ㉒ to J07 to E10 (female) Ⓐ and grounding	Voltage	Below 1 V
		Between wiring harness between C01 (female) ⑬ and E10 (female) Ⓑ and grounding	Voltage	Below 1 V
6	Governor • pump controller defective	★Turn the engine starting switch OFF for the preparations, and hold it in the ON position during the troubleshooting.		
		C01	Resistance value	
		Between ㉒ and ㉑	4.5 – 5.5 V	
		Between ⑬ and ㉑	0.5 – 4.5 V	

Electrical Circuit Diagram for Governor Motor in Governor • Pump Controller



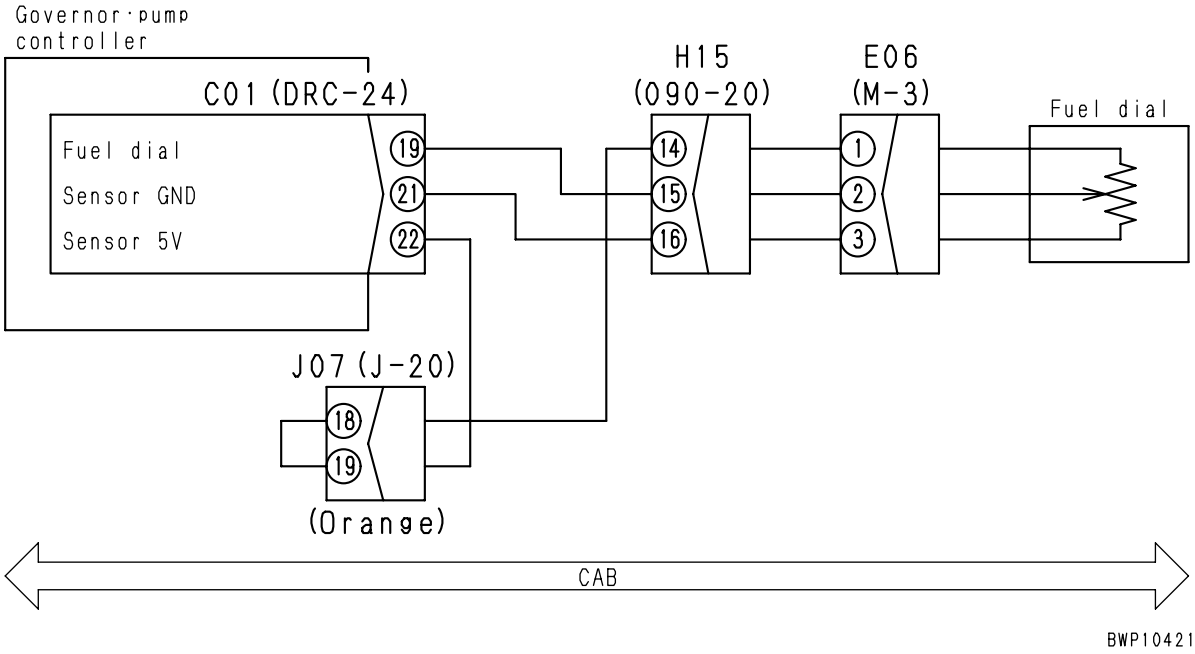
Service Code in Electrical System E308 (Abnormality in fuel dial)

User Code	Service Code	Failure Code	Failure phenomenon	Abnormality in governor fuel dial (in governor • pump controller)
E05	**E308**	**DK10KZ**		
Failure content	• Signal voltage from the from fuel dropped below 0.23 V or exceeded 4.77 V.			
Response from controller	• The controller exercises control by computing the fuel dial position through voltage right before a failure occurred. • If the failure cause disappears, the fuel dial returns to normalcy.			
Phenomenon occurring on machine	• If the fuel dial had been set at FULL before a failure occurred, it does not change to PARTIAL. • If the fuel dial had been set at PARTIALLY before a failure occurred, it does not change to FULL. • There is hunting while the engine is running. • The engine cannot attain the specified rotation at high idling and lacks power.			
Relative information	• Input from the fuel dial (voltage) can be confirmed in the monitor function. (Code No. 030: Fuel dial voltage)			

Presumed cause and standard value in normalcy

	Cause	Standard value in normalcy and references for troubleshooting			
1	Sensor power source defective	If Service Code No. [E226] is displayed, troubleshoot the failure first.			
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.			
		E06 (male)	Resistance value		
		Between ① and ③	4.0 – 6.0 kΩ		
		Between ② and ①	0.25 – 5.0 kΩ		
		Between ② and ③	0.25 – 5.0 kΩ		
3	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 from C01 (female) ㉒ to J07 to E06 (female) ①	Resistance value	Below 1 Ω	
		Wiring harness between C01 (female) ㉑ and E06 (female) ③	Resistance value	Below 1 Ω	
		Wiring harness between C01 (female) ⑲ and E06 (female) ②	Resistance value	Below 1 Ω	
4	Grounding fault of wiring harness (Contact with grounding circuit)	★Turn the engine starting switch OFF for the preparations, and hold it in the OFF position during the troubleshooting.			
		Between wiring harness between C01 (female) ⑲ and E06 (female) ② and grounding	Resistance value	Above 1 MΩ	
5	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.			
		Between wiring harness from C01 (female) ㉒ to J07 to E06 (female) ① and grounding	Voltage	Below 1 V	
		Between wiring harness between C01 (female) ⑲ and E06 (female) ② and grounding	Voltage	Below 1 V	
6	Governor • pump controller defective	★Turn the engine starting switch OFF for the preparations, and hold it in the ON position during the troubleshooting.			
		C01	Resistance value		
		Between ㉒ and ㉑	4.5 – 5.5 V		
		Between ⑲ and ㉑	0.5 – 4.5 V		

Electrical Circuit Diagram for Fuel Dial in Governor • Pump Controller

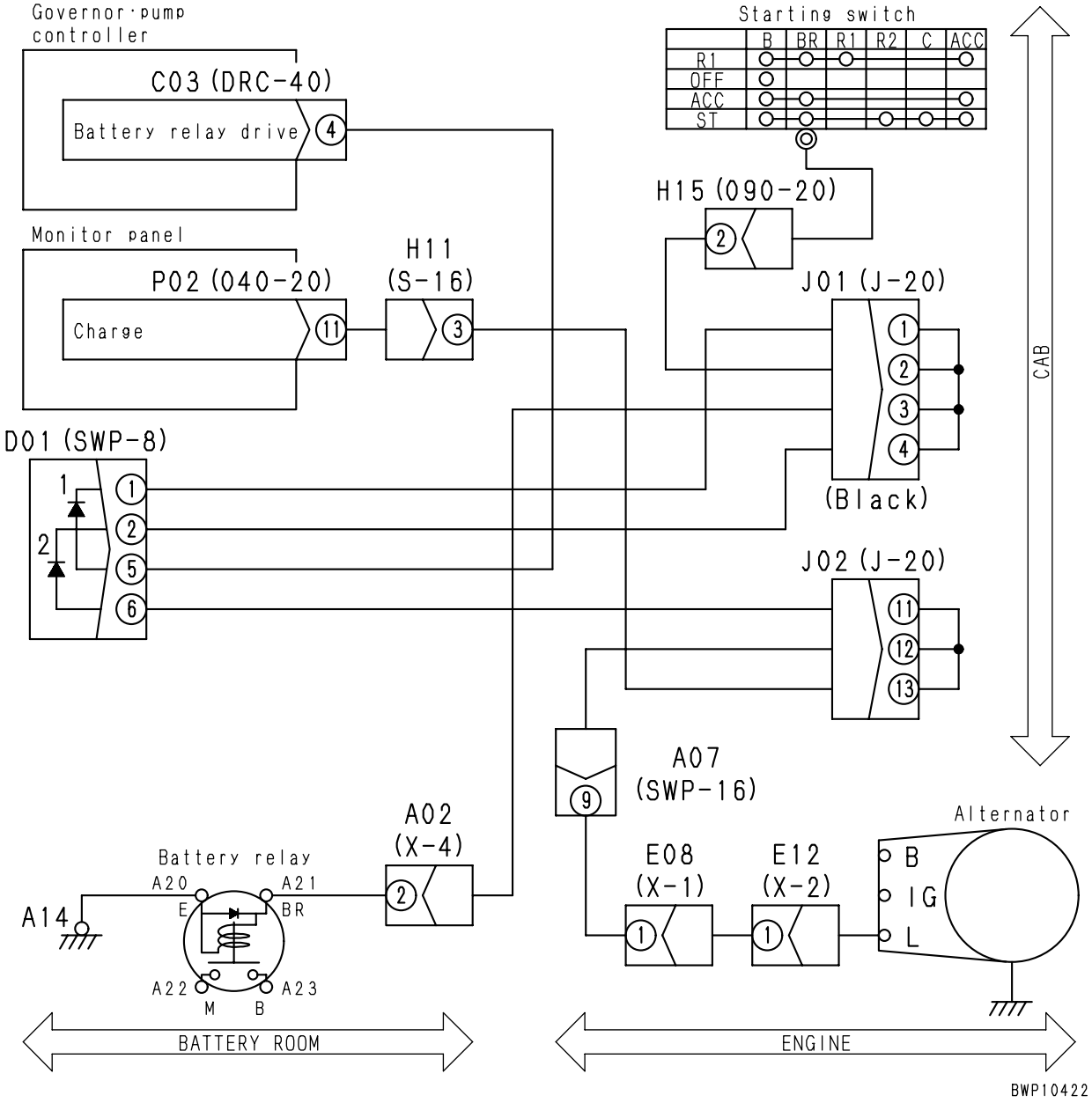


Service Code in Electrical System E315 (Short-circuiting in battery relay)

User Code	Service Code	Failure Code	Failure phenomenon	Short-circuiting in battery relay (in governor • pump controller)
—	**E315**	**D110KB**		
Failure content	• Abnormal current flew to the battery relay drive circuit, when power was supplied to the circuit.			
Response from controller	• The controller turns OFF power to the battery drive circuit. • Even when the failure cause disappears, the relay does not return to normalcy, unless the engine starting switch is once turned OFF.			
Phenomenon occurring on machine	• The engine does not stop.			
Relative information	• It can be confirmed in the monitor function how the battery relay works (ON or OFF). (Code No. 037: Controller output)			

Presumed cause and standard value in normalcy	Cause		Standard value in normalcy and references for troubleshooting			
	1	Battery relay defective (Internal failure)	★Turn the engine starting switch OFF for the preparations, and hold it in the OFF position during the troubleshooting.			
			Battery relay	Continuity & Resistance value		
			Between A21 (BR terminal) and A20 (E terminal)	Continued		
			Between A21 (BR terminal) and grounding	Above 1 MΩ		
	2	Grounding fault of wiring harness (Contact with grounding circuit)	★Turn the engine starting switch OFF for the preparations, and hold it in the OFF position during the troubleshooting.			
			Between wiring harness from C03 (female) ④ to D01 to J01 to A21 (BR terminal) and grounding	Resistance value	Above 1 MΩ	
	3	Governor • pump controller defective	★Turn the engine starting switch OFF for the preparations, and hold it in the ON position during the troubleshooting.			
			C03 (female)	Engine starting switch OFF	Voltage	
			Between ④ and grounding	ON → OFF	20 – 30 V (for 4 to 7 seconds)	

Electrical Circuit Diagram for Battery Relay in Governor • Pump Controller



Service Code in Electrical System E316 (Step-out in governor motor)

User Code	Service Code	Failure Code	Failure phenomenon	Step-out in governor motor (in governor • pump controller)
—	**E316**	**DY10K4**		
Failure content	• There is a big difference between signals from the potentiometer and the set values in the controller.			
Response from controller	• The controller repeats the same controlling motions (step-out). • Even when the failure cause disappears, the governor motor does not return to normalcy, unless the engine starting switch is once turned OFF.			
Phenomenon occurring on machine	• The engine rotation cannot be controlled. • There is hunting in the rotation. • The engine does not stop.			

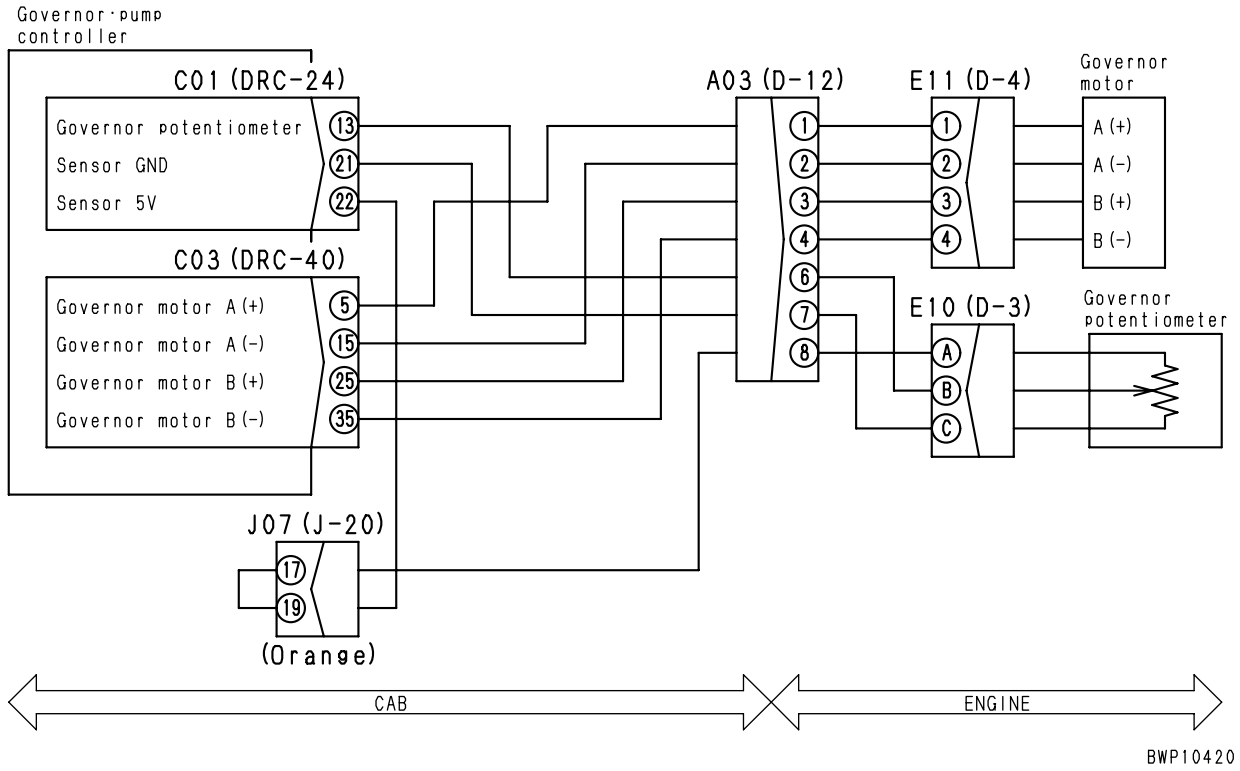
Presumed cause and standard value in normalcy		Cause	Standard value in normalcy and references for troubleshooting
	1	Fuel dial defective	If Service Code [E308] is displayed, troubleshoot that failure first.
	2	Governor potentiometer defective	If Service Code [E306] is displayed, troubleshoot that failure first.
	3	Governor motor defective (disconnection)	If Service Code [E317] is displayed, troubleshoot that failure first.
	4	Governor motor defective (short-circuiting)	If Service Code [E318] is displayed, troubleshoot that failure first.
	5	Governor lever adjustment improper	Refer to the section of "Inspection and Adjustment - Special Function of Monitor Panel" in this manual.
	6	Engine fuel control system defective	Refer to Engine Shop Manual.
	7	Governor • pump controller defective	As this is an internal failure, no troubleshooting can be carried out. (If there is none of the failures listed above, the controller is judged as defective)

Service Code in Electrical System E317 (Disconnection in governor motor Phase A and B)

User Code	Service Code	Failure Code	Failure phenomenon	Disconnection in governor motor Phase A and B (in governor • pump controller)
E05	**E317**	**DY10KA**		
Failure content	• No current flew to the governor motor, when power was supplied to the motor.			
Response from controller	• None in particular. • If the failure cause disappears, the governor returns to normalcy.			
Phenomenon occurring on machine	• The engine rotation drops to low idling. • There is hunting in the rotation • The engine does not stop. • The governor motor steps out.			
Relative information	• Operation of the governor motor (current) can be confirmed in the monitor function. (Code No. 033: Governor motor Phase A current, Code No. 034: Governor motor Phase B current)			

Presumed cause and standard value in normalcy		Cause	Standard value in normalcy and references for troubleshooting			
	1	Governor motor defective (Internal disconnection)	★Turn the engine starting switch OFF for the preparations, and hold it in the OFF position during the troubleshooting.			
			E11 (male)	Resistance value		
			Between ① and ②	2.5 – 7.5 Ω		
			Between ③ and ④	2.5 – 7.5 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 C03 (female) ⑤ and E11 (female) ①	Resistance value	Below 1 Ω	
			Wiring harness between C03 (female) ⑮ and E11 (female) ②	Resistance value	Below 1 Ω	
			Wiring harness between C03 (female) ㉕ and E11 (female) ③	Resistance value	Below 1 Ω	
			Wiring harness between C03 (female) ㉟ and E11 (female) ④	Resistance value	Below 1 Ω	
	3	Governor • pump controller defective	★Turn the engine starting switch OFF for the preparations, and hold it in the OFF position during the troubleshooting.			
			C03 (female)	Resistance value		
			Between ⑤ and ⑮	2.5 – 7.5 Ω		
			Between ㉕ and ㉟	2.5 – 7.5 Ω		

Electrical Circuit Diagram for Governor Motor in Governor • Pump Controller



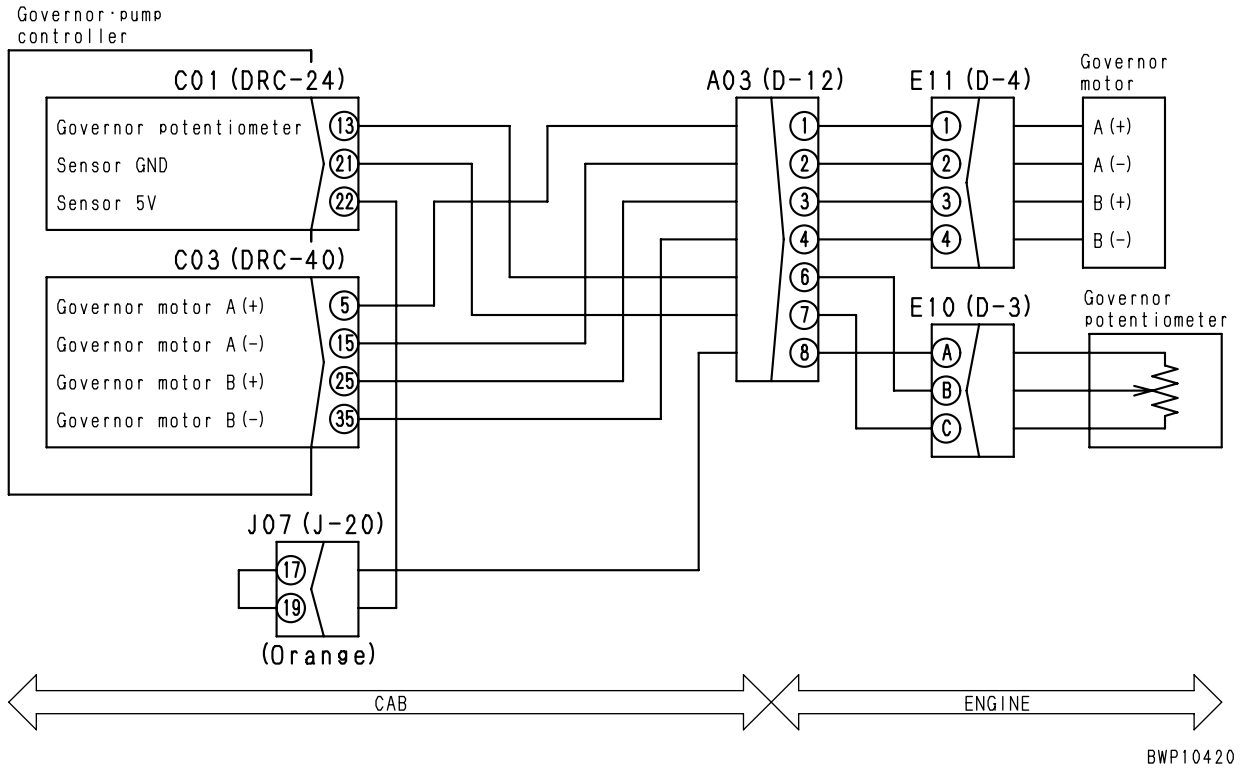
Service Code in Electrical System E318 (Short-circuiting in governor motor Phase A and Phase B)

User Code	Service Code	Failure Code	Failure phenomenon	Disconnection in governor motor Phase A and Phase B (in governor • pump controller system)
E05	**E318**	**DY10KB**		
Failure content	• Abnormal current flew to the governor motor, when power is supplied to the motor.			
Response from controller	• None in particular • If the failure cause disappears, the governor motor returns to normalcy.			
Phenomenon occurring on machine	• The engine rotation cannot be controlled. • The engine rotation drops to low idling. • There is hunting in the rotation. • The engine does not stop.			
Relative information	• Operation of the governor motor (current) can be confirmed in the monitor function. (Code No. 033: Governor motor Phase A current, Code No. 034: Governor motor Phase B current)			

Presumed cause and standard value in normalcy

	Cause	Standard value in normalcy and references for troubleshooting			
1	Governor motor defective (Internal short-circuiting or grounding fault)	★Turn the engine starting switch OFF for the preparations, and hold it in the OFF position during the troubleshooting.			
		E11 (male)	Resistance value		
		Between ① and ②	2.5 – 7.5 Ω		
		Between ③ and ④	2.5 – 7.5 Ω		
		Between ① and grounding	Above 1 MΩ		
		Between ③ and grounding	Above 1 MΩ		
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.			
		Between wiring harness between C03 (female) ⑤ and E11 (female) ① and grounding	Resistance value	Above 1 MΩ	
		Between wiring harness between C03 (female) ⑮ and E11 (female) ② and grounding	Resistance value	Above 1 MΩ	
		Between wiring harness between C03 (female) ㉕ and E11 (female) ③ and grounding	Resistance value	Above 1 MΩ	
		Between wiring harness between C03 (female) ㉟ and E11 (female) ④ and grounding	Resistance value	Above 1 MΩ	
3	Governor • pump controller defective	★Turn the engine starting switch OFF for the preparations, and hold it in the OFF position during the troubleshooting.			
		C03 (female)	Resistance value		
		Between ⑤ and ⑮	2.5 – 7.5 Ω		
		Between ㉕ and ㉟	2.5 – 7.5 Ω		
		Between ⑤ and grounding	Above 1 MΩ		
		Between ⑮ and grounding	Above 1 MΩ		
		Between ㉕ and grounding	Above 1 MΩ		
		Between ㉟ and grounding	Above 1 MΩ		

Electrical Circuit Diagram for Governor Motor in Governor • Pump Controller



Service Code in Electrical System E501 ("Model Selection" function not provided yet)

User Code	Service Code	Failure Code	Failure phenomenon	"Model Selection" function not provided yet (in governor • pump controller system)
—	**E501**	**DA2AKM**		
Failure content	• Model Code is not inputted yet.			
Response from controller	• Model data and rated load cannot be set. • Even when the failure cause disappears, Service Code does not return to normalcy, unless the engine starting switch is once turned OFF.			
Phenomenon occurring on machine	• The excess load alarm does not work normally.			
Relative information	• Model names that the controller recognizes (figure) can be confirmed in the monitor function. (Code No. 150: Model Code)			

		Cause	Standard value in normalcy and references for troubleshooting
Presumed cause and standard value in normalcy	1	Setting work not finished yet	Refer to the section "Special Function of Monitor Panel" in this manual. ★There is a possibility that model selection operation has never been tried with that specific model from its delivery ex-works up to this moment.
	2	Governor • pump controller defective	As this is an internal failure, no troubleshooting can be conducted. (If there is no problem with the setting work above, the controller may be judged as defective.)

Service Mode in Electrical System E502 (Model selecting signal fault)

User Code	Service Code	Failure Code	Failure phenomenon	Model selecting signal fault (in governor • pump controller system)
—	**E502**	**DA20KT**		
Failure content	• Information on the models stored in the controller have been damaged.			
Response from controller	• Model data and rated load cannot be set. • Even when the failure cause disappears, the signal does not return to normal, unless the engine starting switch is once turned OFF.			
Phenomenon occurring on machine	• The excess load alarm does not work normally.			
Relative information	• (Model names that the controller recognizes (figure) can be confirmed in the monitor function. (Code No. 150: Model Code)			

		Cause	Standard value in normalcy and references for troubleshooting
Presumed cause and standard value in normalcy	1	Setting work not finished yet	Refer to the section "Special Function of Monitor Panel" in this manual.
	2	Governor • pump controller defective	As this is an internal failure, no troubleshooting can be conducted. (If there is no problem with the setting work above, the controller may be judged as defective.)

Failure Code in Mechanical System A000N1 (Out-of-rate engine rotation at high idling)

User Code	Service Code	Failure Code	Failure phenomenon	Engine rotation at high idling out of rate (in mechanical system)
—	—	**A000N1**		
Failure content	• Engine rotation above 2,350 rpm was detected for more than 10 seconds, while the engine was running.			
Response from controller	• None in particular • If the failure cause disappears of itself, the engine rotation returns to normalcy.			
Phenomenon occurring on machine	• There is a possibility that the engine is damaged, if is used continuously without adjustment.			
Relative information	• Input from the engine rotation sensor (rpm) can be confirmed in the monitor function. (Code No. 010: Engine rotation)			

		Cause	Standard value in normalcy and references for troubleshooting
Presumed cause and standard value in normalcy	1	Failure in engine mechanical system	Check if there has been an internal or external factor that would cause the engine to overrun at high idling, and troubleshoot the mechanical system of the engine.
	2	Governor • pump controller defective	As this is an internal failure, troubleshooting cannot be conducted. (Unless there is any visible trouble found in the machine, use of the controller may be continued as it is)

Failure Code in Mechanical System A000N2 (Out-of-rate engine rotation at low idling)

User Code	Service Code	Failure Code	Failure phenomenon	Out-of-rate engine rotation at low idling (in mechanical system)
—	—	**A000N2**		
Failure content	• Engine rotation below 500 rpm was detected for more than 10 seconds, while the engine was running.			
Response from controller	• None in particular • If the failure cause disappears of itself, the rotation returns to normalcy.			
Phenomenon occurring on machine	• There is a possibility that the engine is damaged, if it is used continuously without adjustment.			
Relative information	• Input from the engine rotation sensor (rpm) can be confirmed in the monitor function. (Code No. 010: Engine rotation)			

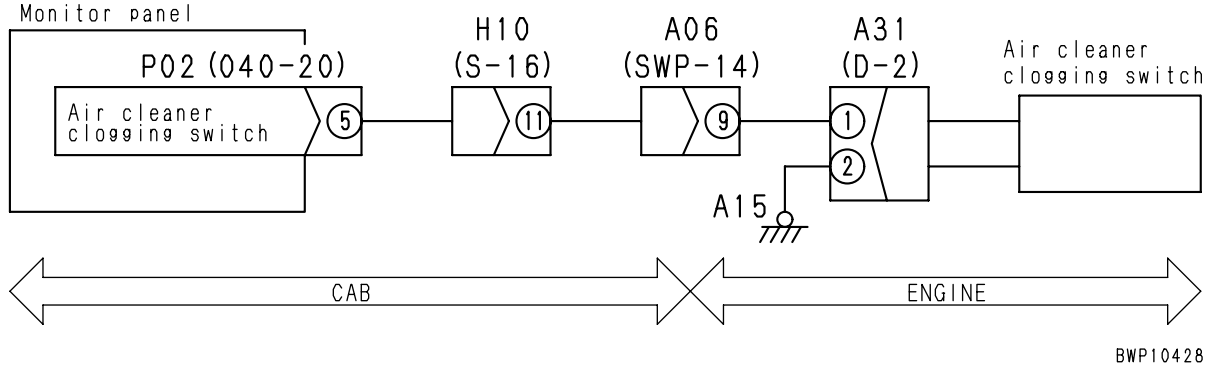
		Cause	Standard value in normalcy and references for troubleshooting
Presumed cause and standard value in normalcy	1	Failure in engine mechanical system	Check if there has been an internal or external factor that would cause the engine to overrun at high idling, and troubleshoot the mechanical system of the engine.
	2	Governor • pump controller defective	As this is an internal failure, troubleshooting cannot be conducted. (Unless there is any visible trouble found in the machine, use of the controller may be continued as it is)

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 normalcy	Cause		Standard value in normalcy 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

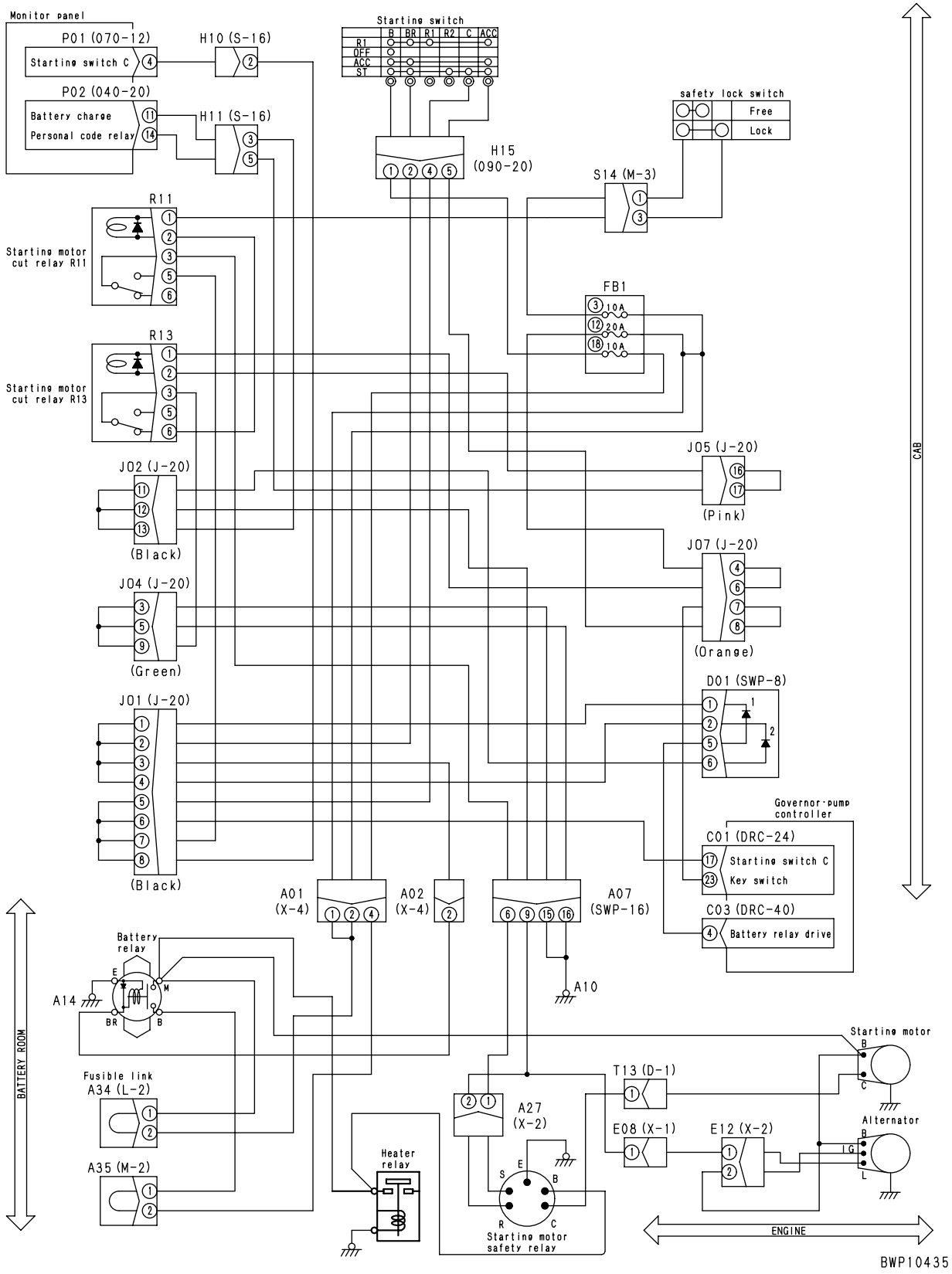


Failure Code in Mechanical System AB00KE (Abnormally lowered charging voltage)

User Code	Service Code	Failure Code	Failure phenomenon	Charging voltage abnormally lowered (in mechanical system)
—	—	**AB00KE**		
Failure content	• Generation signal from the alternator is not inputted, while the engine is running.			
Response from controller	• None in particular			
Phenomenon occurring on machine	• There is a possibility that the battery may not be charged, if charging is continued without corrective action.			
Relative information	• This Failure Code is recorded, if the charging caution symbol is displayed in the monitor panel, while the engine is running. • Input from the alternator (voltage) can be confirmed in the monitor function. (Code No. 043: Charging voltage)			

Presumed cause and standard value in normalcy		Cause	Standard value in normalcy and references for troubleshooting			
	1	Alternator defective (short generating output)	★Turn the engine starting switch OFF for the preparations, and hold it running during the troubleshooting.			
			E12 (male)	Engine rotation	Voltage	
			Between ① and grounding	Above medium speed	27.5 – 29.5 V	
	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 from P02 (female) ⑪ to J02 to E12 (female) ①		Resistance value	Below 1 Ω
	3	Grounding fault of wiring harness (Contact with grounding circuit)	★Turn the engine starting switch OFF for the preparations, and hold it in the OFF position during the troubleshooting.			
			Wiring harness from P02 (female) ⑪ to J02 to E12 (female) ①, or between P02 (female) ⑪ and D01 (female) ⑥, or between P02 (female) ⑪ and A27 (female) ②		Resistance value	Above 1 MΩ
	4	Monitor panel defective	★Turn the engine starting switch OFF for the preparations, and keep the engine running during the troubleshooting.			
			P02	Engine rotation	Voltage	
			Between ⑪ and grounding	Above medium speed	27.5 – 29.5 V	

Electrical Circuit Diagram for Engine Start, Stop and Charging in Monitor Panel

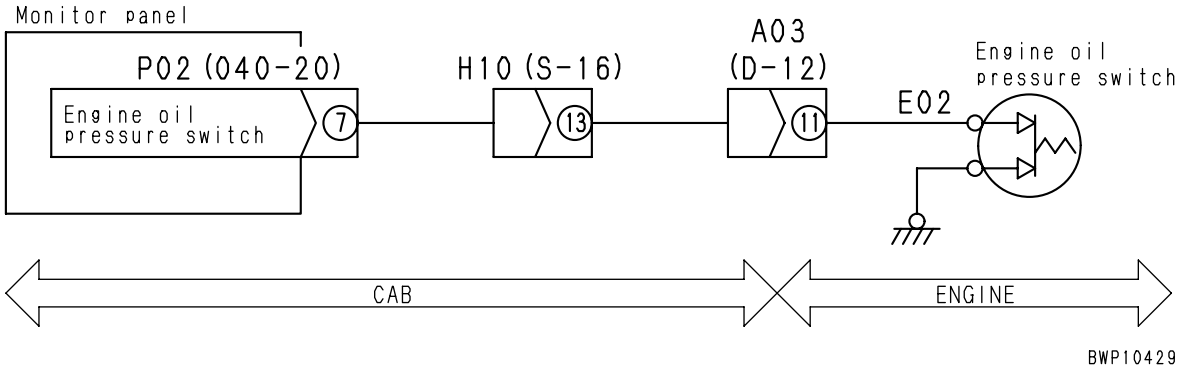


Failure Code in Mechanical System B@BAZG (Abnormally lowered engine oil pressure)

User Code	Service Code	Failure Code	Failure phenomenon	Engine oil pressure abnormally lowered (in mechanical system)
—	—	**B@BAZG**		
Failure content	• The signal circuit in the engine oil pressure switch was closed (i.e. connected with grounding), while the engine was running.			
Response from controller	• None in particular			
Phenomenon occurring on machine	• There is a possibility that the engine may seize, if the engine is kept running without corrective action.			
Relative information	• This Failure Code is recorded, if the engine oil pressure caution symbol is displayed in the monitor panel, while the engine is running. • Input from the engine oil pressure switch (ON or OFF) can be confirmed in the monitor function. (Code No. 046: Monitor input 2)			

Presumed cause and standard value in normalcy		Cause	Standard value in normalcy and references for troubleshooting			
	1	Engine oil pressure lowered (the system in normal condition)	★Check the failure cause and damage to the engine, and then make repairs.			
	2	Engine oil pressure switch defective (Internal short-circuiting)	★Turn the engine starting switch OFF for the preparations, and keep the engine running during the troubleshooting.			
			E02 (on switch side)	Engine oil pressure	Resistance value	
			Between terminal and grounding	When in normal condition	Above 1 MΩ	
				When lowered	Below 1 Ω	
	3	Grounding fault of wiring harness (Contact with grounding circuit)	★Turn the engine starting switch OFF for the preparations, and hold it in the OFF position during the troubleshooting.			
			Between wiring harness between P02 (female) (7) and E02 (terminal) and grounding		Resistance value	Above 1 MΩ
	4	Monitor panel defective	★Turn the engine starting switch OFF for the preparations, and keep the engine running during the troubleshooting.			
			P02	Engine oil pressure	Voltage	
			Between ⑦ and grounding	When in normal condition	20 – 30 V	
				When lowered	Below 1 V	

Electrical Circuit Diagram for Engine Oil Pressure Switch in Monitor Panel

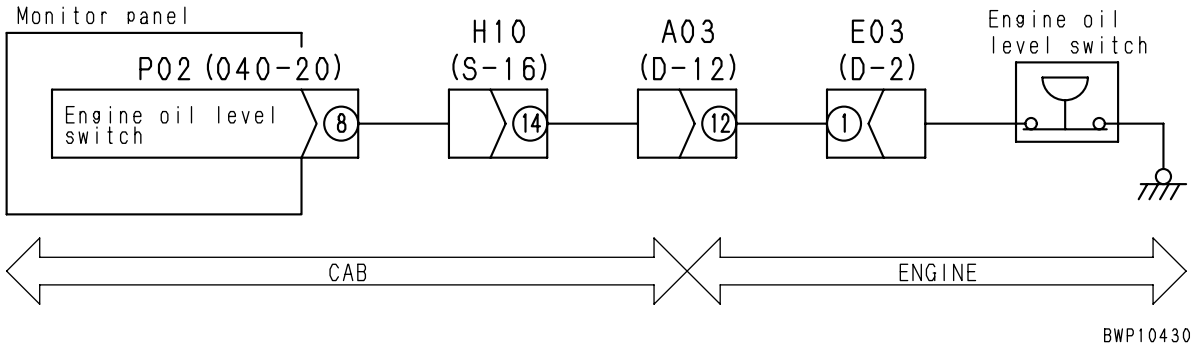


Failure Code in Mechanical System B@BAZK (Abnormally lowered engine oil level)

User Code	Service Code	Failure Code	Failure phenomenon	Engine oil level abnormally lowered (in mechanical system)
—	—	**B@BAZK**		
Failure content	• The signal circuit in the engine oil level switch was opened (i.e. disconnected from grounding), when the engine is stopped (with the starting switch in the ON position).			
Response from controller	• None in particular			
Phenomenon occurring on machine	• There is a possibility that the engine seizes if it is kept running without a corrective action.			
Relative information	• This Failure Code is recorded if the engine oil level caution symbol is displayed, when the engine is stopped (with the starting key in the ON position). • Input from the engine oil level switch (ON or OFF) can be confirmed in the monitor function. (Code No. 046: Monitor input 2)			

Presumed cause and standard value in normalcy		Cause	Standard value in normalcy and references for troubleshooting			
	1	Engine oil level lowered (System in normal condition)	★Check the engine oil level, and refill oil. (If the phenomenon occurs frequently, check the cause)			
	2	Engine oil level switch defective (Internal disconnection)	★Turn the engine starting switch OFF for the preparations, and hold it in the OFF position during the troubleshooting.			
			E03 (male)	Engine oil level	Resistance value	
			Between ① and grounding	When in normal condition	Below 1 Ω	
				When lowered	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 in the OFF position during the troubleshooting.			
			Wiring harness between P02 (female) ⑧ and E03 (female) ①		Resistance value	Below 1 Ω
	4	Monitor panel defective	★Turn the engine starting switch OFF for the preparations, and hold it in the ON position during the troubleshooting.			
			P02	Engine oil pressure	Voltage	
			Between ⑧ and grounding	When in normal condition	Below 1 V	
				When lowered	20 – 30 V	

Electrical Circuit Diagram for Engine Oil Level Switch in Monitor Panel



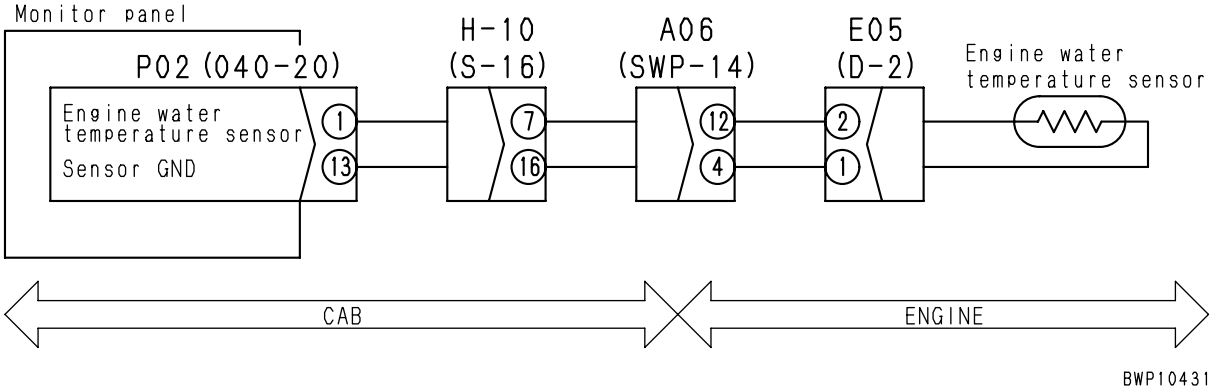
BWP10430

Failure Code in Mechanical System B@BCNS (Engine cooling water overheating)

User Code	Service Code	Failure Code	Failure phenomenon	Engine cooling water overheated (in mechanical system)
—	—	**B@BCNS**		
Failure content	• The engine cooling water sensor inputted a signal of 102°C, while the engine was running.			
Response from controller	• Response from controller			
Phenomenon occurring on machine	• There is a possibility that the engine seizes, if it is kept running without a corrective action.			
Relative information	• This Failure Code is recorded, if the engine cooling water temperature gauge is displayed in the red range, when the engine is running. • Input from the engine cooling water temperature sensor (temperature) can be confirmed in the monitor function. (Code No. 041: Engine cooling water temperature)			

Presumed cause and standard value in normalcy		Cause	Standard value in normalcy and references for troubleshooting			
	1	Engine Overheating (system in normal condition)	★Check the engine for the cause and damage, and repair it.			
	2	Engine cooling water temperature sensor defective (Internal short-circuiting)	★Turn the engine starting switch OFF for the preparations, and hold it in the OFF position during the troubleshooting.			
			E05 (male)	Engine cooling water temperature	Resistance value	
			Between ① and ②	10 – 100 °C	90 – 3.5kΩ	
			Between ② and grounding		Above 1 MΩ	
	3	Grounding fault of wiring harness (Contact with grounding circuit)	★Turn the engine starting switch OFF for the preparations, and hold it in the OFF position during the troubleshooting.			
			Between wiring harness between P02 (female) ① and E05 (female) ② and grounding		Resistance value	Above 1 MΩ
	4	Monitor panel defective	★Turn the engine starting switch OFF for the preparations, and hold it in the OFF position during the troubleshooting.			
			P02 (female)	Engine water temperature	Resistance value	
			Between ① and ⑬	10 – 100 °C	90 – 3.5kΩ	
			Between ① and grounding		Above 1 MΩ	

Electrical Circuit Diagram for Engine Cooling Water Temperature Sensor in Monitor Panel



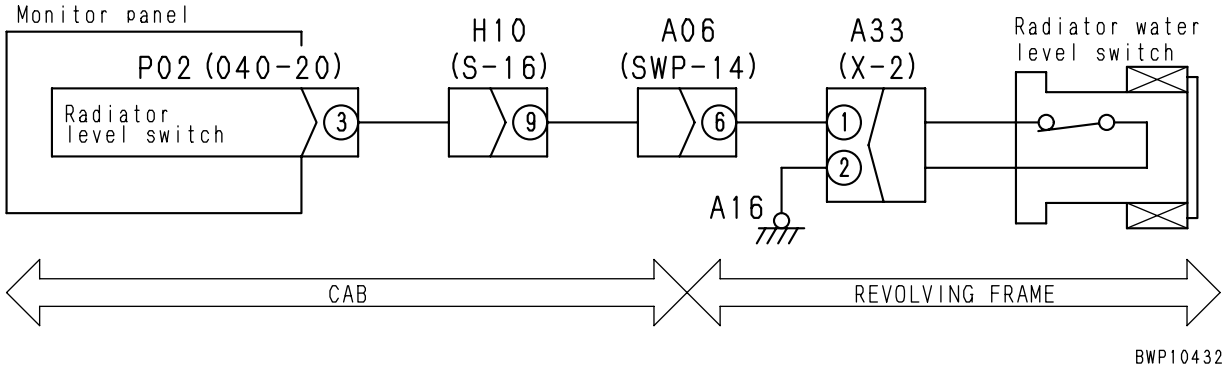
Failure Code in Mechanical System B@BCZK (Abnormally lowered radiator water level)

(Multi-monitor only)

User Code	Service Code	Failure Code	Failure phenomenon	Radiator water level abnormally lowered (in mechanical system)
—	—	**B@BCZK**		
Failure content	• The signal circuit in the radiator water level switch was opened (i.e. disconnected from grounding).			
Response from controller	• None in particular			
Phenomenon occurring on machine	• There is a possibility that the engine seizes, if it is kept running without a corrective action.			
Relative information	• This Failure Code is recorded, if the radiator water level caution symbol is displayed in the monitor panel, when the engine is running. • Input from the radiator water level switch (ON or OFF) can be confirmed in the monitor function. (Code No. 045: Monitor input 1)			

Presumed cause and standard value in normalcy		Cause	Standard value in normalcy and references for troubleshooting			
	1	Radiator water level lowered (system in normal condition)	★Check the water level and refill cooling water. (If this phenomenon occurs frequently, check the cause)			
	2	Radiator water level switch defective (Internal disconnection)	★Turn the engine starting switch OFF for the preparations, and hold it in the OFF position during the troubleshooting.			
			A33 (male)	Engine cooling water level	Resistance value	
			Between ① and ②	When in normal condition	Below 1 Ω	
				When lowered	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 in the OFF position during the troubleshooting.			
			Wiring harness between P02 (female) ③ and A33 (female) ①		Resistance value	Below 1 Ω
			Wiring harness between A33 (female) ② and grounding		Resistance value	Below 1 Ω
	4	Monitor panel defective	★Turn the engine starting switch OFF for the preparations, and hold it in the ON position during the troubleshooting.			
			P02	Engine water temperature	Resistance value	
			Between ③ and grounding	When in normal condition	Below 1 V	
				When lowered	20 – 30 V	

Electrical Circuit Diagram for Radiator Water Level Switch in Monitor Panel



BWP10432

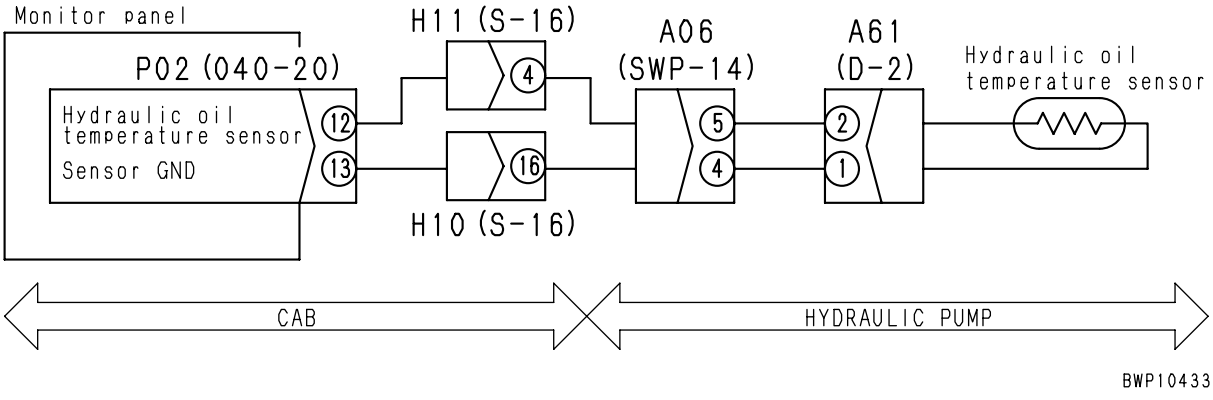
Failure Code in Mechanical System B@HANS (Hydraulic oil overheating)

(Multi-monitor only)

User Code	Service Code	Failure Code	Failure phenomenon	Hydraulic oil overheated (in mechanical system)
—	—	**B@HANS**		
Failure content	• The hydraulic oil temperature sensor inputted a signal of 102°C, while the engine was running.			
Response from controller	• None in particular			
Phenomenon occurring on machine	• There is a possibility that the engine seizes, if it is kept running without a corrective action.			
Relative information	• This Failure Code is recorded, if the hydraulic oil temperature gauge is displayed in the red range, when the engine is running. • Input from the hydraulic oil temperature sensor (temperature) can be confirmed in the monitor function. (Code No. 044: Engine cooling water temperature)			

Presumed cause and standard value in normalcy		Cause	Standard value in normalcy and references for troubleshooting			
	1	Hydraulic oil overheating (system in normal condition)	★Check the cause and damage to the hydraulic equipment, and repair it.			
	2	Hydraulic oil temperature sensor defective (Internal short-circuiting)	★Turn the engine starting switch OFF for the preparations, and hold it in the OFF position during the troubleshooting.			
			A61 (male)	Hydraulic oil temperature	Resistance value	
			Between ① and ②	10 – 100 °C	90 – 3.5kΩ	
			Between ② and grounding		Above 1 MΩ	
	3	Grounding fault of wiring harness (Contact with grounding circuit)	★Turn the engine starting switch OFF for the preparations, and hold it in the OFF position during the troubleshooting.			
			Between wiring harness between P02 (female) ⑫ and A61 (female) ② and grounding		Resistance value	Above 1 MΩ
	4	Monitor panel defective	★Turn the engine starting switch OFF for the preparations, and hold it in the OFF position during the troubleshooting.			
			P02 (female)	Engine water temperature	Resistance value	
			Between ⑫ and ⑬	10 – 100 °C	90 – 3.5kΩ	
			Between ⑫ and grounding		Above 1 MΩ	

Electrical Circuit Diagram for Hydraulic Oil Temperature Sensor in Monitor Panel



TROUBLESHOOTING OF ELECTRICAL SYSTEM (E-MODE)

INFORMATION CONTAINED IN TROUBLESHOOTING TABLE

★ The following information are edited and contained in the "Information Contained in Troubleshooting Table". You are required to proceed with troubleshooting after fully grasping the contents.

Failure information	Phenomena occurring on machine
Relative information	Information on occurred failures and troubleshooting

Presumed cause and standard value in normalcy	Cause		Standard value in normalcy and references for troubleshooting
	1	Cause for presumed failure (The attached No. for filing and reference purpose only. It does not stand for any priority)	<Contents> • The standard values in normalcy by which to judge "good" or "no good" about presumed causes. • References for making judgement of "good" or "no good" <Phenomena of wiring harness fault> • Failure due to disconnection Defective contact with connector or disconnection of wiring harness has occurred. • Grounding fault A wiring harness that is not originally connected with a grounding circuit is in contact with it. • Failure due to short-circuiting A wiring harness that is not originally connected with a power source circuit (24 V) is in contact with it. <Points to remember in troubleshooting> 1) Connector denotation method and handling of T-adapters Insert or connect T-adapters in the following manner, unless specifically otherwise instructed. • If there is no indication of (male) or (female) in the connector No., pull off a connector and insert a T-adapter into both sides of male and female. • If there is an indication of (male9 and (female) in the connection No., pull off a connector and insert a T-adapter into only one side of (male) or (female). 2) Description sequence of pin No. and handling of circuit tester leads Connect the positive lead (+) and negative lead (–) for troubleshooting in the following manner unless specifically otherwise instructed. • Connect the positive lead (+) to a pin No. marked at the front or wiring harness. • Connect the negative lead (–) to a pin No. marked at the rear or wiring harness.
	2		
	3		
	4		
	5		

Relative Electrical Circuit Diagram

This is part of the electrical circuit diagram which shows the portion where the failure occurred.

- Connector No.: Indicates (Type - numbers of a pin) (color)
- Arrow: Roughly indicates the location in the machine where it is installed.

E-1 Engine does not start (Engine does not rotate)

Failure information	• The engine does not start (the engine does not rotate).
Relative information	• The following two engine start locking mechanisms are provided in the engine starting circuit. 1) Engine start locking by means of password in the monitor panel (※) 2) Engine start locking by means of safety lock lever

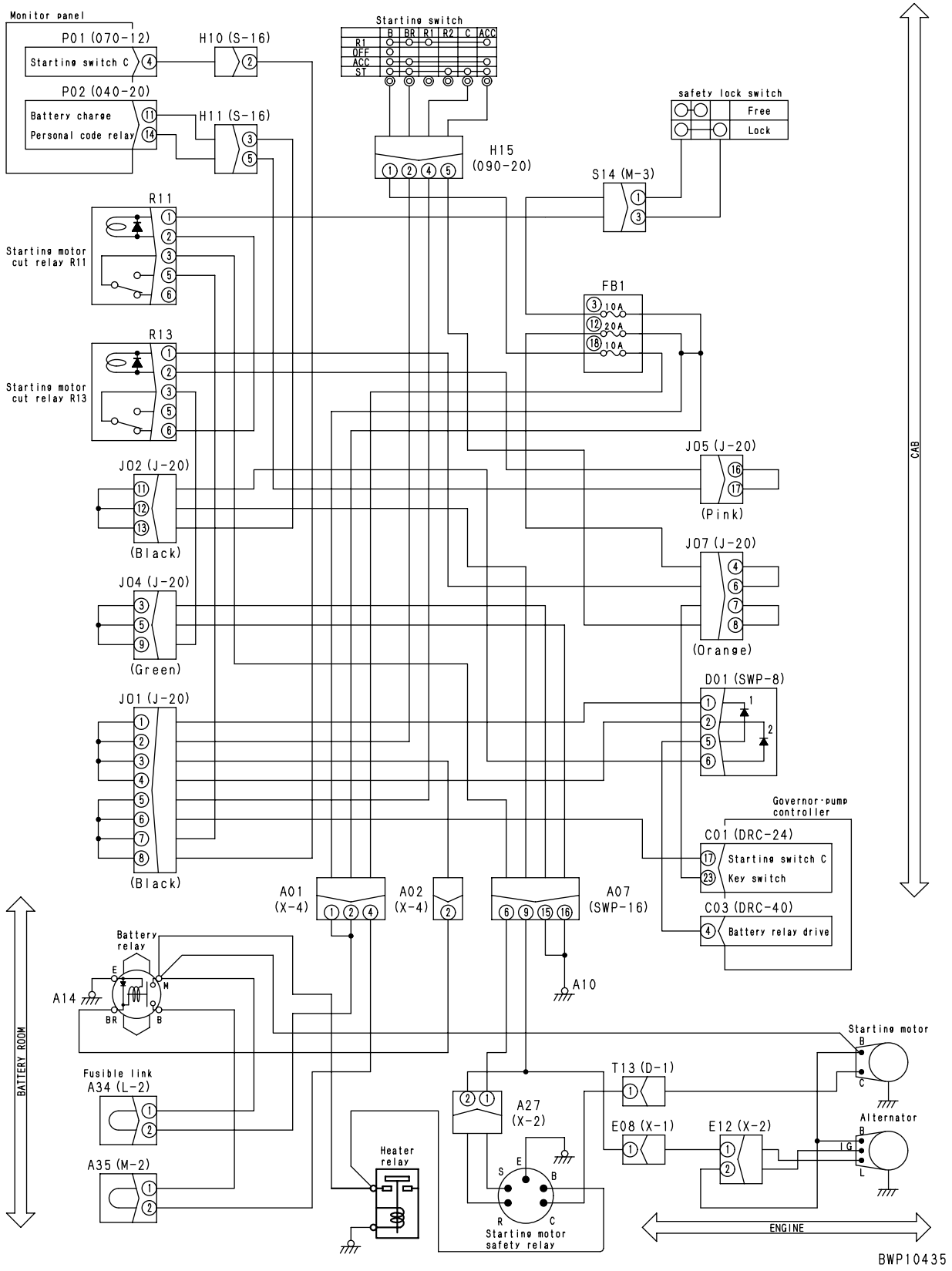
※: The multi-monitor specification machine only.

Presumed cause and standard value in normalcy

	Cause	Standard value in normalcy and references for troubleshooting			
1	Shortage in battery capacity	Battery voltage	Battery electrolyte specific gravity		
		Above 24 V	Above 1.26		
2	Fuse Nos. 3 and 18 and Fusible Link A35 fault	When a fuse or fusible link is blown, there is a big possibility that grounding fault occurred in the circuit. If a monitor lamp does not light up in the monitor panel, check the power source circuit between the battery and the specific fuse.			
3	Engine starting switch fault (Internal disconnection)	★Turn the engine starting switch OFF for the preparations, and hold it in the OFF position during the troubleshooting.			
		H15 (male)	Position	Resistance value	
		Between ① and ④	OFF	Above 1 MΩ	
			Start	Below 1 Ω	
4	Safety lock switch fault (Internal short-circuiting)	★Turn the engine starting switch OFF for the preparations, and hold it in the OFF position during the troubleshooting.			
		S14 (female)	Lock lever	Resistance value	
		Between ① and ③	Release	Below 1 Ω	
			LOCK	Above 1 MΩ	
5	Engine starting motor cut relay, R11 and R13 defective (Internal disconnection or short-circuiting)	★Turn the engine starting switch OFF for the preparations, and hold it in the OFF position during the troubleshooting.			
		R11 (female) & R13 (male)	Resistance value		
		Between ① and ②	100 – 500 Ω		
		Between ③ and ⑤	Above 1 MΩ		
		Between ③ and ⑥	Below 1 Ω		
6	Engine starting motor fault (Internal disconnection or short-circuiting)	★Turn the engine starting switch OFF for the preparations, and keep the engine running during the troubleshooting. (If all of the power source, grounding (GND), generation signal and engine start input are normal and yet the engine start output is not normal, the engine starting motor relay is defective)			
		Safety relay		Engine starting switch	Voltage
		Power source: Between B terminal and grounding		Start	20 – 30 V
		GND (grounding): Between E terminal and grounding			Connected
		Generation signal: Between R terminal (A27 ②) and grounding			Below 1 V
		Engine start input: Between C terminal and grounding			20 – 30 V
		Engine start output: Between S terminal (A27 ①) and grounding			20 – 30 V
7	Engine starting motor fault (Internal disconnection or damage)	★Turn the engine starting switch OFF for the preparations, and keep the engine running during the troubleshooting. (If all of the power source, grounding (GND), generation signal and engine start input are normal and yet the engine start output is not normal, the engine starting motor relay is defective)			
		Engine starting motor		Engine starting switch	Voltage
		Power source: B terminal and grounding		Start	20 – 30 V
		Engine start input: C terminal and grounding			20 – 30 V

Presumed cause and standard value in normalcy	Cause		Standard value in normalcy and references for troubleshooting		
	8	Alternator fault (Internal short-circuit)	★Turn the engine starting switch OFF for the preparations, and hold it in the ON position or running during the troubleshooting.		
			E12 (male)	Voltage	
			Between ① and grounding	Below 1 V	
	9	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 FB1-18 outlet and H15 (female) ①	Resistance value	Below 1 Ω
			Wiring harness from H15 (female) ④ to J01 to R11 (female) ⑤	Resistance value	Below 1 Ω
			Wiring harness between R11 (female) ③ and A27 (female) ①	Resistance value	Below 1 Ω
			Wiring harness between engine starting motor relay C terminal and engine starting motor C terminal	Resistance value	Below 1 Ω
			Wiring harness between FB1-3 and S14 (female) ①	Resistance value	Below 1 Ω
			Wiring harness between S14 (female) ③ and R11 (female) ①	Resistance value	Below 1 Ω
			Wiring harness between R11 (female) ② and R13 (female) ⑥	Resistance value	Below 1 Ω
			Wiring harness from R13 (female) ③ to J04 to grounding	Resistance value	Below 1 Ω
	10	Grounding fault of wiring harness (Contact with grounding circuit)	★Turn the engine starting switch OFF for the preparations, and hold it in the OFF position during the troubleshooting.		
			Between wiring harness from battery relay B terminal (A23) to A35 to FB1-18 and grounding	Resistance value	Above 1 MΩ
			Between wiring harness between FB1-18 outlet and H15 (female) ① and grounding	Resistance value	Above 1 MΩ
			Between wiring harness from H15 (female) ④ to J01 to R11 (female) ⑤ and grounding	Resistance value	Above 1 MΩ
			Between wiring harness between R11 (female) ③ and A27 (female) ① and grounding	Resistance value	Above 1 MΩ
			Between wiring harness between engine starting motor relay C terminal and engine starting motor C terminal and grounding	Resistance value	Above 1 MΩ
			Between wiring harness between FB1-3 and S14 (female) ① and grounding	Resistance value	Above 1 MΩ
			Between wiring harness between S14 (female) ③ and R11 (female) ① and grounding	Resistance value	Above 1 MΩ
			Between wiring harness from R13 (female) ② to J05 to P02 (female) ⑭ and grounding	Resistance value	Above 1 MΩ
	11	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 A27 (female) ② and E12 (female) ①, or wiring harness from A27 (female) ② to J02 to D01 (female) ⑥, or between wiring harness between A27 (female) ② and P02 (female) ⑪ and grounding	Voltage	Below 1 V

Electrical Circuit Diagram for Engine Start, Stop and Battery Charging

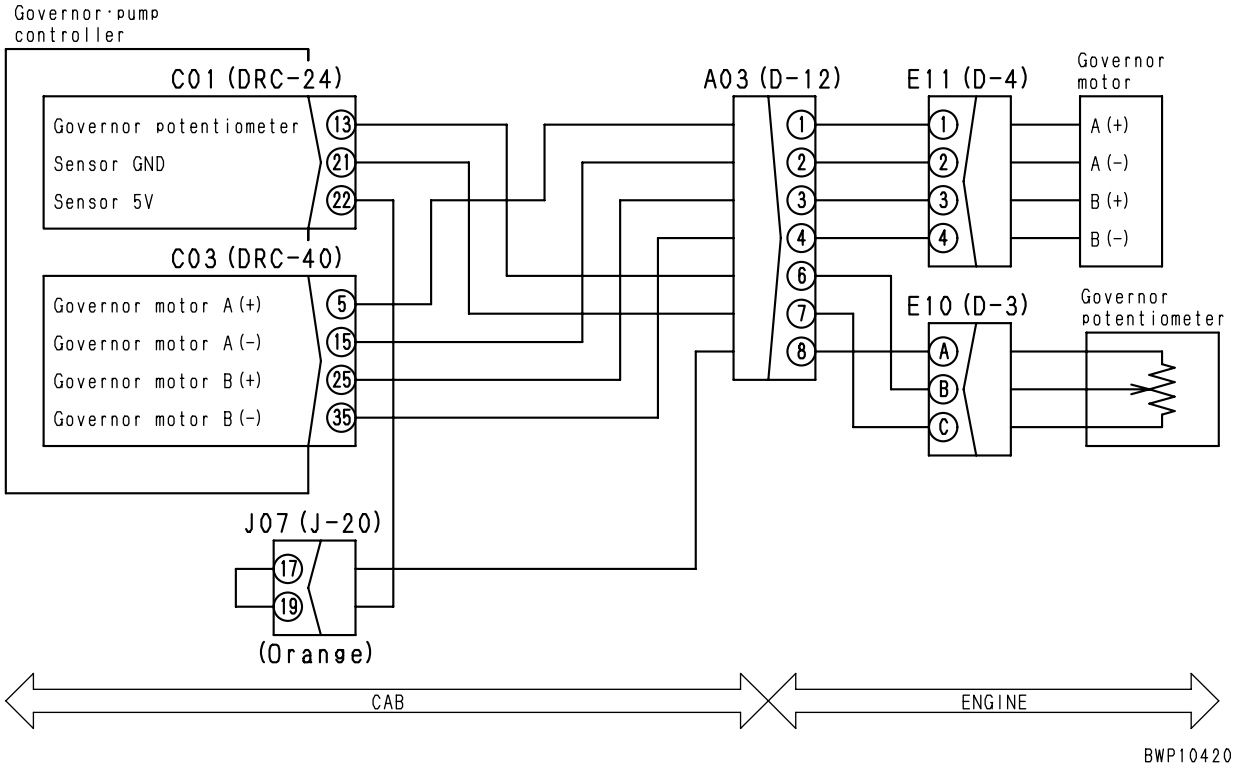


E-2 Engine stops while in operation

Failure information	• The engine suddenly stopped while in operation.
Relative information	• Input from the governor potentiometer (voltage) can be confirmed in the monitor function. (Code No. 031: governor potentiometer voltage)

Presumed cause and standard value in normalcy		Cause	Standard value in normalcy and references for troubleshooting			
	1	Governor potentiometer fault (Internal failure)	★Turn the engine starting switch OFF for the preparations, and hold it in the OFF position during the troubleshooting.			
			E06 (male)	Resistance value		
			Between ① and ③	4.0 – 6.0 kΩ		
			Between ② and ①	0.25 – 5.0 kΩ		
			Between ② and ③	0.25 – 5.0 kΩ		
	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 C01 (female) ⑬ and E10 (female) Ⓑ	Resistance value	Below 1 Ω	
	3	Grounding fault of wiring harness (Contact with grounding circuit)	★Turn the engine starting switch OFF for the preparations, and hold it in the OFF position during the troubleshooting.			
			Between wiring harness between C01 (female) ⑬ and E10 (female) Ⓑ and grounding	Resistance value	Above 1 MΩ	
	4	Governor • pump controller defective	★Turn the engine starting switch OFF for the preparations, and hold it in the ON position during the troubleshooting.			
			C01	Voltage		
			Between ㉒ and ㉑	4.5 – 5.5 V		
			Between ⑬ and ㉑	0.5 – 4.5 V		

Electrical Circuit Diagram for Fuel Dial

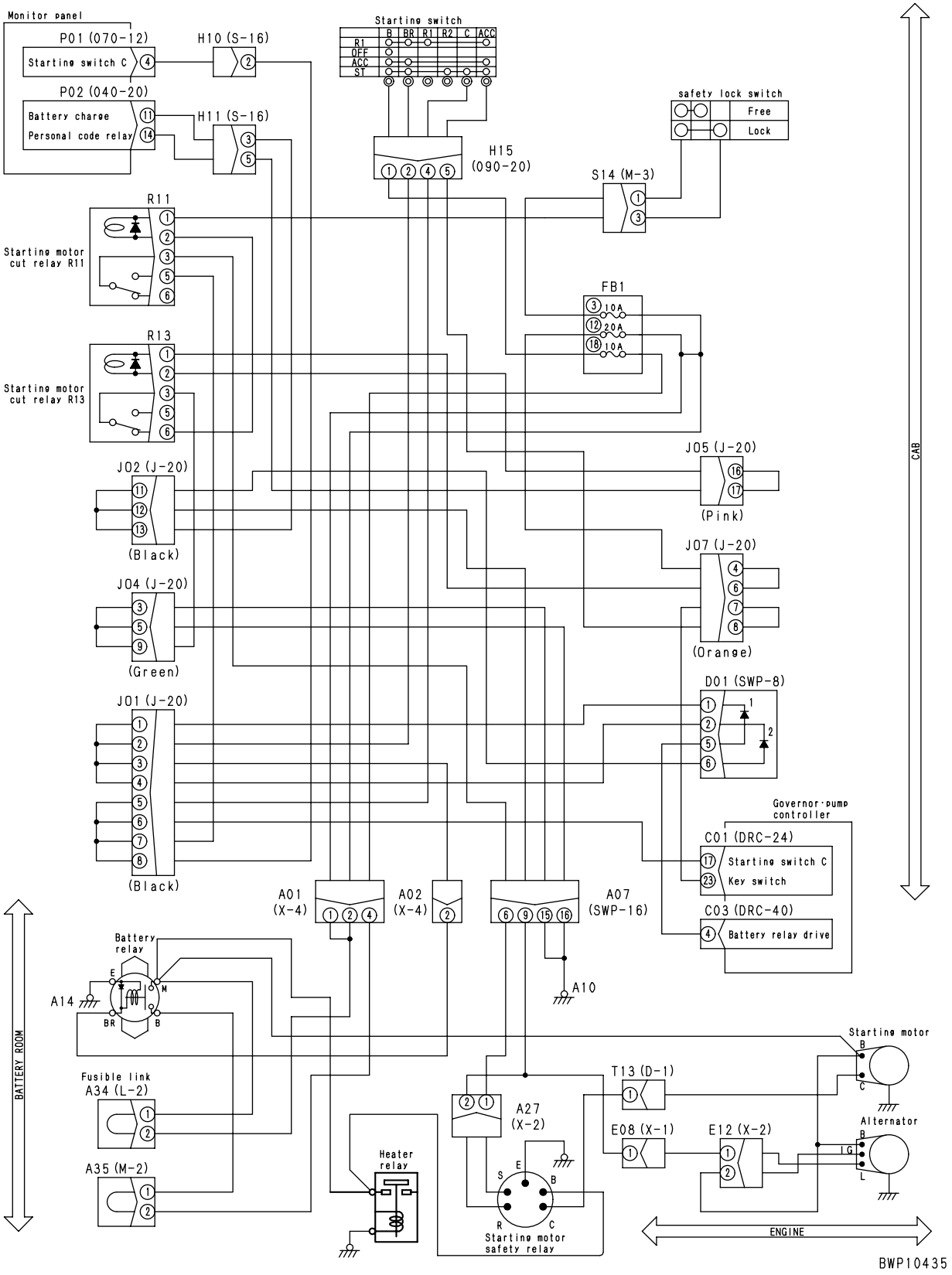


E-3 Engine speed is irregular, or there is hunting

Failure information	• Engine speed is irregular at low idling. • There is hunting. • Engine speed is lower than specified at high idling.
Relative information	• Engine rotation can be confirmed in the monitor function. (Code No. 010: Engine rotation)

Presumed cause and standard value in normalcy		Cause	Standard value in normalcy and references for troubleshooting			
	1	Model code signal fault (Internal failure)	If the monitor display is not normal, proceed to Service Code [E217].			
			Monitoring Code	Item	Normal display	
			002 003	Controller model code	200	
	2	Governor lever improperly adjusted	Refer to the section "Special Function of Monitor Panel" in this manual.			
	3	Governor motor improperly working	If the governor motor lever moves smoothly in the following operations, it is judged as normal. • The fuel dial is operated between low idling and high idling. • The engine is stopped with the fuel dial.			
	4	Engine fuel control system defective	Refer to the Engine Shop Manual.			
	5	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 from C01 (female) ㉓ to J07 to H15 (female) ⑤	Resistance value	Below 1 Ω	
	6	Grounding fault of wiring harness (Contact with grounding circuit)	★Turn the engine starting switch OFF for the preparations, and hold it in the OFF position during the troubleshooting.			
			Between wiring harness between C01 (female) ㉓ to J17 and H15 (female) ⑤ and grounding	Resistance value	Above 1 MΩ	
	7	Governor • pump controller defective	As this is an internal failure, troubleshooting cannot be conducted. (If there is none of the causes from Item 1 to 6 above, the controller is judged as defective)			

Electrical Circuit Diagram for Engine Start and Stop and Battery Charging

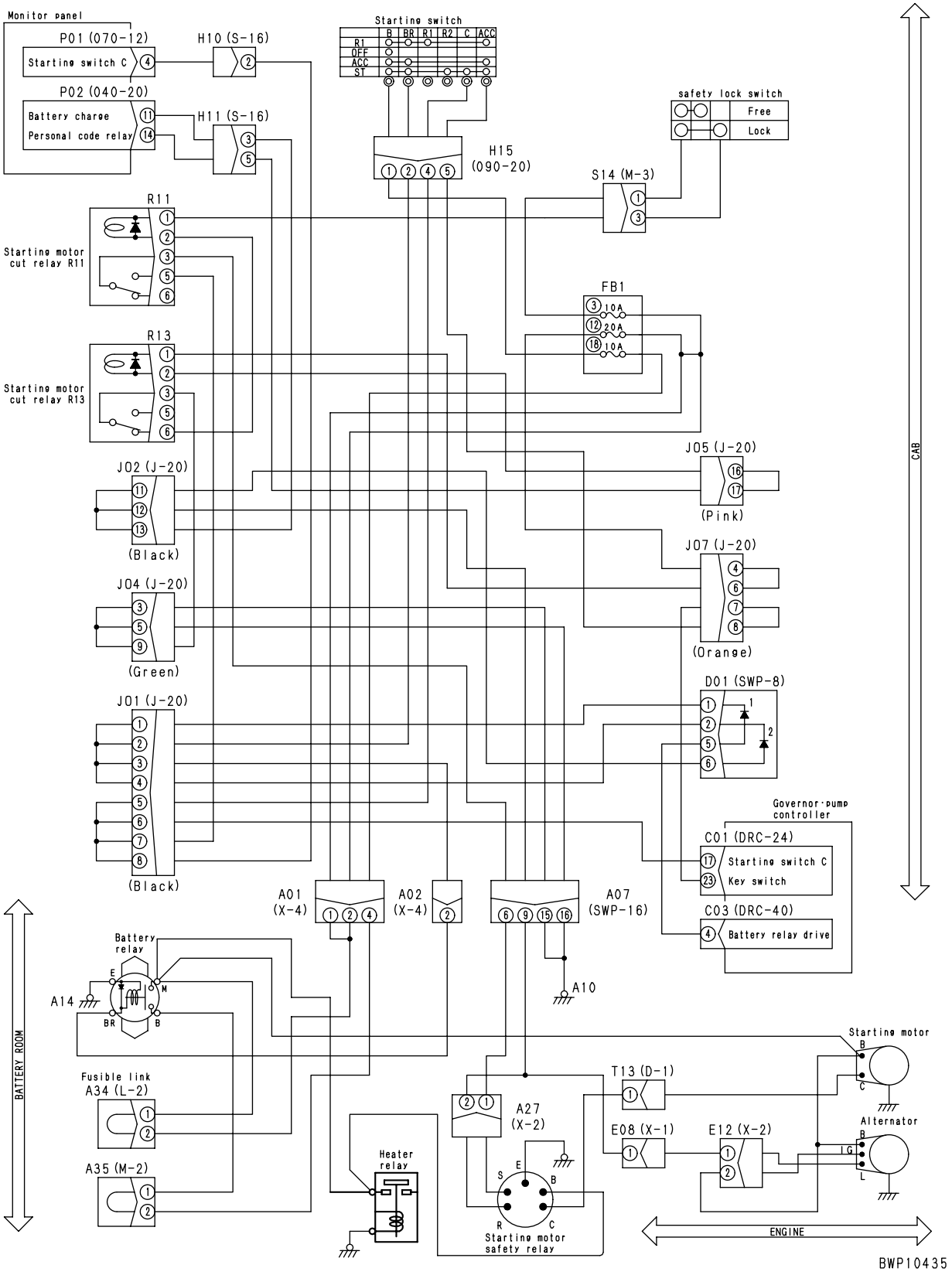


E-4 Engine does not stop

Failure information	• The engine does not stop.
Relative information	• The Governor • pump controller drives the battery relay for the min. 4 seconds and max. 7 seconds from the moment the engine starting switch is turned OFF to the moment the engine completely stops. • It can be confirmed in the monitor function how the battery relay works (ON or OFF) (Code No. 037: Controller output)

Presumed cause and standard value in normalcy	Cause		Standard value in normalcy and references for troubleshooting			
	1	Battery relay fault	If operating sound is heard from the battery relay contact, when turning the engine starting switch, the battery relay is judged as normal. • Starting switch OFF→ON→OFF			
	2	Assembled-type diode D01 fault (Internal disconnection)	★Turn the engine starting switch OFF for the preparations, and hold it in the OFF position during the troubleshooting.			
			D01 (male)	Digital type circuit tester	Continuity	
			Between ⑤ and ①	Diode mode	Continued	
	3	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 C03 (female) ④ and D01 (female) ⑤		Resistance value	Below 1 Ω
			Wiring harness from D01 (female) ① to J01 to battery relay BR terminal (A21)		Resistance value	Below 1 Ω
			Wiring harness between battery relay E terminal (A20) and grounding		Resistance value	Below 1 Ω
	4	Governor • pump controller defective	★Turn the engine starting switch OFF for the preparations, and hold it in the ON position during the troubleshooting.			
			C03	Engine starting switch	Voltage	
			Between ④ and grounding	ON→OFF	20 – 30 V (for 4 to 7 seconds)	

Electrical Circuit Diagram for Engine Start and Stop and Battery Charging



E-5 Auto-decelerator does not work

Failure information	• The auto-decelerator does not work.
Relative information	• Rotation of the auto-decelerator is set at 1,400 rpm. If the fuel dial is not set adjusting to this level, the auto-decelerator does not work. • Confirm the display on the monitor panel, when the engine is running.

Presumed cause and standard value in normalcy	Cause		Standard value in normalcy and references for troubleshooting		
	1	Boom RAISE signal fault	If the display on the monitor panel is not normal, proceed to No. E-21 Troubleshooting.		
			Monitoring code	Item	Normal display
			019	Boom RAISE	Lever operation: ON Lever NEUTRAL: OFF
	2	Boom LOWER signal fault	If the display on the monitor panel is not normal, proceed to No. E-22 Troubleshooting.		
			Monitoring code	Item	Normal display
			019	Boom LOWER	Lever operation: ON Lever NEUTRAL: OFF
	3	Arm DIGGING signal fault	If the display on the monitor panel is not normal, proceed to No. E-23 Troubleshooting.		
			Monitoring code	Item	Normal display
			019	Arm DIGGING	Lever operation: ON Lever NEUTRAL: OFF
	4	Arm DUMPING signal fault	If the display on the monitor panel is not normal, proceed to No. E-24 Troubleshooting.		
			Monitoring code	Item	Normal display
			019	Arm DUMPING	Lever operation: ON Lever NEUTRAL: OFF
	5	Bucket DIGGING signal fault	If the display on the monitor panel is not normal, proceed to No. E-26 Troubleshooting.		
			Monitoring code	Item	Normal display
			021	Bucket DIGGING	Lever operation: ON Lever NEUTRAL: OFF
	6	Bucket DUMPING signal fault	If the display on the monitor panel is not normal, proceed to No. E-27 Troubleshooting.		
			Monitoring code	Item	Normal display
			021	Bucket DUMPING	Lever operation: ON Lever NEUTRAL: OFF
	7	Swing signal fault	If the display on the monitor panel is not normal, proceed to No. E-28 Troubleshooting.		
			Monitoring code	Item	Normal display
			019	Swing	Lever operation: ON Lever NEUTRAL: OFF
	8	Travel signal fault	If the display on the monitor panel is not normal, proceed to No. E-29 Troubleshooting.		
			Monitoring code	Item	Normal display
			019	Travel	Lever operation: ON Lever NEUTRAL: OFF
	9	Attachment signal fault	If the display on the monitor panel is not normal, proceed to No. E-30 Troubleshooting.		
			Monitoring code	Item	Normal display
			021	Service	Lever operation: ON Lever NEUTRAL: OFF
	10	Governor • pump controller defective	As this is an internal failure, troubleshooting cannot be conducted. (If there is none of the causes listed in Item 1 through 9, the controller is judged as defective.		

E-6 Auto engine warm-up device does not work

Failure information	• The auto engine warm-up device does not work.
Relative information	• The auto engine warm-up device is activated, when the engine cooling water temperature is below 30°C, and raise the engine rotation up to 1,200 rpm. • The auto engine warm-up device is released by keeping the fuel dial opening at above 70% for more than 3 seconds, when the engine starting switch is in the ON position or after the engine is started.

<table>
<tr><td rowspan="4">Presumed cause and standard value in normalcy</td><td colspan="2">Cause</td><td colspan="3">Standard value in normalcy and references for troubleshooting</td></tr>
<tr><td rowspan="3">1</td><td rowspan="3">Engine cooling water temperature signal fault</td><td colspan="3">If the display on the monitor panel is not normal, proceed to No. E-14 Troubleshooting.</td></tr>
<tr><td>Monitoring code</td><td>Item</td><td>Normal display</td></tr>
<tr><td>041</td><td>Engine cooling water temperature</td><td>Compare with the actual engine cooling water temperature.</td></tr>
<tr><td>2</td><td>Governor • pump controller defective</td><td colspan="3">As this is an internal failure, troubleshooting cannot be conducted.
(If the fault mentioned in the above item is not found, the Governor • pump controller is judged as defective)</td></tr>
</table>

E-7 Preheater does not work

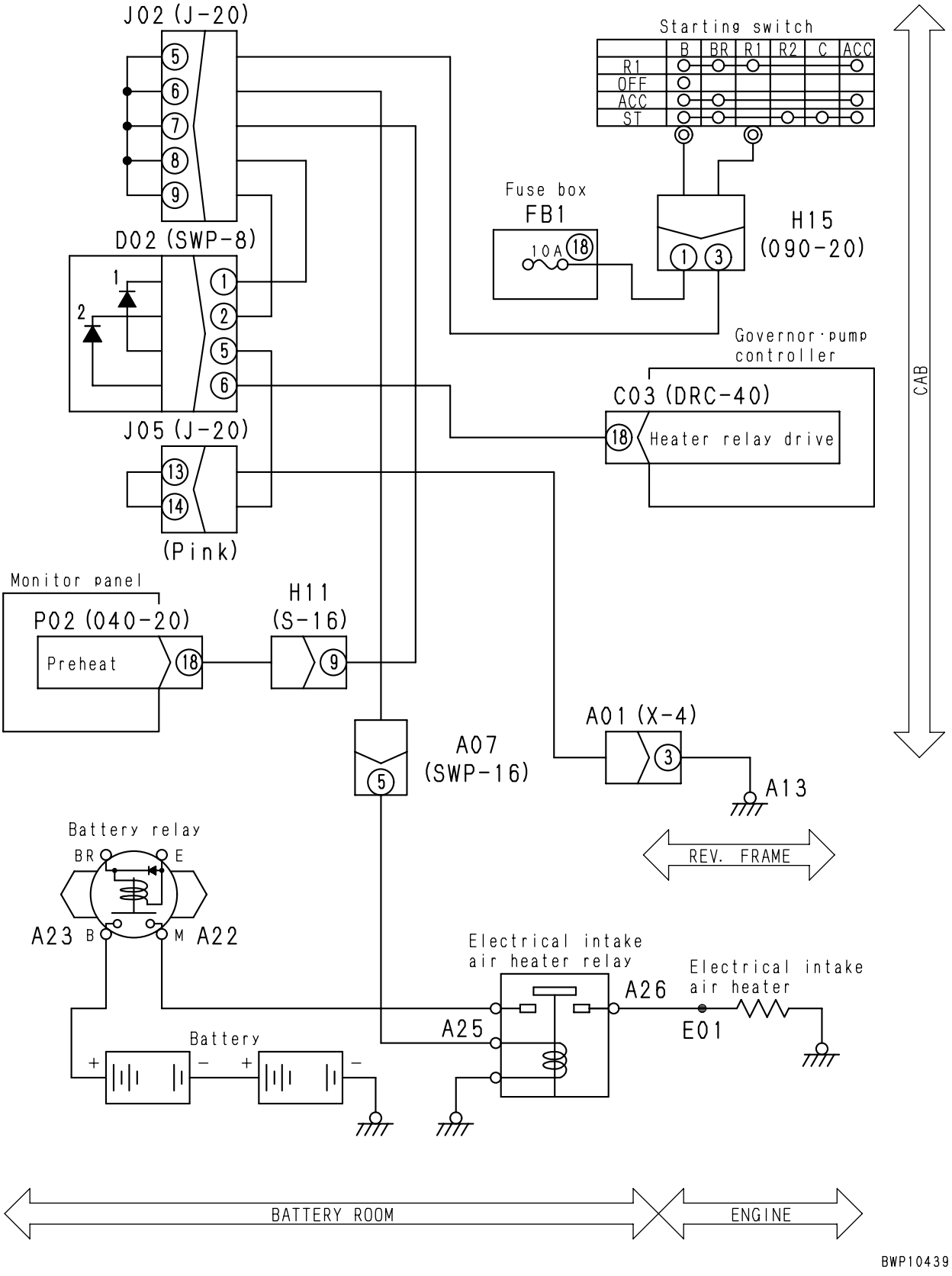
Failure information (1)	• Even if the preheater switch is turned to the PREHEAT position, the preheating monitor lamp does not light up.
Relative information	• Input of the preheating signal (ON or OFF) can be confirmed in the monitor function. (Code No. 045: Monitor input 1)

Presumed cause and standard value in normalcy		Cause	Standard value in normalcy and references for troubleshooting			
	1	Engine starting switch fault	If preheating does not occur (the heater is not warmed up), refer to Failure Phenomenon (2) below.			
	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 P02 (female) ⑱ and J02		Resistance value	Below 1 Ω
	3	Monitor panel fault	★Turn the engine starting switch OFF for the preparations.			
			P02	Engine starting switch	Voltage	
			Between ⑱ and grounding	OFF	Below 1 V	
				HEAT	20 – 30 V	

Failure information (2)	• Even if the preheater switch is turned to the PREHEAT position, the preheater does not become warm.
Relative information	• In low cooling water temperature (lower than 30°C), the governor • pump controller drives the heater relay for 100 seconds after the engine is started and automatically warms up the engine.

Presumed cause and standard value in normalcy		Cause	Standard value in normalcy and references for troubleshooting		
	1	Engine starting switch fault (Internal disconnection)	★Turn the engine starting switch OFF for the preparations.		
			H15 (male)	Engine starting switch	Resistance value
			Between ① and ③	OFF	Above 1 MΩ
				HEAT	Below 1 Ω
	2	Heater relay fault (Internal disconnection)	★Turn the engine starting switch OFF for the preparations, and hold it in the OFF position during the troubleshooting.		
			Heater relay	Continuity and resistance value	
			Between coil terminal and grounding	Continued	
			Between contact terminals	Above 1 MΩ	
	3	Electrical intake air heater (Internal disconnection)	★Turn the engine starting switch OFF for the preparations, and hold it in the OFF position during the troubleshooting.		
			Between heater terminals	Normal if continuity is established.	
	4	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 from H15 (female) ③ to J02 to heater relay terminal (A25)	Resistance value	Below 1 Ω
			Wiring harness between battery relay M terminal (A22) and heater relay terminal	Resistance value	Below 1 Ω

Electrical Circuit Diagram for Engine Preheater



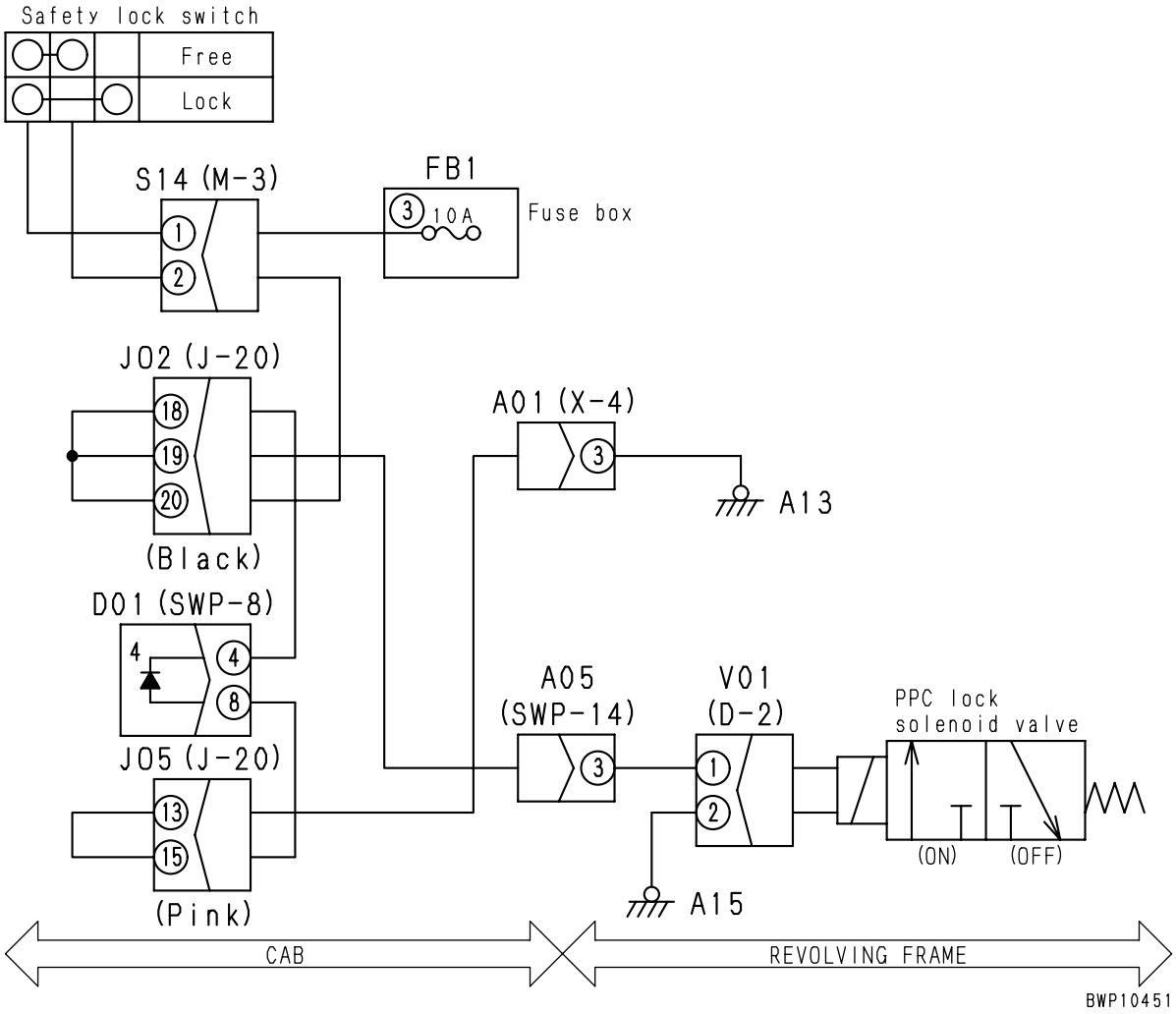
E-8 All work equipment, swing and travel do not move

Failure information	• All the work equipment, swing and travel do not move.
Relative information	—

Presumed cause and standard value in normalcy

	Cause	Standard value in normalcy and references for troubleshooting			
1	Fuse No. 3 fault	If the fuse is blown, there is a big possibility that grounding fault occurred in the circuit.			
2	Safety switch lock defective (Internal disconnection)	★Turn the engine starting switch OFF for the preparations, and hold it in the OFF position during the troubleshooting.			
		S14 (female)	Safety control lever	Resistance value	
		Between ① and ②	Lock	Above 1 MΩ	
			Release	Below 1 Ω	
3	PPC lock solenoid fault (Internal disconnection or short-circuiting)	★Turn the engine starting switch OFF for the preparations, and hold it in the OFF position during the troubleshooting.			
		V01 (male)	Resistance value		
		Between ① and ②	20 – 60 Ω		
		Between ① and grounding	Above 1 MΩ		
4	Assembled-type diode D01 fault (Internal short-circuiting)	★Turn the engine starting switch OFF for the preparations, and hold it in the OFF position during the troubleshooting.			
		D01 (male)	Resistance value		
		Between ⑧ and ④	Above 1 MΩ		
5	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 FB1-3 outlet and S14 (male) ①	Resistance value	Below 1 Ω	
		Wiring harness from S14 (male) ② to J02 to V01 (female) ①	Resistance value	Below 1 Ω	
		Wiring harness between V01 (female) ② and grounding	Resistance value	Below 1 Ω	
6	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.			
		Between wiring harness between FB1-3 outlet and S14 (male) ① and grounding	Resistance value	Above 1 MΩ	
		Wiring harness from S14 (male) ② to J02 to V01 (female) ①, or between wiring harness between S14 (male) ② and D01 (female) ⑧ and grounding	Resistance value	Above 1 MΩ	

Electrical Circuit Diagram for PPC Lock Solenoid



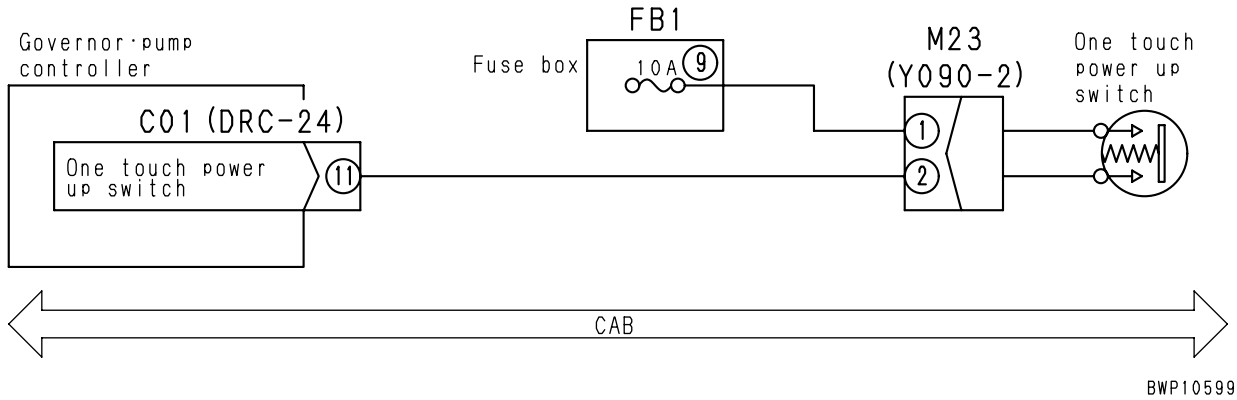
E-9 One-touch Power Max Switch does not work

Failure information	• The one-touch power max. switch does not work.
Relative information	• If the one touch-power max. switch is pressed while the engine is running, the symbol mark is displayed in the monitor panel. • Input from the one-touch power max. switch (left knob switch) can be confirmed in the monitor function. (Code No. 022: Switch input 1)

Presumed cause and standard value in normalcy

	Cause	Standard value in normalcy and references for troubleshooting			
1	Fuse No. 9 fault	If the fuse is blown, there is a big possibility that grounding fault occurred in the circuit.			
2	One-touch power max. switch fault (Internal disconnection)	★Turn the engine starting switch OFF for the preparations, and hold it in the OFF position during the troubleshooting.			
		M23 (male)	One-touch power max. switch	Resistance value	
		Between ① and ②	Release	Above 1 MΩ	
			Depress	Below 1 Ω	
3	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 FB1-9 outlet and M23 (female) ①		Resistance value	Above 1 MΩ
		Wiring harness between M23 (female) ② and C01 (female) ⑪		Resistance value	Above 1 MΩ
4	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.			
		Between wiring harness between FB1-9 outlet and M23 (female) ① and grounding		Resistance value	Above 1 MΩ
		Between wiring harness between M23 (female) ② and C01 (female) ⑪ and grounding		Resistance value	Above 1 MΩ
5	Governor • pump controller defective	★Turn the engine starting switch OFF for the preparations, and hold it in the ON position during the troubleshooting.			
		C01	One-touch power max. switch	Voltage	
		Between ⑪ and grounding	Release	Below 1 V	
			Depress	20 – 30 V	

Electric Circuit Diagram for One-Touch Power Max. Switch

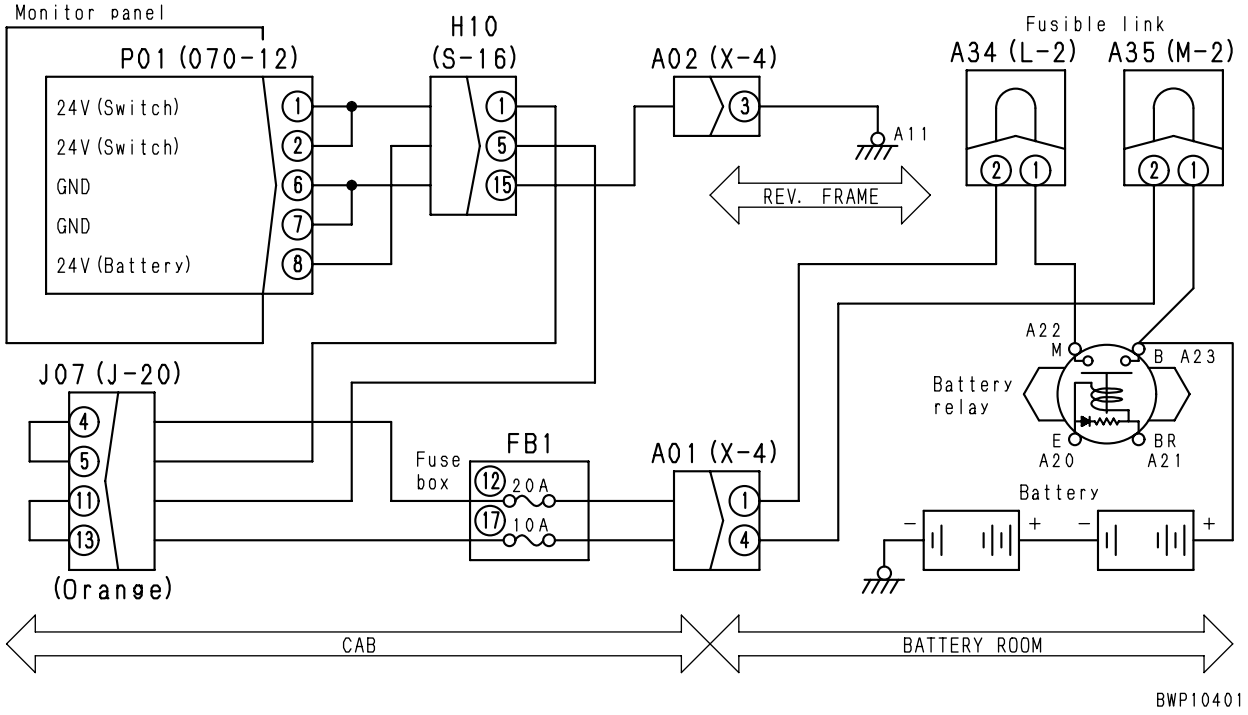


E-10 No display in monitor panel at all

Failure information	• When the engine starting switch is turned ON, there appears no display at all in the monitor panel.
Relative information	—

Presumed cause and standard value in normalcy		Cause	Standard value in normalcy and references for troubleshooting		
	1	Fuse No. 12 fault	If the fuse is blown, there is a big possibility that grounding fault occurred in the circuit.		
	2	Disconnection of wiring harness (Disconnection or defect contact with connector)	★Turn the engine starting switch OFF for the preparations, and hold it in the OFF position during the troubleshooting.		
			Wiring harness from P01 (female) ① ② to J07 to FB1-12	Resistance value	Below 1 Ω
			Wiring harness between P01 (female) ⑥ ⑦ 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.		
			Between wiring harness from P01 (female) ① ② to J07 to FB1-12 outlet and grounding	Resistance value	Above 1 MΩ
	4	Governor • pump controller defective	★Turn the engine starting switch OFF for the preparations, and hold it in the ON position during the troubleshooting.		
			C03	Voltage and resistance value	
			Between ① ② and grounding	Voltage: 20 – 30 V	
			Between ⑥ ⑦ and grounding	Resistance value: Below 1 Ω	

Electrical Circuit Diagram for Power Source in Monitor Panel



E-11 Part of display on monitor panel is missing

Failure information	• Part of the display in the monitor panel is missing.
Relative information	—

Presumed cause and standard value in normalcy		Cause	Standard value in normalcy and references for troubleshooting
	1	Monitor panel LCD fault	If all the LCD in the monitor panel light up (i.e. the screen becomes totally white) by the following switching operation, then the monitor panel is normal. • Switching operation: [↩] + [A] (simultaneous switching operation)
	2	Monitor panel defective	As this is an internal failure, troubleshooting cannot be conducted. (If there is no problem with the above switching operation, the monitor panel is judged as defective)

E-12 Monitor panel displays contents irrelevant to the model

Failure information	• The monitor panels displays contents that have nothing to do with the model on which it is installed.
Relative information	—

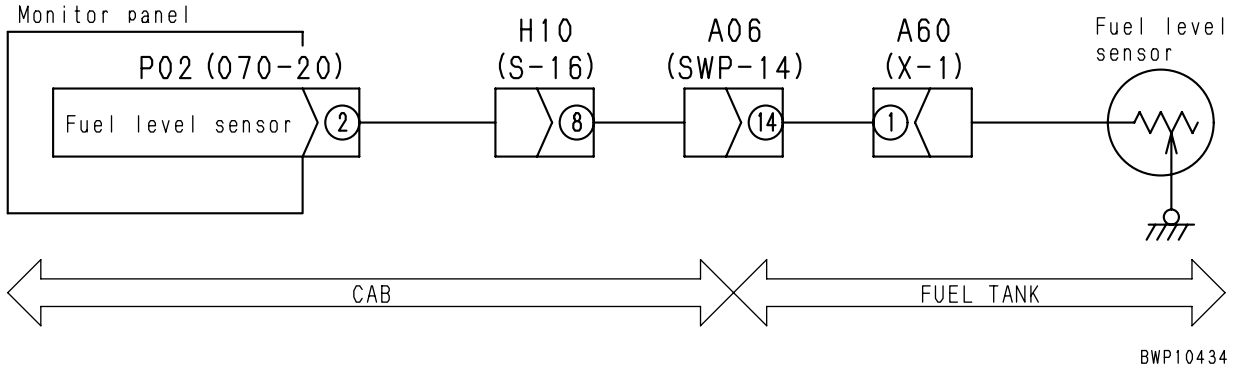
Presumed cause and standard value in normalcy		Cause	Standard value in normalcy and references for troubleshooting		
	1	Model code signal fault (Internal failure)	If the display on the monitor panel is normal, proceed to Service Code [E217].		
			Monitoring code	Item	Normal display
			002 003	Controller model code	200
	2	Monitor panel defective	As this is an internal failure, troubleshooting cannot be conducted. (If there is no problem with the above switching operation, the monitor panel is judged as defective)		

E-13 Fuel level monitor red lamp lights up while engine is running

Failure information	• The fuel level monitor red lamp lighted up while the engine was running.
Relative information	• If the fuel gauge shows in a red range on the monitor panel, the fuel level monitor lamp lights up red. • (5) Input signal from the fuel level sensor (voltage) can be confirmed in the monitor function. (Code No. 042: Fuel level sensor)

Presumed cause and standard value in normalcy		Cause	Standard value in normalcy and references for troubleshooting			
	1	Fuel level lowered (system in normal condition)	★Refill fuel.			
	2	Fuel level sensor fault (Internal disconnection)	★Turn the engine starting switch OFF for the preparations, and hold it in the OFF position during the troubleshooting.			
			A60 (male)	Fuel level	Resistance value	
			Between ① and grounding	FULL (Upper limit)	Approx. 12 Ω	
				EMPTY (Lower limit)	85 – 110 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 P02 (female) ② and A60 (female) ①		Resistance value	Below 1 Ω
	4	Governor • pump controller defective	★Turn the engine starting switch OFF for the preparations, and hold it in the OFF position during the troubleshooting.			
			P02 (female)	Fuel level	Resistance value	
			Between ② and grounding	FULL (Upper limit)	Approx. 12 Ω	
				EMPTY (Lower limit)	85 – 110 Ω	

Electrical Circuit Diagram for Fuel Level Sensor

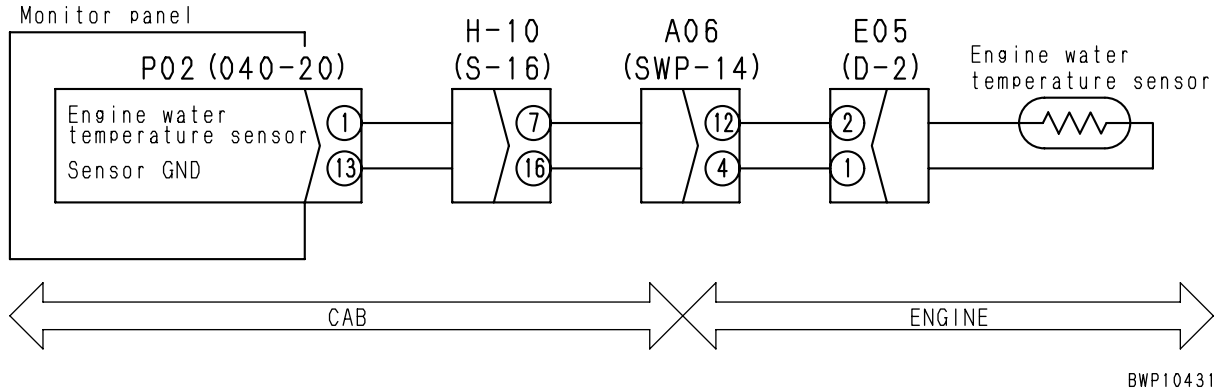


E-14 Engine cooling water temperature gauge does not indicate correctly

Failure information	• The engine cooling water rises normally, but the display does not exceed the white range (C). • The engine cooling water temperature remains stable, but the display rises to the red range (H).
Relative information	• Input from the engine cooling water temperature sensor can be confirmed in the monitor function. (Code No. 041: Engine cooling water temperature)

Presumed cause and standard value in normalcy		Cause	Standard value in normalcy and references for troubleshooting			
	1	Engine cooling water temperature sensor fault (Internal disconnection or short-circuiting)	★Turn the engine starting switch OFF for the preparations, and hold it in the OFF position during the troubleshooting.			
			E05	Engine cooling water temperature	Resistance value	
			Between ① and ②	10 – 100 °C	90 – 3.5 kΩ	
			Between ② and grounding		Above 1 MΩ	
	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 P02 (female) ① and E05 (female) ②		Resistance value	Below 1 Ω
			Wiring harness between P02 (female) ⑬ and E05 (female) ①		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.			
			Between wiring harness between P02 (female) ① and E05 (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.			
			Between wiring harness between P02 (female) ① and E05 (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 OFF position during the troubleshooting.			
			P02	Engine cooling water temperature	Resistance value	
			Between ① and ⑬	10 – 100 °C	90 – 3.5 kΩ	
			Between ① and grounding		Above 1 MΩ	

Electrical Circuit Diagram for Engine Cooling Water Temperature Sensor



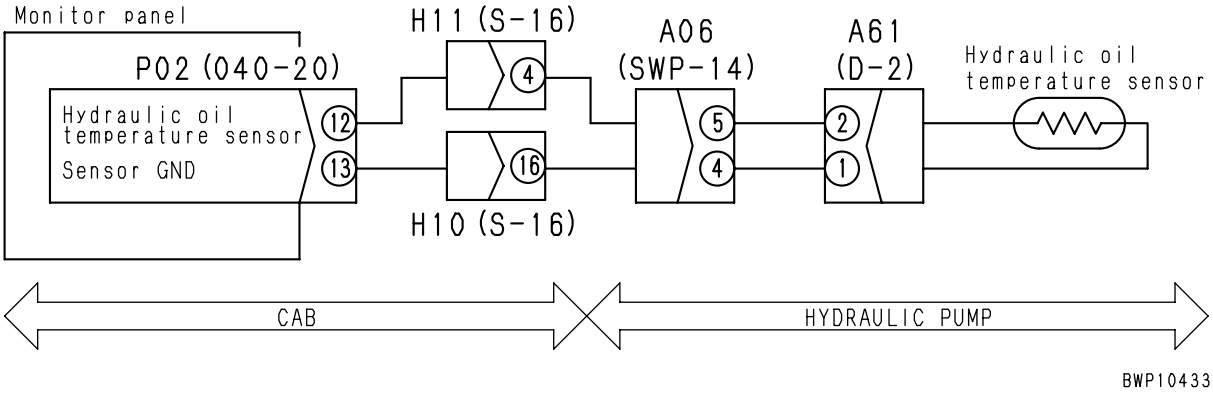
E-15 Hydraulic oil temperature gauge does not display correctly
(Multi-monitor only)

Failure information	• Hydraulic oil temperature rises normally, but the display does not exceed the white range (C). • Hydraulic oil temperature remains stable, but the display rises up the red range (H).
Relative information	• Input from the hydraulic oil temperature sensor can be confirmed in the monitor function. (Code No. 044: Hydraulic oil temperature)

Presumed cause and standard value in normalcy

	Cause	Standard value in normalcy and references for troubleshooting			
1	Hydraulic oil temperature sensor fault (Internal disconnection or short-circuiting)	★Turn the engine starting switch OFF for the preparations, and hold it in the OFF position during the troubleshooting.			
		A61	Engine cooling water temperature	Resistance value	
		Between ① and ②	10 – 100 °C	90 – 3.5 kΩ	
		Between ② and grounding		Above 1 MΩ	
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 P02 (female) ⑫ and A61 (female) ②		Resistance value	Below 1 Ω
		Wiring harness between P02 (female) ⑬ and A61 (female) ①		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.			
		Between wiring harness between P02 (female) ⑫ and A61 (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.			
		Between wiring harness between P02 (female) ⑫ and A61 (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 OFF position during the troubleshooting.			
		P02	Engine cooling water temperature	Resistance value	
		Between ⑫ and ⑬	10 – 100 °C	90 – 3.5 kΩ	
		Between ⑫ and grounding		Above 1 MΩ	

Electrical Circuit Diagram for Hydraulic Oil Temperature Sensor

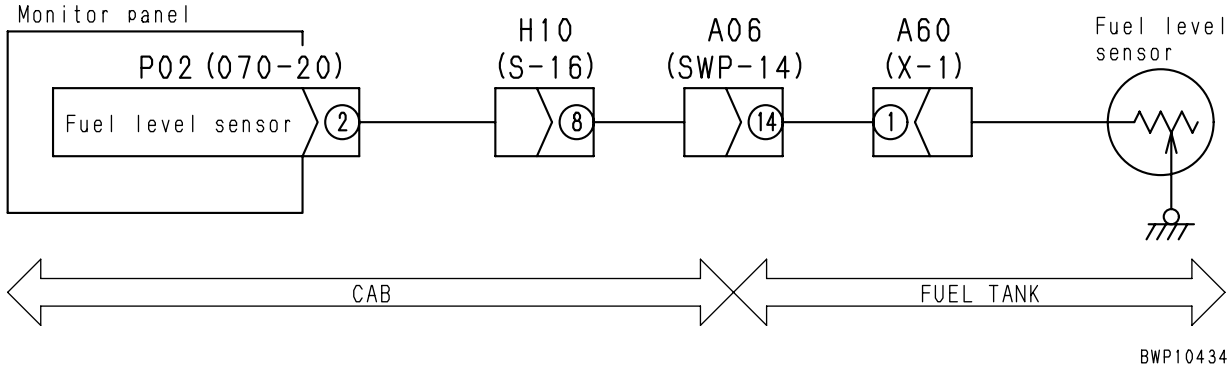


E-16 Fuel gauge does not display correctly

Failure information	• Though fuel was refilled, the display does not exceed the red range (E). • Though the remaining fuel level is low, the display does not drop below the green range (F).
Relative information	• Input from the fuel level sensor (voltage) can be confirmed in the monitor function. (Code No. 042: Fuel sensor voltage)

Presumed cause and standard value in normalcy		Cause	Standard value in normalcy and references for troubleshooting			
	1	Fuel level sensor fault (Internal disconnection or short-circuiting)	★Turn the engine starting switch OFF for the preparations, and hold it in the OFF position during the troubleshooting.			
			A60 (male)	Fuel level	Resistance value	
			Between ① and grounding	FULL (Upper limit)	Approx. 12 Ω	
				EMPTY (Lower limit)	85 – 110 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 P02 (female) ② and A60 (female) ①		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.			
			Between wiring harness between P02 (female) ② and A60 (female) ① 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.			
			Between wiring harness between P02 (female) ② and A60 (female) ① 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 OFF position during the troubleshooting.			
			P01	Fuel level	Resistance value	
			Between ② and grounding	FULL (Upper limit)	Approx. 12 Ω	
				EMPTY (Lower limit)	85 – 110 Ω	

Electrical Circuit Diagram for Fuel Level Sensor

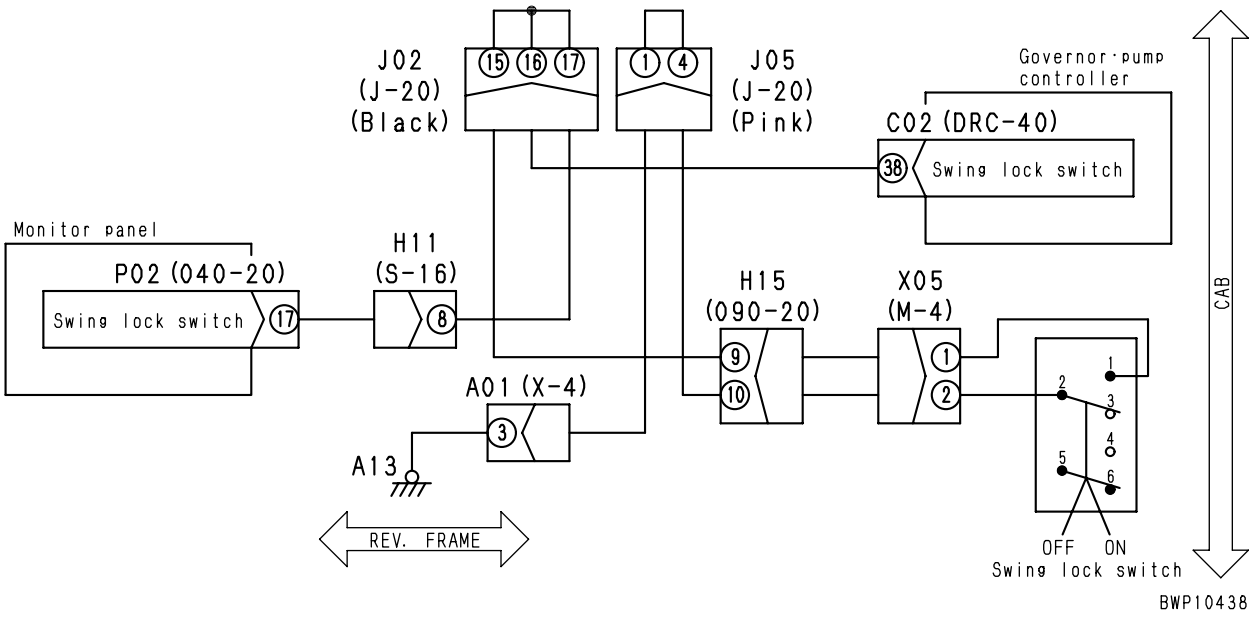


E-17 Swing lock monitor does not display correctly

Failure information	• Though the swing lock switch was turned ON, the swing lock monitor does not light up. • Though the swing lock switch was turned OFF, the swing lock monitor lights up.
Relative information	• Input from the swing lock switch (ON or OFF) can be confirmed in the monitor function. (Code No. 049: Monitor input 3)

Presumed cause and standard value in normalcy		Cause	Standard value in normalcy and references for troubleshooting			
	1	Swing lock switch fault (Internal disconnection or short-circuiting)	★Turn the engine starting switch OFF for the preparations, and hold it in the OFF position during the troubleshooting.			
			X05 (female)	Swing lock switch	Resistance value	
			Between ① and ②	OFF	Above 1 MΩ	
				ON	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 from P02 (female) ⑰ to J02 to X05 (male) ①		Resistance value	Below 1 Ω
			Wiring harness from X05 (male) ② to J05 to 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.			
			Between wiring harness from P02 (female) ⑰ to J02 to X05 (male) ① 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.			
			Between wiring harness from P02 (female) ⑰ to J02 to X05 (male) ① and grounding		Voltage	Below 1 V
	5	Monitor panel defective	★Turn the engine starting switch OFF for the preparations, and hold it in the ON position during the troubleshooting.			
			P02	Swing lock switch	Voltage	
			Between ⑰ and grounding	OFF	20 – 30 V	
				ON	Below 1 V	

Electrical Circuit Diagram for Swing Lock Switch



E-18 When the monitor switch is operated, no display appears

Failure information (1)	• When operating the working mode changing switch, the working mode monitor does not appear.
Relative information	—

Presumed cause and standard value in normalcy		Cause	Standard value in normalcy and references for troubleshooting
	1	Monitor panel defective	As this is an internal failure, troubleshooting cannot be conducted.

Failure information (2)	• When operating the auto-decelerator switch, the auto-deceleration monitor does not appear.
Relative information	★If the auto-decelerator itself does not work, either, carry out No. E-5 Troubleshooting.

Presumed cause and standard value in normalcy		Cause	Standard value in normalcy and references for troubleshooting
	1	Monitor panel defective	As this is an internal failure, troubleshooting cannot be conducted.

Failure information (3)	• When operating the travel speed shifting switch, the travel speed monitor does not appear.
Relative information	★If the travel speed does not actually change, carry out No. H-21 Troubleshooting.

Presumed cause and standard value in normalcy		Cause	Standard value in normalcy and references for troubleshooting
	1	Monitor panel defective	As this is an internal failure, troubleshooting cannot be conducted.

Failure information (4)	• When operating the windshield wiper switch, the windshield wiper monitor does not appear.
Relative information	★If the windshield wiper itself does not work, either, carry out No. E-19 Troubleshooting.

Presumed cause and standard value in normalcy		Cause	Standard value in normalcy and references for troubleshooting
	1	Monitor panel defective	As this is an internal failure, troubleshooting cannot be conducted.

Failure information (5)	• When operating the select switch, the adjustment display does not appear. • When operating the LCD monitor adjusting switch, the adjustment display does not appear. • When operating the maintenance switch, the item display does not appear.
Relative information	—

Presumed cause and standard value in normalcy		Cause	Standard value in normalcy and references for troubleshooting
	1	Monitor panel defective	As this is an internal failure, troubleshooting cannot be conducted.

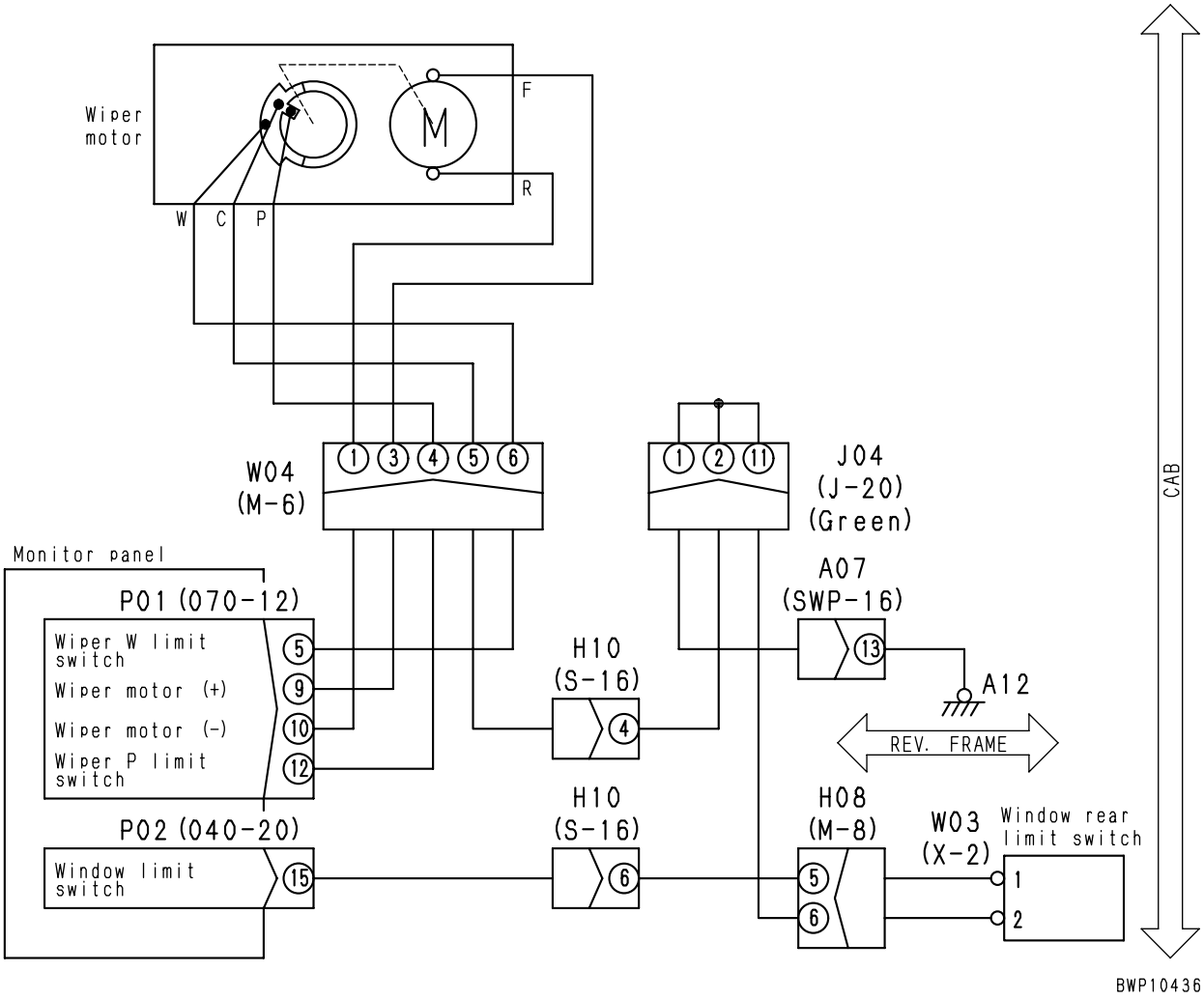
E-19 Windshield wiper does not work

Failure information	• The windshield wiper does not work.
Relative information	• Input from the window rear limit switch (ON or OFF) can be confirmed in the monitor function. (Code No. 049: Monitor input 3)

Presumed cause and standard value in normalcy

	Cause	Standard value in normalcy and references for troubleshooting		
1	Window rear limit switch fault (Internal disconnection or short-circuiting)	★Turn the engine starting switch OFF for the preparations, and hold it in the OFF position during the troubleshooting.		
		W03 (Switch side)	Front window	Resistance value
		Between ① and ②	When installed at front	Above 1 MΩ
			When retracted at rear	Below 1 Ω
2	Windshield wiper motor fault (Internal disconnection or short-circuiting)	★Turn the engine starting switch OFF for the preparations, and hold it in the OFF position during the troubleshooting.		
		W04 (male)	Continuity and resistance value	
		Between ③ and ①	Continued	
		Between ③ ① and grounding	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 in the OFF position during the troubleshooting.		
		Wiring harness between P01 (female) ⑨ and W04 (female) ③	Resistance value	Below 1 Ω
		Wiring harness between P01 (female) ⑩ and W04 (female) ①	Resistance value	Below 1 Ω
4	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.		
		Between wiring harness between P02 (female) ⑮ and W03 ①	Resistance value	Above 1 MΩ
5	Monitor panel fault (Rear limit switch system)	★Turn the engine starting switch OFF for the preparations, and hold it in the ON position during the troubleshooting.		
		P02	Front window	Voltage
		Between ⑮ and grounding	When installed at front	20 – 30 V
			When retracted at rear	Below 1 V
	Monitor panel fault (Windshield wiper motor system)	★Turn the engine starting switch OFF for the preparations, and hold it in the ON position during the troubleshooting.		
		P02	Windshield wiper switch	Resistance value
		Between ⑨ and grounding Between ③ and grounding	OFF	Below 3 V
			ON	Below 3 V ⇔ 20 – 30 V (Constant cycle)

Electrical Circuit Diagram for Windshield Wiper Motor

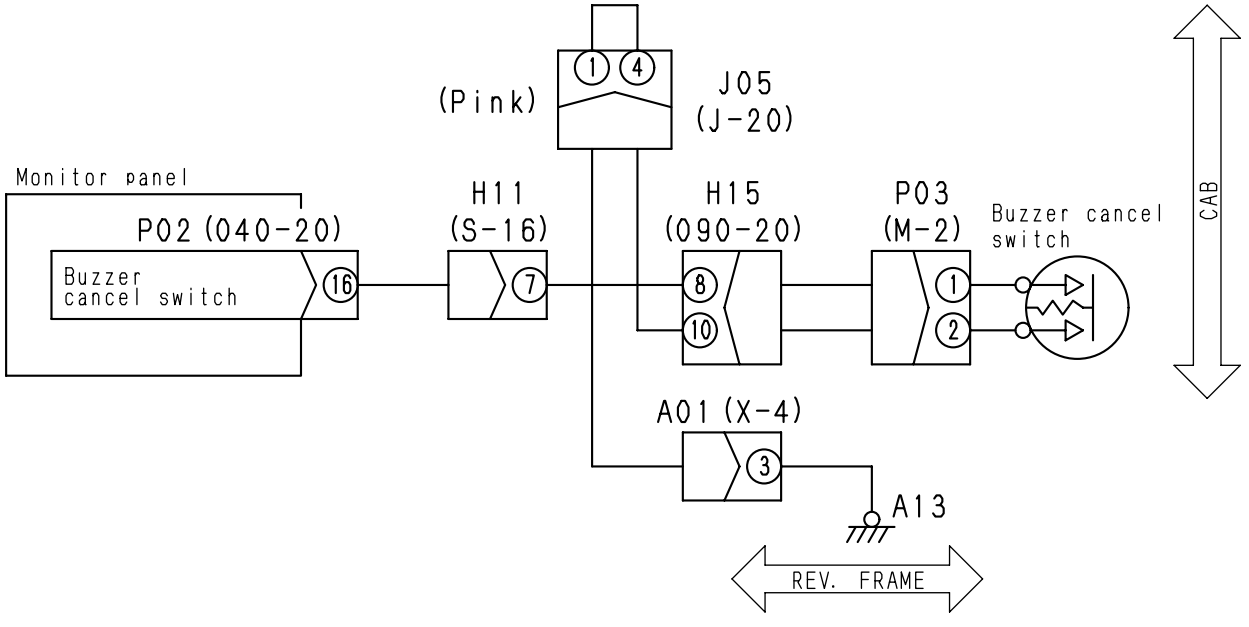


E-20 Alarming buzzer cannot be cancelled

Failure information	• The alarming buzzer cannot be cancelled.
Relative information	• Input from the alarming buzzer cancellation switch (ON or OFF) can be confirmed in the monitor function. (Code No. 049: Monitor input 3)

Presumed cause and standard value in normalcy		Cause	Standard value in normalcy and references for troubleshooting			
	1	Alarming buzzer cancellation switch fault (Internal disconnection or short-circuiting)	★Turn the engine starting switch OFF for the preparations, and hold it in the OFF position during the troubleshooting.			
			P03 (female)	Alarming buzzer cancellation switch	Resistance value	
			Between ① and ②	Release	Above 1 MΩ	
				Depress	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 P02 (female) ⑯ and P03 (male) ①		Resistance value	Below 1 Ω
			Wiring harness from P03 (male) ② to J05 to grounding		Resistance value	Below 1 Ω
	3	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.			
			Between wiring harness between P02 (female) ⑯ and P03 (male) ① and grounding		Voltage	Below 1 V
	4	Monitor panel fault	★Turn the engine starting switch OFF for the preparations, and hold it in the ON position during the troubleshooting.			
			P02	Alarming buzzer cancellation switch	Voltage	
			Between ⑯ and grounding	Release	20 – 30 V	
				Depress	Below 1 V	

Electrical Circuit Diagram for Alarming Buzzer Cancellation Switch



BWP10437

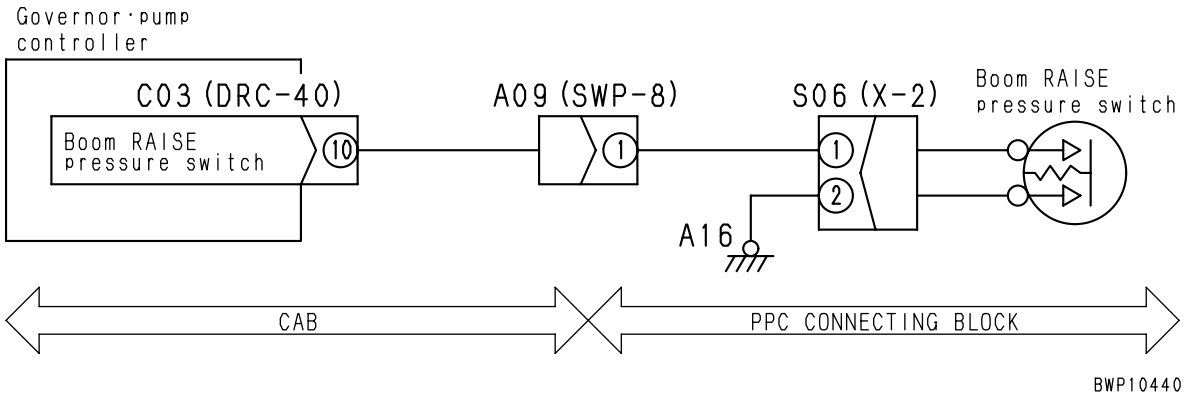
E-21 "Boom RAISE" is not correctly displayed in monitor function

Failure information	• "Boom RAISE" is not correctly displayed in the monitor function on the monitor panel.
Relative information	—

Presumed cause and standard value in normalcy

	Cause	Standard value in normalcy and references for troubleshooting			
1	Boom RAISE PPC hydraulic switch fault (Internal disconnection or short-circuiting)	★Turn the engine starting switch OFF for the preparations, and keep the engine running during the troubleshooting.			
		S06 (male)	Boom control lever	Resistance value	
		Between ① and ②	NEUTRAL	Above 1 MΩ	
			RAISE	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 C03 (female) ⑩ and S06 (female) ①		Resistance value	Below 1 Ω
		Wiring harness between S06 (female) ② 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.			
		Between wiring harness between C03 (female) ⑩ and S06 (female) ① 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.			
		Between wiring harness between C03 (female) ⑩ and S06 (female) ① 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.			
		C03	Boom control lever	Voltage	
		Between ⑩ and grounding	NEUTRAL	20 – 30 V	
			RAISE	Below 1 V	

Electrical Circuit Diagram for Boom RAISE PPC Hydraulic Switch

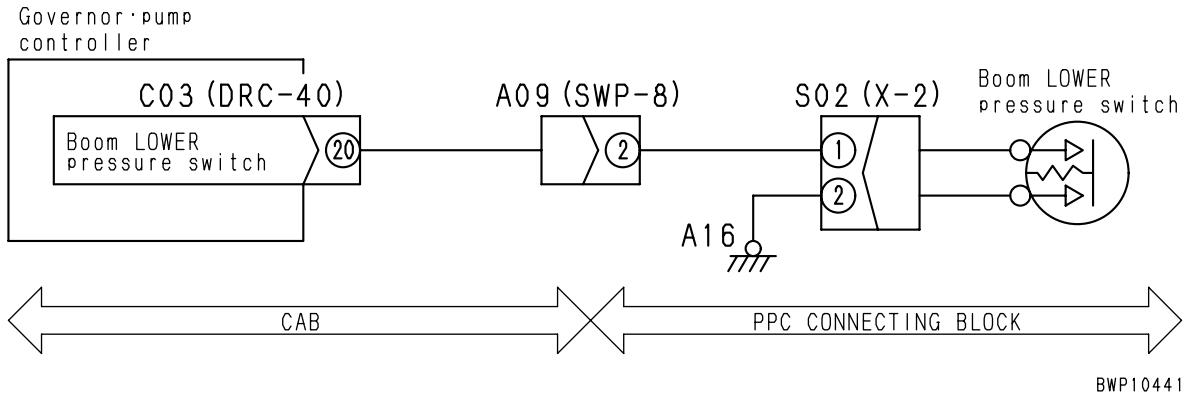


E-22 "Boom LOWER" is not correctly displayed in monitor function

Failure information	• "Boom LOWER" is not correctly displayed in the monitor function on the monitor panel.
Relative information	—

Presumed cause and standard value in normalcy		Cause	Standard value in normalcy and references for troubleshooting			
	1	Boom LOWER PPC hydraulic switch fault (Internal disconnection or short-circuiting)	★Turn the engine starting switch OFF for the preparations, and keep the engine running during the troubleshooting.			
			S02 (male)	Boom control lever	Resistance value	
			Between ① and ②	NEUTRAL	Above 1 MΩ	
				LOWER	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 C03 (female) ⑳ and S02 (female) ①		Resistance value	Below 1 Ω
			Wiring harness between S02 (female) ② 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.			
			Between wiring harness between C03 (female) ⑳ and S02 (female) ① 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.			
			Between wiring harness between C03 (female) ⑳ and S02 (female) ① 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.			
			C03	Boom control lever	Voltage	
			Between ⑳ and grounding	NEUTRAL	20 – 30 V	
				LOWER	Below 1 V	

Electrical Circuit Diagram for Boom LOWER PPC Hydraulic Switch

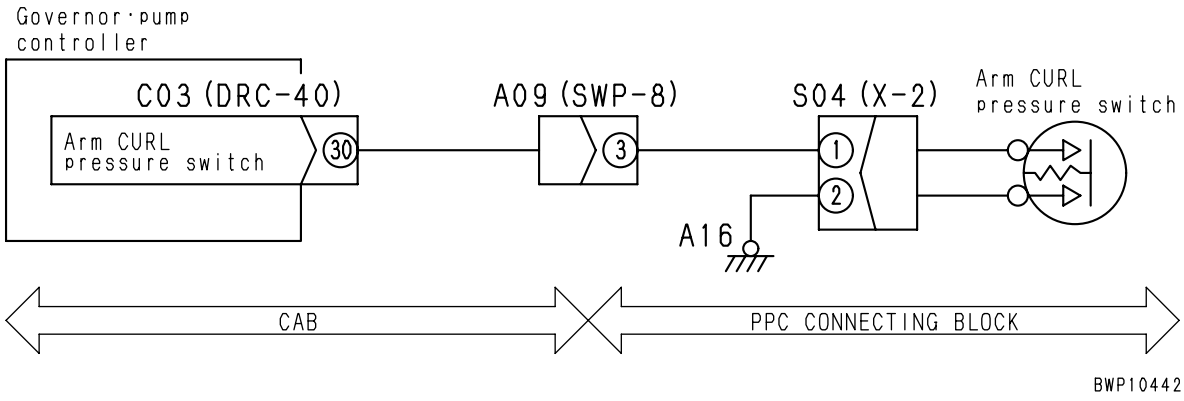


E-23 "Arm DIGGING" is not correctly displayed in monitor function

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

Presumed cause and standard value in normalcy		Cause	Standard value in normalcy and references for troubleshooting			
	1	Arm DIGGING PPC hydraulic switch fault (Internal disconnection or short-circuiting)	★Turn the engine starting switch OFF for the preparations, and keep the engine running during the troubleshooting.			
			S04 (male)	Arm control lever	Resistance value	
			Between ① and ②	NEUTRAL	Above 1 MΩ	
				DIGGING	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 C03 (female) ㉚ and S04 (female) ①		Resistance value	Below 1 Ω
			Wiring harness between S04 (female) ② 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.			
			Between wiring harness between C03 (female) ㉚ and S04 (female) ① 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.			
			Between wiring harness between C03 (female) ㉚ and S04 (female) ① 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.			
			C03	Arm control lever	Voltage	
			Between ㉚ and grounding	NEUTRAL	20 – 30 V	
				DIGGING	Below 1 V	

Electrical Circuit Diagram for Arm DIGGING PPC Hydraulic Switch

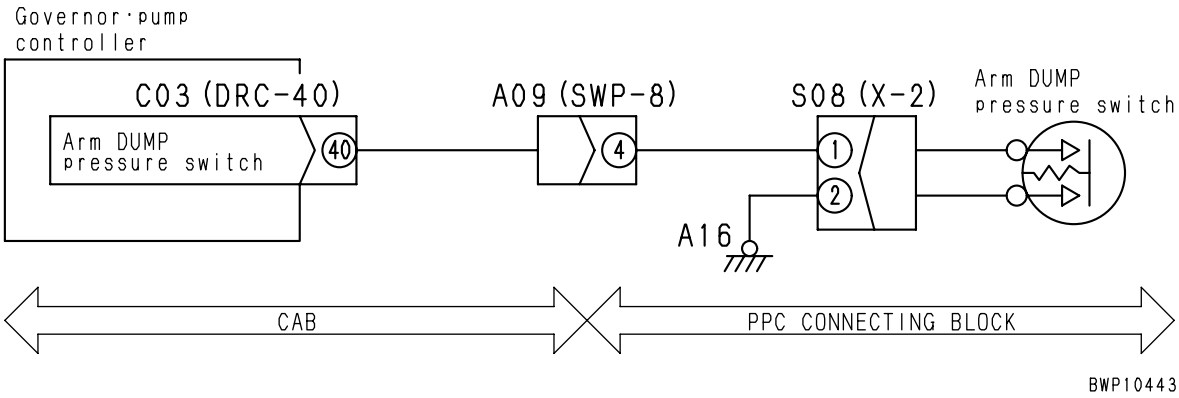


E-24 "Arm DUMPING" is not correctly displayed in monitor function

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

Presumed cause and standard value in normalcy		Cause	Standard value in normalcy and references for troubleshooting			
	1	Arm DUMPING PPC hydraulic switch defect (Internal disconnection and short-circuiting)	★Turn the engine starting switch OFF for the preparations, and keep the engine running during the troubleshooting.			
			S08 (male)	Arm 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 C03 (female) ㊵ and S08 (female) ①		Resistance value	Below 1 Ω
			Wiring harness between S08 (female) ② 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.			
			Between wiring harness between C03 (female) ㊵ and S08 (female) ① 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.			
			Between wiring harness between C03 (female) ㊵ and S08 (female) ① 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.			
			C03	Arm control lever	Voltage	
			Between ㊵ and grounding	NEUTRAL	20 – 30 V	
				DUMPING	Below 1 V	

Electrical Circuit Diagram for Arm DUMPING PPC Hydraulic Switch

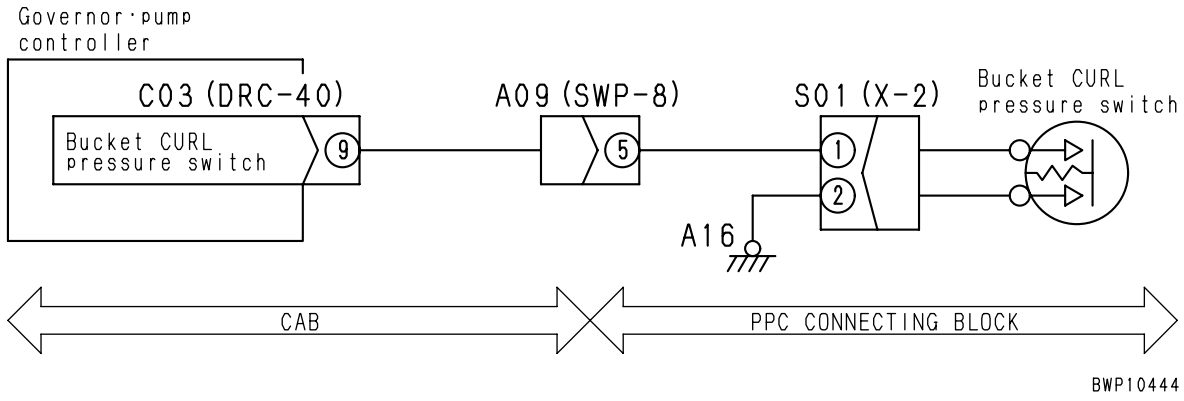


E-25 "Bucket DIGGING" is not correctly displayed in monitor function

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

Presumed cause and standard value in normalcy		Cause	Standard value in normalcy and references for troubleshooting			
	1	Bucket DIGGING 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.			
			S01 (male)	Bucket control lever	Resistance value	
			Between ① and ②	NEUTRAL	Above 1 MΩ	
				DIGGING	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 C03 (female) ⑨ and S01 (female) ①		Resistance value	Below 1 Ω
			Wiring harness between S01 (female) ② 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.			
			Between wiring harness between C03 (female) ⑨ and S01 (female) ① 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.			
			Between wiring harness between C03 (female) ⑨ and S01 (female) ① 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.			
			C03	Bucket control lever	Voltage	
			Between ⑨ and grounding	NEUTRAL	20 – 30 V	
				DIGGING	Below 1 V	

Electrical Circuit Diagram for Bucket DIGGING PPC hydraulic Switch

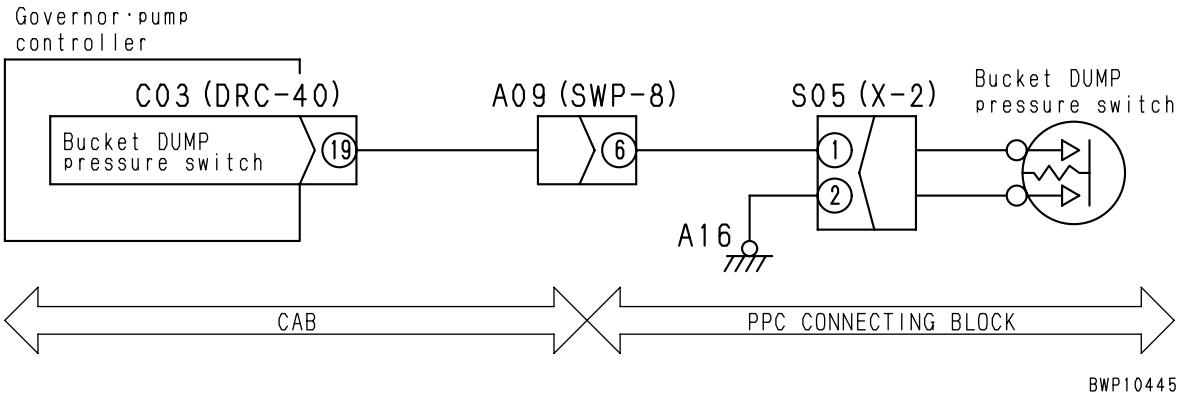


E-26 "Bucket DUMPING" is not correctly displayed in monitor function

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 normalcy		Cause	Standard value in normalcy 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.			
			S05 (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 C03 (female) ⑲ and S05 (female) ①		Resistance value	Below 1 Ω
			Wiring harness between S05 (female) ② 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.			
			Between wiring harness between C03 (female) ⑲ and S05 (female) ① 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.			
			Between wiring harness between C03 (female) ⑲ and S05 (female) ① 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.			
			C03	Bucket control lever	Voltage	
			Between ⑲ and grounding	NEUTRAL	20 – 30 V	
				DUMPING	Below 1 V	

Electrical Circuit Diagram for Bucket DUMPING PPC hydraulic Switch



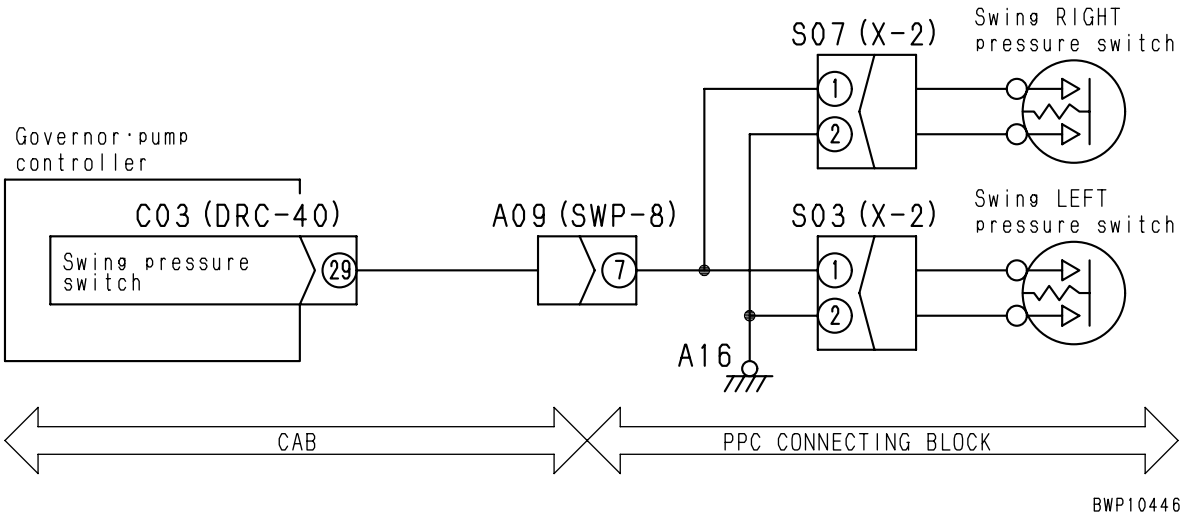
E-27 "SWING" is not correctly displayed in monitor function

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

Presumed cause and standard value in normalcy

Cause		Standard value in normalcy and references for troubleshooting			
1	Swing PPC hydraulic switch, left, fault (Internal disconnection or short-circuiting)	★Turn the engine starting switch OFF for the preparations, and keep the engine running during the troubleshooting.			
		S03 (male)	Swing control lever	Resistance value	
		Between ① and ②	NEUTRAL	Above 1 MΩ	
			Left	Below 1 Ω	
2	Swing PPC hydraulic switch, right, fault (Internal disconnection or short-circuiting)	★Turn the engine starting switch OFF for the preparations, and keep the engine running during the troubleshooting.			
		S07 (male)	Swing control lever	Resistance value	
		Between ① and ②	NEUTRAL	Above 1 MΩ	
			Right	Below 1 Ω	
3	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 C03 (female) ㉙ and S03 (female) ①, or wiring harness between C03 (female) ㉙ and S07 (female) ①		Resistance value	Below 1 Ω
		Wiring harness between S03 (female) ② and grounding		Resistance value	Below 1 Ω
		Wiring harness between S07 (female) ② and grounding		Resistance value	Below 1 Ω
4	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 C03 (female) ㉙ and S03 (female) ①, or wiring harness between C03 (female) ㉙ and S07 (female) ① and grounding		Resistance value	Above 1 MΩ
5	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 C03 (female) ㉙ and S03 (female) ①, or wiring harness between C03 (female) ㉙ and S07 (female) ① and grounding		Voltage	Below 1 V
6	Governor • pump controller defective	★Turn the engine starting switch OFF for the preparations, and hold it in the ON position during the troubleshooting.			
		C03	Swing control lever	Voltage	
		Between ㉙ and grounding	NEUTRAL	20 – 30 V	
			Right or left	Below 1 V	

Electrical Circuit Diagram for Right and Left Swing PPC hydraulic Switches

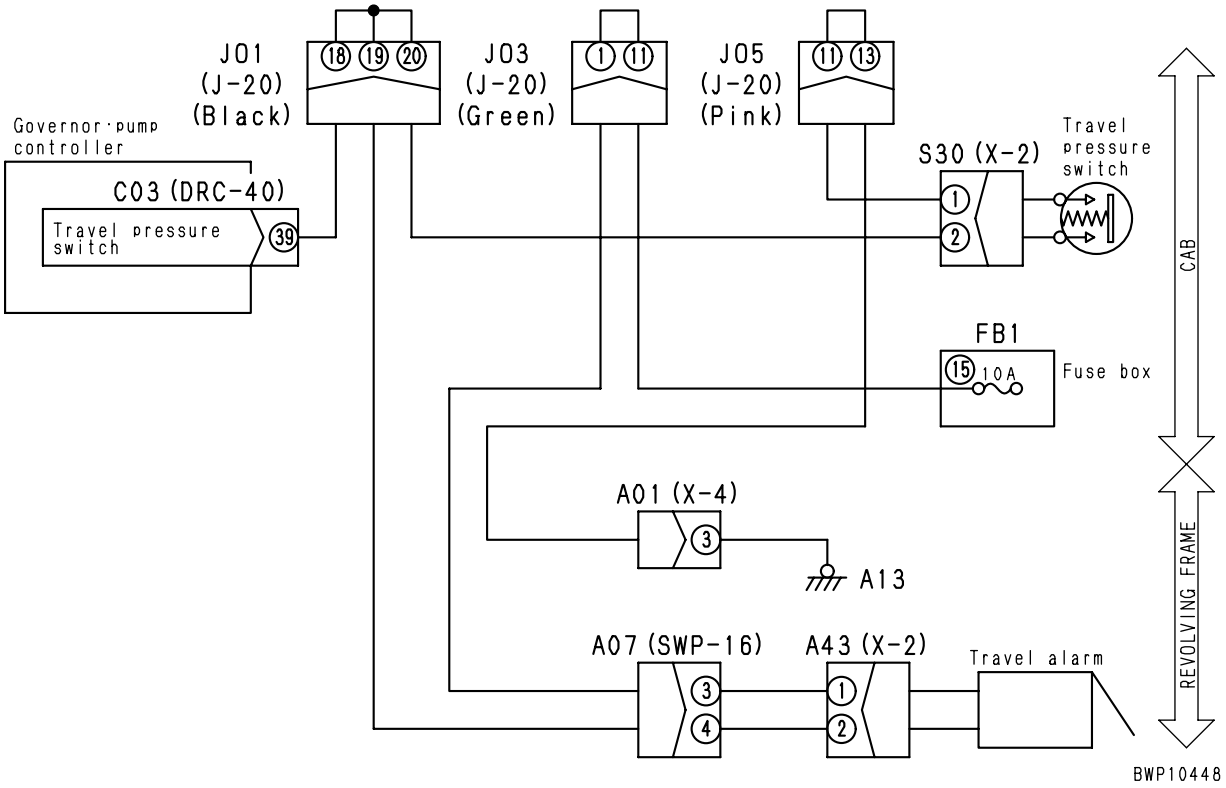


E-28 "TRAVEL" is not correctly displayed in monitor function

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

<table>
<tr><td rowspan="16">Presumed cause and standard value in normalcy</td><td colspan="2">Cause</td><td colspan="4">Standard value in normalcy and references for troubleshooting</td></tr>
<tr><td rowspan="4">1</td><td rowspan="4">Travel PPC hydraulic switch fault (Internal disconnection or short-circuiting)</td><td colspan="4">★Turn the engine starting switch OFF for the preparations, and keep the engine running during the troubleshooting.</td></tr>
<tr><td>S30 (male)</td><td>Travel control lever</td><td colspan="2">Resistance value</td></tr>
<tr><td rowspan="2">Between ① and ②</td><td>NEUTRAL</td><td colspan="2">Above 1 MΩ</td></tr>
<tr><td>Forward or reverse</td><td colspan="2">Below 1 Ω</td></tr>
<tr><td rowspan="3">2</td><td rowspan="3">Disconnection of wiring harness (Disconnection or defective contact with connector)</td><td colspan="4">★Turn the engine starting switch OFF for the preparations, and hold it in the OFF position during the troubleshooting.</td></tr>
<tr><td colspan="2">Wiring harness from C03 (female) ㊴ to J01 to S30 (female) ②</td><td>Resistance value</td><td>Below 1 Ω</td></tr>
<tr><td colspan="2">Wiring harness from S30 (female) ② to J05 to grounding</td><td>Resistance value</td><td>Below 1 Ω</td></tr>
<tr><td rowspan="2">3</td><td rowspan="2">Grounding fault of wiring harness (Contact with grounding (GND) circuit)</td><td colspan="4">★Turn the engine starting switch OFF for the preparations, and hold it in the OFF position during the troubleshooting.</td></tr>
<tr><td colspan="2">Wiring harness from C03 (female) ㊴ to J01 to S30 (female) ②, or between wiring harness between C03 (female) ㊴ and A43 (female) ② and grounding</td><td>Resistance value</td><td>Above 1 MΩ</td></tr>
<tr><td rowspan="2">4</td><td rowspan="2">Short-circuiting of wiring harness (Contact with 24 V circuit)</td><td colspan="4">★Turn the engine starting switch OFF for the preparations, and hold it in the ON position during the troubleshooting.</td></tr>
<tr><td colspan="2">Wiring harness from C03 (female) ㊴ to J01 to S30 (female) ②, or between wiring harness between C03 (female) ㊴ and A43 (female) ② and grounding</td><td>Voltage</td><td>Below 1 V</td></tr>
<tr><td rowspan="4">5</td><td rowspan="4">Governor • pump controller defective</td><td colspan="4">★Turn the engine starting switch OFF for the preparations, and hold it in the ON position during the troubleshooting.</td></tr>
<tr><td>C03</td><td>Travel control lever</td><td colspan="2">Voltage</td></tr>
<tr><td rowspan="2">Between ㊴ and grounding</td><td>NEUTRAL</td><td colspan="2">20 – 30 V</td></tr>
<tr><td>Forward or backward</td><td colspan="2">Below 1 V</td></tr>
</table>

Electrical Circuit Diagram for Travel PPC hydraulic Switch and Travel Alarm

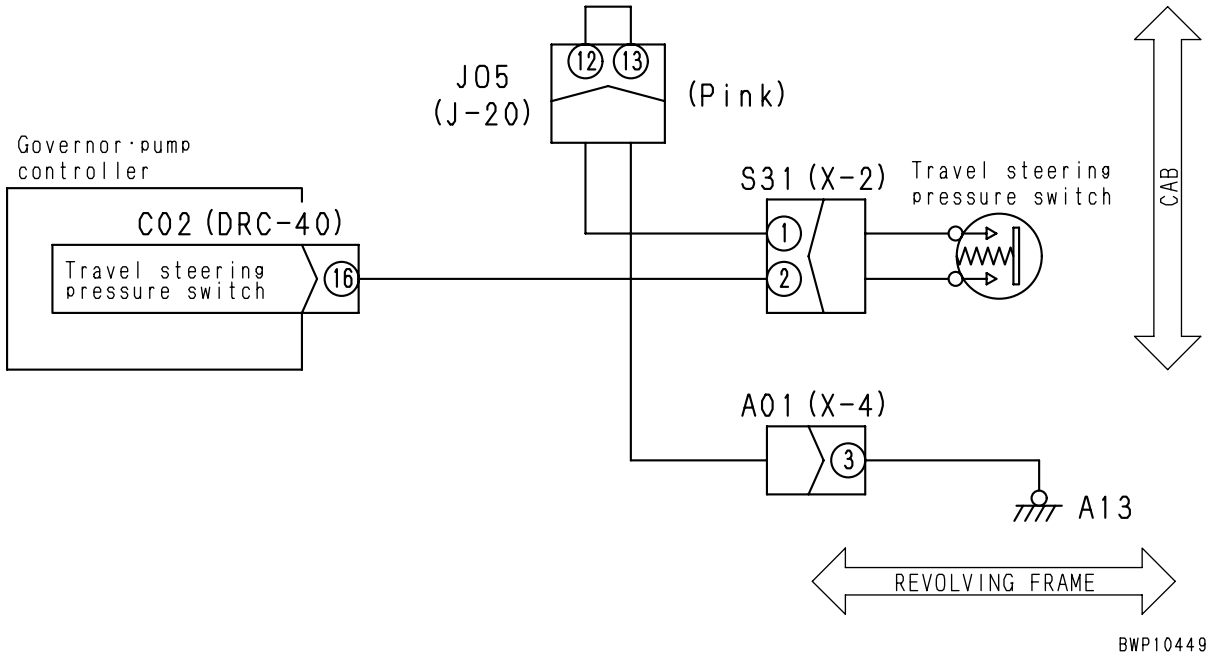


E-29 "Travel Differential Pressure" is not correctly displayed in monitor function

Failure information	• "Travel Differential Pressure" is not correctly displayed in the monitor function (special function) on the monitor panel.
Relative information	• When pressure difference is created between the right and left travel PPC circuits (in steering), the travel differential mechanism is turned ON.

Presumed cause and standard value in normalcy		Cause	Standard value in normalcy and references for troubleshooting			
	1	Travel steering PPC hydraulic switch fault (Internal disconnection or short-circuiting)	★Turn the engine starting switch OFF for the preparations, and keep the engine running during the troubleshooting.			
			S31 (male)	Travel control lever	Resistance value	
			Between ① and ②	NEUTRAL	Above 1 MΩ	
				One side of right or left only	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 C03 (female) ⑯ and S31 (female) ②		Resistance value	Below 1 Ω
			Wiring harness from S31 (female) ② to J05 to 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.			
			Between wiring harness between C03 (female) ⑯ and S31 (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.			
			Between wiring harness between C03 (female) ⑯ and S31 (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.			
			C03	Travel control lever	Voltage	
			Between ⑯ and grounding	NEUTRAL	20 – 30 V	
				One side of right or left only	Below 1 V	

Electrical Circuit Diagram for Travel and Steering PPC hydraulic Switch



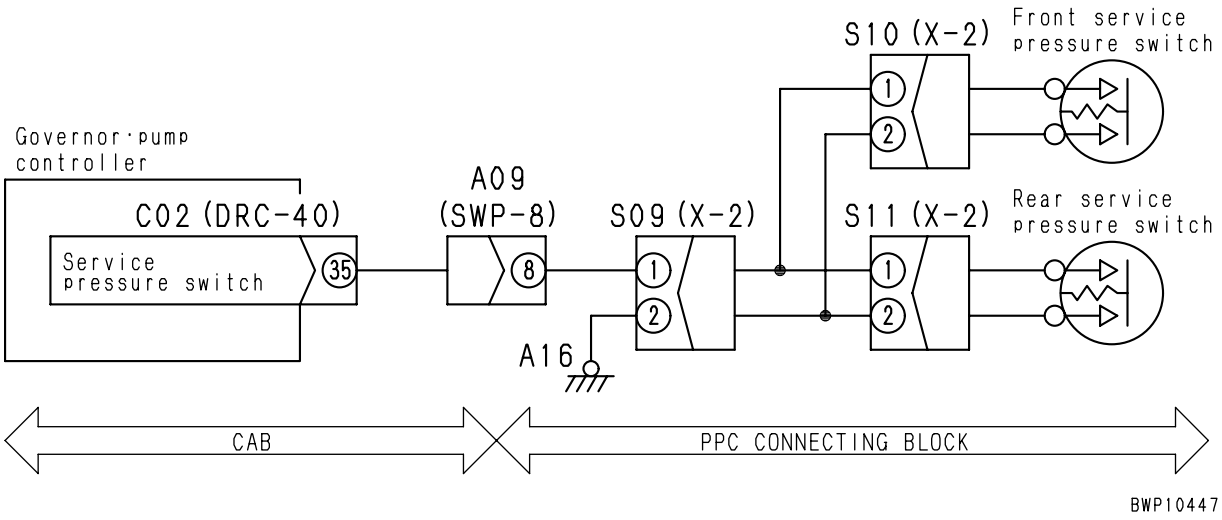
E-30 "Service" is not correctly displayed in monitor function

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

Presumed cause and standard value in normalcy

Cause		Standard value in normalcy and references for troubleshooting			
1	Service (front) PPC hydraulic switch fault (Internal disconnection or short-circuiting)	★Turn the engine starting switch OFF for the preparations, and keep the engine running during the troubleshooting.			
		S10 (male)	Service pedal	Resistance value	
		Between ① and ②	NEUTRAL	Above 1 MΩ	
			Front	Below 1 Ω	
2	Service (rear) PPC hydraulic switch fault (Internal disconnection or short-circuiting)	★Turn the engine starting switch OFF for the preparations, and keep the engine running during the troubleshooting.			
		S11 (male)	Service pedal	Resistance value	
		Between ① and ②	NEUTRAL	Above 1 MΩ	
			Rear	Below 1 Ω	
3	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 C03 (female) ㉟ and S10 (female) ①, or wiring harness between C03 (female) ㉟ and S11 (female) ①		Resistance value	Below 1 Ω
		Wiring harness between S10 (female) ② and grounding		Resistance value	Below 1 Ω
4	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 C03 (female) ㉟ and S10 (female) ①, or between wiring harness between C03 (female) ㉟ and S11 (female) ① and grounding		Resistance value	Above 1 MΩ
5	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 C03 (female) ㉟ and S10 (female) ①, or between wiring harness between C03 (female) ㉟ and S11 (female) ① and grounding		Voltage	Below 1 V
6	Governor • pump controller defective	★Turn the engine starting switch OFF for the preparations, and hold it in the ON position during the troubleshooting.			
		C03	Service pedal	Voltage	
		Between ㉟ and grounding	NEUTRAL	20 – 30 V	
			Front or rear	Below 1 V	

Electrical Circuit Diagram for Service PPC hydraulic Switch

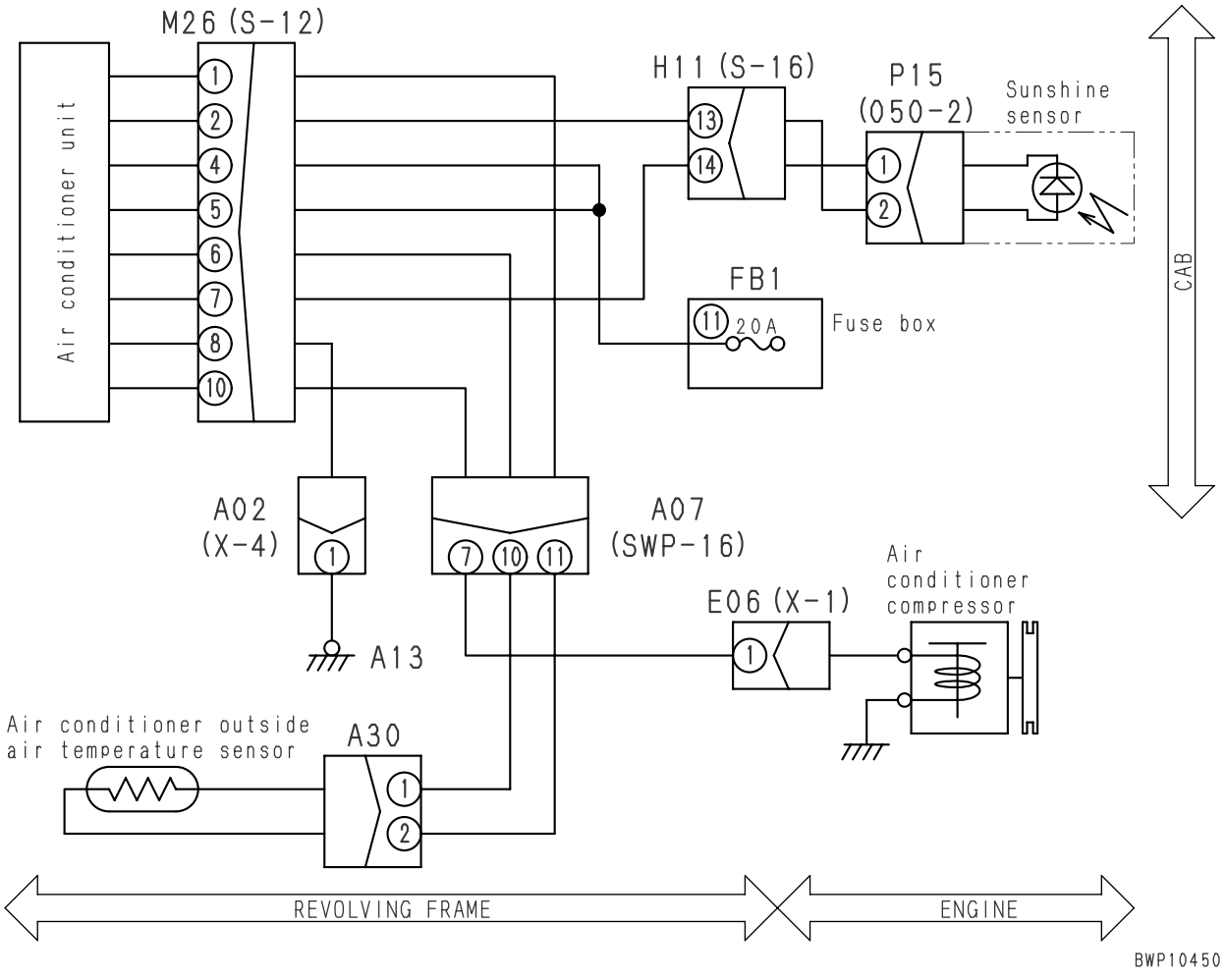


E-31 Air Conditioner does not work

Failure information	• The air conditioner does not work.
Relative information	• For the electrical circuit diagram inside the air conditioner unit, refer to the section of STRUCTURE AND FUNCTION - Air Conditioner in this manual.

Presumed cause and standard value in normalcy		Cause	Standard value in normalcy and references for troubleshooting		
	1	Fuse No. 11 fault	When the fuse is blown, there is a big possibility that grounding fault occurred in the circuit.		
	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 FB1-11 outlet and M26 (male) ④ ⑤	Resistance value	Below 1 Ω
			Wiring harness between M26 (male) ⑧ 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.		
			Between wiring harness between FB1-11 outlet and M26 (male) ④ ⑤ and grounding	Voltage	Above 1 MΩ
	4	Air conditioner unit defective	★Turn the engine starting switch OFF for the preparations, and hold it in the ON position during the troubleshooting.		
			M26	Voltage	
			Between ④ ⑤ and ⑧	20 – 30 V	

Electrical Circuit Diagram for Air Conditioner

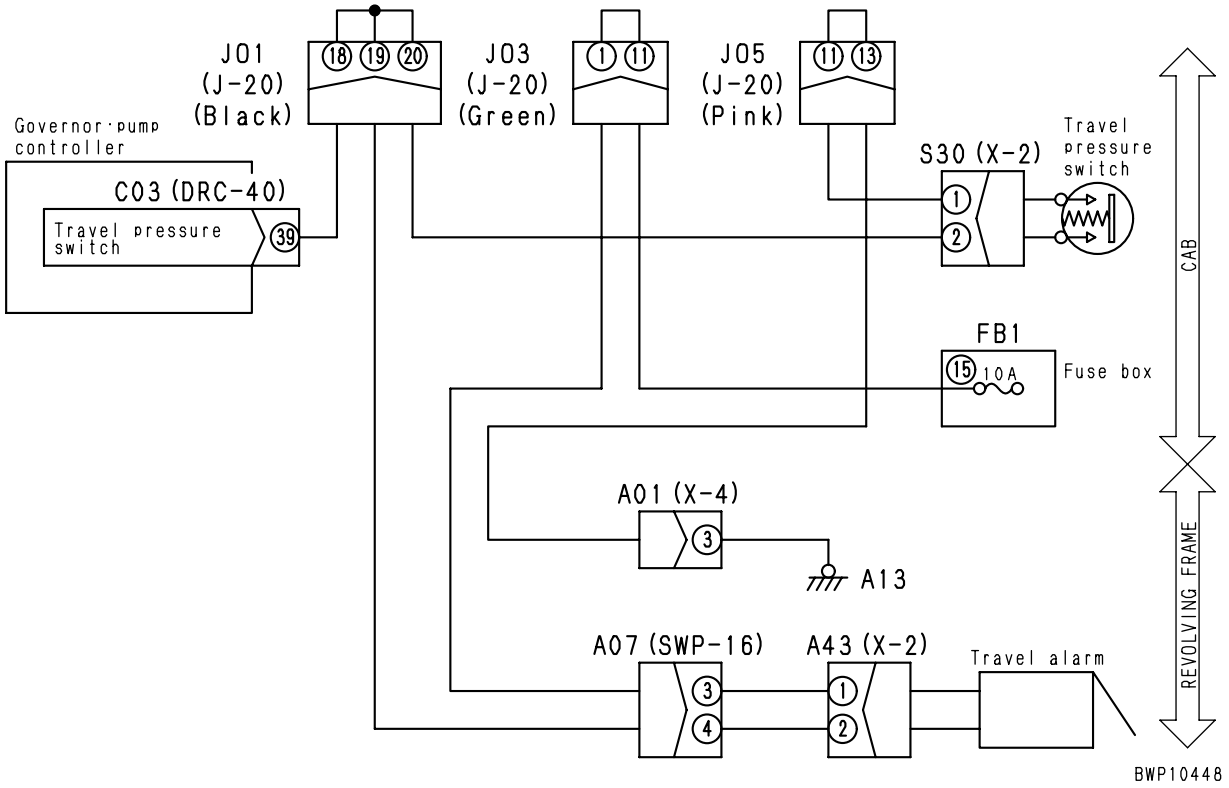


E-32 Travel alarm does not sound

Failure information	• The travel alarm does not sound while the machine is traveling. • The alarm begins to sound when the machine is at a standstill.
Relative information	—

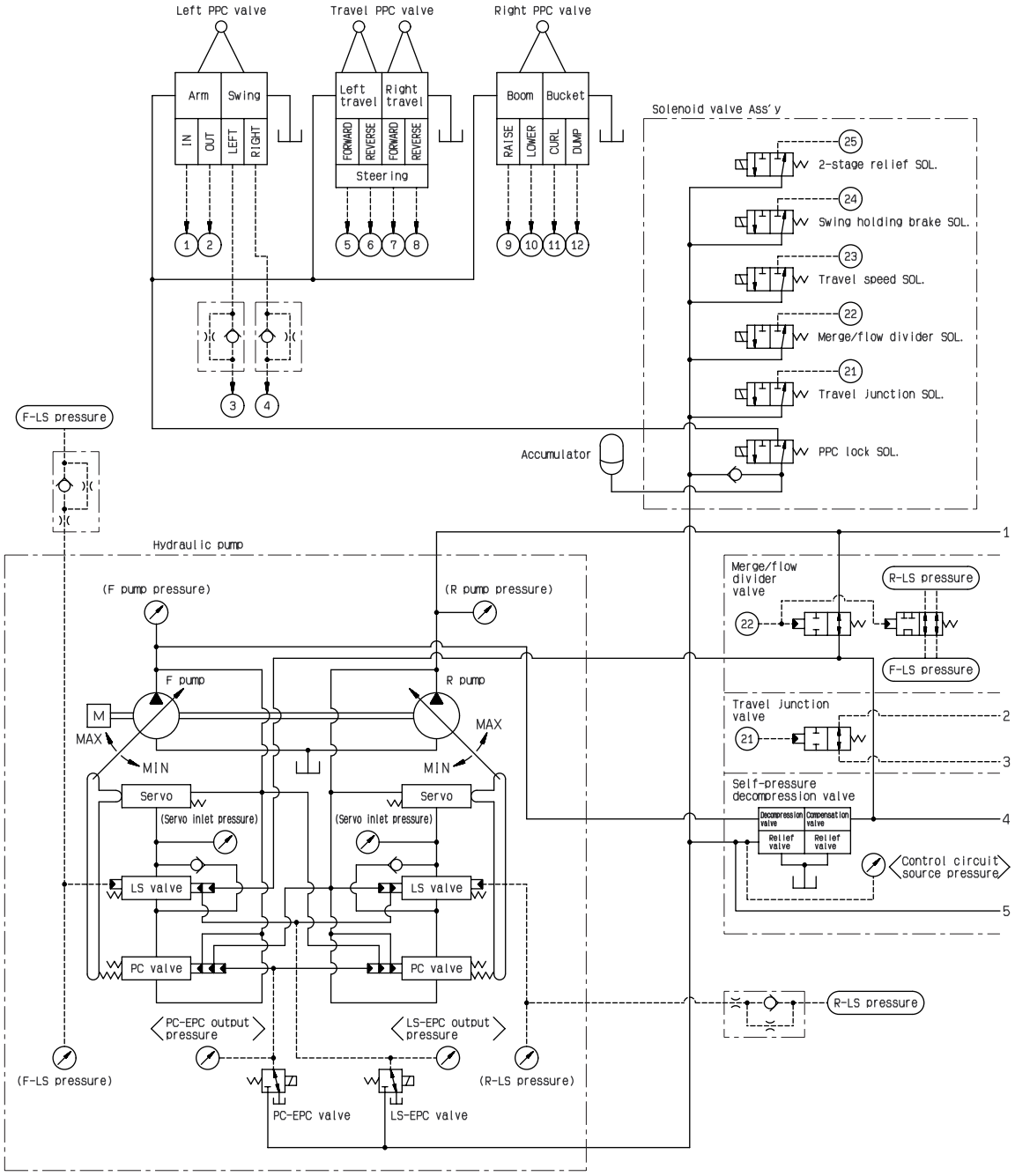
Presumed cause and standard value in normalcy		Cause	Standard value in normalcy and references for troubleshooting			
	1	Fuse No. 15 fault	When the fuse is blown, there is a big possibility that grounding fault occurred in the circuit.			
	2	Travel signal fault	If the monitor display is not correct, proceed to No. E-21 Troubleshooting.			
			Monitoring code	Item	Normal display	
			019	Travel	Control lever operation: ON Control lever NEUTRAL: OFF	
	3	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 FB1-15 outlet to J03 and A43 (female) ①		Resistance value	Below 1 Ω
			Wiring harness between A43 (female) ② and J01 ⑲		Resistance value	Below 1 Ω
	4	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.			
			Between wiring harness between FB1-15 outlet to J03 and A43 (female) ① and grounding		Resistance value	Above 1 MΩ
	5	Travel alarm fault	As this is an internal failure, troubleshooting cannot be conducted. (If none of the causes listed in Item 1 through 4 above is found, the travel alarm is judged as defective)			

Electrical Circuit Diagram for Travel PPC Hydraulic Switch and Travel Alarm



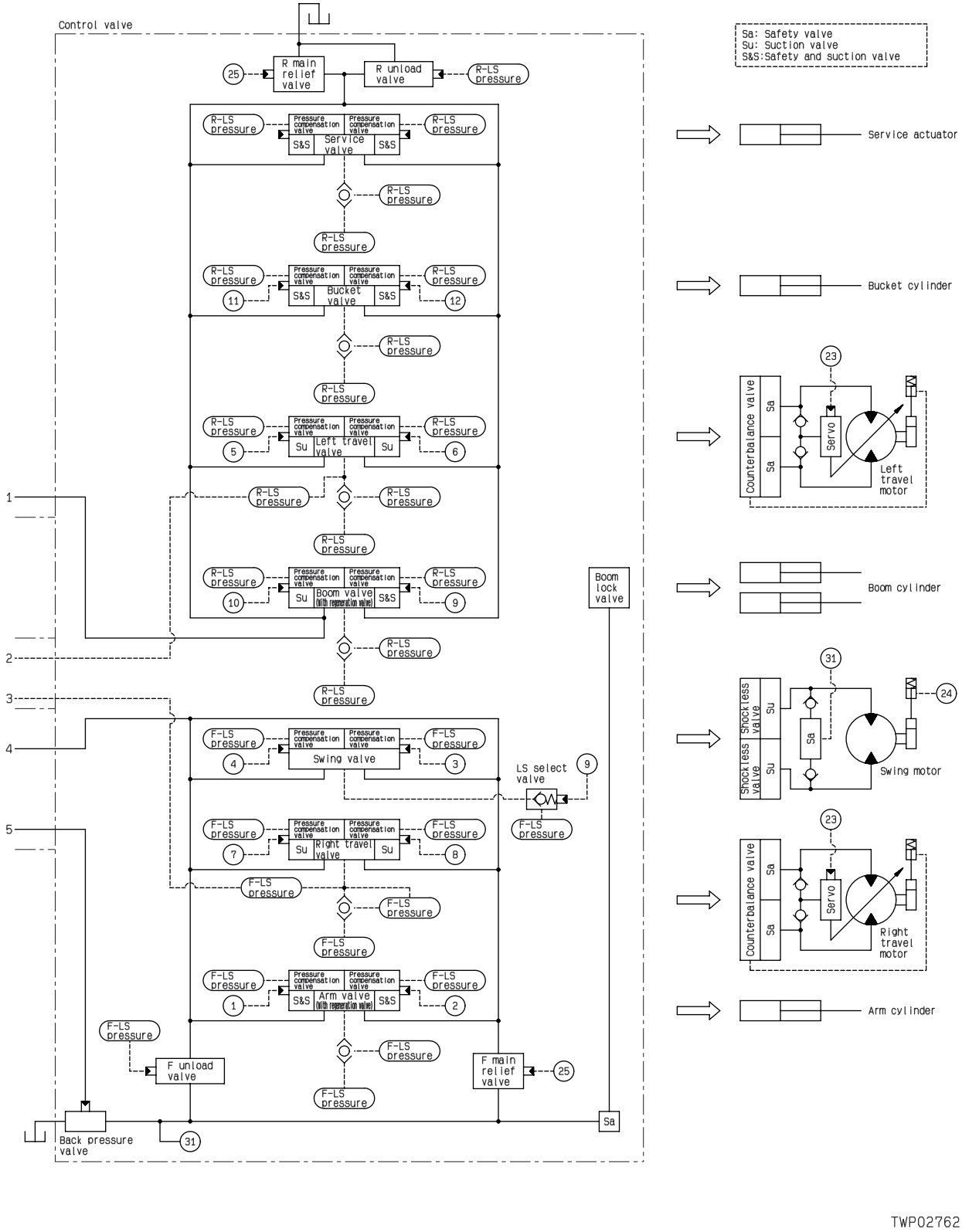
TROUBLESHOOTING OF HYDRAULIC AND MECHANICAL SYSTEM (H-MODE)

SYSTEM CHART FOR HYDRAULIC AND MECHANICAL SYSTEMS



TWP02761

★ This is a system chart that has been drawn up by simplifying the whole hydraulic circuit chart. Use it as a reference material when troubleshooting the hydraulic and mechanical systems.



INFORMATION CONTAINED IN TROUBLESHOOTING TABLE

★ Troubleshooting Table and Related Circuit Diagram collectively carry the following information. Carry out troubleshooting work after fully grasping their contents.

Failure information	Phenomena occurring on machine
Relative information	Information on occurred failures and troubleshooting

Presumed cause and standard value in normalcy		Cause	Standard value in normalcy and references for troubleshooting
	1	Cause for presumed failure (The attached No. for filing and reference purpose only. It does not stand for any priority)	<Contents> • The standard values in normalcy by which to judge "good" or "no good" about presumed causes. • References for making judgement of "good" or "no good"
	2		
	3		
	4		
	5		

H-1 All work equipment lack power, or travel and swing speeds are slow

Failure information	• All the work equipment lack power, or their travel and swing speeds are slow.
Relative information	• Set the working mode at A mode for troubleshooting.

Presumed cause and standard value in normalcy

	Cause	Standard value in normalcy and references for troubleshooting		
1	Malfunctioning of unload valve	★Stop engine for preparations. Start troubleshooting at engine high idling.		
		Control lever	Unload pressure	
		All control levers in NEUTRAL	3.9 ± 1.0 MPa {40 ± 10kg/cm^2}	
2	Improper adjustment or malfunctioning of main relief valve	★Stop engine for preparations. Start troubleshooting at engine high idling.		
		Control lever	Main relief pressure	
		Arm, DIGGING	33.3 – 36.8 MPa {340 – 375kg/cm^2}	
		If the pressure does not return to normalcy even after the adjustment, malfunctioning of main relief valve or its internal failure is suspected. In that case, check the valve itself.		
3	Malfunctioning of self pressure decompression valve	★Stop engine for preparations. Start troubleshooting at engine high idling.		
		Control lever	Control circuit source pressure	
		All control levers in NEUTRAL	2.83 – 3.43 MPa {29 – 35kg/cm^2}	
4	Improper adjustment or malfunctioning of PC valve	★Stop engine for preparations. Start troubleshooting at engine high idling.		
		Oil pressure to be measured	Measurement condition	Oil pressure ratio
		Pump delivery pressure	Swing lock: ON Arm digging relief	1
		PC valve output pressure		Approx. 3/5
		If the oil pressure does not return to normalcy even after the adjustment, malfunctioning of PC valve or its internal failure is suspected. In that case, check the valve itself.		
5	Malfunctioning of LS-EPC valve	★Stop engine for preparations. Start troubleshooting at engine high idling.		
		Travel speed	Travel control lever	LS-EPC output pressure
		Lo	NEUTRAL	Approx. 2.9 MPa {Approx. 30 kg/cm^2}
		Hi	Travel control lever	0{0}
6	Improper adjustment or malfunctioning of LS valve	★Stop engine for preparations. Start troubleshooting at engine high idling.		
		Oil pressure to be measured	Oil pressure ratio	
			All control levers in NEUTRAL	Travel without load (control lever held at half stroke)
		Pump delivery pressure	Nearly equal pressure	1
		LS valve output pressure		Approx. 3/5
		If the oil pressure does not return to normalcy even after the adjustment, malfunctioning of LS valve or its internal failure is suspected. In that case, check the valve itself.		
7	Malfunctioning of servo piston	Malfunctioning of servo piston is suspected. Check the piston itself.		
8	Piston pump defective	If none of the above listed causes is detected, the piston pump is suspected of deteriorated performance, malfunctioning or internal failure.		

H-2 Engine speed sharply drops or engine stalls

Failure information	• The engine speed sharply drops or the engine stalls.
Relative information	• Relative Information

Presumed cause and standard value in normalcy

	Cause	Standard value in normalcy and references for troubleshooting
1	Improper adjustment or malfunctioning of main relief valve	★Stop engine for preparations. Start troubleshooting at engine high idling. Control lever: Arm, DIGGING — Main relief pressure: 33.3 – 36.8 MPa {340 – 375kg/cm^2} If the oil pressure does not return to normalcy even after the adjustment, malfunctioning of the main relief valve or its internal failure is suspected. In that case, check the valve itself.
2	Improper adjustment or malfunctioning of PC valve	★Stop engine for preparations. Start troubleshooting at engine high idling. Oil pressure to be measured: Pump delivery pressure — Measurement condition: Swing lock: ON, Arm digging relief — Oil pressure ratio: 1 Oil pressure to be measured: PC valve output pressure — Measurement condition: Swing lock: ON, Arm digging relief — Oil pressure ratio: Approx. 3/5 If the oil pressure does not return to normalcy even after the adjustment, malfunctioning of the PC valve or its internal failure is suspected. In that case, check the valve itself.
3	Improper adjustment or malfunctioning of LS valve	★Stop engine for preparations. Start troubleshooting at engine high idling. Oil pressure to be measured: Pump delivery pressure — Oil pressure ratio: All control levers in NEUTRAL: Travel without load (control lever held at half stroke): 1 Oil pressure to be measured: LS valve output pressure — Oil pressure ratio: All control levers in NEUTRAL: Travel without load (control lever held at half stroke): Approx. 3/5 If the oil pressure does not return to normalcy even after the adjustment, malfunctioning of the LS valve or its internal failure is suspected. In that case, check the valve itself.
4	Orifice or filter in servo equipment clogged	The orifice or filter in the pump servo equipment is suspected of clogging. Check the equipment itself.
5	Malfunction of servo piston	The servo piston is suspected of malfunction. Check the piston itself.

H-3 No work equipment, travel or swing move

Failure information	• No work equipment nor 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	Malfunctioning of self pressure decompression valve	★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 dumper. 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 get 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-5 Auto-decelerator does not work

Failure information	• The auto-decelerator does not work.
Relative information	• This troubleshooting mode is applied when the auto-decelerator does not work, while operating the travel control lever. (A shuttle valve is provided between PPC valve and the hydraulic switch only in the travel circuit -actually located inside PPC valve) • 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 travel PPC valve (shuttle valve)	★Stop engine for preparations. Start troubleshooting at engine high idling.	
			Travel control lever	PPC valve output pressure
			NEUTRAL	0{0}
			Operation	Above 2.7 MPa {Above 28 kg/cm^2}

H-6 Fine control mode does not function

Failure information	• The fine control mode poorly functions or its response is slow.
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 LS-EPC valve	★Stop engine for preparations. Start troubleshooting at engine high idling.		
			Travel speed	Travel control lever	LS-EPC valve output pressure
			Lo	NEUTRAL	Approx. 2.9 MPa {Approx. 30 kg/cm^2}
			Hi	Travel control lever	0{0}
	2	Orifice in LS circuit clogged	The orifice in the LS circuit is presumed to be clogged. Check the orifice itself.		
	3	Improper adjustment or malfunctioning of LS valve	★Stop engine for preparations. Start troubleshooting at engine high idling.		
			Oil pressure to be measured	Oil pressure ratio	
				All control levers in NEUTRAL	Travel without load (control lever held at half stroke)
			Pump delivery pressure	Nearly equal oil pressure	1
			PC valve output pressure		Approx. 3/5
			If the oil pressure does not return to normalcy even after the adjustment, malfunctioning of the LS valve or its internal failure is suspected. In that case, check the valve itself.		
	4	Malfunctioning of servo piston	Malfunctioning of the servo piston is suspected. Check the piston itself.		

H-7 Boom moves slowly or lacks power

Failure information	• The boom moves slowly or lacks power
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 right PPC valve (in boom circuit)	★Stop engine for preparations. Start troubleshooting at engine high idling.	
			Boom lever	PPC valve output pressure
			NEUTRAL	0{0}
			RAISE or LOWER	Above 2.7 MPa {Above 28 kg/cm^2}
	2	Malfunction of merge/divide solenoid valve	★Stop engine for preparations. Start troubleshooting at engine high idling.	
			Working mode	Solenoid output pressure
			A mode	0{0}
			Other than A mode	2.84 – 3.43 MPa {29 – 35 kg/cm^2}
	3	Malfunctioning of merge/divide valve (main and LS valves)	The merge/divide valve (main and LS valves) is presumed to malfunction. Check the valve itself.	
	4	Malfunctioning of boom control valve (spool)	The spool in the boom control valve is presumed to malfunction. Check the valve itself.	
	5	Malfunctioning of boom control valve (pressure compensation valve)	The pressure compensation valve in the boom control valve is presumed to malfunction. Check the valve itself.	
	6	Malfunctioning of boom control valve (regeneration valve)	The regeneration valve in the boom control valve or the seal is presumed to malfunction. Check the valve itself.	
	7	Malfunctioning of boom control valve (lock valve)	The lock valve in the boom control valve is presumed to malfunction. Check the valve itself.	
	8	Malfunctioning of safety valve for lock valve or seal defective	The safety valve for the lock valve is presumed to malfunction, or the seal is suspected to be defective. Check the valve itself.	
	9	Malfunctioning of boom control valve (suction valve) or seal defective	The suction valve in the boom control valve is presumed to malfunction, or the seal is suspected to be defective.	
	10	Malfunctioning of boom control valve (safety and suction valves) or seal defective	The safety and suction valves in the boom control valve are presumed to malfunction, or the seal is suspected to be defective. Check those valves themselves.	
	11	Malfunctioning of LS shuttle valve (left travel, bucket and service valves)	LS shuttle valves in the left travel control valve, bucket control valve and service control valve are presumed to malfunction. Check those valves themselves.	
	12	Boom cylinder defective	★Stop engine for preparations. Start troubleshooting at engine high idling.	
			Boom lever	Amount oil leakage from cylinder
			Raise relief	20 cc/min

H-8 Arm moves slowly or lacks power

Failure information	• The arm moves slowly, or lacks power.
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 left PPC valve (arm circuit)	★Stop engine for preparations. Start troubleshooting at engine high idling.	
		Arm lever	PPC valve output pressure
		NEUTRAL	0{0}
		DIGGING or DUMPING	Above 2.7 MPa {Above 28 kg/cm^2}
2	Malfunctioning of merge/divide solenoid valve	★Stop engine for preparations. Start troubleshooting at engine high idling.	
		Working mode	Solenoid output pressure
		A mode	0{0}
		Other than A mode	2.84 – 3.43 MPa {29 – 35 kg/cm^2}
3	Malfunctioning of merge/divide valve (main and LS valves)	The merge/divide valve (main and LS valves) is presumed to malfunction. Check the valve itself.	
4	Malfunctioning of arm control valve (spool)	The spool in the arm control valve is presumed to malfunction. Check the valve itself.	
5	Malfunctioning of arm control valve (pressure compensation valve)	The pressure compensation valve in the arm control valve is presumed to malfunction. Check the valve itself.	
6	Malfunctioning of arm control valve (regeneration valve)	The generation valve in the arm control valve is presumed to malfunction, or the seal is suspected to be defective. Check the valve itself.	
7	Malfunctioning of arm control valve (safety and suction valves) or seal defective	The safety and suction valves in the arm control valve are presumed to malfunction, or the seal is suspected of defect. Check those valves themselves.	
8	Malfunctioning of LS shuttle valve (right travel, boom, left travel, bucket and service valves)	LS shuttle valves in the right travel control valve, boom control valve, left travel control valve, bucket control valve and service valve are presumed to malfunction. Check those valves themselves.	
9	Arm cylinder defective	★Stop engine for preparations. Start troubleshooting at engine high idling.	
		Arm lever	Amount oil leakage from cylinder
		Digging relief	20 cc/min

H-9 Bucket moves slowly or lacks power

Failure information	• The bucket moves slowly, or lacks power.
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 right PPC valve (bucket circuit)	★Stop engine for preparations. Start troubleshooting at engine high idling.	
			Bucket lever	PPC valve output pressure
			NEUTRAL	0{0}
			DIGGING or DUMPING	Above 2.7 MPa {Above 28 kg/cm^2}
	2	Malfunctioning of bucket control valve (spool)	The spool in the bucket control valve is presumed to malfunction. Check the valve itself.	
	3	Malfunctioning of bucket control valve (pressure compensation valve)	The pressure compensation valve in the bucket control valve is presumed to malfunction. Check the valve itself.	
	4	Malfunctioning of bucket control valve (safety and suction valves) or seal defective	The safety and suction valves in the bucket control valve are presumed to malfunction, or the seal is suspected to be defective. Check those valves themselves.	
	5	Malfunction of LS shuttle valve (service valve)	The LS shuttle valve in the service control valve is presumed to malfunction. Check the valve itself.	
	6	Bucket cylinder defective	★Stop engine for preparations. Start troubleshooting at engine high idling.	
			Bucket lever	Amount oil leakage from cylinder
			Digging relief	20 cc/min

H-10 Work equipment does not move in its single operation

Failure information	• The boom does not move when operated independently. • The arm does not move when operated independently. • The bucket does not move when operated independently.
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.	
			Work equipment control lever	PPC valve output pressure
			NEUTRAL	0{0}
			Operation	Above 2.7 MPa {Above 28 kg/cm^2}
	2	Malfunctioning of work equipment control valve (spool)	The spool in the work equipment control valve is presumed to malfunction. Check the valve itself.	

H-11 Work equipment has a bit too fast hydraulic drift

Failure information (1)	• Hydraulic drift of the boom is a bit too fast.
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	Boom cylinder defective	★Stop engine for preparations. Start troubleshooting at engine high idling.	
			Boom control lever	Amount oil leakage from cylinder
			Raise relief	20 cc/min
	2	Boom control lever (lock valve) seal defective	The seal at lock valve in the boom control lever is suspected to be defective. Check the valve itself.	
	3	Seal at safety valve for lock valve defective	The seal at the safety valve in the lock valve is suspected to be defective. Check the valve itself.	

Failure information (2)	• Hydraulic drift of the arm is a bit too fast.
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	Arm cylinder defective	★Stop engine for preparations. Start troubleshooting at engine high idling.	
			Arm control lever	Amount oil leakage from cylinder
			Digging relief	20 cc/min
	2	Arm control valve (safety and suction valves) seal defective	The seal for safety and suction valves in the arm control valve is suspected to be defective. Check the valve itself. ★Whether the seal is defective or not may well be determined by changing for other safety and suction valves. (Do not attempt to change them for the safety and suction valves for the boom LOWER and the lock valve, because the set pressure differs)	
	3	Arm control valve (spool) seal defective	The seal for spool in the arm control valve is suspected to be defective. Check the seal itself.	
	4	Arm control valve (pressure compensation valve) seal defective	The seal for pressure compensation valve in the arm control valve is suspected to be defective. Check the seal itself.	

Failure information (3)	• Hydraulic drift of the bucket is a bit too fast.
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	Bucket cylinder defective	★Stop engine for preparations. Start troubleshooting at engine high idling.	
			Bucket control lever	Amount oil leakage from cylinder
			Digging relief	20 cc/min
	2	Bucket control valve (safety and suction valves) seal defective	The seal for the safety and suction valves in the bucket control lever is suspected to be defective. Check the seal itself. ★Whether the seal is defective or not may well be determined by changing for other safety and suction valves. (Do not attempt to change them for the safety and suction valves for the boom LOWER and the lock valve, because the set pressure differs)	
	3	Bucket control valve (spool) seal defective	The seal for spool in the bucket control valve is suspected to be defective. Check the seal itself.	
	4	Bucket control valve (pressure compensation valve) seal defective	The seal for pressure compensation valve in the bucket control valve is suspected to be defective. Check the seal itself.	

H-12 Work equipment has big time lag

Failure information	• The work equipment has a big time lag.
Relative information	• Set the working mode at A mode for the troubleshooting.

<table>
<tr><td rowspan="6">Presumed cause and standard value in normalcy</td><td colspan="2">Cause</td><td colspan="3">Standard value in normalcy and references for troubleshooting</td></tr>
<tr><td rowspan="4">1</td><td rowspan="4">Malfunctioning of LS-EPC valve</td><td colspan="3">★Stop engine for preparations. Start troubleshooting at engine high idling.</td></tr>
<tr><td>Travel speed</td><td>Travel control lever</td><td>LS-EPC valve output pressure</td></tr>
<tr><td>Lo</td><td>NEUTRAL</td><td>Approx. 2.9 MPa {approx. 30 kg/cm^2}</td></tr>
<tr><td>Hi</td><td>Operation</td><td>0{0}</td></tr>
<tr><td>2</td><td>Malfunctioning of control valve (regeneration valve) - with boom and arm only</td><td colspan="3">The regeneration valve in the control valve is presumed to malfunction. Check the valve itself.</td></tr>
<tr><td>3</td><td>Malfunctioning of control valves (safety & suction valve)</td><td colspan="3">The safety and suction valves of the control valve are presumed to malfunction. Check those valves themselves directly.
★For the arm and boom, whether they are defective or not may well be determined by changing them for other safety and suction valves. (Do not attempt to change them for the safety and suction valves for the boom LOWER and the lock valve, because each set pressure differs)</td></tr>
<tr><td>4</td><td>Malfunctioning of control valve (pressure compensation valve)</td><td colspan="3">The pressure compensation valve of the control valve is presumed to malfunction. Check the valve itself directly.</td></tr>
</table>

H-13 Other work equipment moves when relieving single circuit

Failure information	• Other work equipment moves when relieving the single circuit of specific work equipment.
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	Control valve (pressure compensation valve) seal defective	The seal for pressure compression valve in the control valve is suspected to be defective. Check the seal itself.

H-14 One-touch power max. switch does not operate

Failure information	• The one-touch power max. switch does not operate.
Relative information	• Set the working mode at A mode for the troubleshooting.

<table>
<tr><td rowspan="5">Presumed cause and standard value in normalcy</td><td colspan="2">Cause</td><td colspan="2">Standard value in normalcy and references for troubleshooting</td></tr>
<tr><td rowspan="3">1</td><td rowspan="3">Malfunctioning of 2-stage solenoid valve</td><td colspan="2">★Stop engine for preparations. Start troubleshooting at engine high idling.</td></tr>
<tr><td>Swing lock switch</td><td>Solenoid valve output pressure</td></tr>
<tr><td>OFF</td><td>0{0}</td></tr>
<tr><td>ON</td><td>2.84 – 3.43 MPa {29 – 35kg/cm^2}</td></tr>
<tr><td>2</td><td>Malfunctioning of main relief valve</td><td colspan="2">The main relief valve is presumed to malfunction. Check the valve itself.</td></tr>
</table>

H-15 In compound operation, work equipment with larger load moves slowly

Failure information	• In a compound operation, work equipment with larger load tends to move slowly.
Relative information	—

Presumed cause and standard value in normalcy		Cause	Standard value in normalcy and references for troubleshooting	
	1	Malfunctioning of pressure compensation valve for work equipment with larger load	The pressure compensation valve for the work equipment with larger load is presumed to malfunction. Check the valve itself.	
			Combination of compound operation	Work equipment with larger load
			Boom RAISE + arm DIGGING	Boom RAISE
			Boom RAISE + arm DUMPING	Arm DUMPING
			Boom RAISE + bucket DIGGING	Boom RAISE
			Arm DUMPING + bucket DIGGING	Arm DUMPING
			Boom LOWER + arm DUMPING	Arm DUMPING

H-16 In swing + boom RAISE operation, boom moves slowly

Failure information	• In a compound operation of swing + boom RAISE, the boom tends to move slowly.
Relative information	• If the boom moves slowly in the single operation of boom RAISE, carry out the H-7 check first.

Presumed cause and standard value in normalcy		Cause	Standard value in normalcy and references for troubleshooting
	1	Malfunctioning of LS select valve or seal defective	The LS select valve is presumed to malfunction, or the seal is suspected to be defective. Check the valve and seal themselves.

H-17 In swing + travel, travel speed drops sharply

Failure information	• In a compound operation of swing + travel, the travel speed drops sharply.
Relative information	• If the travel speed is slow in the single operation of travel, carry out the H-19 check first.

Presumed cause and standard value in normalcy		Cause	Standard value in normalcy and references for troubleshooting
	1	Malfunctioning of LS shuttle valve (left travel and swing)	The LS shuttle valve in the left travel control valve or the swing control valve is presumed to malfunction. Check both of them directly.

H-18 Machine swerves in travel

Failure information	• The machine tends to swerve while traveling.
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 travel PPC valve	★Stop engine for preparations. Start troubleshooting at engine high idling.		
		Travel control lever	PPC valve output pressure	
		Forward or reverse	Above 2.7 MPa {Above 28 kg/cm^2}	
		Differential output between right and left sides	0.4 MPa {4 kg/cm^2}	
2	Malfunctioning of self-pressure decompression valve	★Stop engine for preparations. Start troubleshooting at engine high idling.		
		Control lever	Control circuit source pressure	
		All control levers in NEUTRAL	2.83 – 3.43 MPa {29 – 35 kg/cm^2}	
3	Improper adjustment or malfunctioning of LS valve	★Stop engine for preparations. Start troubleshooting at engine high idling.		
		Oil pressure to be measured	Oil Pressure ratio	
			All control levers in NEUTRAL	Travel without load (control lever held at half stroke)
		Pump delivery pressure	Nearly equal pressure	1
		LS valve output pressure		Approx. 3/5
4	Malfunctioning of travel interlocking solenoid valve	★Stop engine for preparations. Start troubleshooting at engine high idling.		
		Travel control lever	PPC valve output pressure	
		Operating one side only	0 {0}	
		Operating both sides	2.84 – 3.43 MPa {29 – 35 kg/cm^2}	
5	Malfunctioning of travel interlocking valve	The travel interlocking valve is presumed to malfunction. Check the valve itself.		
6	Malfunctioning of travel control valve (spool)	The spool in the travel interlocking valve is presumed to malfunction. Check the spool itself.		
7	Malfunction of travel motor	★Stop engine for preparations. Start troubleshooting at engine high idling.		
		Travel control lever	Amount of oil leakage from travel motor	
		Travel relief	27.2 ⊣/min	
8	Final drive defective	The final drive is suspected of an internal failure. Check the inside of the final drive directly. ★An internal failure in the final drive may well be determined by an abnormal noise from within, abnormal heat or metal chip or dust contained in the drained oil.		

H-19 Machine travels slowly

Failure information	• The machine's travel speed is slow.
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 travel PPC valve	★Stop engine for preparations. Start troubleshooting at engine high idling.		
		Travel control lever	PPC valve output pressure	
		Forward or reverse	Above 2.7 MPa {Above 28 kg/cm^2}	
		Output differential between right and left or front and rear	Below 0.4 MPa {Below 4 kg/cm^2}	
2	Malfunctioning of self-pressure decompression valve	★Stop engine for preparations. Start troubleshooting at engine high idling.		
		Control lever	Control circuit source pressure	
		All control levers in NEUTRAL	2.83 – 3.43 MPa {29 – 35kg/cm^2}	
3	Malfunctioning of LS-EPC valve	★Stop engine for preparations. Start troubleshooting at engine high idling.		
		Travel speed	Travel control lever	LS-EPC valve output pressure
		Lo	NEUTRAL	Approx. 2.9 MPa {approx. 30 kg/cm^2}
		Hi	Travel control lever	0 {0}
4	Malfunction of travel control valve (spool)	The spool in the travel control valve is presumed to malfunction. Check the spool itself.		
5	Malfunctioning of travel control valve (pressure compensation valve)	The pressure compensation valve in the travel control valve is presumed to malfunction. Check the valve itself.		
6	Malfunctioning of travel control valve (suction valve)	The suction valve in the travel control valve is presumed to malfunction. Check the valve itself.		
7	Malfunctioning of LS shuttle valve (bucket)	The LS shuttle valve in the bucket control valve is presumed to malfunction. Check the valve itself.		
7	Malfunction of travel motor	★Stop engine for preparations. Start troubleshooting at engine high idling.		
		Travel control lever	Amount of oil leakage from travel motor	
		Travel relief	27.2 ¬/min	
8	Final drive defective	The final drive is suspected of an internal failure. Check the inside of the final drive directly. ★An internal failure in the final drive may well be determined by an abnormal noise from within, abnormal heat or metal chip or dust contained in the drained oil.		

H-20 Machine cannot be easily steered or lacks power

Failure information	• The machine cannot be easily steered.
Relative information	• Set the working mode at A mode for the troubleshooting.

<table>
<tr><td rowspan="15">Presumed cause and standard value in normalcy</td><td colspan="2">Cause</td><td colspan="2">Standard value in normalcy and references for troubleshooting</td></tr>
<tr><td rowspan="4">1</td><td rowspan="4">Malfunctioning of travel PPC valve (steering spool)</td><td colspan="2">★Stop engine for preparations. Start troubleshooting at engine high idling.</td></tr>
<tr><td>Travel control lever</td><td>PPC valve output pressure (steering)</td></tr>
<tr><td>NEUTRAL on both sides</td><td>0 {0}</td></tr>
<tr><td>Operating one side only</td><td>Above 2.7 MPa
{Above 28 kg/cm^2}</td></tr>
<tr><td rowspan="4">2</td><td rowspan="4">Malfunctioning of travel inter-locking solenoid valve</td><td colspan="2">★Stop engine for preparations. Start troubleshooting at engine high idling.</td></tr>
<tr><td>Travel control lever</td><td>Solenoid valve output pressure</td></tr>
<tr><td>Operating both sides</td><td>0 {0}</td></tr>
<tr><td>Operating one side only</td><td>2.84 – 3.43 MPa
{29 – 35 kg/cm^2}</td></tr>
<tr><td>3</td><td>Malfunctioning of travel inter-locking valve</td><td colspan="2">The travel interlocking valve is presumed to malfunction. Check the valve itself.</td></tr>
<tr><td rowspan="4">4</td><td rowspan="4">Malfunctioning of merge/divide solenoid valve</td><td colspan="2">★Stop engine for preparations. Start troubleshooting at engine high idling.</td></tr>
<tr><td>Travel control lever</td><td>Solenoid valve output pressure</td></tr>
<tr><td>Operating both sides</td><td>0 {0}</td></tr>
<tr><td>Operating one side only</td><td>2.84 – 3.43 MPa
{29 – 35 kg/cm^2}</td></tr>
<tr><td>5</td><td>Malfunctioning of merge/divide valve</td><td colspan="2">The merge/divide valve is presumed to malfunction. Check the valve itself.</td></tr>
<tr><td>6</td><td>Malfunction of travel control valve (spool)</td><td colspan="2">The spool in the travel control valve is presumed to malfunction. Check the spool itself.</td></tr>
<tr><td>7</td><td>Malfunctioning of travel control valve (pressure compensation valve)</td><td colspan="2">The pressure compensation valve in the travel control valve is presumed to malfunction. Check the valve itself.</td></tr>
<tr><td>8</td><td>Malfunctioning of travel control valve (suction valve)</td><td colspan="2">The suction valve in the travel control valve is presumed to malfunction. Check the valve itself.</td></tr>
<tr><td>9</td><td>Malfunctioning of LS shuttle valve (bucket)</td><td colspan="2">The LS shuttle valve in the bucket control valve is presumed to malfunction. Check the valve itself.</td></tr>
<tr><td>10</td><td>Check valve seal defective at LS oil pressure pickup port</td><td colspan="2">The seal in the check valve of LS oil pressure pickup port is suspected to be defective. Check the seal itself.</td></tr>
<tr><td>11</td><td>Malfunctioning of travel motor (safety valve)</td><td colspan="2">The seal in the check valve of the travel motor is suspected to be defective. Check the seal itself.
★Whether the seal is defective or not may well be determined by swapping the motors between forward and reverse, or right and left.</td></tr>
<tr><td>12</td><td>Malfunctioning of travel motor (check valve)</td><td colspan="2">The seal in the check valve of the travel motor is suspected of defect. Check the seal itself.
★Whether the seal is defective or not may well be determined by swapping the motors between forward and reverse, or right and left.</td></tr>
</table>

H-21 Travel speed does not shift, or it is too slow or fast.

Failure information	• Travel speed does not shift, or it is either too fast or slow.
Relative information	• Set the working mode at A mode for the troubleshooting.

<table>
<tr><td rowspan="14">Presumed cause and standard value in normalcy</td><td colspan="2">Cause</td><td colspan="3">Standard value in normalcy and references for troubleshooting</td></tr>
<tr><td rowspan="9">1</td><td rowspan="9">Malfunctioning of LS-EPC valve</td><td colspan="3">★Stop engine for preparations. Start troubleshooting at engine high idling.</td></tr>
<tr><td>Travel speed</td><td>Travel control lever</td><td>Monitoring [15]</td></tr>
<tr><td>Lo</td><td rowspan="3">Fine control
(to the extent that the decelerator is released)</td><td>810 mA</td></tr>
<tr><td>(※ Mi)</td><td>470 mA</td></tr>
<tr><td>Hi</td><td>0 mA</td></tr>
<tr><td colspan="3">★Stop engine for preparations. Start troubleshooting at engine high idling.</td></tr>
<tr><td>Travel speed</td><td>Travel control lever</td><td>LS-EPC valve output pressure</td></tr>
<tr><td>Lo</td><td>NEUTRAL</td><td>Approx. 2.9 MPa
{approx. 30 kg/cm^2}</td></tr>
<tr><td>Hi</td><td>Operation</td><td>0 {0}</td></tr>
<tr><td rowspan="4">2</td><td rowspan="4">Malfunctioning of travel speed solenoid valve</td><td colspan="3">★Stop engine for preparations. Start troubleshooting at engine high idling.</td></tr>
<tr><td>Travel speed</td><td>Travel control lever</td><td>LS-EPC valve output pressure</td></tr>
<tr><td>Lo</td><td>NEUTRAL</td><td>0 {0}</td></tr>
<tr><td>Hi</td><td>Operation</td><td>2.84 – 3.43 MPa
{29 – 35 kg/cm^2}</td></tr>
<tr><td>3</td><td>Malfunctioning of travel motor (speed shifting)</td><td colspan="3">The travel motor is presumed to malfunction when shifting speed. Check the speed shifting portion directly.</td></tr>
</table>

※ : The "Mi" mode is on the multi-monitor specification machine only.

H-22 Track shoe does not turn (on one side only)

Failure information	• A track shoe does not turn (only on one side).
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	Travel control valve (suction valve) seat defective	The suction valve seat in the travel control valve is suspected of defect. Check the seat itself.	
	2	Travel motor (safety valve) seat defective	The safety valve seat in the travel motor is suspected of defect. Check the seat itself.	
	3	Travel motor (check valve) seat defective	The check valve seat in the travel motor is suspected of defect. Check the seat itself.	
	4	Travel Motor speed reduced	★Stop engine for preparations. Start troubleshooting at engine high idling.	
			Travel control lever	Amount of oil leakage from travel motor
			Travel relief	27.2 ¬/min
	5	Final drive defective	The final drive is suspected of an internal failure. Check the inside of the final drive directly. ★A failure inside the final drive may well be determined by an abnormal noise from within, abnormal heat generated or metal dust or chips contained in the drained oil.	

H-23 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 / Operation; Solenoid valve: 0 {0} / 2.84 – 3.43 MPa {29 – 35 kg/cm²}
	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/cm²} 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 ⊐/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 / Swing operation; PPC valve output pressure: 0 {0} / Above 2.7 MPa {Above 28 kg/cm²}
	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.

H-24 Swing acceleration is poor, or swing speed is slow

Failure information (1)	• Swing acceleration is poor, or swing speed is slow.
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 LS shuttle valve (all LS shuttles)	The LS shuttle valves for all the control valves are presumed to malfunction. Check them directly.		
	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	Swing control lever	Swing relief pressure
			ON	Swing relief	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	Amount of oil leakage from swing motor	
			Swing relief	Below 10 ⊐/min	

Failure information (2)	• Swing acceleration is poor only on one side, or swing speed is slow.
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.	
			Swing control lever	PPC valve output pressure
			NEUTRAL	0 {0}
			Left or right	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 valve itself.	
	3	Malfunctioning of swing motor (pressure compensation valve)	The pressure compensation valve in the swing motor is presumed to malfunction. Check the valve itself.	
	4	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 the result.	
	5	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.	

H-25 Excessive overrun when stopping swing

Failure information (1)	• The work equipment overruns excessively when stopping swing.
Relative information	• Set the working mode at A mode for the troubleshooting.

	Cause		Standard value in normalcy and references for troubleshooting		
Presumed cause and standard value in normalcy	1	Improper adjustment or malfunctioning of swing motor (safety valve)	★Stop engine for preparations. Start troubleshooting at engine high idling.		
			Swing lock switch	Swing control lever	Swing relief pressure
			ON	Swing relief	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.		
	2	Swing motor defective	★Stop engine for preparations. Start troubleshooting at engine high idling.		
			Control lever	Amount of oil leakage from swing motor	
			Swing relief	Below 10 ⊐/min	

Failure information (2)	• Swing acceleration is poor only on one side, or swing speed is slow.
Relative information	• Set the working mode at A mode for the troubleshooting.

	Cause		Standard value in normalcy and references for troubleshooting	
Presumed cause and standard value in normalcy	1	Malfunctioning of PPC valve	★Stop engine for preparations. Start troubleshooting at engine high idling.	
			Swing control lever	PPC valve output pressure
			NEUTRAL	0 {0}
			Left or right	Above 2.7 MPa {Above 28 kg/cm^2}
	2	Swing PPC slow return valve clogged	The PPC slow return valve is suspected of clogging. Check the valve itself. ★Whether the valve is clogged or not may well be determined by swapping the right and left valves and watching the result.	
	3	Malfunctioning of swing control valve (spool)	The spool in the swing control valve is resumed to malfunction. Check the valve itself.	
	4	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 the result.	
	5	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.	

H-26 There is big shock when stopping swing

Failure information	• There is a big shock caused when stopping a swing 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 swing PPC valve	★Stop engine for preparations. Start troubleshooting at engine high idling.	
			Swing control lever	PPC valve output pressure
			NEUTRAL	0 {0}
			Left or right	Above 2.7 MPa {Above 28 kg/cm^2}
	2	Malfunctioning of swing PPC slow return valve	The swing PPC slow return valve is presumed to malfunction. Check the valve itself. ★Whether the valve malfunctions or not may well be determined by swapping the right and left valves and watching the result.	

H-27 There is big abnormal noise caused when stopping swing

Failure information	• There is a big abnormal noise caused when stopping a swing 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 backpressure valve	The backpressure valve is presumed to malfunction. Check the valve itself.
	2	Malfunction of swing motor (safety valve)	The safety valve in the swing motor is presumed to malfunction. Check the valve itself.
	3	Malfunction of swing motor (suction valve)	The seal in 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 valves and watching the result.
	4	Swing machinery defective	The swing machinery is suspected of an internal failure. Check the inside of the machinery itself. ★A failure inside the swing machinery may well be determined by monitoring abnormal noise, abnormal heat generated or metal dust or chips contained in the drained oil.

H-28 Swing natural drift is too big

Failure information (1)	• Natural drift of the swing is too big (when the parking brake is activated).
Relative information	• When the emergency swing release switch is in the OFF position (this is a normal condition), the swing and parking brake is activated and the swing is fixed with a disc brake.

Presumed cause and standard value in normalcy		Cause	Standard value in normalcy and references for troubleshooting	
	1	Swing and parking brake solenoid valve malfunctioned	★Stop engine for preparations. Start troubleshooting at engine high idling.	
			Swing control lever	Solenoid valve output pressure
			NEUTRAL	0 {0}
			Left or right	2.84 – 3.43 MPa {29 – 35 kg/cm^2}
	2	Swing motor (parking brake portion) malfunctioned	The parking portion of the swing motor is suspected of malfunctioning and interior failure. Check that portion directly.	

Failure information (2)	• Natural drift of the swing is too big (when the parking brake is released).
Relative information	• When the emergency swing release switch is in the ON condition (this is an emergent condition), the swing and parking brake is released and the swing is retained only hydraulically.

Presumed cause and standard value in normalcy		Cause	Standard value in normalcy and references for troubleshooting
	1	Swing control valve (spool) malfunctioned	The seal in the spool of the swing control valve is suspected of defect. Check the spool itself directly.
	2	Swing control valve (pressure compensation valve) malfunctioned	The pressure compensation valve seal in the swing control valve is suspected of defect. Check the valve itself directly.
	3	Swing motor (safety valve) defective	The safety valve seal in the swing motor is suspected of defect. Check the valve itself directly.
	4	Swing motor (suction valve) defective	The suction valve seal in the swing motor is suspected of defect. Check the valve itself directly.
	5	Swing motor (check valve) defective	The check valve seal in the swing motor is suspected of defect. Check the valve itself directly.

30 DISASSEMBLY AND ASSEMBLY

HOW TO READ THIS MANUAL

REMOVAL AND INSTALLATION OF ASSEMBLIES

SPECIAL TOOLS

- Special tools that are deemed necessary for removal or installation of parts are listed.
- List of the special tools contains the following kind of information.
  1) Necessity
     ■: Special tools which cannot be substituted, should always be used.
     ●: Special tools which are very useful if available, can be substituted with commercially available tools.
  2) Distinction of new and existing special tools
     N: Tools with new part numbers, newly developed for this model.
     R: Tools with upgraded part numbers, remodeled from already available tools for other models.
     Blank: Tools already available for other models, used without any modification.
  3) Circle mark (○) in sketch column:
     A circle mark means that a sketch of the special tool is presented in the section of Sketches for Special Tools.

★ Part No. of special tools starting with 79*T means that they are locally made parts and as such not interchangeable with those made by Komatsu in Japan e.g. 79*T--- xxx --- xxxx.

REMOVAL OF PARTS

- The REMOVAL Section contains procedures, precautions and the amount of oil or water to be drained.
- Various symbols used in the REMOVAL Section are explained and listed below.

 This mark indicates safety-related precautions which must be followed when doing the work.

★ This mark gives guidance or precautions when doing the procedure.

 This mark shows that there are instructions or precautions for installing parts.

 This mark shows oil or water to be drained.

INSTALLATION OF PARTS

- Except where otherwise instructed, install parts is the reverse order of removal.
- Instructions and precautions for installing parts are shown with  mark in the INSTALLATION Section, identifying which step the instructions are intended for.
- Marks shown in the INSTALLATION Section stand for the following.

 This mark indicates safety-related precautions which must be followed when doing the work.

★ This mark gives guidance or precautions when doing the procedure.

 This mark stands for a specific coating agent to be used.

 This mark indicates the specified torque.

 This mark indicates an amount of oil or water to be added.

SKETCHES OF SPECIAL TOOLS

- Various special tools are illustrated for the convenience of local manufacture.

DISASSEMBLY AND ASSEMBLY OF ASSEMBLIES

SPECIAL TOOLS

- Special tools which are deemed necessary for disassembly and assembly are listed in this section.
- List of the special tools contains the following kind of information.

1) Necessity
   ■: Special tools which cannot be substituted, should always be used.
   ●: Special tools which are very useful if available, can be substituted with commercially available tools.

2) Distinction of new and existing special tools
   N: Tools with new part numbers, newly developed for this model.
   R: Tools with upgraded part numbers, remodeled from already available tools for other models.

Blank: Tools already available for other models, used without any modification.

3) Circle mark (○) in sketch column:
   A circle mark means that a sketch of the special tool is presented in the section of Sketches for Special Tools.

4) Part No. of special tools starting with 79*T means that they are locally made parts and as such not interchangeable with those made by Komatsu in Japan e.g. 79*T--- xxx --- xxxx.

DISASSEMBLY

- The DISASSEMBLY Section contains procedures, precautions and the amount of oil or water to be drained.
- Various symbols used in the DISASSEMBLY Section are explained and listed below.


This mark indicates safety-related precautions which must be followed when doing the work.
★ This mark gives guidance or precautions when doing the procedure.


This mark shows that there are instructions or precautions for installing parts.


This mark shows oil or water to be drained.

ASSEMBLY

- Section titled ASSEMBLY contain procedures, precautions and the know-how for the work, as well as the amount of oil or water to be added.
- Various symbols used in the ASSEMBLY Section are explained and listed below.


This mark indicates safety-related precautions which must be followed when doing the work.
★ This mark gives guidance or precautions when doing the procedure.


This mark stands for a specific coating agent to be used.

This mark indicates the specified torque.


This mark indicates an amount of oil or water to be added.

SKETCHES OF SPECIAL TOOLS

1) Various special tools are illustrated for the convenience of local manufacture.

PRECAUTIONS WHEN PERFORMING OPERATION

Be sure to follow the general precautions given below when performing removal or installation (disassembly or assembly) of units.

1. Precautions when performing removal work

- If the engine coolant water contains antifreeze, dispose of it correctly.
- After disconnecting hoses or tubes, cover them or install blind plugs to prevent dirt or dust from entering.
- When draining oil, prepare a container of adequate size to catch the oil.
- Confirm the match marks showing the installation position, and make match marks in the necessary places before removal to prevent any mistake when assembling.
- To avoid loosening any wire contacts, do not pull on the wires. In-order to prevent excessive force to the wiring, hold onto the connectors when disconnecting them.
- Fasten tags to wires and hoses to identify and show their installation position and help prevent any mistakes when re-installing.
- Count and check the number and thickness of the shims, and keep them in a safe place.
- When raising or lifting components, be sure to use proper lifting equipment of ample strength and safety.
- When using forcing screws to remove any components, tighten the forcing screws uniformly in turn.
- Before removing any unit, clean the surrounding area and install a cover to prevent any dust or dirt from entering after removal.

★ **Precautions when handling piping during disassembling**

Fit the following blind plugs into the piping after disconnecting it during disassembly operations.

A. Hoses and tubes using sleeve nuts

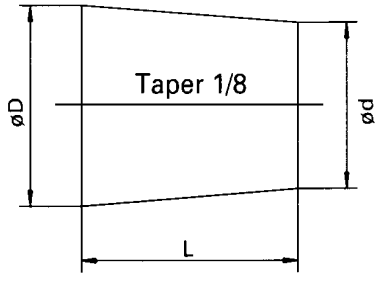
Nominal number	Plug (nut end)	Sleeve nut (elbow end) Use the two items below as a set
02	07376-50210	07221-20210 (Nut), 07222-00210 (Plug)
03	07376-50315	07221-20315 (Nut), 07222-00312 (Plug)
04	07376-50422	07221-20422 (Nut), 07222-00414 (Plug)
05	07376-50522	07221-20522 (Nut), 07222-00515 (Plug)
06	07376-50628	07221-20628 (Nut), 07222-00616 (Plug)
10	07376-51034	07221-21034 (Nut), 07222-01018 (Plug)
12	07376-51234	07221-21234 (Nut), 07222-01219 (Plug)

B. Split flange type hoses and tubes

Nominal number	Flange (hose end)	Sleeve head (tube end)	Split flange
04	07379-00400	07378-10400	07371-30400
05	07379-00500	07378-10500	07371-30500

C. If the part is not under hydraulic pressure, the following corks can be used:

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



DEW00401

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

★ When operating the hydraulic cylinders for the first time after reassembling cylinders, pumps and other hydraulic equipment removed for repair, bleed the air as follows:

1. Start the engine and run it at low idle.
2. Operate the work equipment control lever to operate the hydraulic cylinders, 4 - 5 times, stopping the cylinders 100 mm from the end of their stroke.
3. Next operate the hydraulic cylinder 3 - 4 times to the end of its stroke.
4. After doing this run the engine at normal speed.

★ When using the machine for the first time after repair or long storage, follow the same procedure.

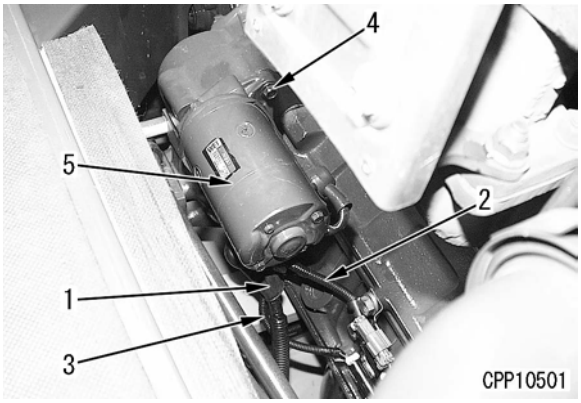
3. Precautions when completing the operations
   - If the engine coolant water has been drained, tighten the drain valve, and add coolant water to the specified level. Run the engine to circulate the coolant water through the system. Then check the coolant water level again.
   - If the hydraulic equipment has been removed and installed again, add engine oil to the specified level. Run the engine to circulate the oil through the system. Then check the oil level again.
   - If the piping or hydraulic equipment, have been removed for repair, Bleed the air from the system after reassembling the parts.
   - ★ For details, see TESTING AND ADJUSTING, Bleeding air.
   - Add the specified amount of grease (molybdenum disulphide grease) to the work equipment related parts.

REMOVAL AND INSTALLATION OF STARTING MOTOR ASSEMBLY

REMOVAL

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

1. Open up the engine hood.
2. Disconnect the two wires from the engine starting motor at: ※1
   - Wire (1) and (2) from terminal B.
   - Wire (3) from the T13 side of terminal C.
3. Remove two mounting bolts (4) to detach engine starting motor assembly (5). ※2



INSTALLATION

- Install in reverse order of removal.

※1

N·m Engine starting motor Terminal B Securing nut:
17.7 to 24.5 Nm (1.8 to 2.5 kgm)

※2

Both faces of engine starting motor gasket: Gasket sealant (LG-1)

N·m Engine starting motor Terminal B Securing nut:
43 ± 6 Nm (4.38 ± 0.61 kgm)

REMOVAL AND INSTALLATION OF FUEL INJECTION PUMP ASSEMBLY

SPECIAL TOOLS

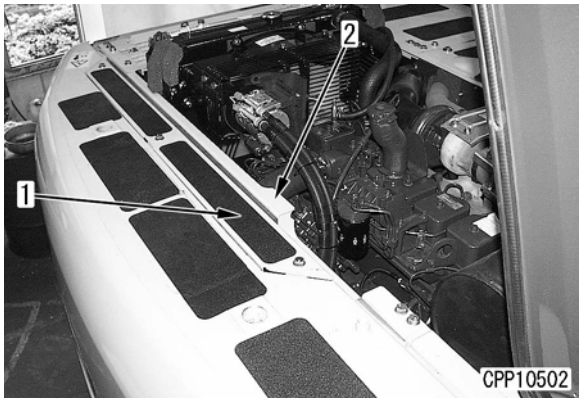
Mark	Part No.	Part Name	Necessity	Qty	Distinction*	Sketch
A	795-799-1390	Puller	■	1		

*Distinction between new and existing part.

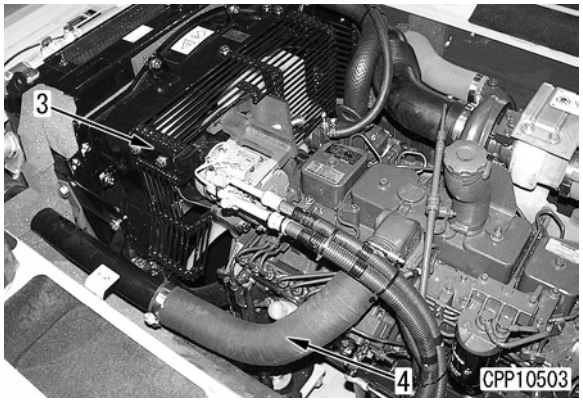
REMOVAL

⚠ Leave the negative (-) terminal of the battery disconnected.

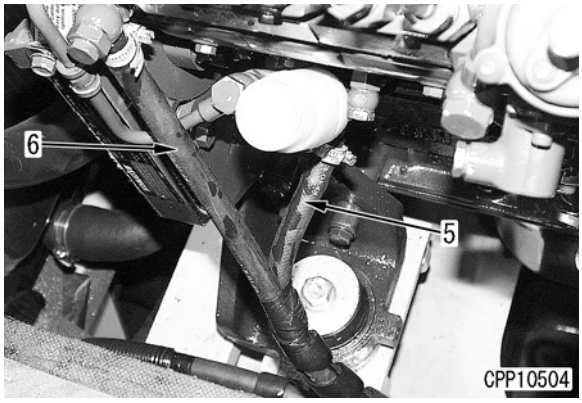
1. Open up the engine hood.
2. Remove plate (1) and cover (2).



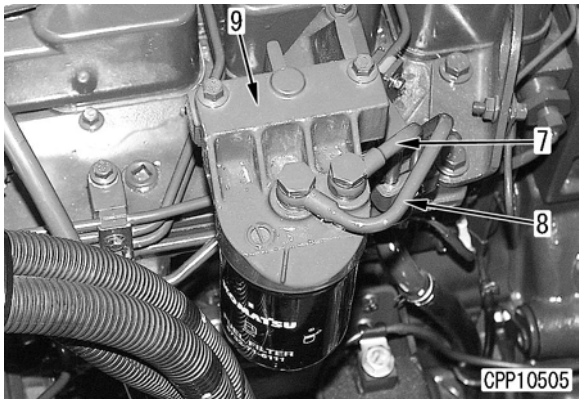
3. Take off radiator fan guard (3).
4. Disconnect air intake hose (4). ※1



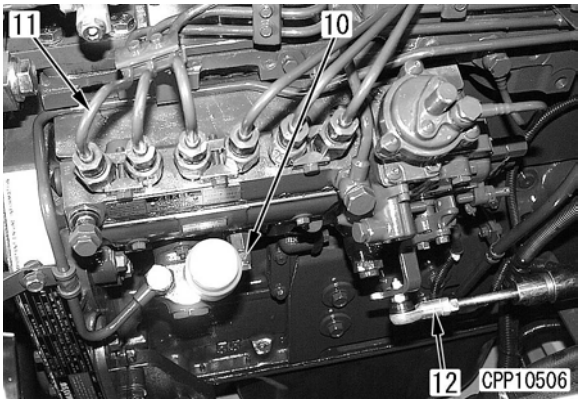
5. Disconnect fuel inlet hose (5) and fuel outlet hos ※2
   ★ When disconnecting the hoses, oil will flow out. Stop the flow by inserting a wooden plug into the hoses.



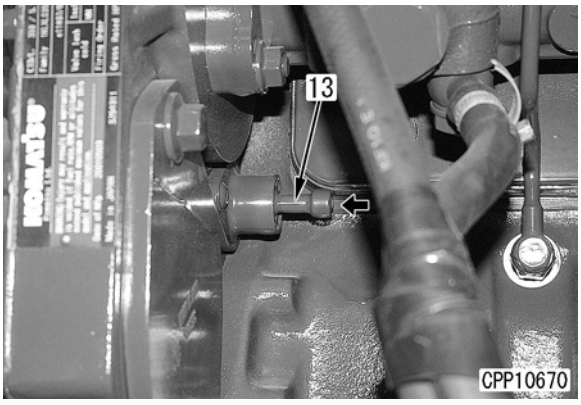
6. Disconnect tubes (7) and (8) between the fuel filter and the fuel injection pump, then remove fuel filter bracket (9). ※3



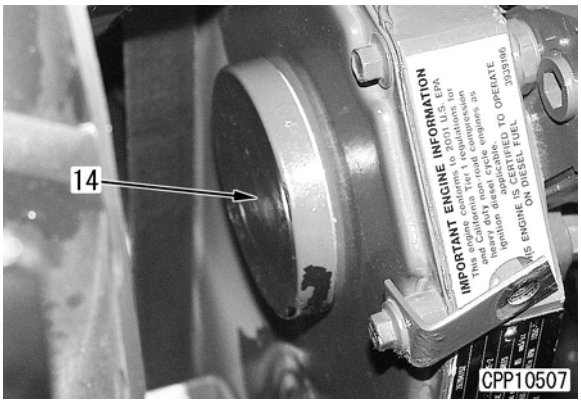
7. Disconnect lubrication tube (10).
8. Disconnect six delivery tubes (11). ※4
9. Detach E11 governor motor connector and then detach governor spring (12) on the fuel injection pump side. ※5



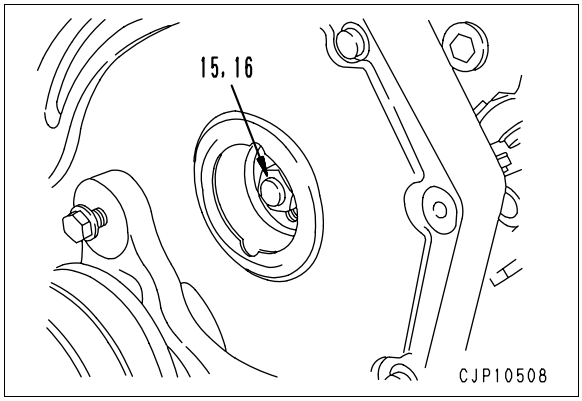
10. Adjust the timing gear to the injection timing, using timing pin (13) on the timing gear side.
    ★ Refer to the Inspection and Adjustment of Fuel Injection Timing Section.



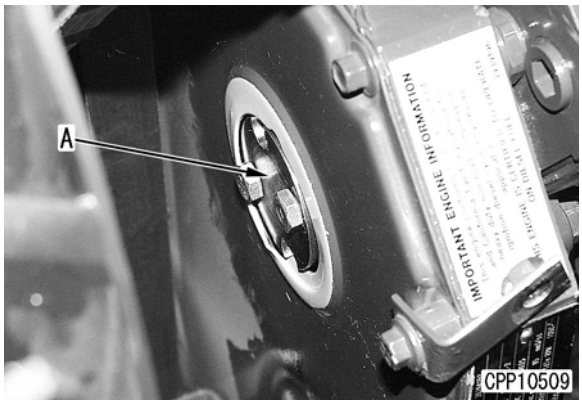
11. Unscrew cap (14) to remove it.
    ★ Use a filter wrench to unscrew the cap.



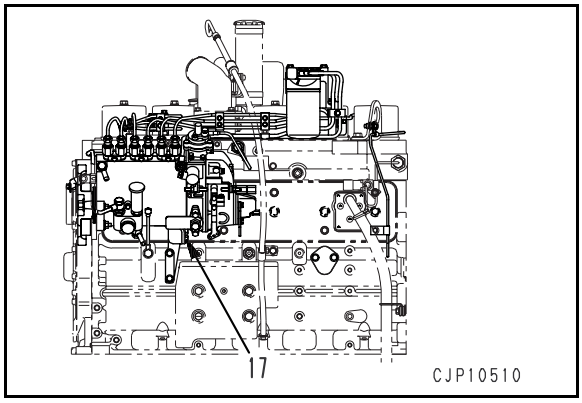
12. Remove nut (15) and washer (16) from the fuel injection pump. ※6
    ★ Be careful not to drop the nut or washer inside the case.



13. Separate the fuel injection pump shaft and drive gear, using tool **A**.

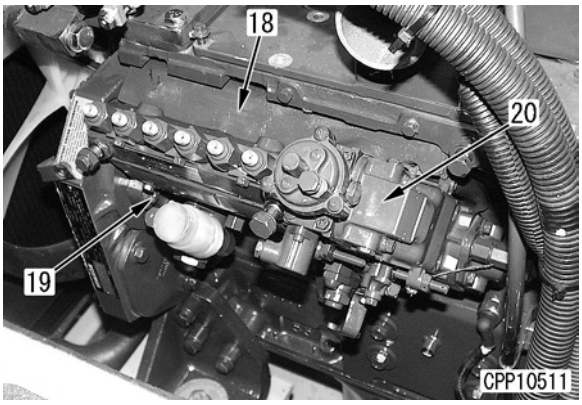


14. Remove two bracket mounting bolts (17) on the lower part of the fuel injection pump.



15. Remove sound absorbing material (18).

16. Remove four nuts (19) to remove fuel injection pump assembly (20). ※7



INSTALLATION

- Install in reverse order of removal.

※1

N·m Air intake hose clamp:
5.4 - 6.4 Nm (0.55 - 0.65 kgm)

※2

N·m Hose clamp:
2.84 - 3.82 Nm (0.29 - 0.39 kgm)

※3

N·m Joint bolt:
19.6 - 29.4 Nm (2.0 - 3.0 kgm)

※4

N·m Sleeve nut:
24 ± 4 Nm (2.45 ± 0.41 kgm)

※5

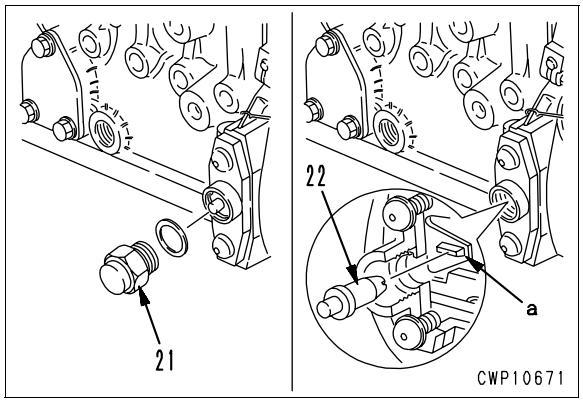
★ Adjust the governor lever stroke, refer to the Special Function of Monitor Panel section in the INSPECTION AND ADJUSTMENT chapter, of this manual.

※6

N·m Nut: 95 ± 10 Nm (9.7 ± 1.0 kgm)

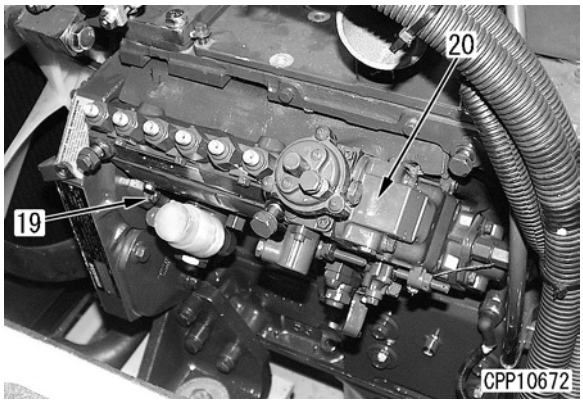
※7

- Install the fuel injection pump assembly in the following manner.
  1) Check that the timing pin is properly adjusted to the fuel injection timing.
     ★ Refer to Step 10 in the previous procedure, REMOVAL.
  2) Remove plug (21), then reverse timing pin (22) of the fuel injection pump and assemble the plug to the pump again.
     ★ Check that the cutout portion on the timing pin is engaged with protrusion **a** inside the pump.
     ★ Refer to the Inspection and Adjustment of Fuel Injection Timing section of the TESTING AND ADJUSTING, chapter in this manual.



  3) Mount fuel injection pump assembly (20) and secure it with four nuts (19).

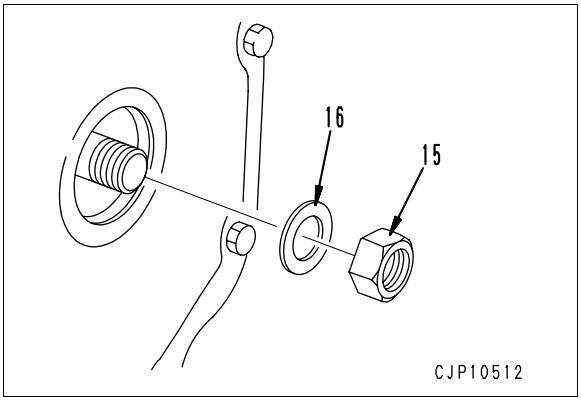
N·m Nut: 9.8 ± 2 Nm (1.0 ± 0.2 kgm)



4) Install washer (16) and tighten it with nut (15) temporarily.
   ★ When installing the nut and washer, be careful not to let them fall into the case.

   ⚠ Tighten the nut temporarily to the following specified torque. Take care not to damage the timing pin.

   N·m Nut temporary tightening torque:
   12.5 ± 2.5 Nm (1.27 ± 0.25 kgm)



5) Disengage the timing pin on the timing gear side from protrusion **a**, and return the position of the timing pin of the fuel injection pump to the original point.
6) Tighten fuel injection pump mounting nut (15) to the specified torque.

   N·m Nut: 95 ± 10 Nm (9.7 ± 1.01 kgm)

- Air bleeding
  Bleed air from the fuel injection system.

REMOVAL AND INSTALLATION OF ENGINE FRONT SEAL

SPECIAL TOOLS

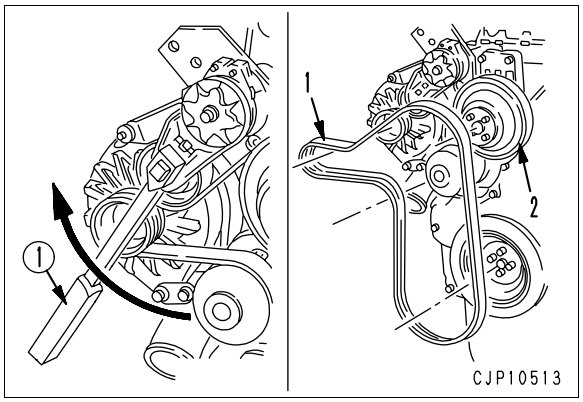
Mark	Part No.	Part Name	Necessity	Qty	Distinction*	Sketch
A	795-799-1380	Installer	●	1		

*Distinction between new and existing part.

REMOVAL

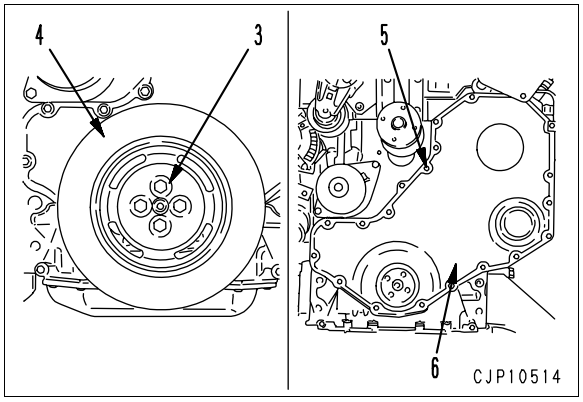
1. Remove the radiator assembly, refer to the Removal and Installation of Radiator Assembly section in this manual.

2. Take off engine fan belt (1) and pulley (2), using lever b.

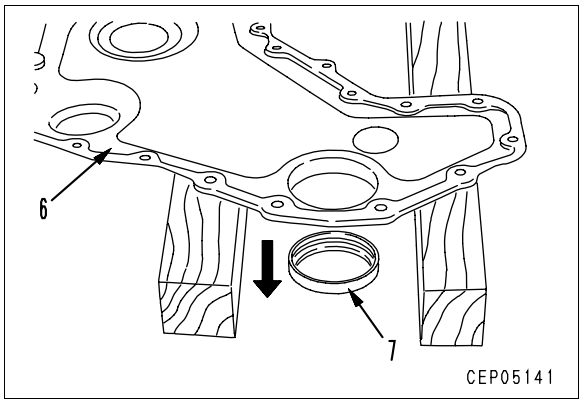


3. Remove four mounting bolts (3), and then take off the crankshaft pulley and pulsation damper (4). ※1

4. Remove 20 mounting bolts (5) to take off cover (6). ※2



5. Holding cover (6) securely and using a screwdriver, push out oil seal (7) from the backside to the front side of the cover. ※3



INSTALLATION

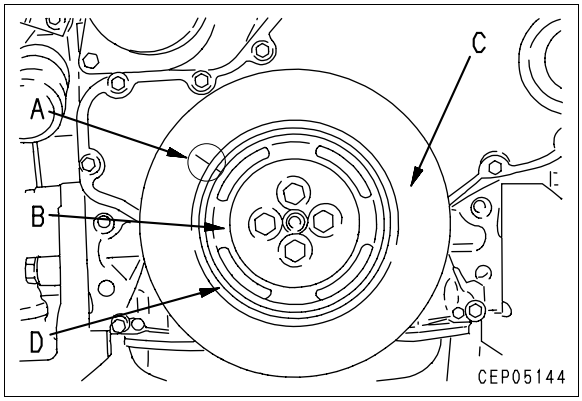
- Install in reverse order of removal.

※1

N·m Crankshaft pulley and pulsation damper mounting bolt:
125 ± 5 Nm (12.75 ± 0.51 kgm)

★ Tighten the crankshaft pulley and pulsation damper mounting bolt temporarily, then install engine fan belts and tighten the bolt to the specified torque.

★ Check both index lines on damper hub B and on inertial material C (marked as A), when installing the pulsation damper. If the two index lines are misaligned by more than 1.59 mm, replace the pulsation damper. Replace rubber material D, if it is defective.



※2

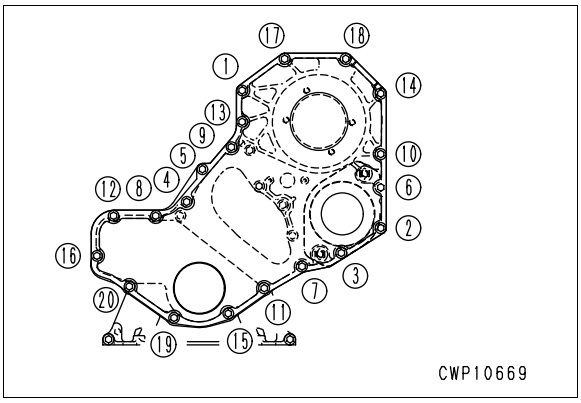
★ Protrusion of the gear housing gasket from the oil pan installation face should be kept less than 0.25 mm.

★ 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.

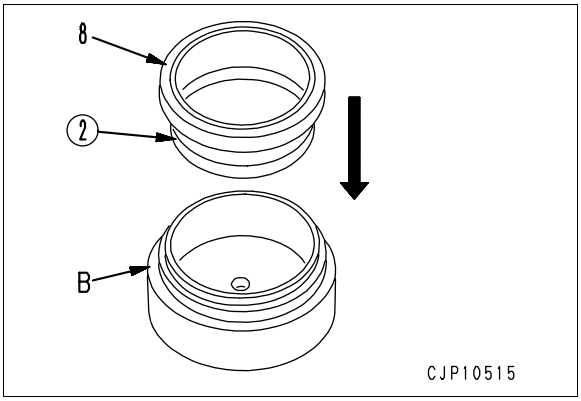


※3

★ Install the oil seal in the following manner.

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

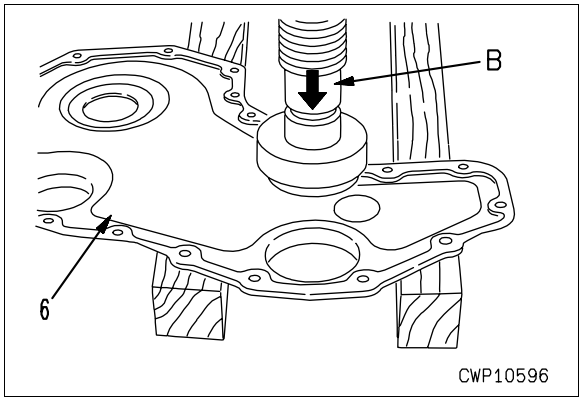
2) Place the oil seal onto tool **B** with the dust and lip faces turned upward.



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

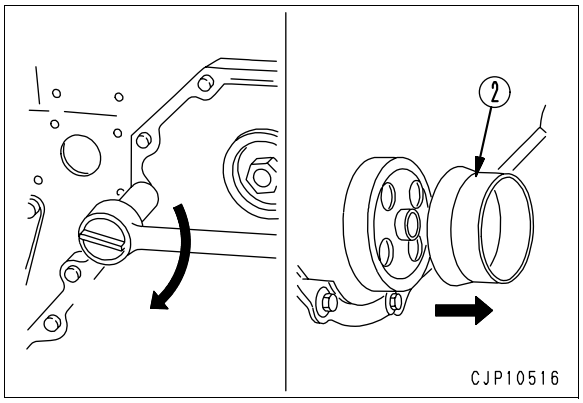
★ Push the oil seal in until tool **B** contacts the bottom of cover (6).

★ 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).

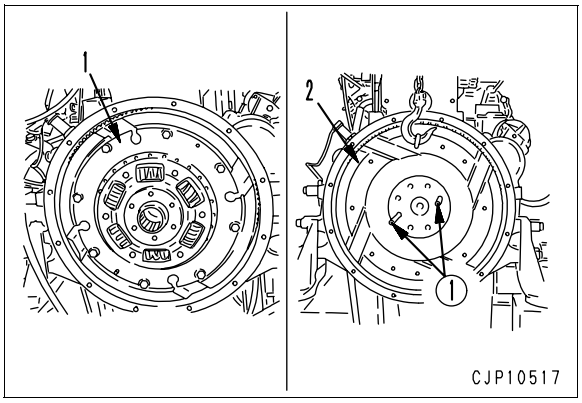
Cover installing face:
Gasket sealant (LG-6)



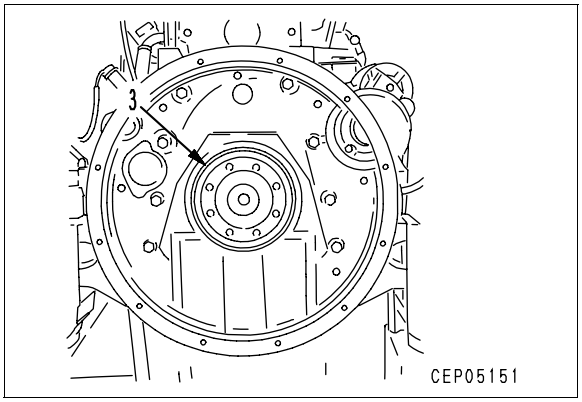
REMOVAL AND INSTALLATION OF ENGINE REAR SEAL

REMOVAL

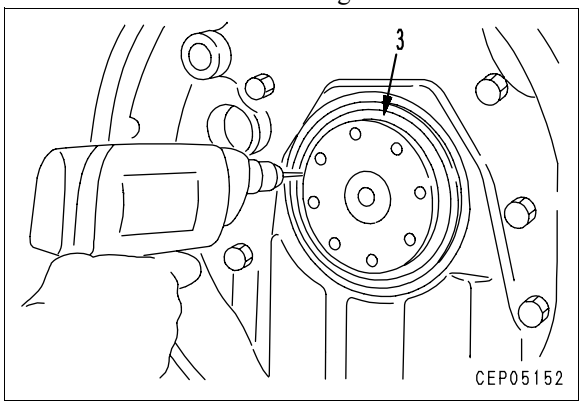
1. Remove the hydraulic pump assembly, refer to the Hydraulic Pump Assembly Removal section in this manual.
2. Remove damper assembly (1).
3. Remove the mounting bolts from flywheel assembly (2) and set guide bolts b. Then lift it off to remove it. ※1



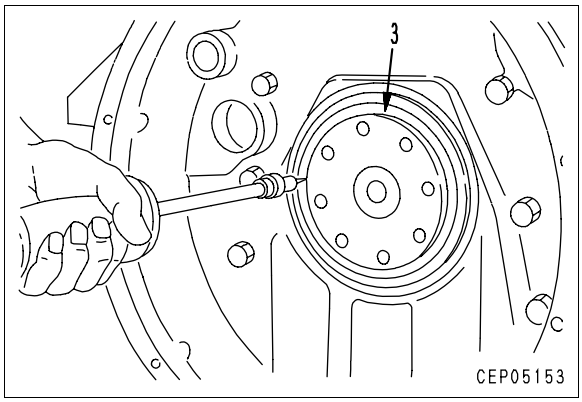
4. Remove seal (3). ※2
   - ★ A suggested method for removing the seal is to drill a hole approx. 3 mm in diameter on the seal carrier, then insert a slide hammer with a dent puller attached into the hole and pull the seal out.
   - ★ The seal may be removed by destroying the seal carrier with a hammer. When using this method, take care so the flywheel seal and crankshaft wear ring are not damaged.



★ Drill a hole of approx. 3 mm in diameter on the seal carrier with a drilling machine.



★ Attach a dent puller to a slide hammer and insert the hammer into the drilled hole. Then pull out seal (3) by sliding the hammer.



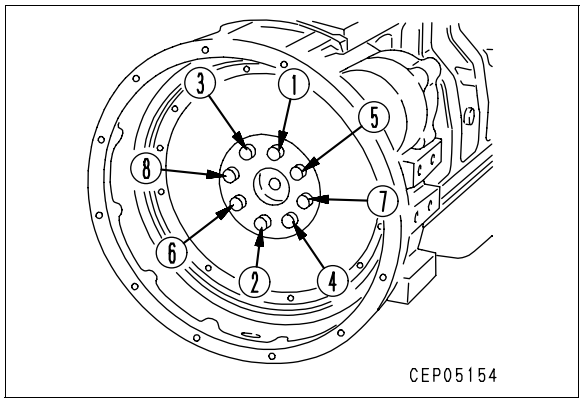
INSTALLATION

- Install in reverse order of removal.

※1

N·m Flywheel mounting bolt:
137 ± 7 Nm (13.97 ± 0.71 kgm)

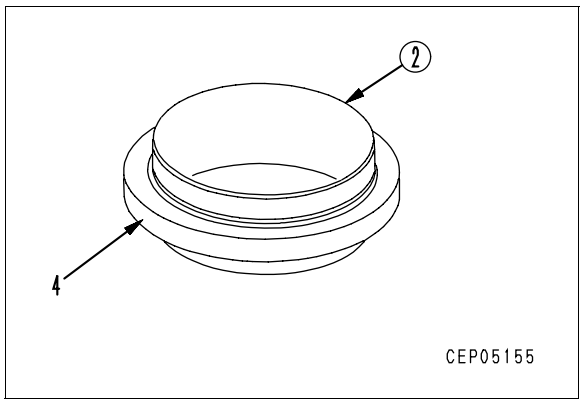
★ Tighten the mounting bolts in the sequence illustrated below.



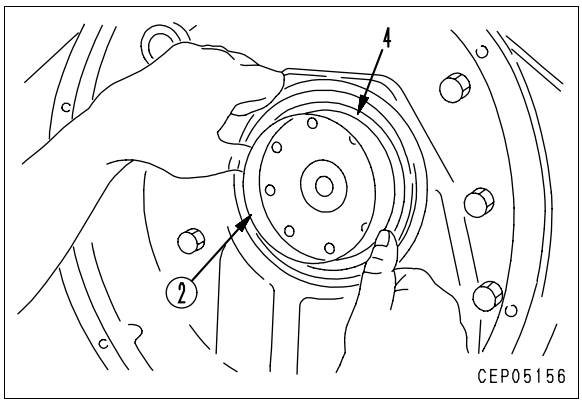
※2

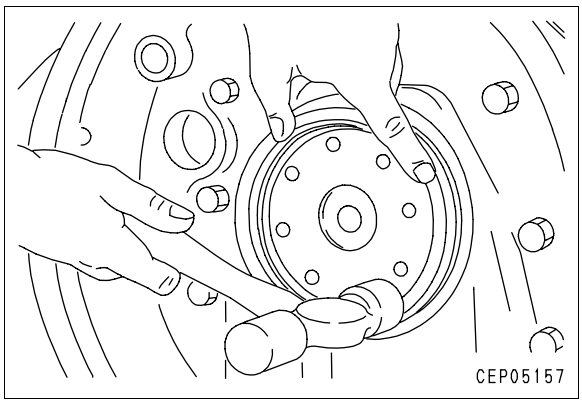
★ Install the oil seal in the following manner.

1) Attach pilot (2) to new oil seal (4).
   ★ Before installing the oil seal, clean the crankshaft sealing face and the seal lip face. Remove all oil and dry thoroughly to prevent oil leakage.



2) Push the oil seal into the flywheel by inserting pilot (2) with oil seal (4) into the crankshaft.
3) Pull out pilot (2). Push the oil seal into the front cover from the inside to the outside.
4) Install the oil seal on the flywheel housing to the proper depth. Use an alignment tool.
   ★ Tap the head, bottom, right and left sides of the alignment tool to make sure that the seal carrier is not twisted, when it is being pushed in.





REMOVAL AND INSTALLATION OF CYLINDER HEAD ASSEMBLY

SPECIAL TOOLS

Mark		Part No.	Part Name	Necessity	Qty	Distinction*	Sketch
C	1	795-799-1170	Installer	■	1		
	2	790-331-1110	Wrench	■	1		

*Distinction between new and existing part.

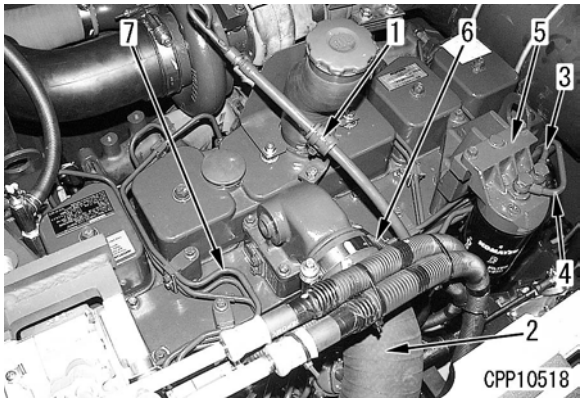
REMOVAL

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

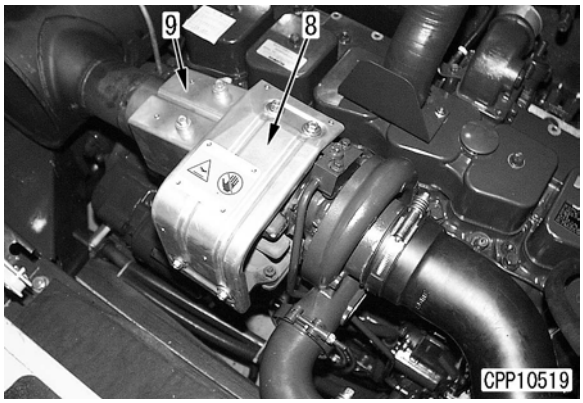
1. Drain engine coolant.

   Cooling water: 22.8 **l**

2. Close the fuel stop valve.
3. Open up the engine hood.
4. Remove clamp (1) from the engine oil level gauge guide. ※1
   ★ Put the clamp aside near the counterweight after removing it.
5. Disconnect air intake hose (2). ※2
6. Disconnect tubes (3) and (4) between the fuel filter and the fuel injection pump. ※3
7. Remove bracket (5) in one piece with the fuel filter assembly. ※4
8. Remove ribbon heater harness CN-E01 (6).
9. Disconnect six delivery tubes (7). ※5

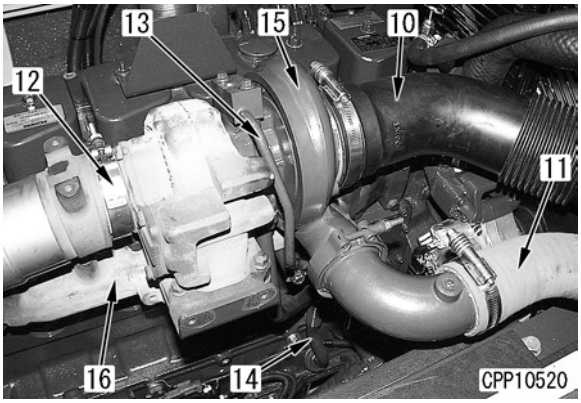


10. Remove heat cover (8) from the turbocharger assembly.
11. Remove exhaust muffler connector cover (9).



12. Disconnect air cleaner suction hose (10). ※6
13. Disconnect air intake hose (11) between the turbocharger and the after-cooler. ※7
14. Remove V clamp (12) from the exhaust muffler.
15. Disconnect lubricant inlet tube (13) and lubricant outlet tube (14).
16. Remove turbocharger assembly (15).

17. Detach exhaust manifold (16). ※8

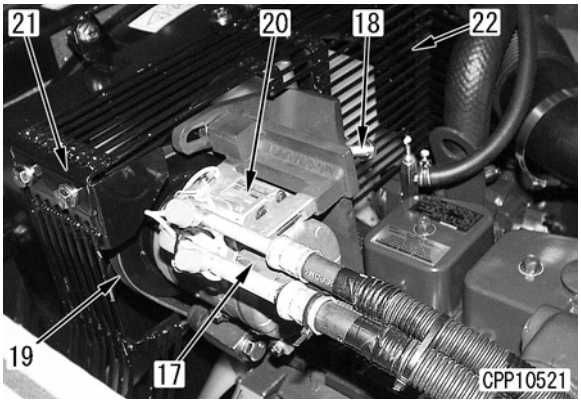


18. Detach air compressor wiring connector CN-E06 (17).

19. Loosen tension on the air compressor belt, then loosen adjusting bolt (18) to remove belt (19). ※9

20. Remove air compressor assembly (20).
    ★ Remove the mounting bracket in one piece with the air compressor assembly and put them aside near the counter weight.

21. Detach radiator fan guards (21) and (22).

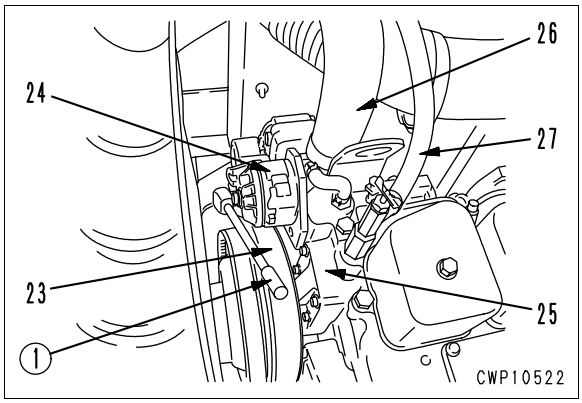


22. Loosen air compressor belt (23), using wrench b and remove it.
    ⚠ Be careful not to get a finger caught in the belt, when removing it.

23. Remove tension pulley (24).

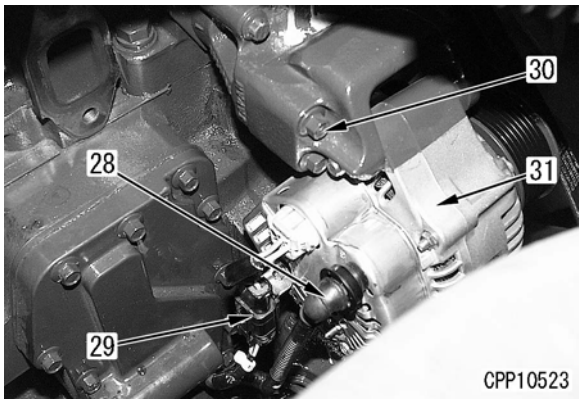
24. Remove the four mounting bolts to detach the fan and fan pulley (25). ※10
    ★ Put the fan pulley aside near the radiator.

25. Disconnect radiator inlet hose (26) and heater hose (27). ※11

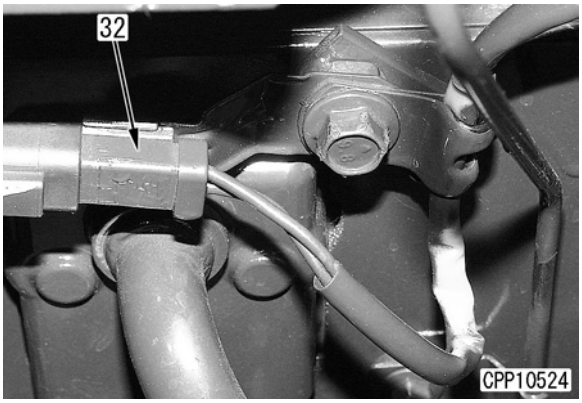


26. Disconnect connector E12 (29) at terminal B (28) from the alternator.

27. Remove three alternator bracket mounting bolts (30) and the two alternator plate mounting bolts, and remove alternator assembly (31) in one piece with the bracket.

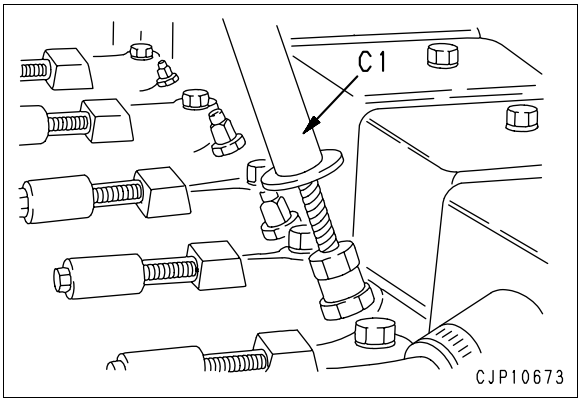


28. Disconnect connector E05 (32) from the engine cooling water temperature sensor, and remove the wiring clamp.

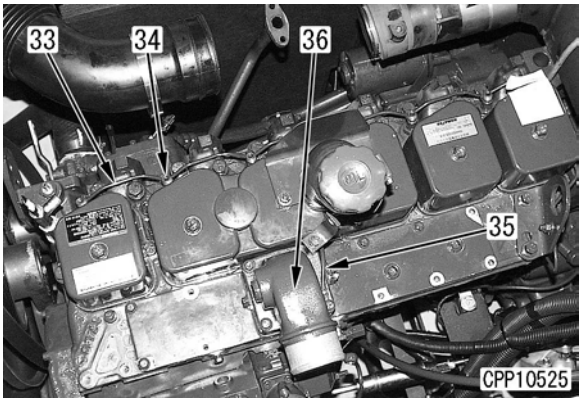


29. Remove the clamps (two places) and disconnect the spill tube (33). ※12

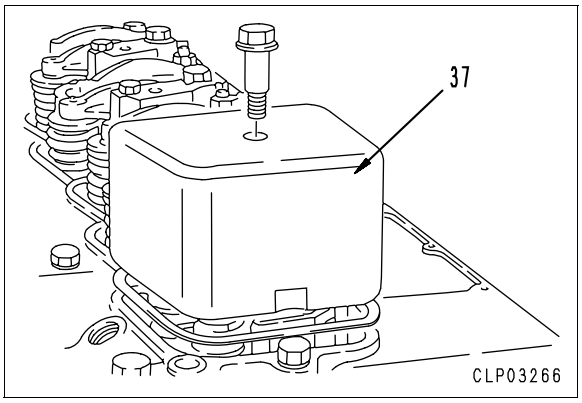
30. Remove six nozzle holders (34). ※13
    - ★ If it is difficult to remove the nozzle holder assemblies, use tool **C1**.
    - ★ Be careful not to allow dust or foreign matter to stick where the nozzle holder assembly is installed.



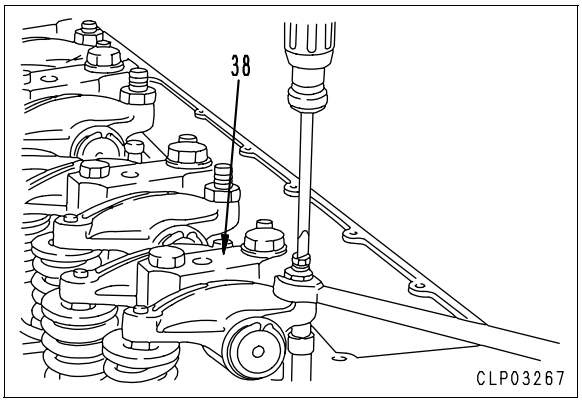
31. Disconnect ribbon heater wiring (35) and remove air intake connector (36).



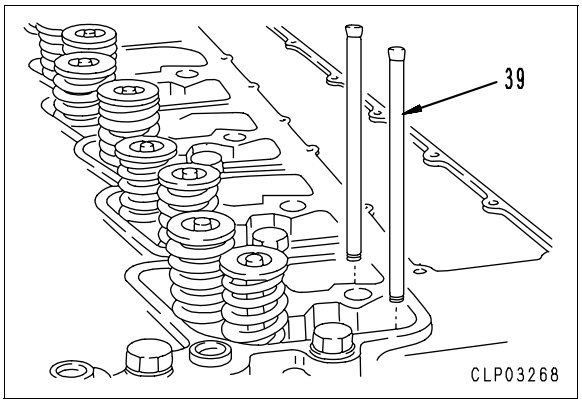
32. Remove head cover (37). ※14



33. Detach rocker arm assembly (38). ※15
    - ★ Loosen the lock nut, and unscrew the adjusting screw 2 to 3 turns.



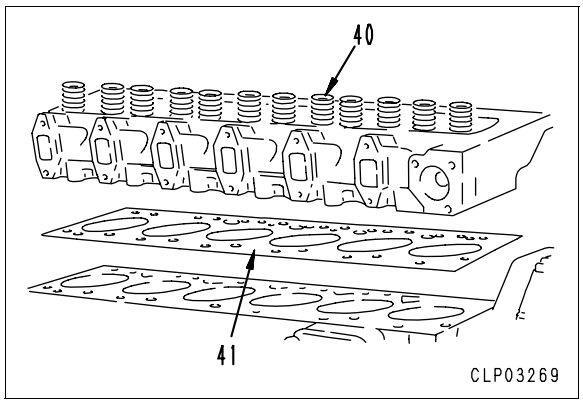
34. Remove push rod (39). ※16



35. Remove 26 mounting bolts from cylinder head assembly (40) and lift it off for disassembly. ※17

kg Cylinder head assembly: 52 kg

36. Remove cylinder head gasket (41). ※18



INSTALLATION

- Install in reverse order of removal.

※1

★ Coat the threads of the clamp bolt (used for securing the engine oil level gauge guide) with gasket sealant.

※2

N·m Air intake hose clamp bolt:
5.4 - 6.4 Nm (0.55 - 0.65 kgm)

※3

N·m Joint bolt:
19.6 - 29.4 Nm (2.0 - 3.0 kgm)

※4

★ Coat the threads of only one bolt on the head cover side of the fuel filter bracket with gasket sealant.

※5

N·m Sleeve nut:
24 ± 4 Nm (2.45 ± 0.41 kgm)

※6

N·m Air cleaner suction hose clamp bolt: 5.4 - 6.4 Nm (0.55 - 0.65 kgm)

※7

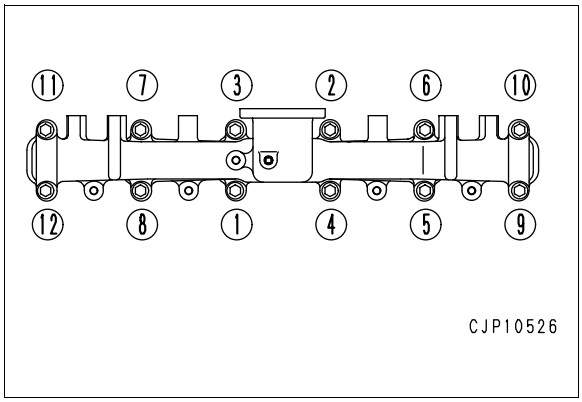
N·m Intake air hose clamp bolt:
5.4 - 6.4 Nm (0.55 - 0.65 kgm)

※8

★ Tighten the exhaust manifold mounting bolts in the sequence illustrated below.

N·m Exhaust manifold mounting bolt:

1st step: Tighten to 24 ± 4 Nm (2.45 ± 0.41 kgm) in the sequence of (1) through (12).
2nd step: Tighten to 43 ± 6 Nm (4.38 ± 0.61 kgm) in the sequence of (1) through (12).
3rd step: Tighten to 43 ± 6 Nm (4.38 ± 0.61 kgm) in the sequence of (1) through (4).



※9

★ Refer to the Inspection and Adjustment of Air Compressor Belt Tension section in the TESTING AND ADJUSTING chapter in this manual.

※10

N·m Radiator fan and fan pulley mounting bolt:
33 ± 5 Nm (3.37 ± 0.51 kgm)

※11

N·m Radiator inlet hose clamp bolt:
8.3 - 9.3 Nm (0.85 - 0.95 kgm)

N·m Heater hose clamp bolt:
8.83 - 14.7 Nm (0.9 - 1.5 kgm)

※12

N·m Spill tube bolt:
30 ± 5 Nm (3.06 ± 0.51 kgm)

※13

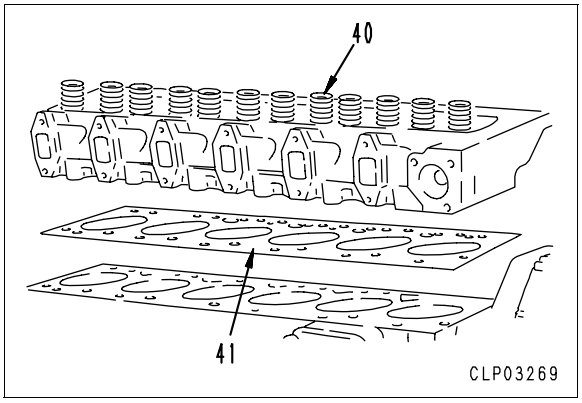
N·m Nozzle holder assembly:
60 ± 9 Nm (6.12 ± 0.92 kgm)

※14

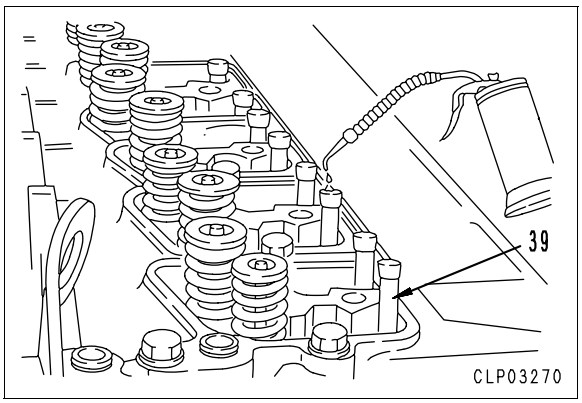
N·m Head cover mounting bolt:
24 ± 4 Nm (2.45 ± 0.41 kgm)

※15 ※16 ※17 ※18

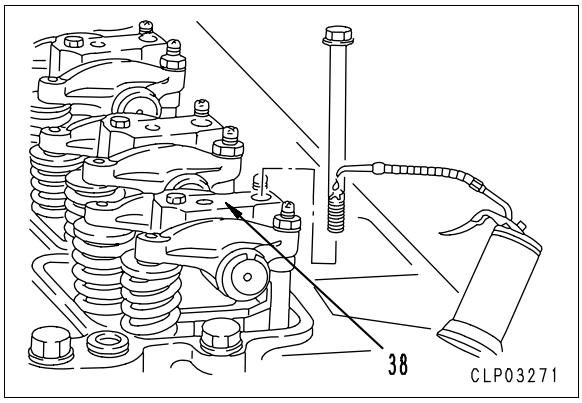
- Mount the rocker arm assembly and the cylinder head assembly in the following manner.
  - ★ Check that there is no dust or foreign matter stuck to the cylinder head installing face or inside the cylinders.
  1) Place cylinder head gasket (41) on the cylinder block.
     - ★ Check that the gasket is properly matched with the cylinder block holes.
  2) Lift cylinder head assembly (40) and place it on the cylinder block.



3) Assemble push rod (39).
   - ★ Coat the push rod surface with engine oil (15W-40).



4) Install rocker arm assembly (38) and tighten the bolts by hand.
   - ★ Check that the adjusting screw ball is well seated in the push rod socket.
   - ★ Coat the threads and seat surface of mounting bolts (8 mm and 12 mm) with engine oil (15W-40).

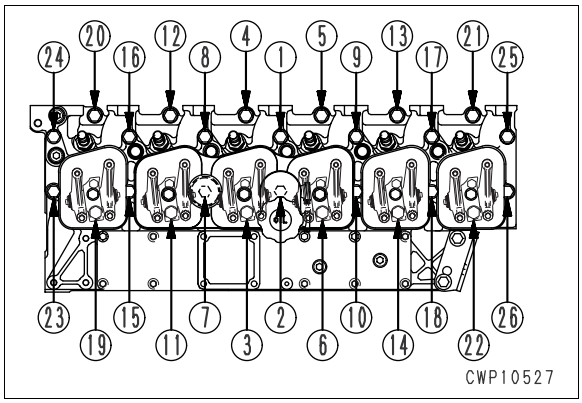


5) Tighten the cylinder head mounting bolts in the sequence as illustrated below.
   - ★ Coat the threads and seat surface of the mounting bolts with engine oil (15W-40).

N·m Cylinder head mounting bolt:

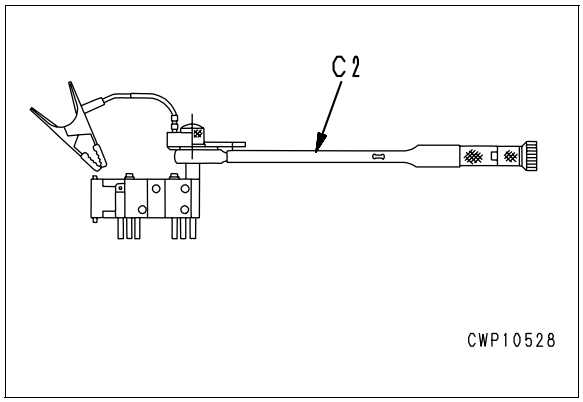
1st step: Tighten to 90 ± 5 Nm
(9.18 ± 0.51 kgm) in the sequence of (1) through (26).

2nd step: Tighten to 120 ± 5 Nm
(12.24 ± 0.51 kgm) in the sequence of (3), (6), (11), (14), (19) and (22).

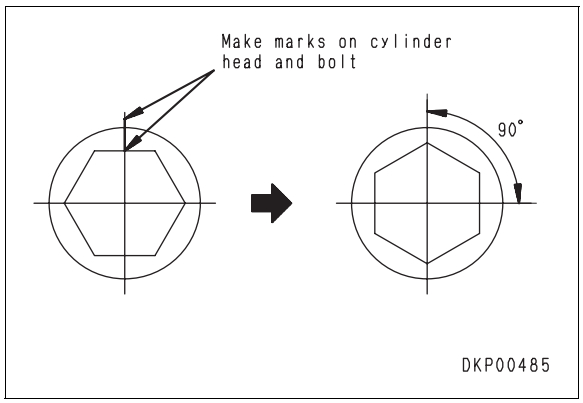


3rd step:

i) If Tool **C2** is used:
Using an angle tightening wrench (Tool **C2**), tighten the bolts by turning them 90° ± 5° in the sequence of (1) through (26).

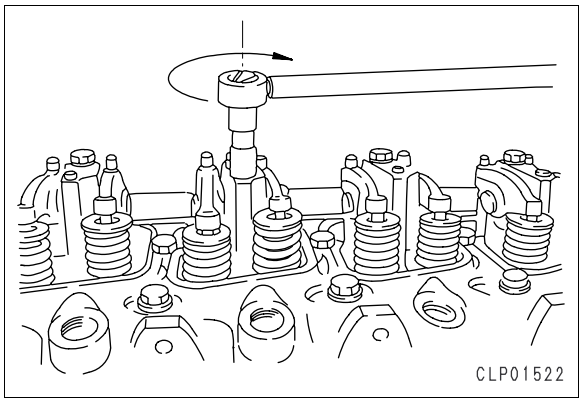


ii) If Tool **C2** is not used:
Put counter mark on the bolts and cylinder head with a felt-tip pen, and then tighten the bolts by turning them to 90° ± 5°.



6) Tighten the rocker arm assembly mounting bolts (8 mm).

N·m Rocker arm assembly mounting bolt:
24 ± 3 Nm (2.45 ± 0.31 kgm)



7) Adjust the valve clearance.
★ Refer to the Adjusting of Valve Clearance section in the TESTING AND ADJUSTING chapter of this manual.

- Refilling cooling water
Refill engine cooling water up to the specified level. Let the cooling water circulate to release any air pockets by starting the engine. Check the water level again.

REMOVAL AND INSTALLATION OF RADIATOR ASSEMBLY

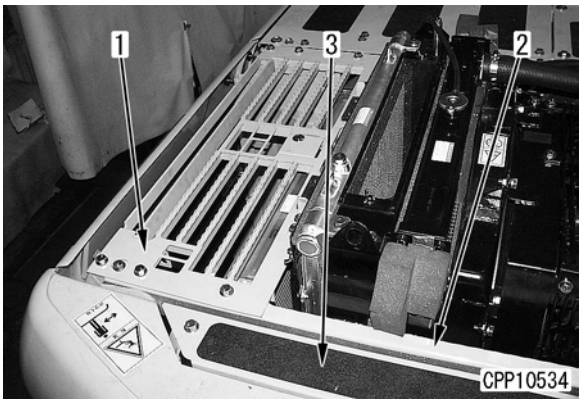
REMOVAL

1. Drain the engine cooling water.

   Engine cooling water: Approx. 22.8 **l**

2. Open up the engine hood.

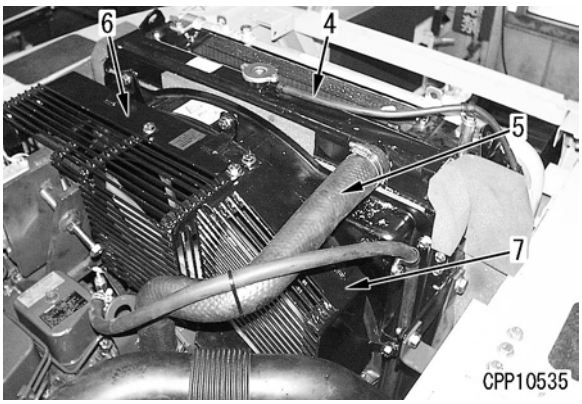
3. Remove covers (1), (2) and (3).



4. Disconnect reservoir tank hose (4).
   ★ Disconnect the hose at the radiator side.

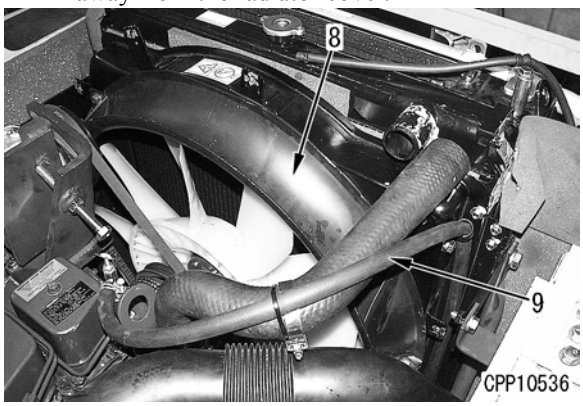
5. Disconnect two radiator hoses (5) on the upper and lower sides. ※1

6. Remove radiator fan guards (6) and (7).

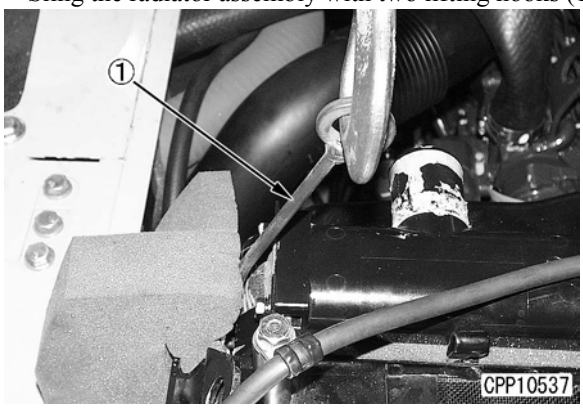


7. Remove bell mouth shroud (8). ※2

8. Remove the mounting clamp for heater hose (9).
   ★ After removing the clamp, keep the heater hose away from the radiator cover.



9. Sling the radiator assembly with two lifting hooks (1).



10. Remove the four radiator mounting bolts and lift out the radiator assembly (10) .

    kg Radiator assembly: 45 kg

INSTALLATION

- Install in reverse order of removal.

※1

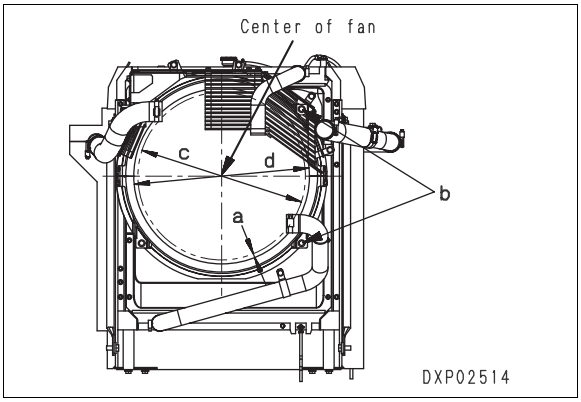
N·m Radiator hose clamp bolt:
8.3 - 9.3 Nm (0.85 - 0.95 kgm)

※2

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

★ Adjust clearance **a** between the radiator circumference and the bell mouth shroud, using oblong hole **b** for mounting the bell mouth shroud, 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 13 mm
  - Fan diameter c: ∅620
  - Shroud inner diameter d: ∅650



- Refilling engine cooling water
  Refill engine cooling water through the water filler port up to the specified level. Let the water circulate to release any air pockets by starting the engine. Check the water level again.

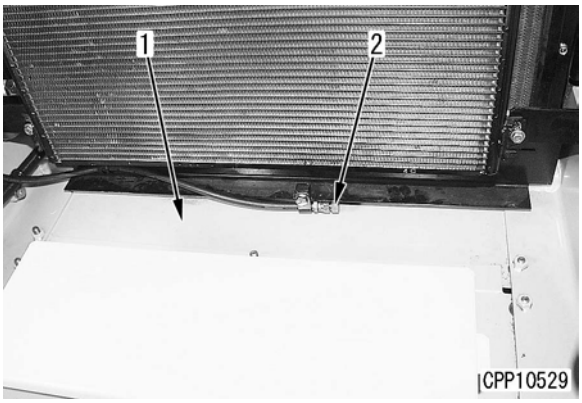
Engine cooling water: Approx. 22.8 **l**

REMOVAL AND INSTALLATION OF HYDRAULIC OIL COOLER ASSEMBLY

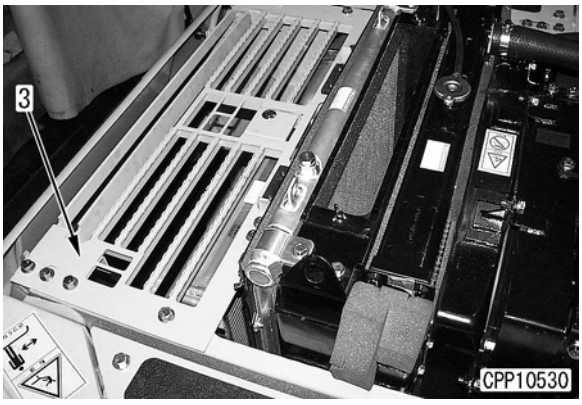
REMOVAL

1. Open up the engine hood.
2. Remove cover (1).
3. Remove hydraulic oil cooler drain plug (2) and drain the hydraulic oil.
   - ★ Before draining oil, unscrew the hydraulic tank cap to release the pressure inside the tank, and drain oil through the cooler hose.
   - ★ If a plug on top of the hydraulic oil cooler is loosened, draining oil becomes easier.

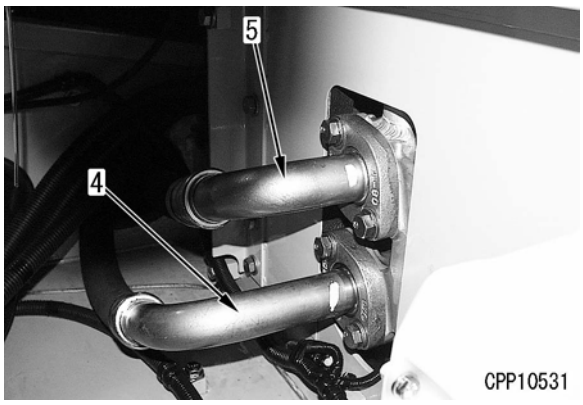
   Hydraulic oil cooler: Approx. 5.0 **l**



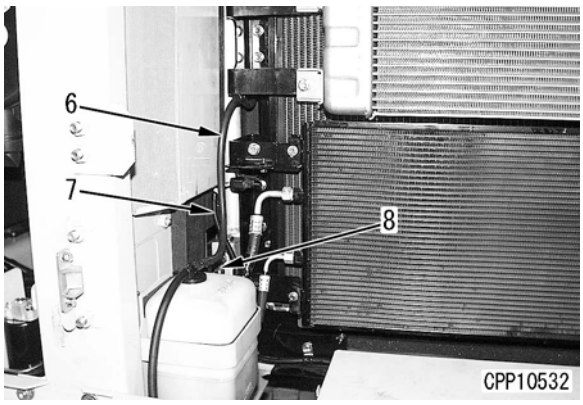
4. Remove cover (3).



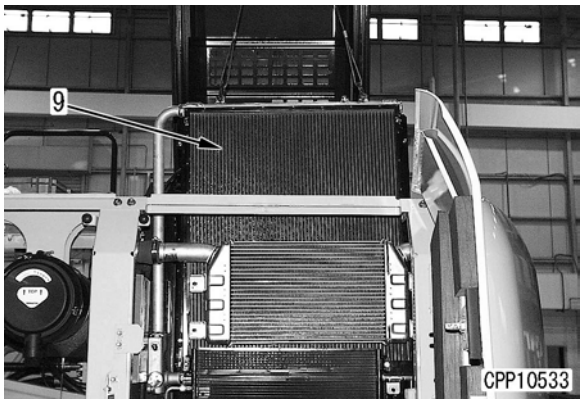
5. Detach control valve drain hose (4) and tank return hose (5).
   - ★ Plug the hoses to prevent oil from flowing out.



6. Remove the mounting clamp and put aside reservoir tank hose (6).
   - ★ When lifting out the hydraulic oil cooler, keep it where it will not interfere with other parts.
7. Remove the mounting clamp and disconnect A30 air conditioner ambient temperature sensor (7) from the condenser bracket.
8. Disconnect hydraulic oil cooler drain hose (8).



9. Remove four mounting bolts from hydraulic oil cooler assembly (9) and lift it out.
   ★ If bolts for the after-cooler and condenser mounting bracket are removed beforehand, removing the hydraulic oil cooler assembly becomes easier.



INSTALLATION

- Install in reverse order of removal.
- Refilling hydraulic oil (hydraulic tank)
  Refill hydraulic oil through oil filler port up to the specified level and circulate oil in the hydraulic system by starting the engine. Then check the oil level again.

Hydraulic oil cooler: Approx. 5.0 **l**

REMOVAL AND INSTALLATION OF ENGINE AND HYDRAULIC PUMP ASSEMBLIES

SPECIAL TOOLS

Mark	Part No.	Part Name	Necessity	Qty	Distinction*	Sketch
D	796-460-1210	Oil Stopper	■	1		

*Distinction between new and existing part.

REMOVAL

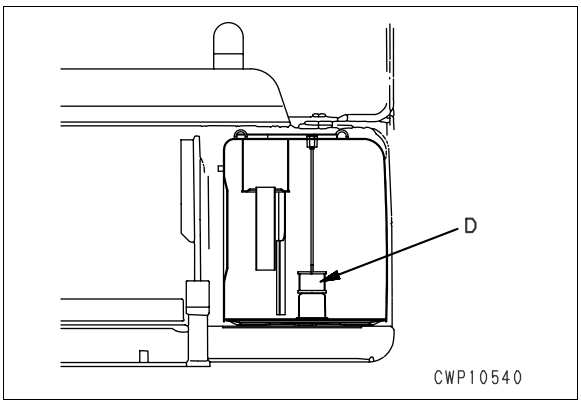
⚠ Lower the work equipment to the ground for safety and stop the engine. Disconnect the cable from the negative terminal (-) of the battery.

⚠ To release the internal pressure, gradually loosen the oil filler cap on the hydraulic tank.

★ Attach an identification tag to each pipe. This will avoid a possible mistake when reinstalling.

1. Remove the hydraulic tank strainer and stop the flow of oil, using Tool **D**.
   ★ When not using tool **D**, remove the drain plug to drain oil from the hydraulic tank and piping.

   Hydraulic tank: Approx. 240 **l**



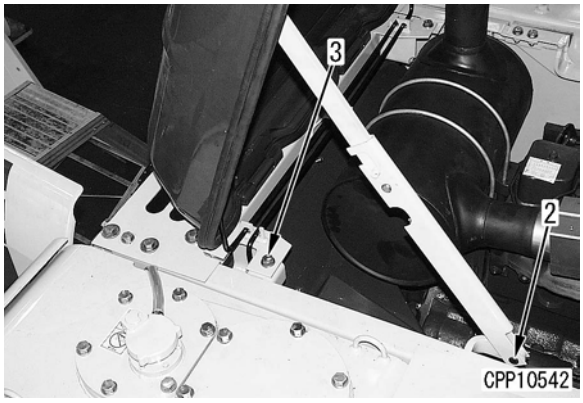
2. Drain engine cooling water.

   Engine cooling water: Approx. 22.8 **l**

3. Lift up engine hood (1).

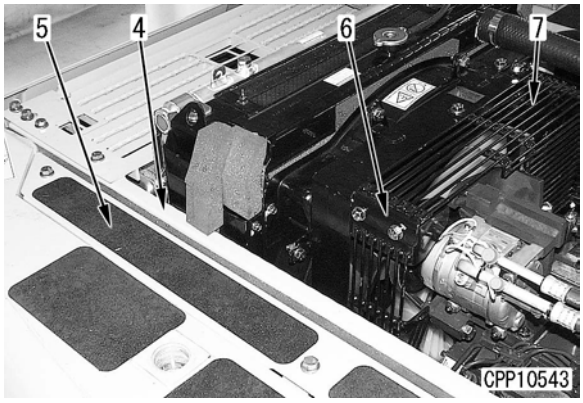
⚠ Support the engine hood with an appropriate strap and lifting device.

4. Remove pin (2) and mounting bolt (3). Lift off the hood and set it aside.



5. Remove covers (4) and (5).

6. Remove radiator fan guards (6) and (7).



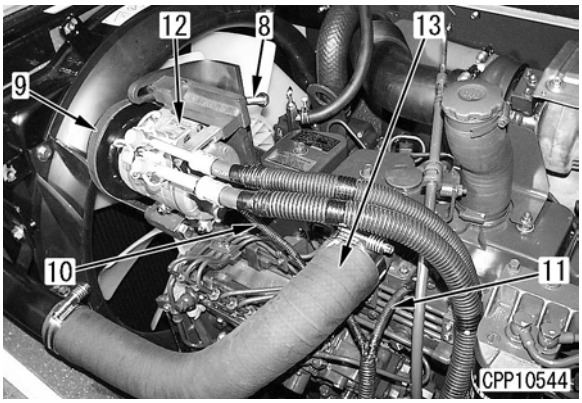
7. Loosen air compressor belt tension adjusting bolt (8) and remove belt (9).

8. Disconnect E06 air conditioner wiring connector (10) and E01 ribbon heater wiring connector (11).

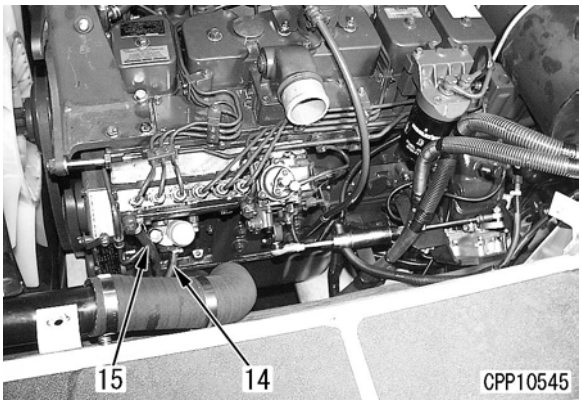
9. Displace air compressor assembly (12). ※1

   ★ Remove air compressor assembly (12) in one piece with the bracket, and set them aside near the counter weight.

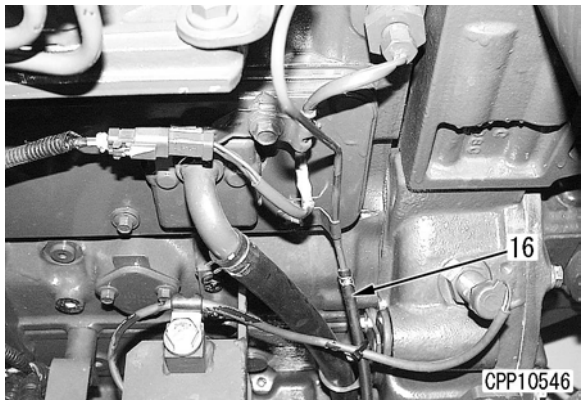
10. Disconnect air intake hose (13). ※2



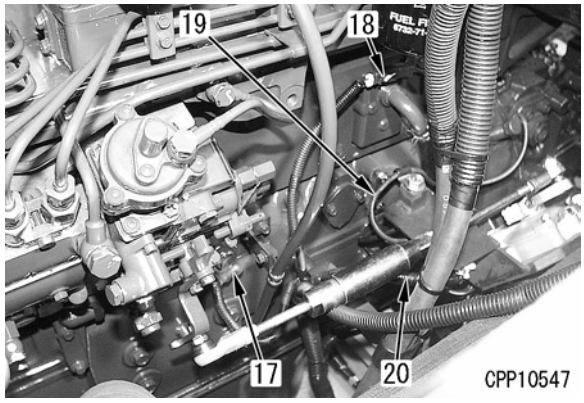
11. Disconnect fuel inlet hose (14) and fuel outlet hose (15). ※3



12. Disconnect fuel return hose (16).

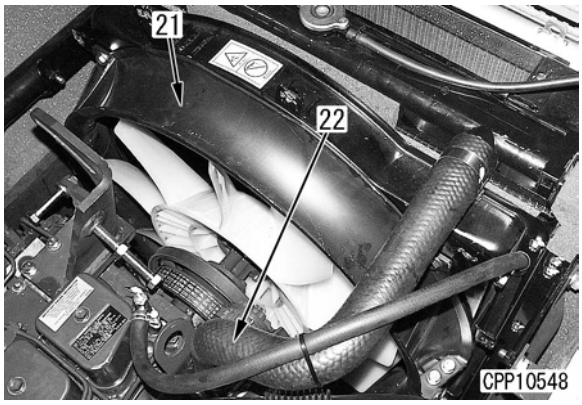


13. Disconnect engine wiring connectors at the following five points.
   - (17): E02 (Engine oil temperature switch)
   - (18): E05 (Engine cooling water temperature sensor)
   - (19): E04 (Engine revolution sensor)
   - (20): E10 (Governor and potentiometer)
     E11 (Governor and motor)

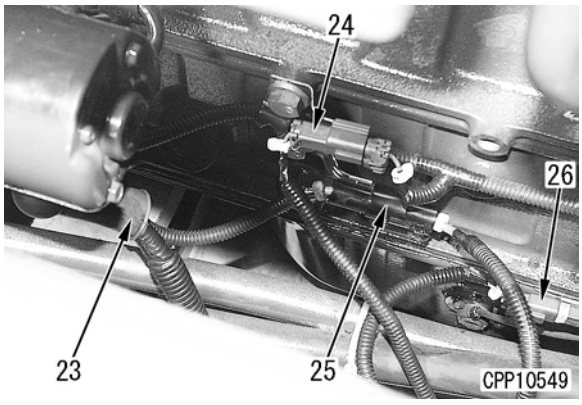


14. Remove bell mouth shroud (21).

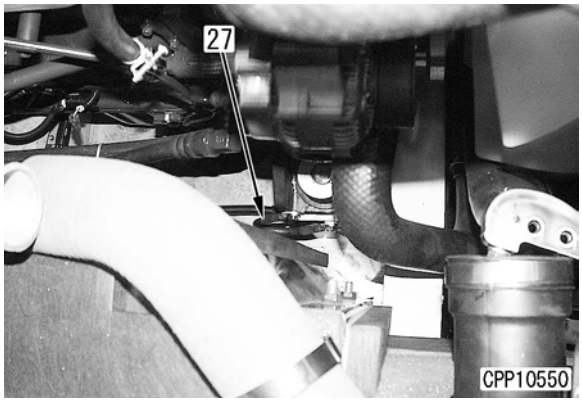
15. Disconnect two radiator hoses (22) on the upper and lower sides. ※4



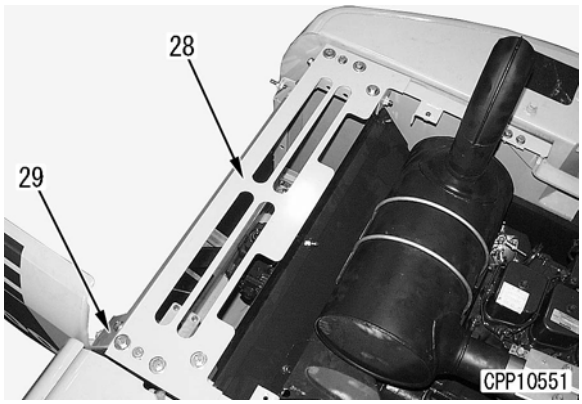
16. Disconnect engine starting motor wiring (23) and connectors (24), (25) and (26).
    - (23): Engine starting motor terminal B (red)
    - (24): E08 (Intermediate connector)
    - (25): T13 (Engine starting motor terminal C)
    - (26): E03 (Engine oil level sensor)



17. Disconnect engine ground (27).

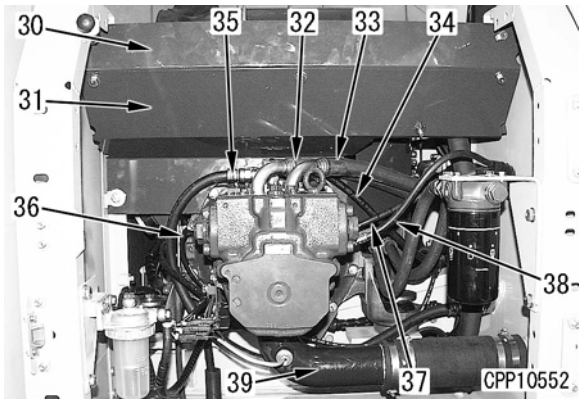


18. Remove cover (28) and plate (29).

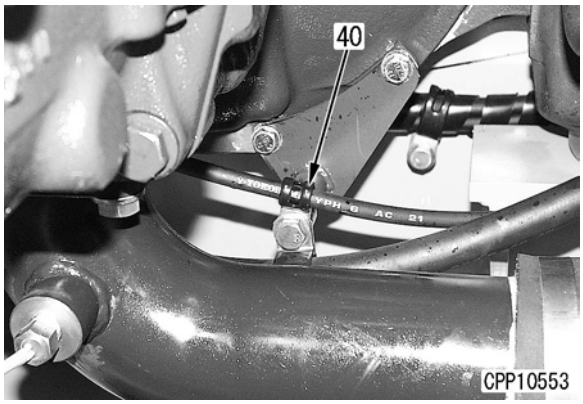


19. Remove covers (30) and (31).

20. Disconnect eight hoses. ※5
    - (32): Front pump discharging port hose
    - (33): Rear pump discharging port hose
    - (34): Pump pressure input port hose
    - (35): Drain port hose
    - (36): EPC source pressure port hose (color band, yellow)
    - (37): Load pressure input port hose (color band, red)
    - (38): Load pressure input port hose
    - (39): Suction port hose

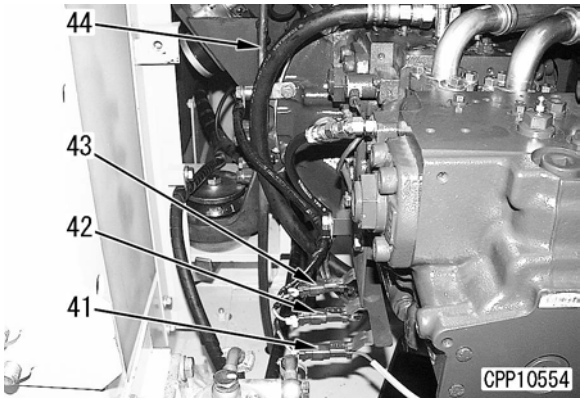


21. Remove clamp (40).



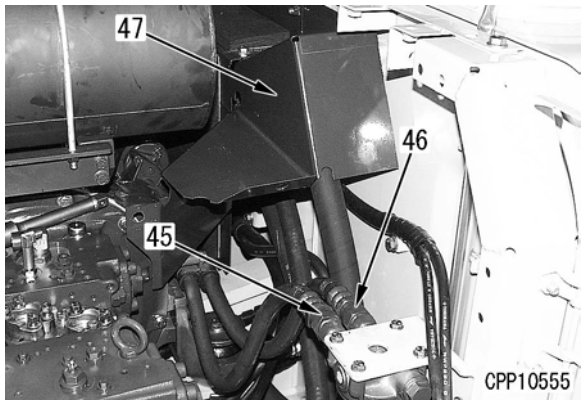
22. Disconnect the pump wiring connectors at the following three points.
    - (41): A61 (Hydraulic oil temperature sensor)
      Color band, white
    - (42): V21 (PC-EPC solenoid valve)
      Color band, white
    - (43): V22 (LS-EPC solenoid valve)
      Color band, red

23. Disconnect exhaust muffler drain tube (44).



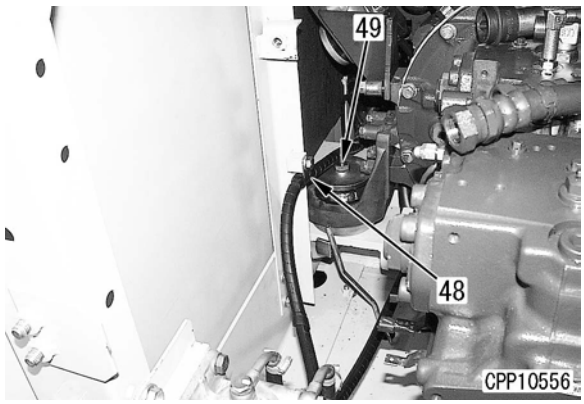
24. Disconnect engine oil filter outlet hose (45) and engine oil filter inlet hose (46).

25. Remove cover (47).



26. Remove water separator wiring clamp (48).

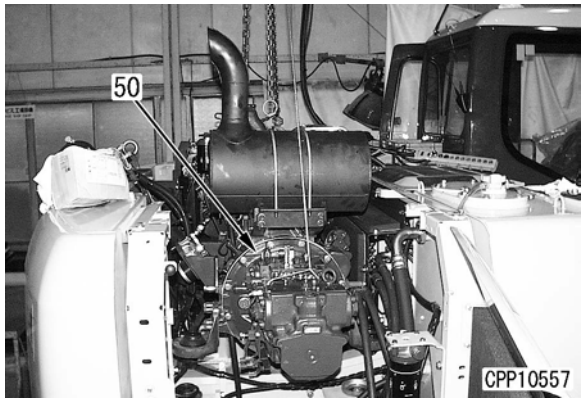
27. Remove four engine mounting bolts (49) at the front and rear. ※6



★ Check that there is no wiring or piping still connected.

28. Lift out engine and hydraulic pump assembly (50).

kg Engine and hydraulic pump assembly: 770 kg



INSTALLATION

- Install in reverse order of removal.

※1

★ Refer to the Inspection and Adjustment of Air Compressor Belt Tension section in the TESTING AND ADJUSTING chapter of this manual.

※2

N·m Air intake hose clamp screw:
5.4 - 6.4 Nm (0.55 - 0.65 kgm)

※3

N·m Fuel inlet hose clamp screw:
29.4 ± 4.9 Nm (3.0 ± 0.5 kgm)

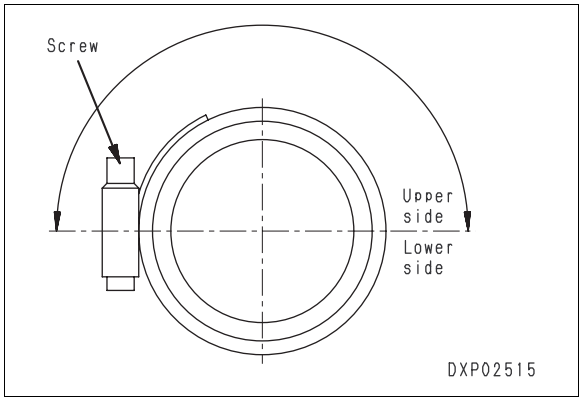
※4

N·m Radiator hose clamp screw:
8.3 - 9.3 Nm (0.85 - 0.95 kgm)

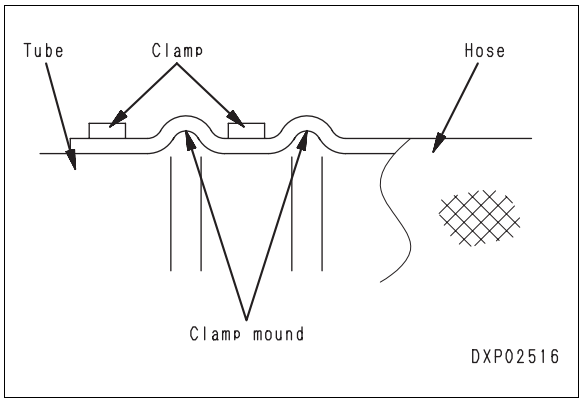
※5

★ After tightening the suction hose clamp screw, check that the screw is in the position as illustrated below.

N·m Suction hose clamp screw:
8.8 ± 0.5 Nm (90 ± 5 kgm)



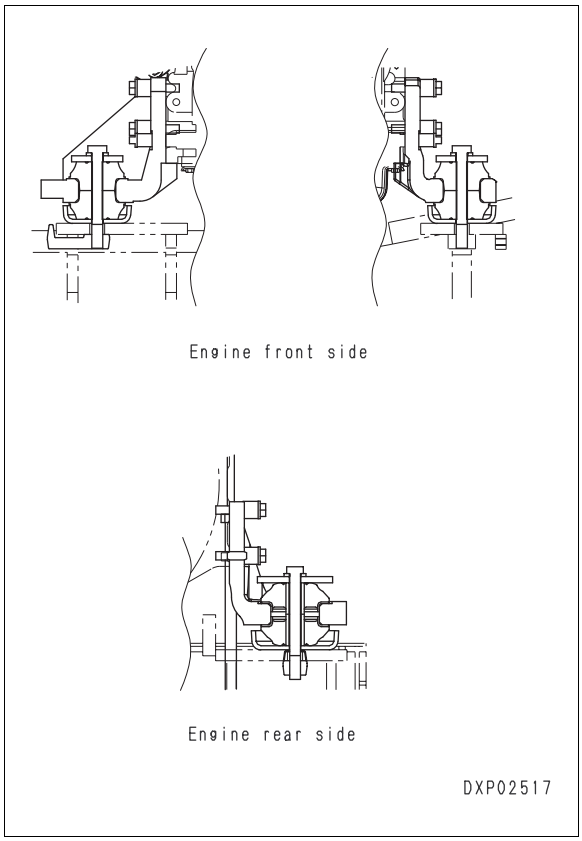
★ Install the hose clamp and tighten the clamp screw as shown in the diagram below.



※6

★ The engine mounting rubber pads differ in shape at the front and rear. Place them as illustrated below, and install the engine and hydraulic pump assembly.

N·m Engine mounting bolt:
245 - 308.7 Nm (25 - 31.5 kgm)



- Refilling engine cooling water
  Refill engine cooling water through the water filler port up to the specified level.

  Engine cooling water: Approx. 22.8 **l**

- Refilling hydraulic oil (hydraulic tank)
  Refill hydraulic oil through oil filler port up to the specified level.

  Hydraulic tank: Approx. 240 **l**

★ Let the water circulate to release any air pockets by starting the engine. Check the water level again.

★ Circulate oil in the hydraulic system by starting the engine. Then check the oil level again.

- Air bleeding
  Refer to the Air Bleeding of Various Part section in the TESTING AND ADJUSTING chapter of this manual.

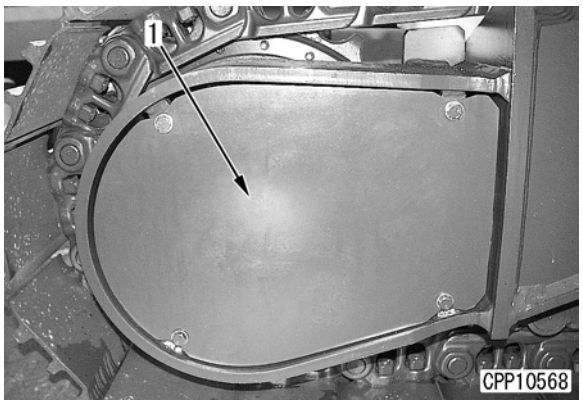
REMOVAL AND INSTALLATION OF FINAL DRIVE ASSEMBLY

REMOVAL

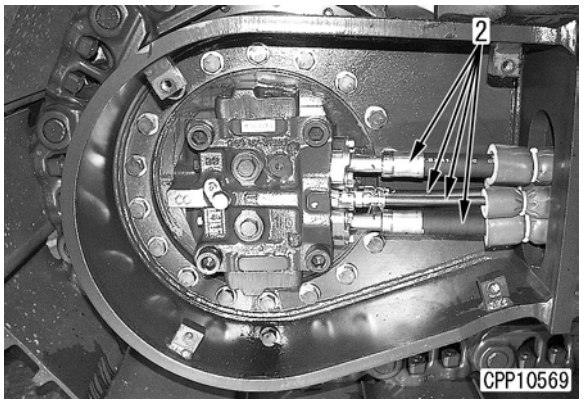
1. Remove the sprocket, refer to the Removing Sprocket section in this manual.

⚠ Lower the work equipment to the ground for safety. Stop the engine and loosen the oil filler cap on the hydraulic tank to release pressure inside.

2. Remove cover (1).



3. Disconnect four travel motor hoses (2).

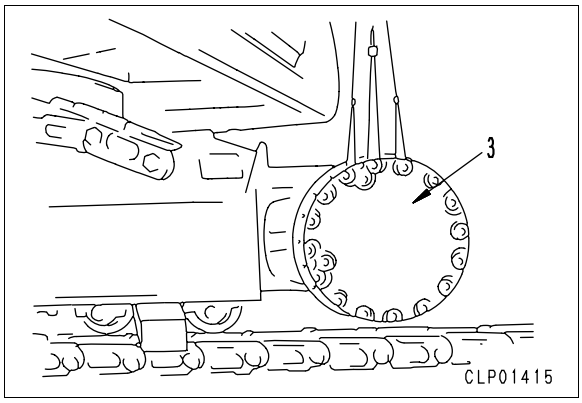


4. Remove the 18 mounting bolts from final drive assembly (3) and lift if off to remove.

※1

★ Be careful. Do not damage the face of the fitting seal at the base of the hose.
★ When lifting off the final drive assembly, do not use a tapped hole for lifting the cover.

kg Final drive assembly: 330 kg



INSTALLATION

- Install in reverse order of removal.

※1

N·m Final drive assembly mounting bolt: 245 - 309 Nm (25 - 31 kgm)

- Refilling hydraulic oil
  Refill hydraulic oil through the oil filler port to the specified level, and let the oil circulate in the hydraulic system by starting the engine. Then check the oil level again.
- Air bleeding
  Refer to the Air Bleeding of Variuos Part section in the TESTING AND ADJUSTING chapter of this manual.

DISASSEMBLY AND ASSEMBLY OF FINAL DRIVE ASSEMBLY

SPECIAL TOOLS

Mark		Part No.	Part Name	Necessity	Qty	Distinction*	Sketch
F	1	796-427-1200	Wrench	■	1		
	2	796T-427-1220	Push tool	■	1		○
		790-101-2510	Block	■	1		
		792-104-3940	Bolt	■	2		
		01580-11613	Nut	■	2		
		01643-31645	Washer	■	2		
		01643-32060	Washer	■	2		
		790-105-2100	Jack	■	1		
		790-101-1102	Pump	■	1		
	3	790-331-1110	Wrench	■	1		
	4	791-545-1510	Installer	■	1		

*Distinction between new and existing part.

DISASSEMBLY

1. Draining Oil

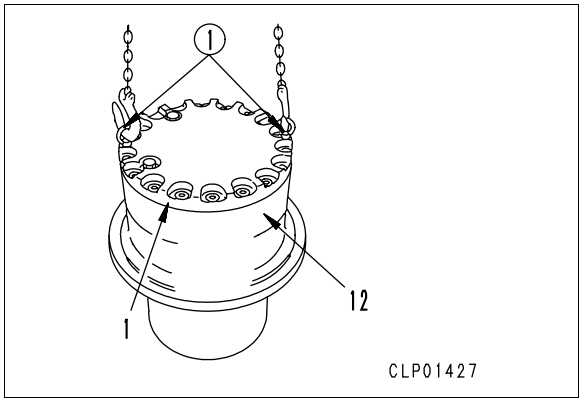
Remove drain plug and drain oil from final drive case.

Final drive case: Approx. 4.7 **l**

2. Cover

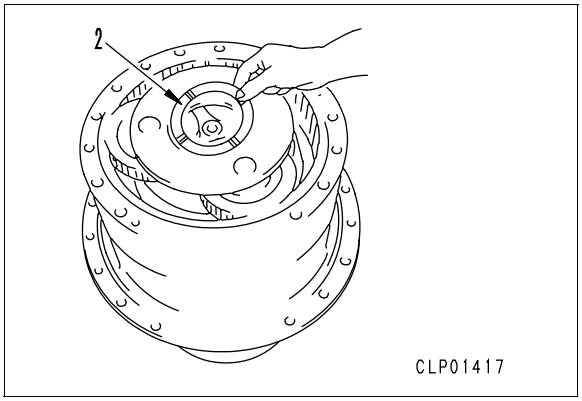
Remove mounting bolts, then remove cover (1) using eyebolts b.

★ When raising ring gear (12) and cover (1) as one unit, tap the ring gear with a wooden hammer to remove the ring gear.



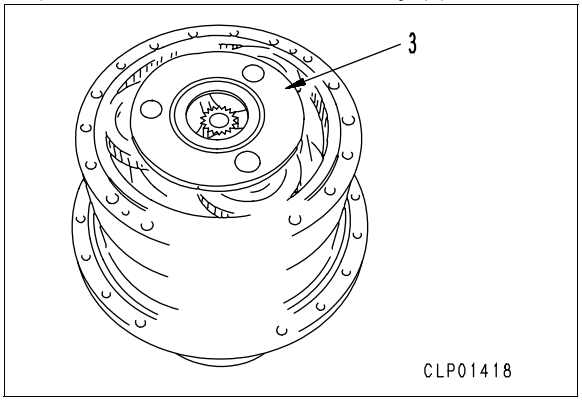
3. Spacer

Remove spacer (2).

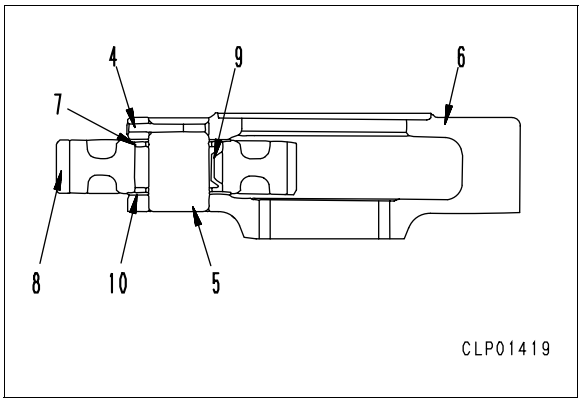


4. No. 1 carrier assembly

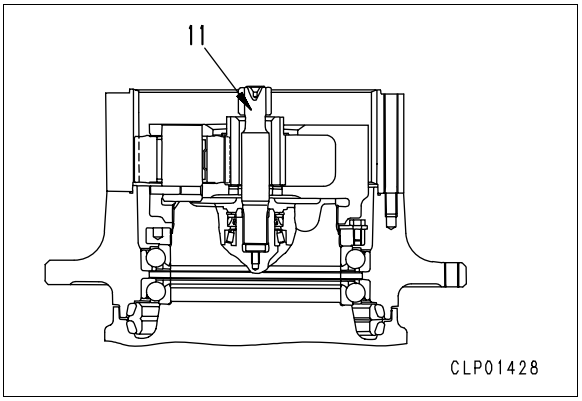
1) Remove No. 1 carrier assembly (3).



2) Disassemble No. 1 carrier assembly as follows.
   i) Push in pin (4) and pull out shaft (5) from carrier (6).
      ★ After removing the shaft, remove pin (4).
   ii) Remove thrust washer (7), gear (8), bearing (9), and thrust washer (10).



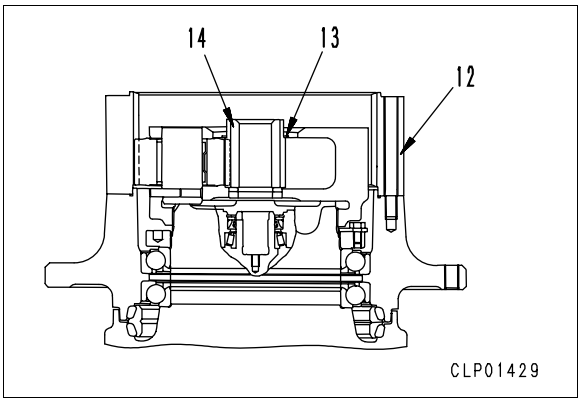
5. No.1 sun gear shaft
Remove No. 1 sun gear shaft (11).



6. Ring gear
Remove ring gear (12).

7. Thrust washer
Remove thrust washer (13).

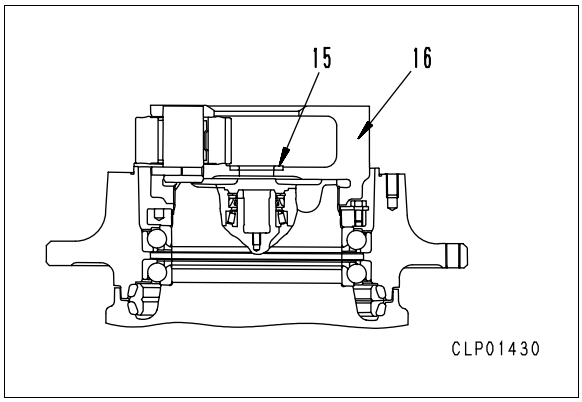
8. No. 2 sun gear
Remove No. 2 sun gear (14).



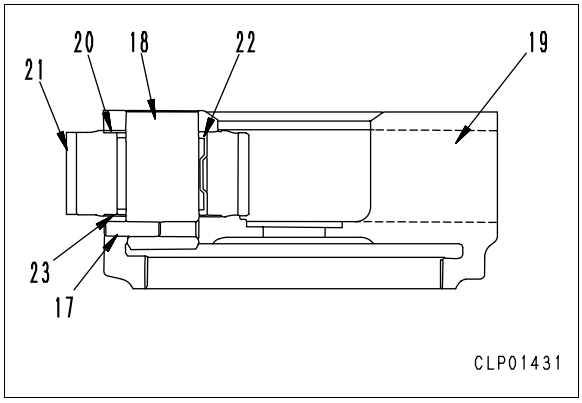
9. Thrust washer
Remove thrust washer (15).

10. No. 2 carrier assembly

1) Remove No. 2 carrier assembly (16)

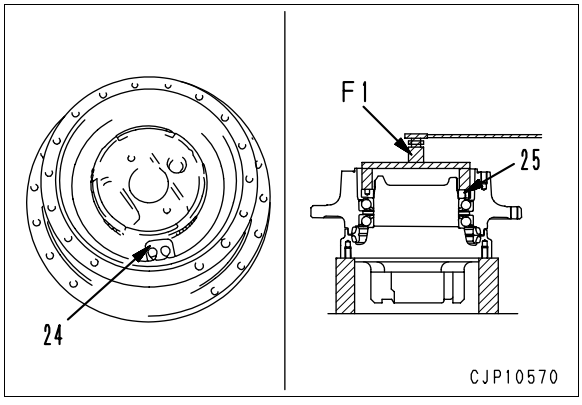


2) Disassemble No. 2 carrier assembly as follows.
   i) Push in pin (17) and pull out shaft (18) from carrier (19).
      ★ After removing the shaft, remove pin (17).
   ii) Remove thrust washer (20), gear (21), bearing (22), and thrust washer (23).



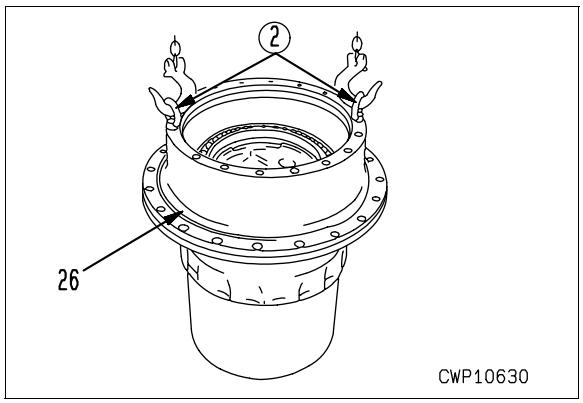
11. Nut

1) Remove lock plate (24).
2) Use tool F1 and remove nut (25).

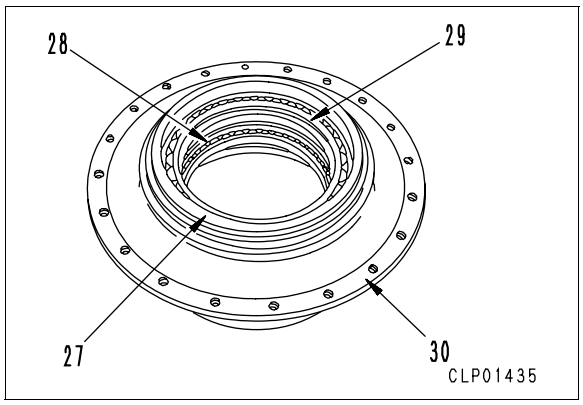


12. Hub assembly

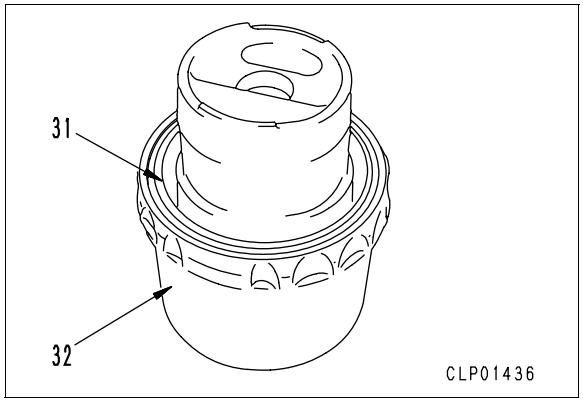
1) Using eyebolts c, remove hub assembly (26) from travel motor.



2) Disassemble hub assembly as follows.
   i) Remove floating seal (27).
   ii) Remove bearing (28) and (29) from hub (30).
   ★ When removing bearing (28), do not hit the resin retainer of the bearing.



3) Remove floating seal (31) from travel motor (32).

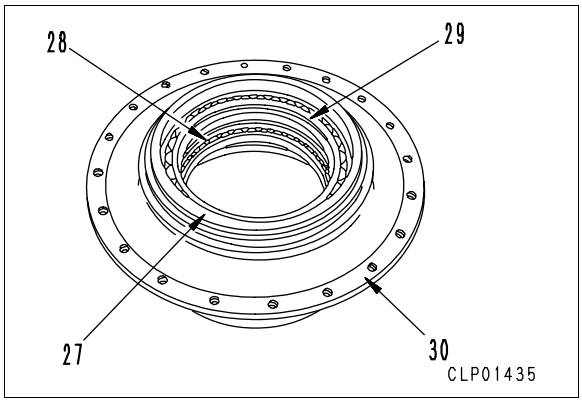


ASSEMBLY

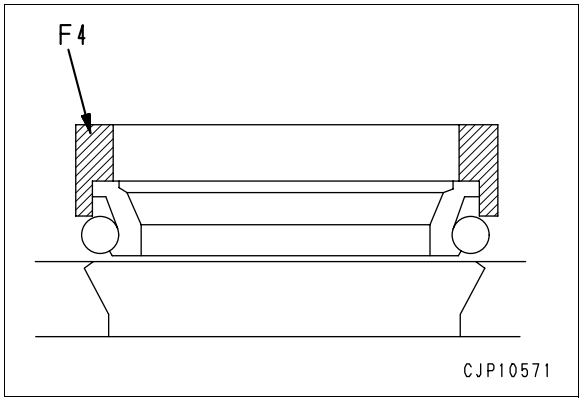
★ Clean all parts and check for dirt or damage.
Coat the sliding surfaces of all parts with engine oil before installing.

1. Hub assembly

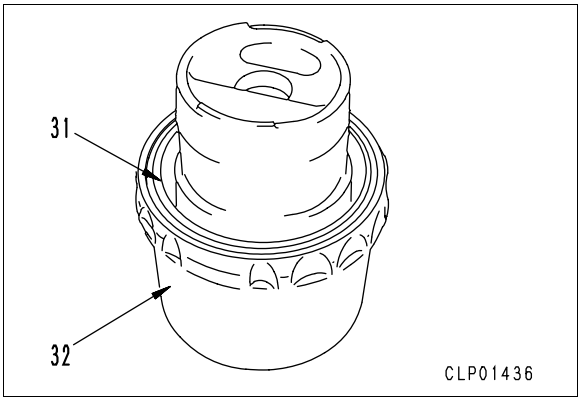
1) Using push tool, press fit bearings (28) and (29) to hub (30).



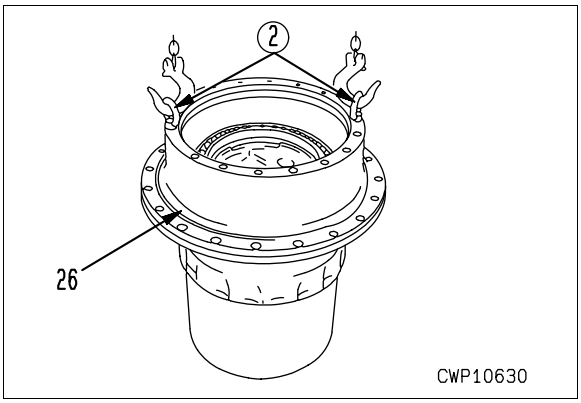
2) Using tool **F4**, install floating seal (26).
   ★ Remove all oil and grease from the O-ring and O-ring contact surface. Dry the parts before installing the floating seal.
   ★ After installing the floating seal, check that the angle of the floating seal is within 1 mm.
   ★ After installing the floating seal, coat the sliding surface thinly with engine oil.



3) Using tool **F4**, install floating seal (31) onto travel motor (32).
   ★ The procedure for installation is the same as in Step 2. above.

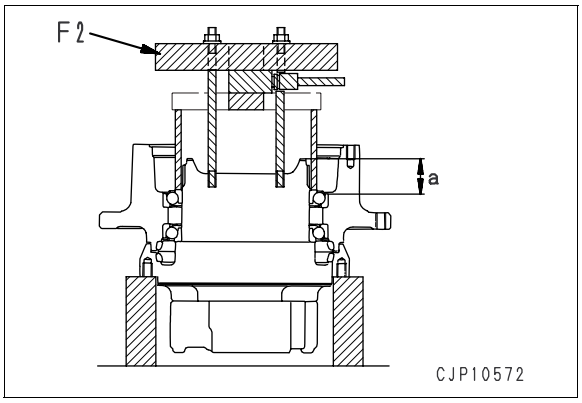


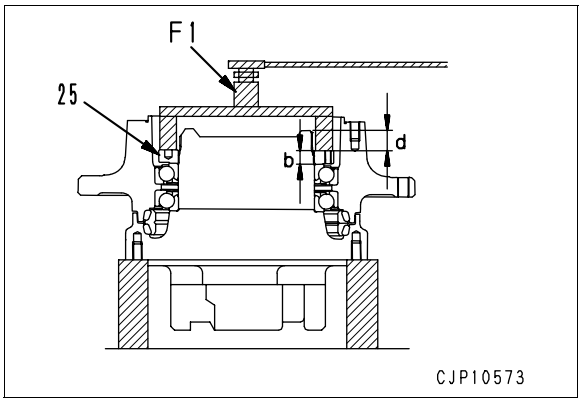
4) Using eyebolts c, set hub assembly (26) onto the travel motor. Use the push tool and tap to press fit the bearing.



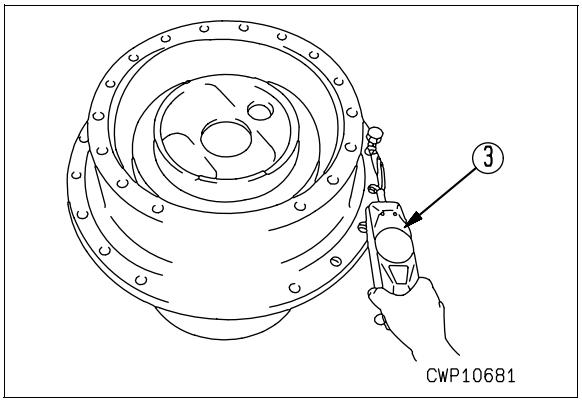
2. Nut

1) Install nut as follows.
   i) Using tool **F2**, push bearing inner race.
      ★ Do not heat the bearing with a burner, or directly push or hit the resin retainer.
      ★ Pushing force:
      8.8 - 12.7 kN (0.9 - 1.3 tons)
      ★ Rotate the hub 2 - 3 times before applying the pushing force to the bearing inner race.
   ii) Measure dimension **a** in the condition in Step 1) above.
   iii) Measure thickness **b** of the nut itself.
   iv) Calculate **a - b = c.**
   v) Using tool **F1**, tighten nut (25) to a point where dimension **d** is $\mathbf{c}^{0}_{-0.1}$.

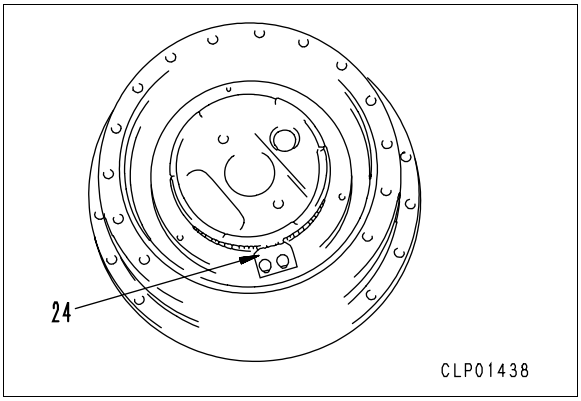




   vi) Using push-pull scale d, measure tangential force in the direction of rotation of the hub in relation to the motor case.
      ★ Tangential force: **Max. 294 N {30 kg}**
      ★ The tangential force is the maximum force when starting rotation.



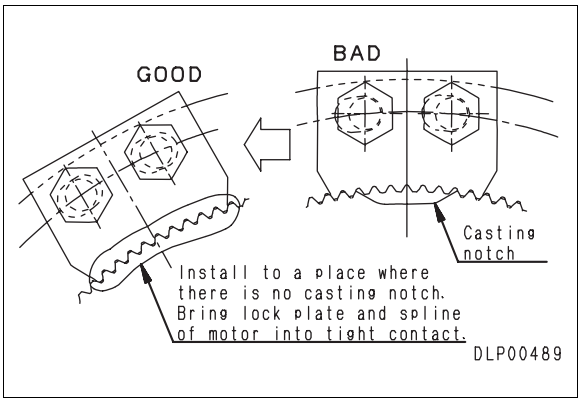
vii) Install lock plate (24).



★ Install the lock plate as shown in the diagram.

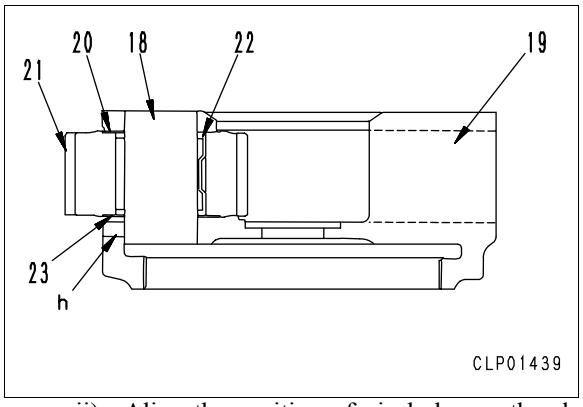
Thread of mounting bolt:
Thread tightener (LT-2)

★ Do no coat the tap portion of the nut with thread tightener (LT-2).

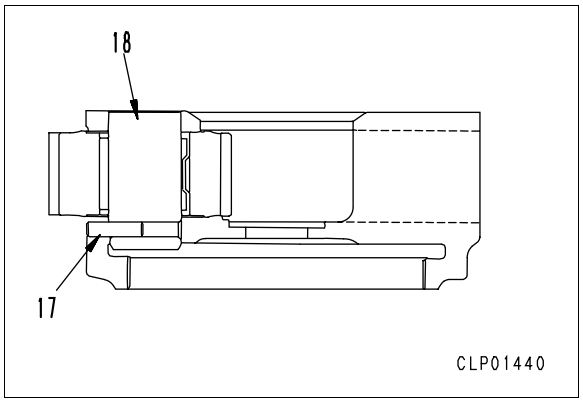


3. No. 2 carrier assembly

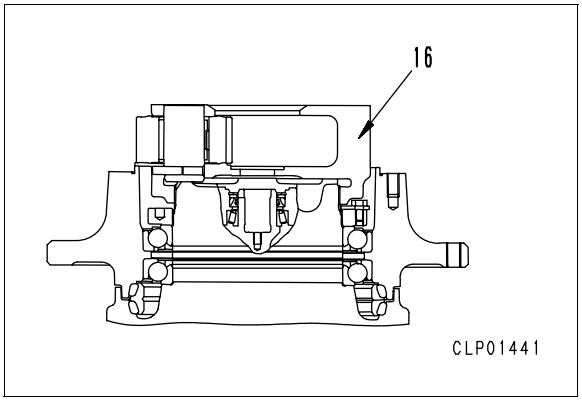
1) Assemble No. 2 carrier assembly as follows.
   ★ Replace thrust washers (20), (23) and pin (17) with new ones.
   ★ There are remains of caulking when the pin is inserted at the end face of hole **h** at the side of the carrier. Remove the caulked metal from the inside diameter of the hole before starting to assemble.
   i) Assemble bearing (22) to gear (21), fit top and bottom thrust washers (20) and (23), and set gear assembly in carrier (19).



   ii) Align the position of pin holes on the shaft and carrier, then tap with a plastic hammer to install shaft (18).
      ★ When installing the shaft, rotate the planetary gear. Be careful not to damage the thrust washer.
   iii) Insert pin (17).
      ★ After inserting the pin, caulk the pin portion of the carrier.
   ★ After assembling the carrier assembly, check that gear (21) rotates smoothly.



2) Install No. 2 carrier assembly (16).
   ★ Align the position so that the three tips of the gear shafts of the carrier assembly (16) enter the three hollows in the end face of the motor case, then install.

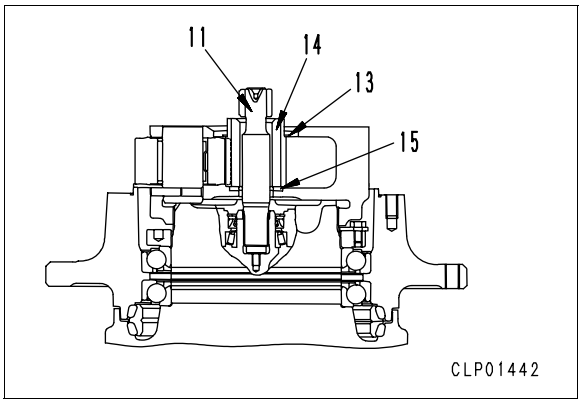


4. Thrust washer
Install thrust washer (15).

5. No. 2 sun gear
Install No. 2 sun gear (14).

6. Thrust washer
Install thrust washer (13).

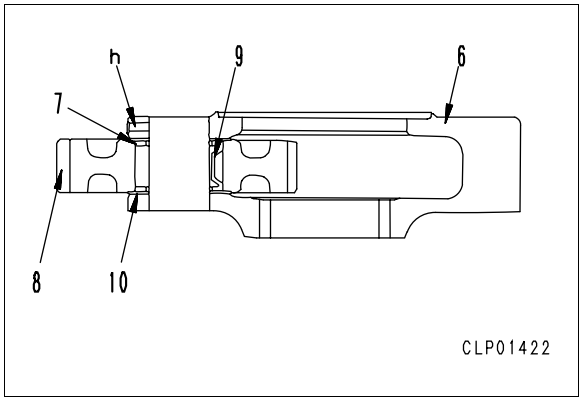
7. No. 1 sun gear shaft
Install No. 1 sun gear shaft (11).



8. No. 1 carrier assembly

1) No. 1 carrier assembly as follows.
   ★ Replace thrust washers (7), (10) and pin (4) with new ones.
   ★ There are remains of caulking when the pin is inserted at the end face of hole **h** at the side of the carrier. Remove the caulked metal from the inside diameter of the hole before starting to assemble.

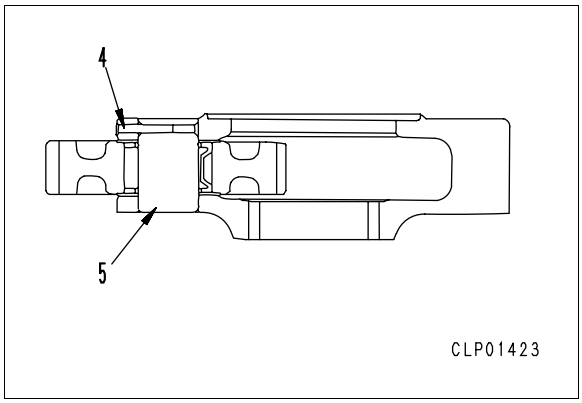
i) Assemble bearing (9) to gear (8), fit top and bottom thrust washers (7) and (10), and set gear assembly in carrier (6).



ii) Align the position of pin holes on the shaft and carrier, then tap with a plastic hammer to install shaft (5).
   ★ When installing the shaft, rotate the planetary gear. Be careful not to damage the thrust washer.

iii) Insert pin (4).
   ★ After inserting the pin, caulk the pin portion of the carrier.

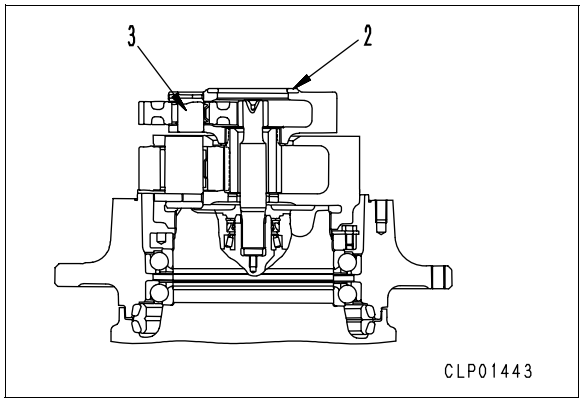
★ After assembling the carrier assembly, check that gear (8) rotates smoothly.



2) Install No. 1 carrier assembly (3).

9. Spacer

Install spacer (2).

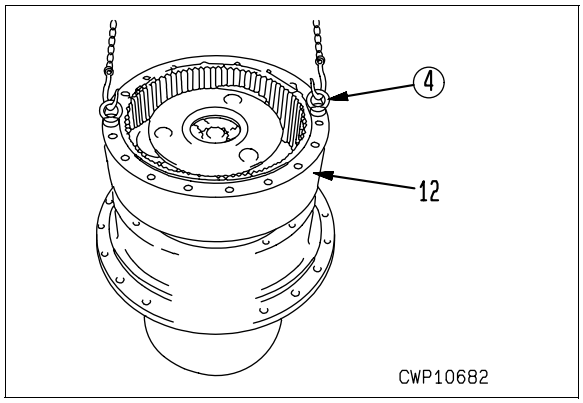


10. Ring gear

Fit O-ring to hub end. Then using eyebolts e, align the position of the bolt holes on hub and ring gear (12), and install.

★ Remove all grease and oil from the mating surface of the ring gear and hub.

★ Do not put any gasket sealant on the mating surface of the ring gear and hub under any circumstances.

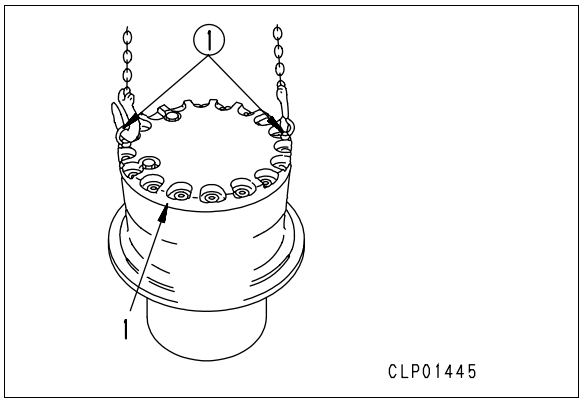


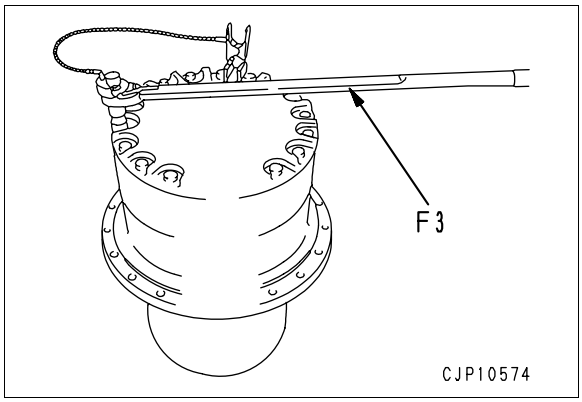
11. Cover

Using eyebolts b, fit cover (1), then tighten mounting bolts with angle tightening wrench F3.

Mounting surface of cover:
Gasket sealant (LG-6)

Mounting bolt:
1st pass: **98 Nm {10 kgm}**
2nd pass: **Turn 80 - 90°**





12. Refilling with oil

Tighten drain plug and add engine oil through oil filler.

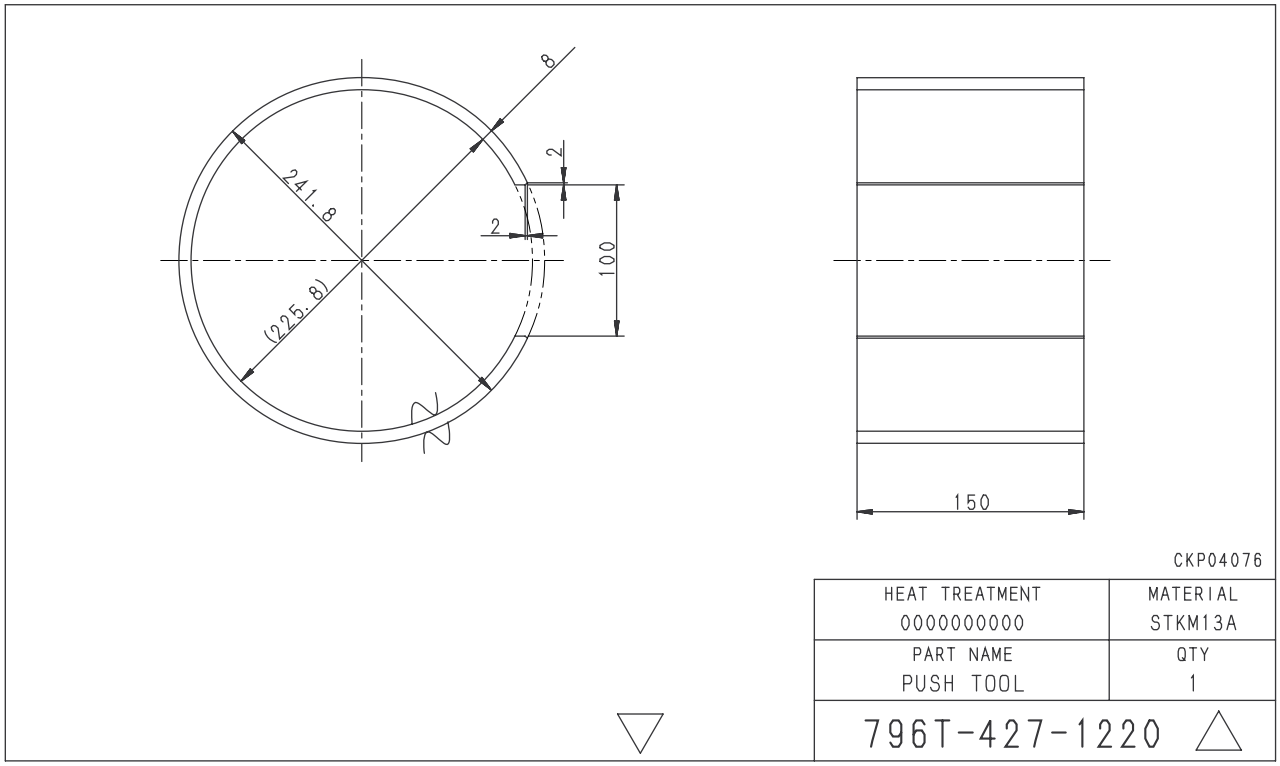
Final drive case: **Approx. 4.7 l**

★ Do a final check of the oil level at the determined position after installing the final drive assembly to the chassis.

SKETCHES OF SPECIAL TOOLS

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

F2 Push Tool



REMOVAL AND INSTALLATION OF SWING MOTOR AND SWING MACHINERY ASSEMBLY

REMOVAL

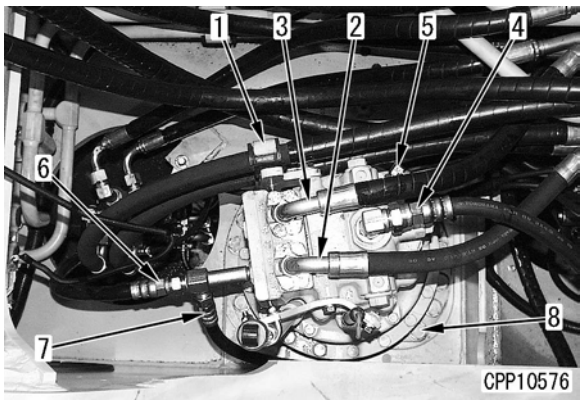
⚠ Release the residual pressure in the hydraulic circuit. Refer to the Release of Remaining Pressure in Hydraulic Circuit section in the TESTING AND ADJUSTING chapter of this manual.

⚠ Lower the work equipment to the ground for safety. After stopping the engine, loosen the oil filler cap on the fuel tank to release the residual pressure inside the tank and move the safety lock lever to the LOCK position.

1. Remove the mounting bracket for hose clamp (1).
   ★ Keep the removed mounting bracket away from the swing motor and swing machinery assembly.

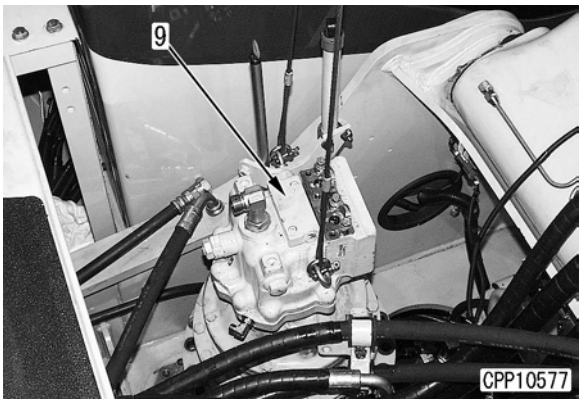
2. Disconnect six swing motor hoses (2) through (7).
   - (2): Between the swing motor and control valve (MA port)
   - (3): Between the swing motor and control valve (MB port)
   - (4): Suction hose (S port)
   - (5): Pilot hose for relieving swing brake (B port)
   - (6): Between the drain hose and swing motor, and swivel joint (T port)
   - (7): Between drain hose and swing motor, and hydraulic tank (T port)

3. Remove 12 mounting bolts (8). ※1



4. Lift off swing motor and swing machinery assembly (9) to remove.
   ★ When lifting off the swing motor and swing machinery assembly for removal, do so slowly so that the hoses and other parts may not be damaged.

   kg Swing motor and swing machinery assembly: 230 kg



INSTALLATION

- Install in reverse order of removal.

※1

N·m Swing motor and swing machinery assembly mounting bolt:
490 - 608 Nm (50 - 62 kgm)

- Refilling hydraulic oil
  Refill hydraulic oil through the oil filler port to the specified level. Let the oil circulate in the hydraulic system by starting the engine. Then check the oil level again.
- Air bleeding
  Refer to the Air Bleeding of Various Parts section in the TESTING AND ADJUSTING chapter of this manual.

DISASSEMBLY AND ASSEMBLY OF SWING MOTOR AND SWING MACHINERY ASSEMBLY

SPECIAL TOOLS

Mark		Part No.	Part Name	Necessity	Qty	Distinction*	Sketch
G	1	796-426-1120	Push tool	■	1		
	2	790-101-5401	Push tool kit	■	1		
		• 790-101-5471	• Plate		1		
		• 790-101-5421	• Grip		1		
		• 01010-51240	• Bolt		1		

*Distinction between new and existing part.

DISASSEMBLY

1. Draining oil

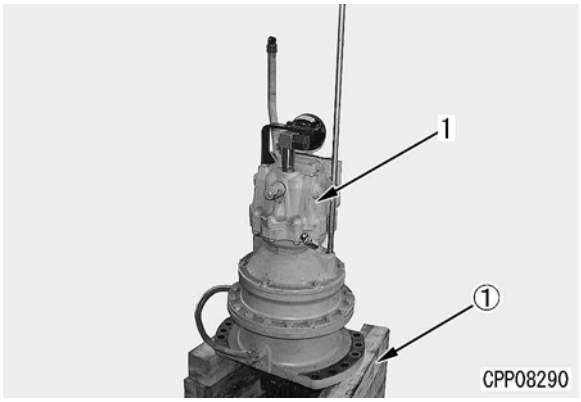
Loosen the drain plug and drain oil from the swing machinery case.

Swing machinery case: Approx. 6.6 **l**

2. Swing motor assembly

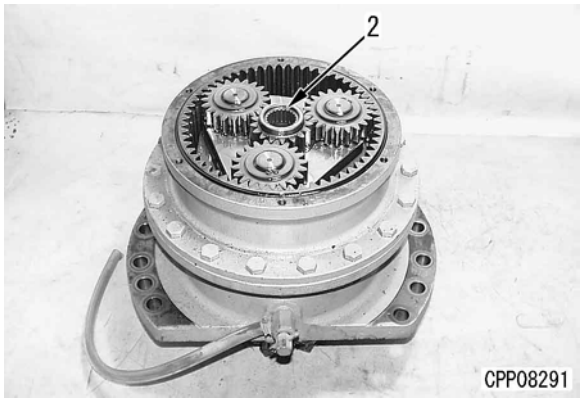
1) Place swing motor and swing machinery assembly on block (1).
2) Remove the six mounting bolts to disconnect swing motor assembly (1).

kg Swing motor assembly: 70 kg



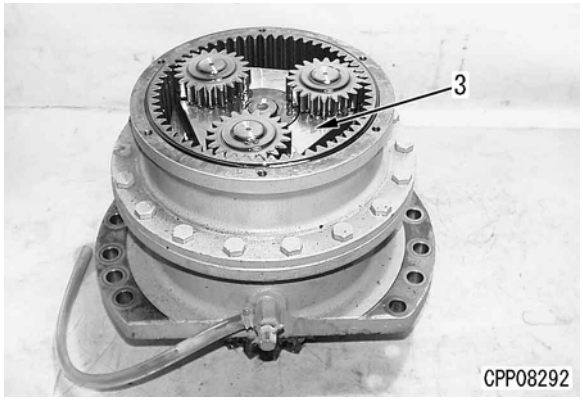
3. No. 1 Sun gear

1) Remove No. 1 sun gear (2).

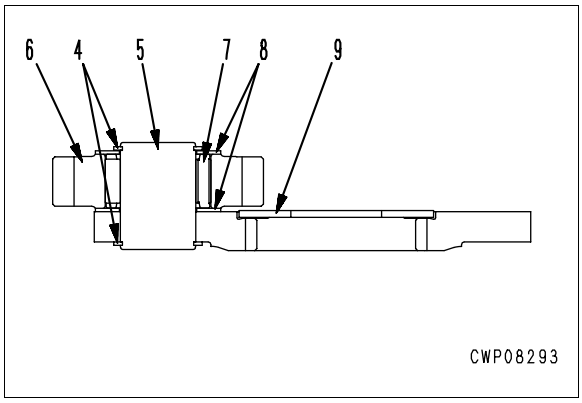


4. No. 1 carrier assembly

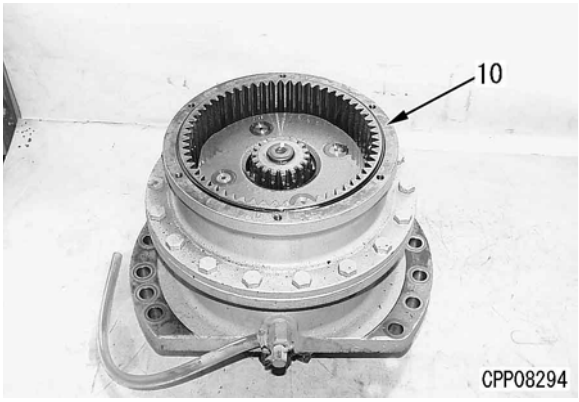
1) Disassemble No. 1 carrier assembly (3).



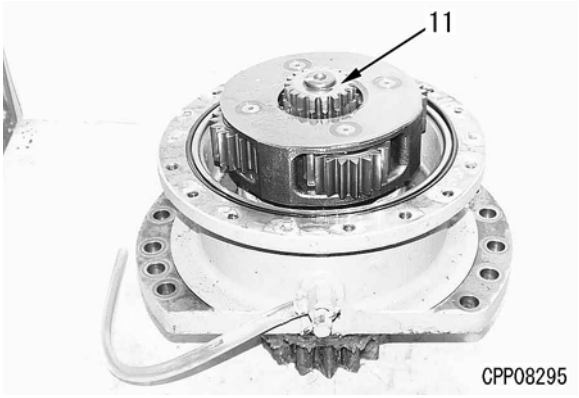
2) Disassemble the No. 1 carrier assembly in the following manner.
Remove snap ring (4) first and then remove shaft (5), gear (6), bearing (7), thrust washer (8) and plate (9).



5. Ring gear
Remove the mounting bolts and remove ring gear (10).



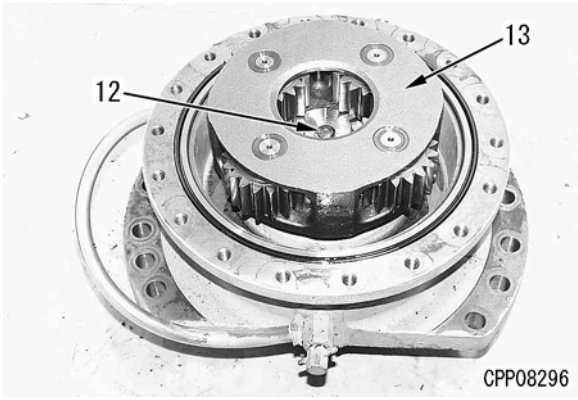
6. No. 2 sun gear
Remove No. 2 sun gear (11).



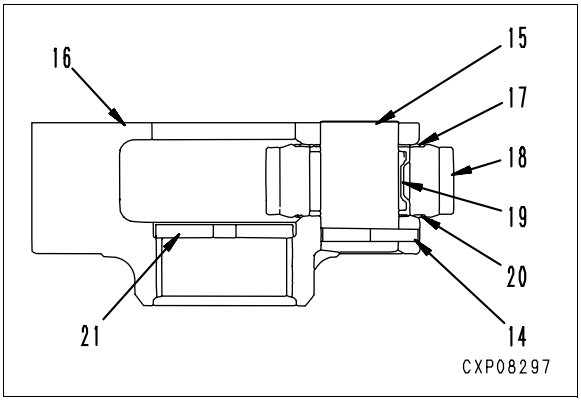
7. Bolt
Remove the holder mounting bolt (12).

8. No. 2 carrier assembly

1) Remove No. 1 carrier assembly (13).

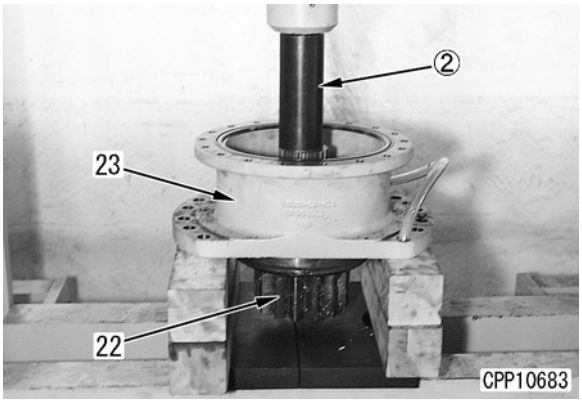


2) Disassemble the No. 2 carrier assembly by hand in the following manner.
   i) Insert pin (14) and drive shaft (15) out of carrier (16).
   ★ Pull out pin (14) after removing the shaft.
   ii) Remove thrust washer (17), gear (18), bearing (19) and thrust washer (20).
   iii) Remove plate (21).

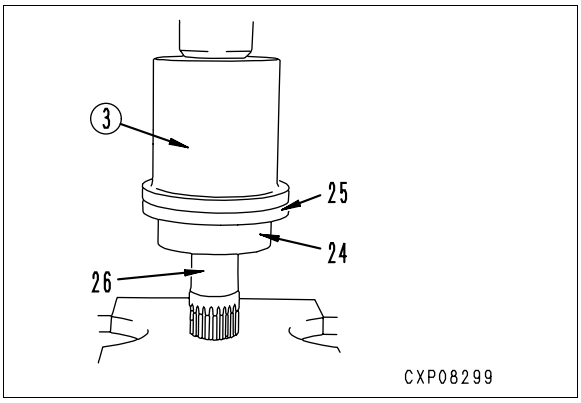


9. Shaft assembly

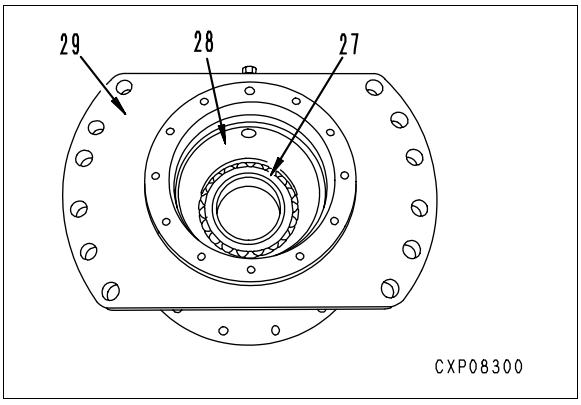
1) Set the shaft case assembly to a press, and push shaft assembly (22) out of shaft case assembly (23), using push tool c.



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

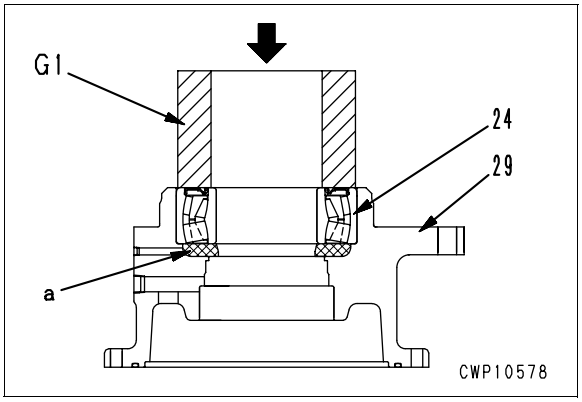
★ Clean all related parts and check that there is no dust or damage on the surface. Coat sliding surfaces with engine oil and then assemble the parts.

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**.

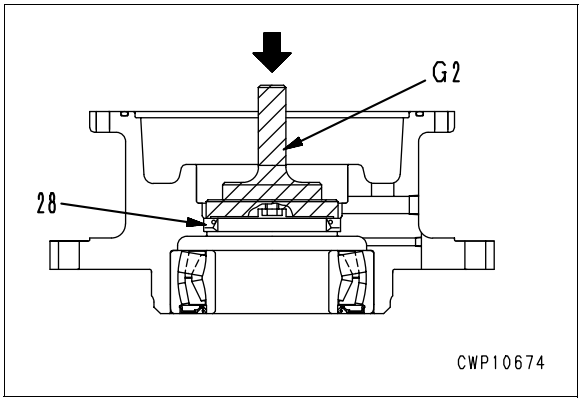


2. Oil seal
Press-fit oil seal (28), using tool **G2**.

Oil seal circumference:
Gasket sealant (LG-6)

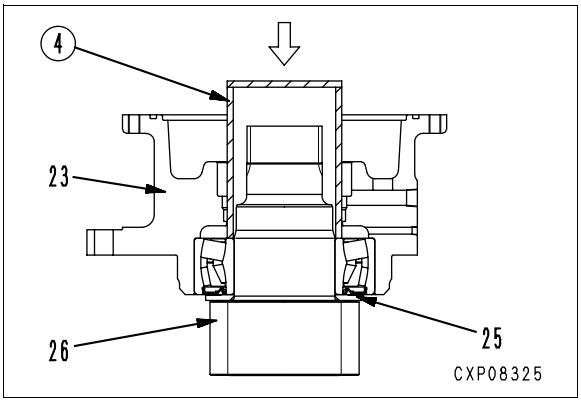
★ When press-fitting, take care so that gasket sealant (LG-6) will not stick to the lip surface of the oil seal.

Oil seal lip surface: Grease (G2-LI)



3. Case assembly

1) Set plate (25) onto shaft (26).
2) Set case assembly (23) onto shaft (26), and press-fit the bearing inner rail portion, using push tool e.

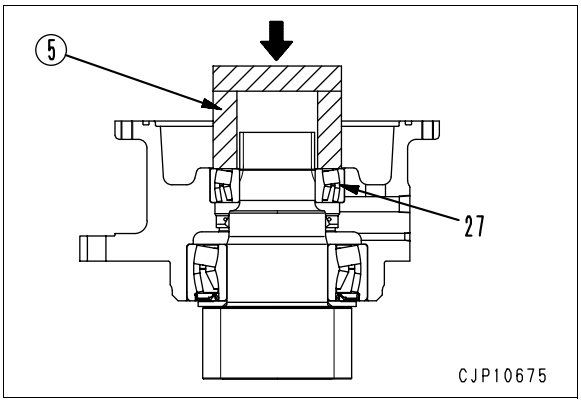


4. Bearing

Press-fit bearing (27), using tool f.

★ When press-fitting the bearing, press both inner and outer races of the bearing at the same time. Avoid pressing the inner race only.

★ After the bearing is press-fitted, check that the case will turn freely.



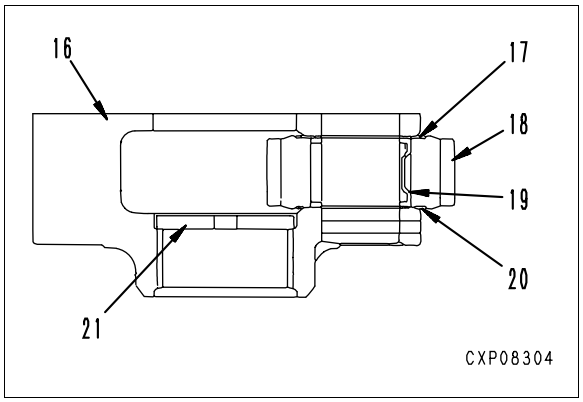
5. No. 2 carrier assembly

1) Reassemble the No. 2 carrier assembly in the following manner.

★ There are traces of expansion on the end surface of carrier side hole **h** which were originally caused when the pin was inserted. Make such the end surfaces are smooth enough before reassembly.

i) Assemble plate (21) in carrier (16).

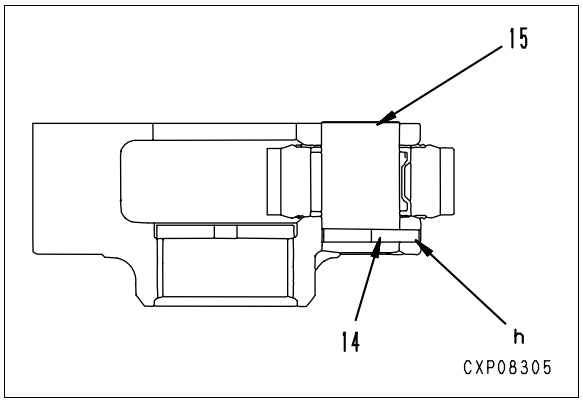
ii) Assemble bearing (19) in gear (18), then fit upper and lower thrust washers (17) and (20) to the gear and set the gear assembly to carrier (16).



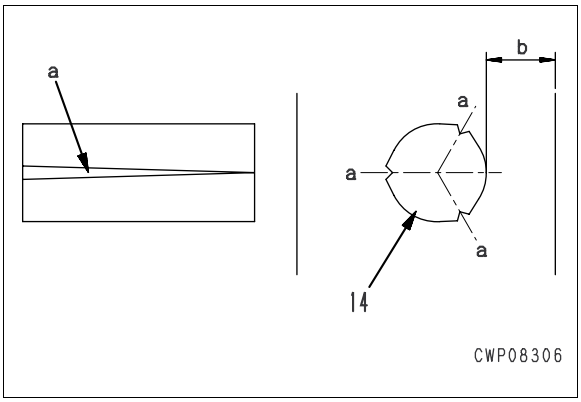
iii) Align both pin holes of the shaft and the gear, and install shaft (15), tapping it with a plastic hammer.

★ Install the shaft, rotating the planetary gear. Take care so the thrust washer is not damaged.

iv) Insert pin (14).



★ When inserting the pin, take care so that any of the three pawls provided on the circumference (Portion **a**) will not come to the slender side of the carrier (Portion **b**). Take note, however, that the slender side is likely to be on the opposite side of the carrier, depending on actual individual items. Pay attention so that a pin pawl will not come to the slender side of the carrier any way.



★ Expand the pin of the carrier after inserting.

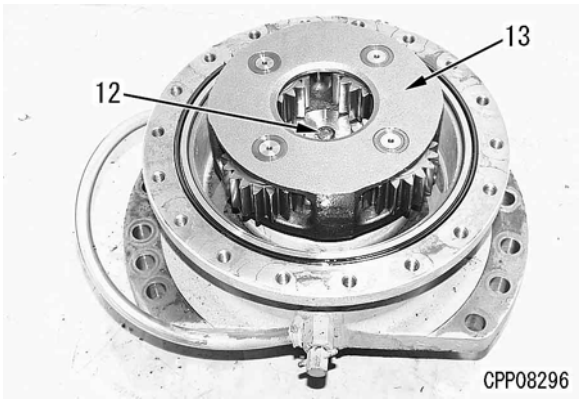
2) Assemble No. 2 carrier assembly (13).

6. Bolt

Tighten bolt (12).

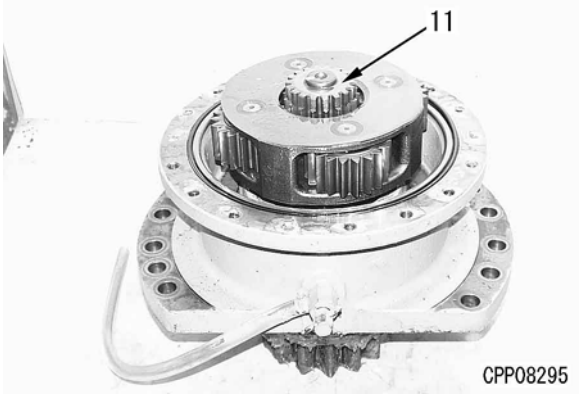
Mounting bolt thread:
Adhesive compound (LT-2)

Mounting bolt:
157 - 196 Nm (16 - 20 kgm)



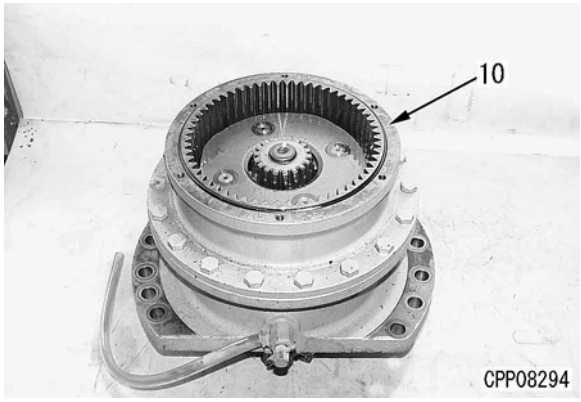
7. No. 2 sun gear

Install No. 2 sun gear (11).

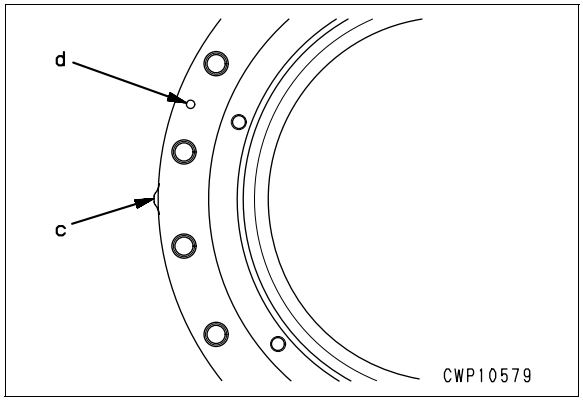


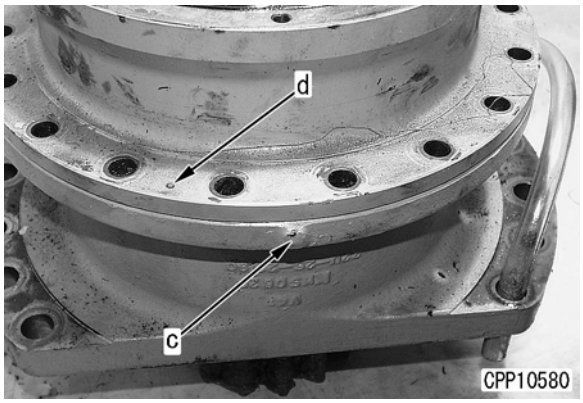
8. Ring gear

Fit an O-ring to case (29) and install ring gear (10), using an eyebolt (M10 x 1.5).



★ Bring a counter mark on the ring gear (Portion **c**) and a convex portion on the case flange (Portion **d**) to the positions illustrated at right, and install the ring gear.





★ Degrease the mating faces of ring gear (10) and case (29)

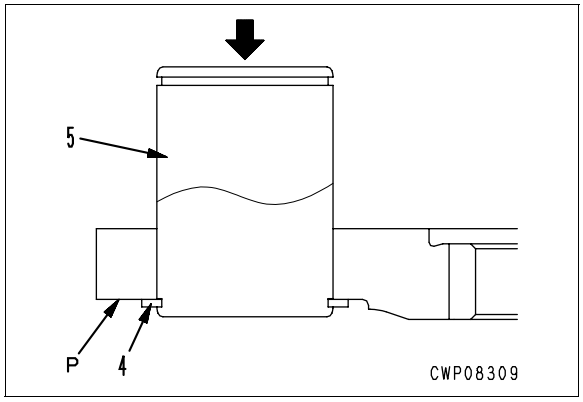
★ Never allow gasket sealant to stick to the mating faces of ring gear (10) and case (29).

N·m Ring gear mounting bolt:
157 - 196 Nm (16 - 20 kgm)

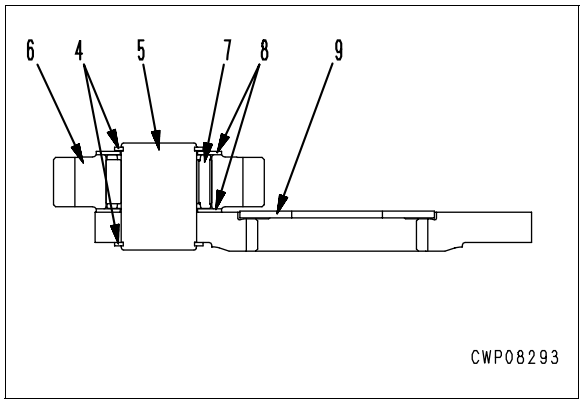
★ Do not install a washer.

9. No. 1 carrier assembly

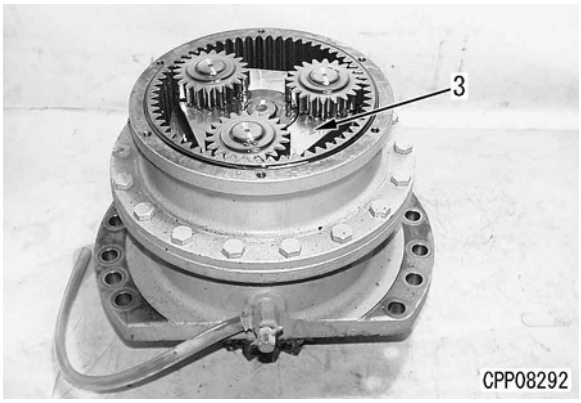
1) Assemble the No. 1 carrier in the following manner.
   i) Press-fit shaft (5) into the carrier in the direction of the arrow until the snap ring groove can be seen.
   ii) After installing snap ring (4), push it back from the opposite side until it comes to contact **p** face on the carrier. Take care not to push it back excessively.



   iii) After installing plate (9), install thrust washer (8), bearing (7), gear (6) and snap ring (5).

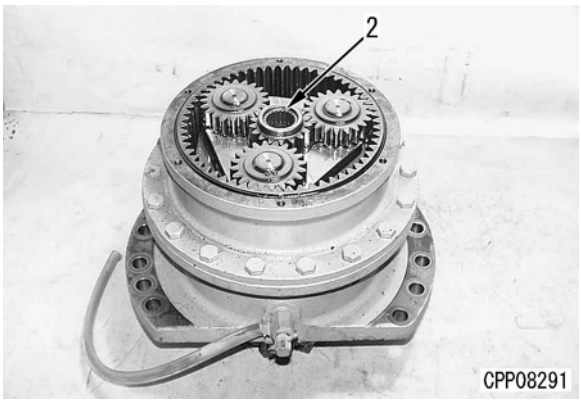


2) Install No. 1 carrier assembly (3).



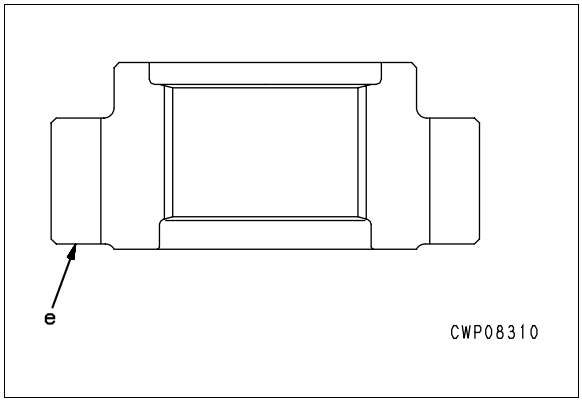
10. No. 1 sun gear assembly

Install No. 1 sun gear (2).



★ When installing the No. 1 sun gear, be careful not to install it upside down.

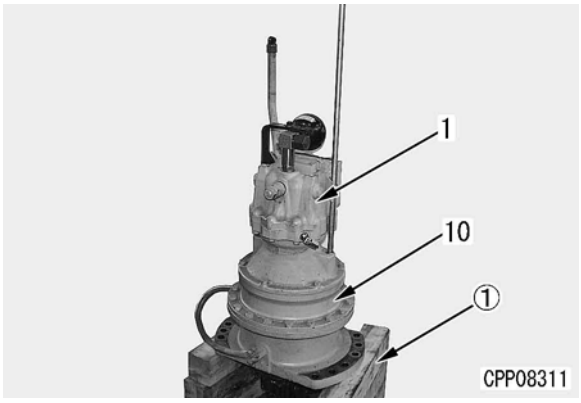
★ Install the No. 1 sun gear with the tooth portion (Portion **e**) facing down.



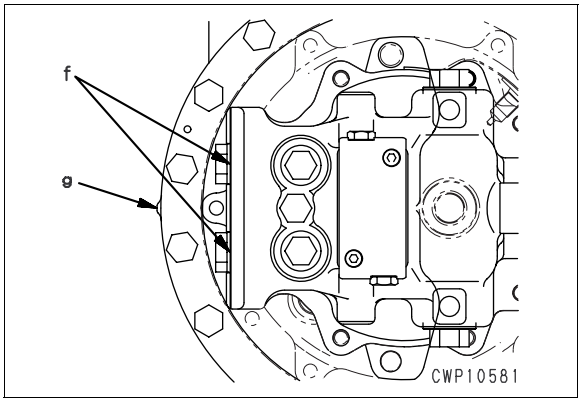
11. Swing motor assembly

After installing an O-ring to ring gear (10), mount the swing motor assembly (1).

kg Swing motor assembly: 70 kg



★ Align the motor port position (Portion **f**) and the case convex portion (Portion **g**) as illustrated at right.



★ Degrease both mating surfaces of swing motor assembly (1) and ring gear (10).

★ Never allow gasket sealant to stick to the mating surfaces of swing motor assembly (1) and ring gear (10).

N·m Swing motor mounting bolt:
59 - 74 Nm (6 - 7.5 kgm)

12. Refilling hydraulic oil

Screw in the drain plug and refill hydraulic oil through the oil filler port to the specified level.

Swing machinery case: Approx. 6.6 **l**

DISASSEMBLY AND ASSEMBLY OF CARRIER ROLLER ASSEMBLY

★ This section deals with only precautions to be followed when reassembling the carrier roller assembly.

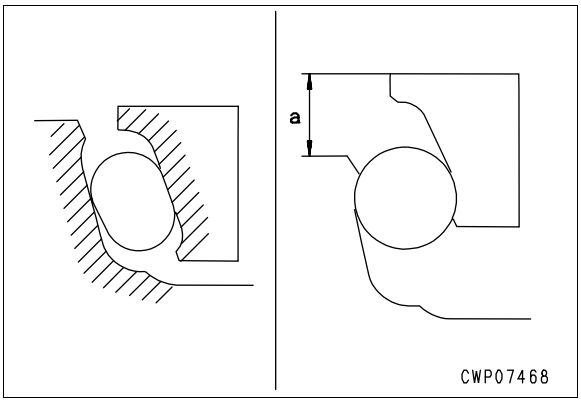
SPECIAL TOOLS

Mark	Part No.	Part Name	Necessity	Qty	Distinction*	Sketch
K	790-101-5001	Push tool kit	●	1		
	• 790-101-5081	• Plate				
	• 790-101-5021	• Grip				
	• 01010-50816	• Bolt				
	790-434-1660	Installer	■	1		
	790-101-1000	Oil pump	■	1		

*Distinction between new and existing part.

ASSEMBLY

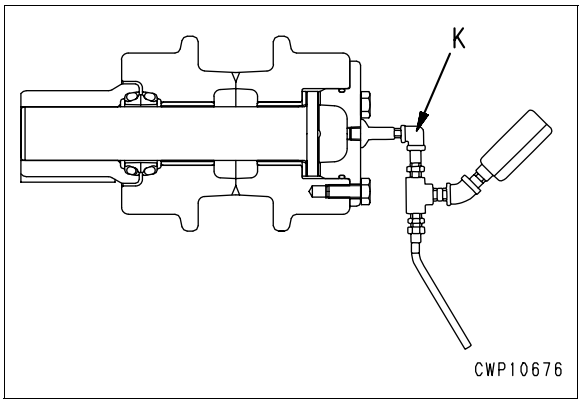
- Floating seal
  - ★ Before installing a floating seal, completely degrease both contact surfaces of the O-ring and the floating seal (hatched area in the illustration). Furthermore, take care so that no dust will stick to the contact surface of the floating seal.
  - ★ After inserting the floating seal, check that inclination of the seal is less than 1 mm and that protrusion **a** of the seal remains within the range of 9 - 11 mm.



- Carrier roller cover mounting bolt

  N·m Carrier roller cover mounting bolt: 44.12 - 53.93 Nm (4.5 - 5.5 kgm)

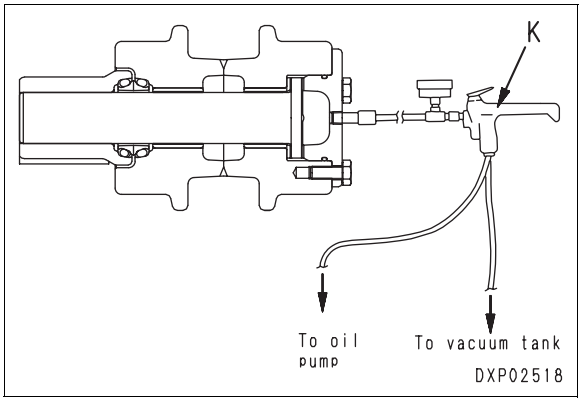
- Carrier roller
  - ★ Check the amount of air leakage from the seal with tool **K** by applying the standard pressure to the oil filler port.
  - ★ Check that the gauge needle does not go down, when the below standard pressure is applied for 10 seconds.
    Standard pressure: **0.1 Mpa (1 kg/cm²)**



  - ★ Fill the carrier roller assembly with oil, using tool **K**, and screw in the plug.

    Carrier roller: 75 - 85 cc (E030-CD)

    N·m Carrier roller plug: 30.89 - 37.75 Nm (3.15 - 3.85 kgm)



DISASSEMBLY AND ASSEMBLY OF TRACK ROLLER ASSEMBLY

★ This chapter deals with only precautions to be followed when reassembling the TRACK Roller Assembly.

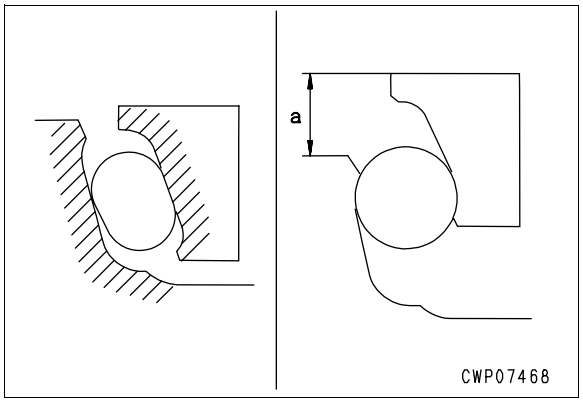
SPECIAL TOOLS

Mark	Part No.	Part Name	Necessity	Qty	Distinction*	Sketch
L	790-101-5201	Push tool kit	●	1		
	• 790-101-5221	• Grip				
	• 01010-51225	• Bolt				
	• 790-101-5261	• Plate				
	790-434-1640	Installer	■	1		
	790-101-1000	Oil pump	■	1		
	790-331-1110	Wrench	■	1		

*Distinction between new and existing part.

ASSEMBLY

- Floating seal
  - ★ Before installing a floating seal, completely degrease both contact surfaces of the O-ring and the floating seal (hatched area in the illustration). Furthermore, take care so that no dust will stick to the contact surface of the floating seal.
  - ★ After inserting the floating seal, check that inclination of the seal is less than 1 mm and that protrusion **a** of the seal remains within the range of 7 - 11 mm.



- Plug

Track roller oil: 190 - 200 cc (EO30-CD)

N·m Plug: 10 - 20 Nm (1 - 2 kgm)

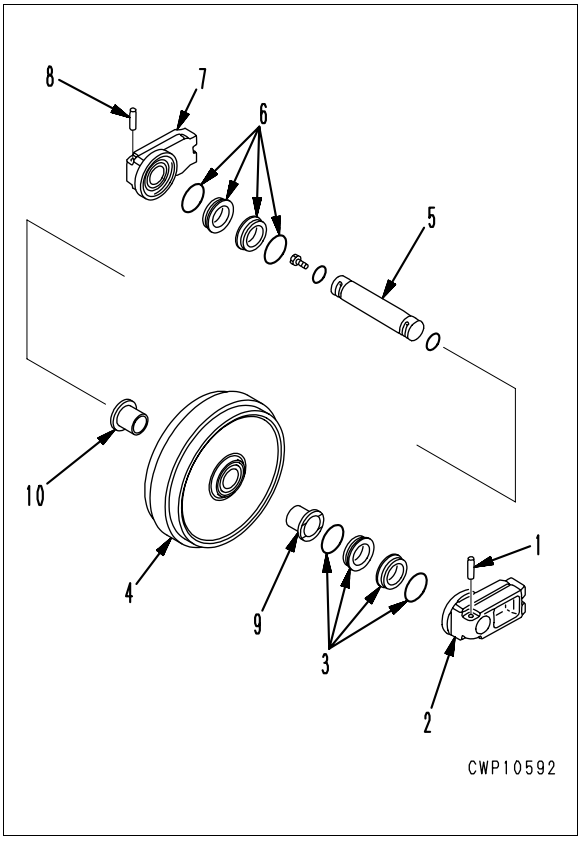
DISASSEMBLY AND ASSEMBLY OF IDLER ASSEMBLY

SPECIAL TOOLS

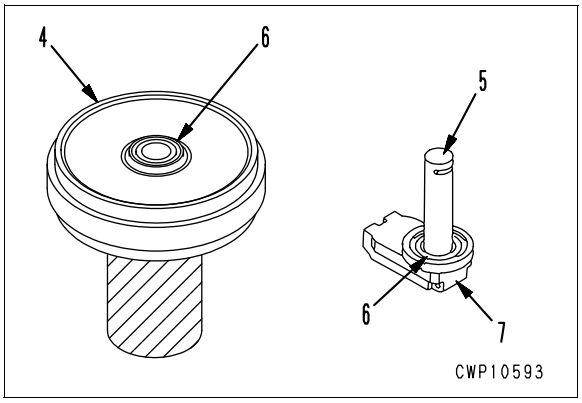
Mark	Part No.	Part Name	Necessity	Qty	Distinction*	Sketch
H	790-101-5201	Push tool kit	●	1		
	• 790-101-5221	• Grip				
	• 01010-51225	• Bolt				
	• 790-101-5271	• Plate				
	790-434-1630	Installer	■	1		
	790-101-1000	Oil pump	■	1		

*Distinction between new and existing part.

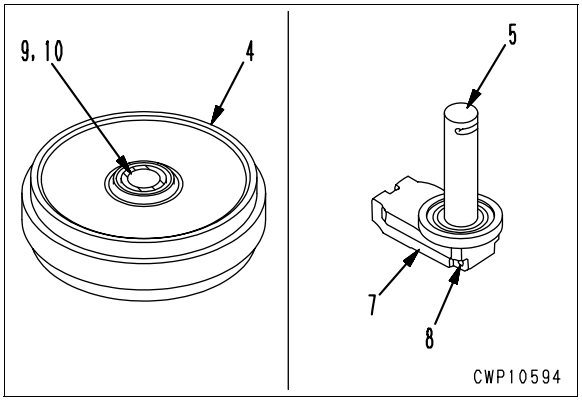
DISASSEMBLY



1. Remove dowel pin (1) and then support (2).
2. Remove floating seal (3) from support (2) and idler (4).
3. Detach idler (4) from shaft (5) and support assembly (7).
   ★ The idler contains 80 cc of oil. Drain the oil at this stage of disassembly. Take care and spread a cloth on the floor to prevent smearing the floor with flushing oil.
4. Remove floating seal (6) on the opposite side from idler (4), shaft (5) and support assembly (7).

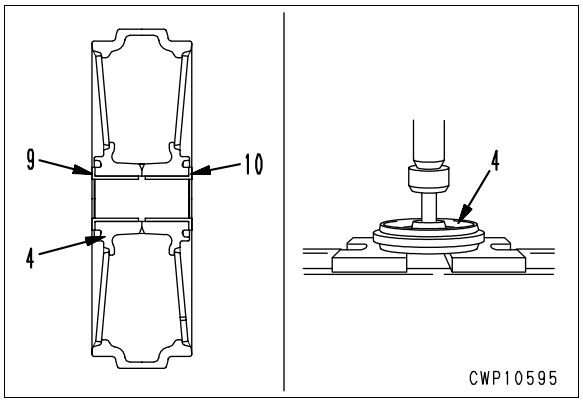


5. Remove dowel pin (8) to detach support (7) from shaft (5).
6. Remove bushings (9) and (10) from idler (4).

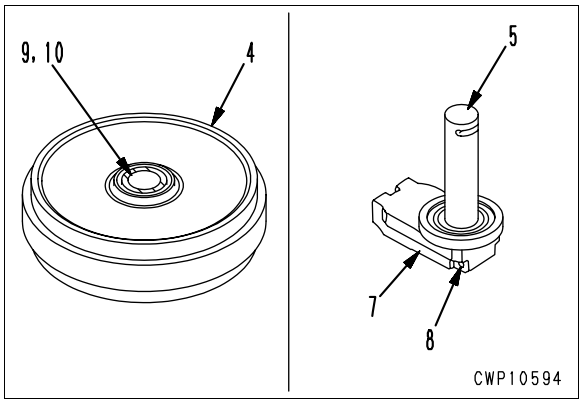


ASSEMBLY

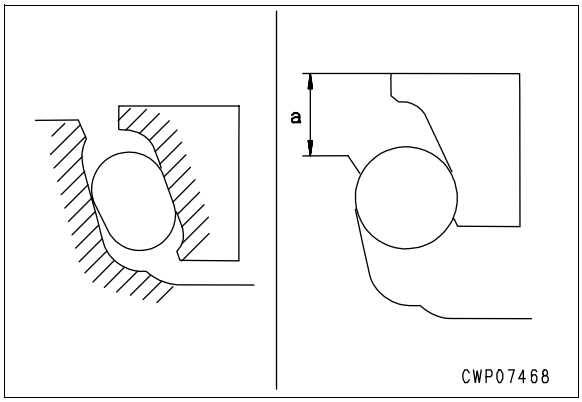
1. Press fit bushing (9) and (10) to idler (4).

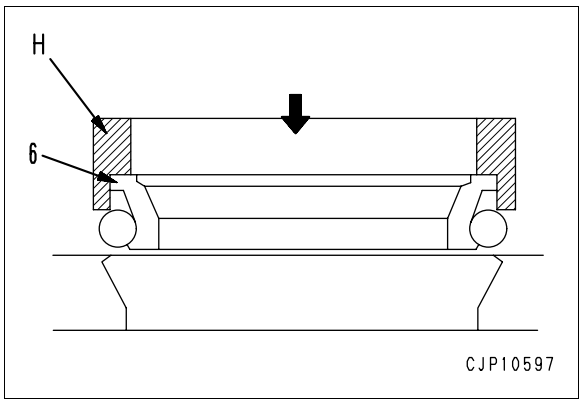


2. Fit O-ring and install support (7) to shaft (5) with dowel pin (8).

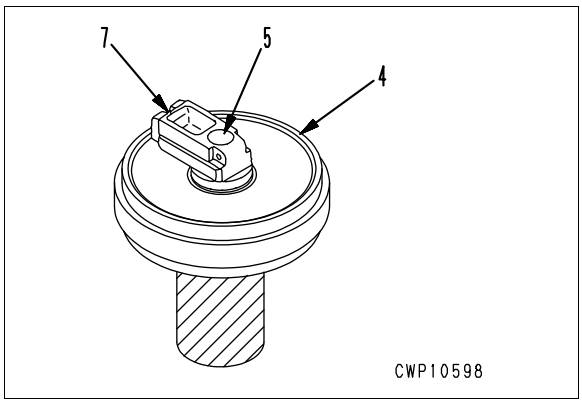


3. Using tool **H**, install floating seal (6) to idler (4), shaft (5) and support (7) assembly.
   ★ Floating seal
   Before installing the floating seal, completely degrease both contact surfaces of an O-ring and the floating seal (hatched area in the illustration). Furthermore, take care so that no dust will stick to the contact surface of the floating seal.
   ★ After inserting the floating seal, check that inclination of the seal is less than 1 mm and that protrusion **a** of the seal remains within the range of 5 - 7 mm.

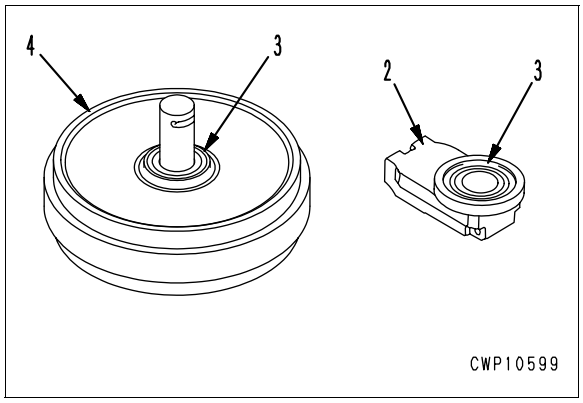




4. Assemble shaft (5) and support (7) assembly to idler (4).

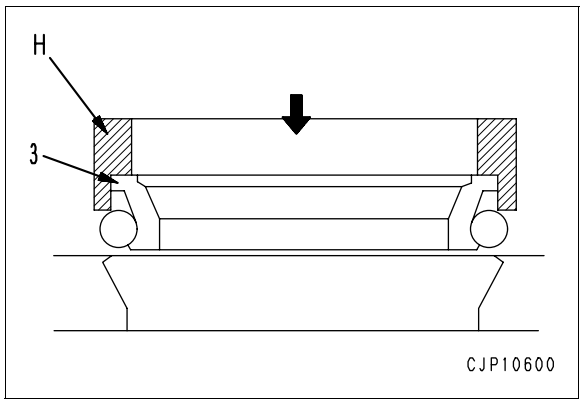


5. Using tool **H**, install floating seal (3) to idler (4) and support (2).



★ Coat the sliding surface of the floating seal with oil, and be careful not to let any dirt or dust get stuck to it.

★ Remove all grease and oil from the contact surface of the O-ring and the floating seal.

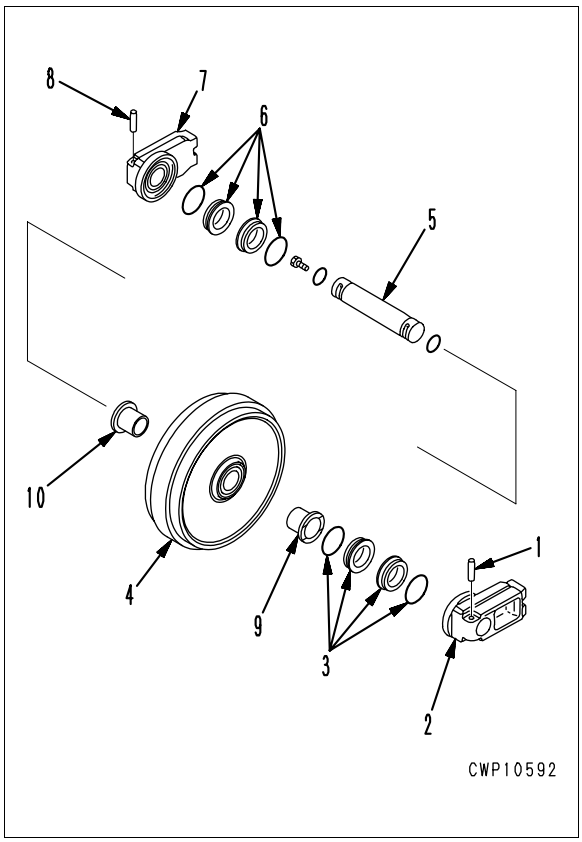


6. Install O-ring, then install support (2) with dowel pin (1).

7. Add oil and tighten plug.

Oil: **Approx. 80 cc (SAE30)**

Plug: **205.8 ± 49 Nm {21 ± 5 kgm}**



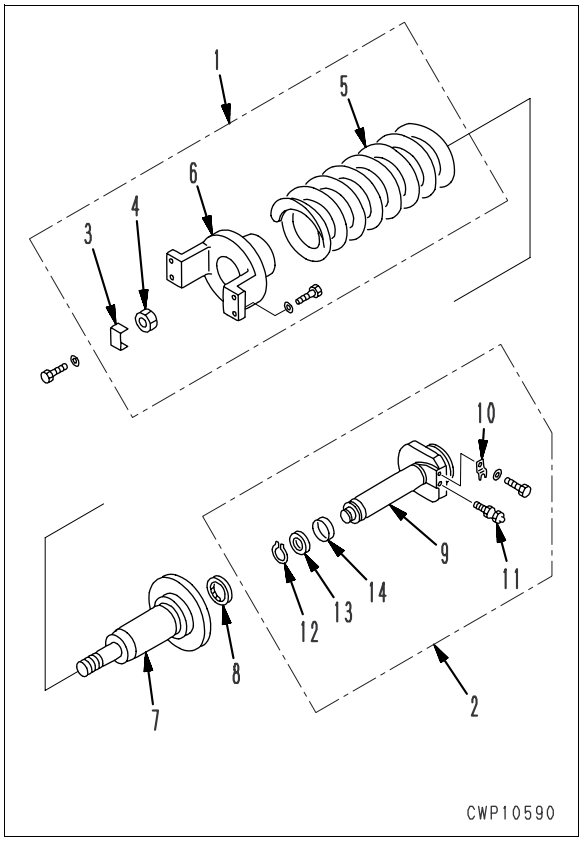
DISASSEMBLY AND ASSEMBLY OF RECOIL SPRING ASSEMBLY

SPECIAL TOOLS

Mark		Part No.	Part Name	Necessity	Qty	Distinction*	Sketch
J	1	790-600-2001	Compressor (A)	■	1		
		or					
		791-685-8006	Compressor (B)	■	1		
		790-201-2780	Spacer	■	1		
		791-635-3160	Extension	■	1		
		790-101-1600	Cylinder (686 kN - 70 T)	■	1		
		790-101-1102	Pump	■	1		
		791-640-2180	Guide bolt	■	1	N	
	2	790-201-1500	Push tool kit	●	1		
		• 790-201-1620	• Plate		1		
		• 790-101-5021	• Grip		1		
		• 01010-50816	• Bolt		1		

*Distinction between new and existing part.

DISASSEMBLY



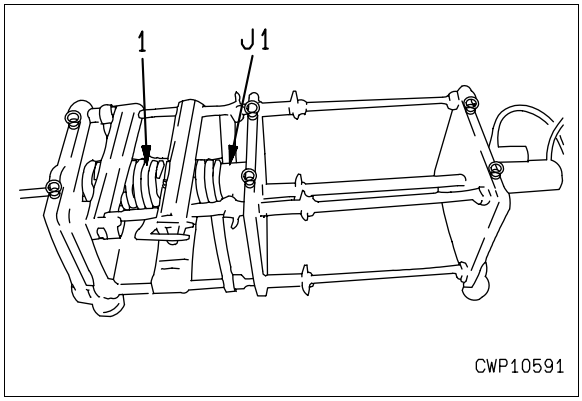
1. Remove piston assembly (2) from recoil spring assembly (1).

2. Disassembly of recoil spring assembly

1) Set recoil spring assembly (1) to tool **J1**.

⚠ The recoil spring is under large installed load, so be very sure to set the tool properly.
Failure to do this is dangerous.

★ Installed load of spring: **108.8 kN {11,100 kg}**

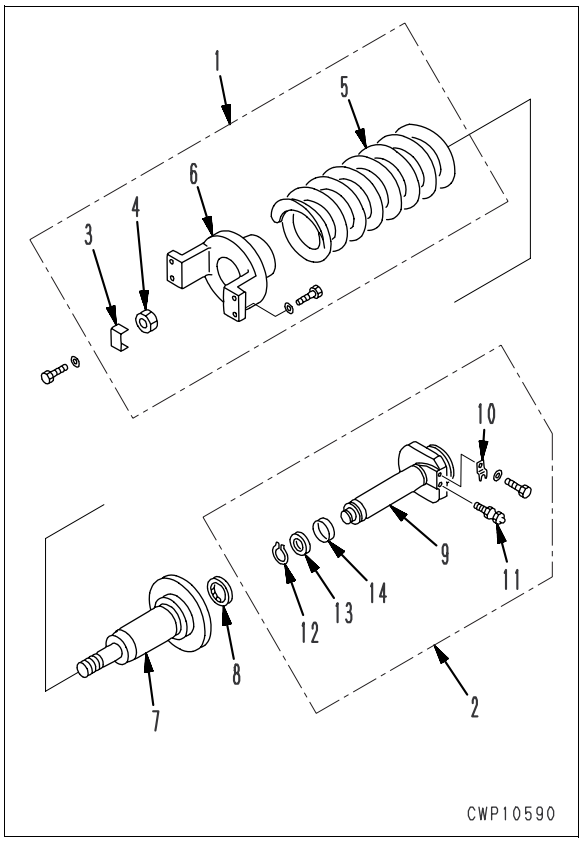


2) Apply hydraulic pressure slowly to compress spring and remove lock plate (3). Then remove nut (4).
   ★ Compress the spring to a point where the nut becomes loose.
   ★ Release the hydraulic pressure slowly and release the tension of the spring.
   ★ Free length of spring: **558 mm**
3) Remove yoke (6), cylinder (7), and dust seal (8) from spring (5).

3. Dissassembly of piston assembly

1) Remove lock plate (10) from piston (9), then remove valve (11).
2) Remove snap ring (12), then remove U-packing (13) and ring (14).

ASSEMBLY

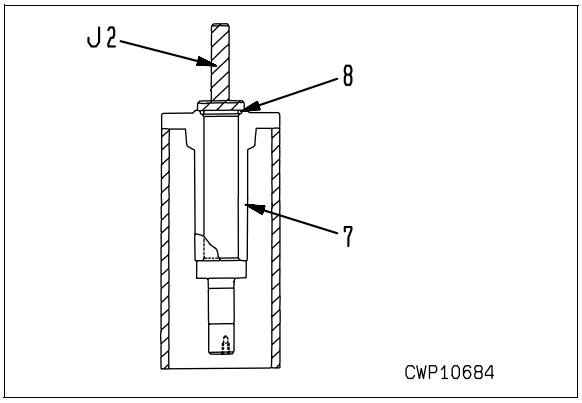


1. Assembly of piston assembly

1) Assemble ring (14) and U-packing (13) to piston (9) and secure with snap ring (12).
2) Tighten valve (11) temporarily, and secure with lock plate (10).

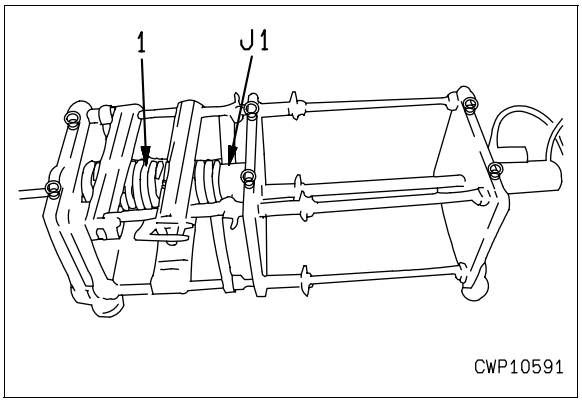
2. Assembly of recoil spring assembly

1) Using tool **J2**, install dust seal (8) to cylinder (7).

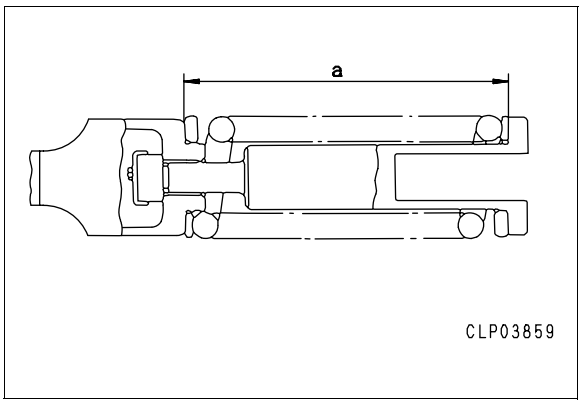


2) Assemble cylinder (7) and yoke (6) to spring (5), and set in tool **J1**.

Sliding portion of cylinder:
Grease (G2-L1)



3) Apply hydraulic pressure slowly to compress the spring and tighten nut (4) so that the installed length of the spring is dimension "**a**", then secure it with lock plate (3).
   ★ Installed length "**a**" of spring:
   437 mm



4) Remove recoil spring assembly (1) from tool **J1**.

3. Assemble piston assembly (2) to recoil spring assembly (1).

Sliding portion of wear ring:
Grease (G2-L1)

★ Install the piston assembly so the valve installing position is on the outside.
★ Fill the inside of the cylinder with 300 cc of grease (G2-L1), then bleed the air and check that grease comes out of the grease hole.

REMOVAL AND INSTALLATION OF SPROCKET

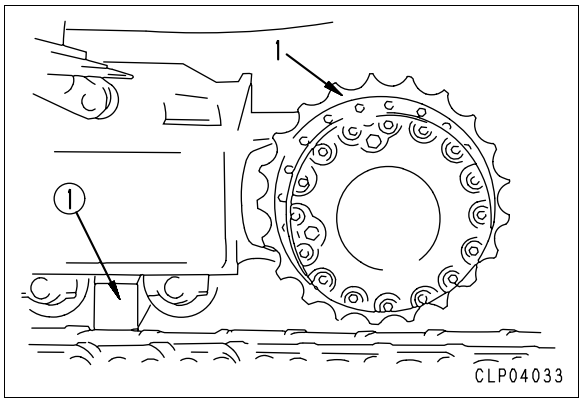
REMOVAL

1. Remove track shoe assembly. For details, see TRACK SHOE ASSEMBLY, REMOVAL.

2. Swing work equipment 90°, push up chassis with work equipment and place block b between track frame and track shoe.

3. Lift off sprocket (1). ※1

kg Sprocket: **40 kg**



INSTALLATION

- Install in reverse order of removal.

※1

Thread of sprocket mounting bolt:
Gasket sealant (LG-6)

N·m Sprocket mounting bolt:
441 - 490 Nm {45 - 50 kgm}

REMOVAL AND INSTALLATION OF TRACK SHOE ASSEMBLY

SPECIAL TOOLS

Mark	Part No.	Part Name	Necessity	Qty	Distinction*	Sketch
M	791-630-3000	Remover & Installer	■	1		
	790-101-1300	Cylinder (980 kN - 100 T)	■	1		
	790-101-1102	Pump	■	1		

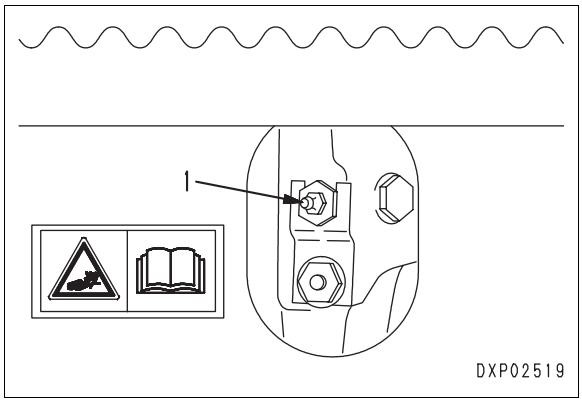
*Distinction between new and existing part.

REMOVAL AND EXPANSION OF TRACK SHOE ASSEMBLY (IRON)

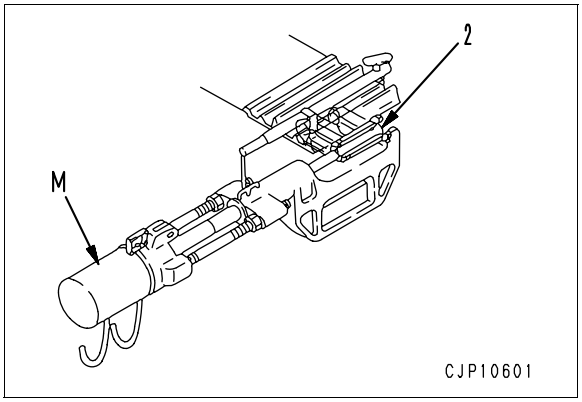
1. Stop the machine at a point where the master pin is midway between the idler and carrier roller, and where there is space to lay out the track assembly on the ground.

2. Lower work equipment, then loosen lubricator (1), and relieve track tension. ※1

⚠ The adjustment cylinder is under extremely high pressure. Never loosen the lubricator more than one turn. If the grease does not come out, move the machine backwards and forwards.

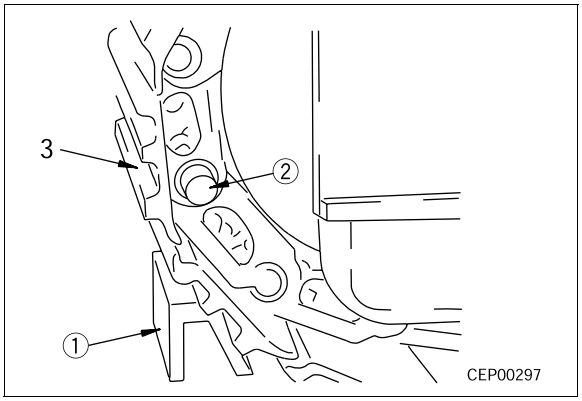


3. Using tool **M**, pull out master pin (2). ※2



4. Remove tool **M** and move the machine forward so the position of temporary pin c is at the front of the idler. Place block b in position.

5. Remove temporary pin c, and remove the dust seal. Drive the machine in reverse to lay out the track ※3



INSTALLATION

- Install in reverse order of removal.

※1

★ Refer to the Inspection and Adjustment of Track Shoe Tension section in the TESTING AND ADJUSTING chapter of this manual.

- Installation procedures for shoe bolts and nuts

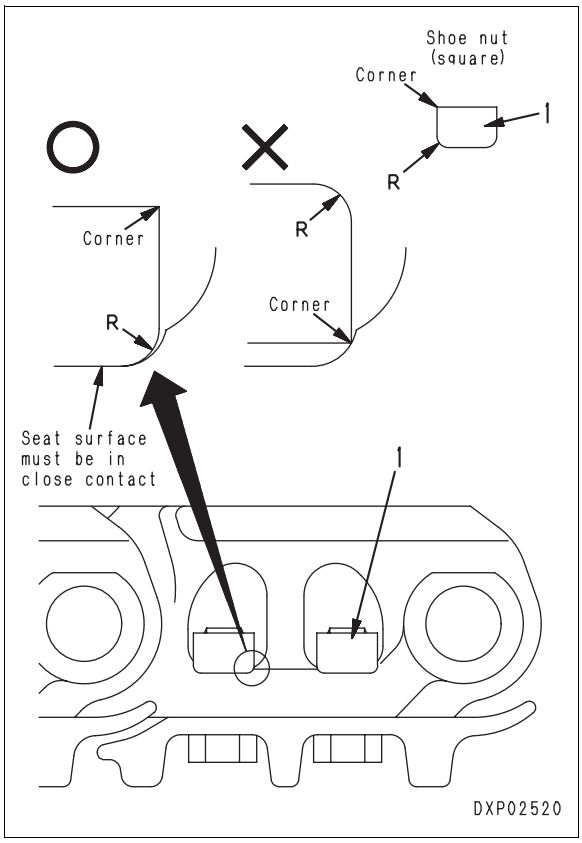
1) Turn the R side of shoe nut (1) to the link seat surface, and assemble the shoes in a way that both seat surfaces are in close contact with each other.

★ If the shoe bolts are installed in reverse, nut corners will interfere with the link seat surface and raise the nut, which can cause the bolt to loosen.

2) Tighten the shoe bolts to the following torques.

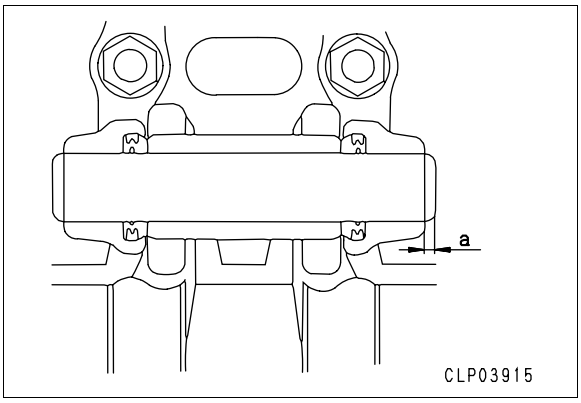
1st step (initial torque):
490 ± 50 Nm (50 ± 5 kgm)
2nd step (finishing torque):
490 - 610 Nm (50 - 62 kgm)
(For swamp shoes)
Retightening angle for 2nd step:
120 ± 10°

★ Retighten the shoe bolts after checking that the mating surfaces are in close contact.



※2

★ Press-fit the master pin, using tool **M**, in such a way that the master pin protrusion amount is the following dimension **a**.
Master pin protrusion amount **a**:
2.5 ± 1 mm



※3

★ Before installing a dust seal, coat its contact surface with the bushing with grease (G2-LI).

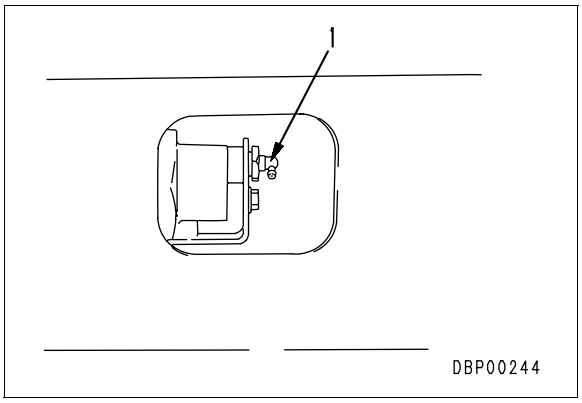
★ If you have road liners (rubber pad type shoe plates), replace the shoe plates with new ones immediately when it is discovered that the rubber is worn out or broken. Otherwise, the shoe bolt heads will be damaged. Once the bolt heads are crushed, it becomes extremely difficult to remove them.

REMOVAL AND EXPANSION OF ROAD LINERS

1. Stop the machine so the master pin is right above the idler and the track shoe assembly can be expanded to the front and to the rear.

2. Lower the work equipment to the ground, and unscrew lubricator (1) to loosen track shoe tensi※1

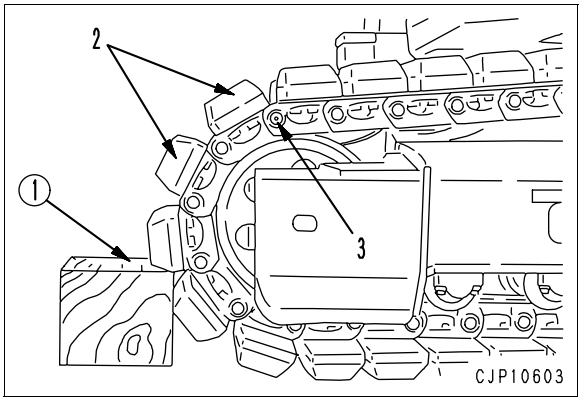
⚠ The pressure inside the adjusting cylinder is kept quite high. Do not attempt to unscrew lubricator (1) by more than one turn. If grease inside oozes out poorly, move the machine back and forth.



3. Remove road liners (2). ※2

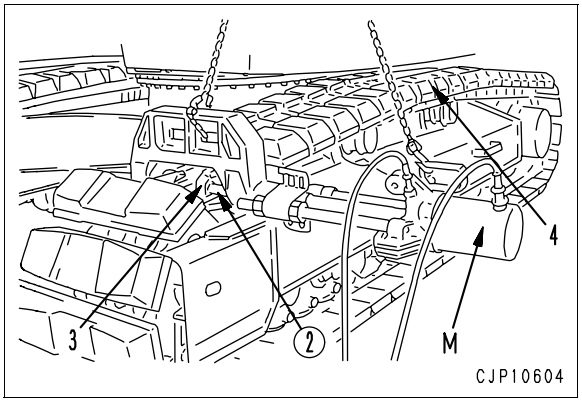
4. Place block B against the shoe assembly.

5. Using tool **M** and dumb pin C, pull out master pi※3



6. Take tool M away, move the machine forward and pull out with dumb pin (2).

7. Remove the dust seal and expand track shoe assembly (4), while moving the machine forward. ※4



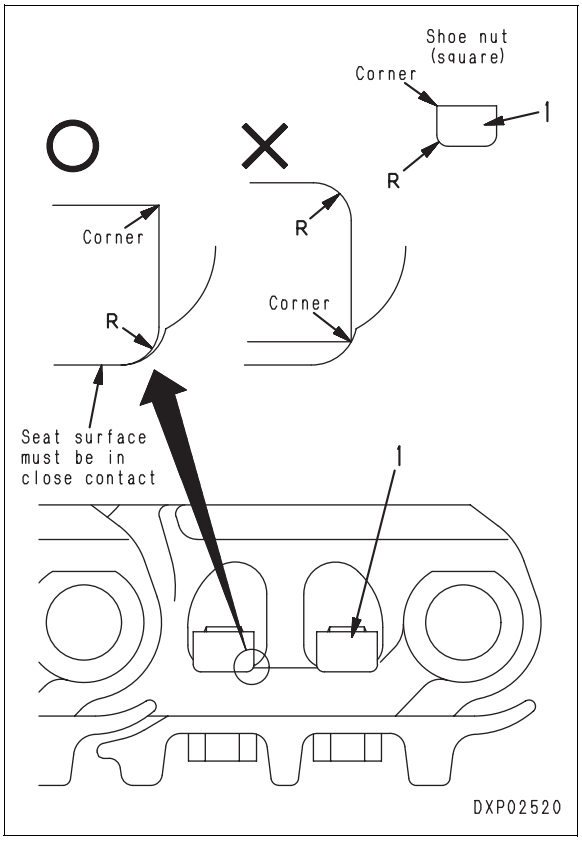
INSTALLATION OF ROAD LINERS

- Install in reverse order of removal.

※1

★ Refer to the Inspection and Adjustment of Track Shoe Tension section in the TESTING AND ADJUSTING chapter of this manual.

- Installation procedures for shoe bolts and nuts
  1) Turn the R side of shoe nut (1) to the link seat surface, and assemble the shoes so that both seat surfaces are in close contact with each other.
     ★ If the shoe bolts are installed in reverse, nut corners will interfere with the link seat surface and raise the nut, which can cause the bolt to loosen.
  2) Tighten the shoe bolts to the following torques.
     1st step (initial torque):
     490 ± 50 Nm (50 ± 5 kgm)
     Retightening angle for 2nd step:
     120 ± 10°
     ★ Retighten the shoe bolts after checking that the mating surfaces are in close contact.

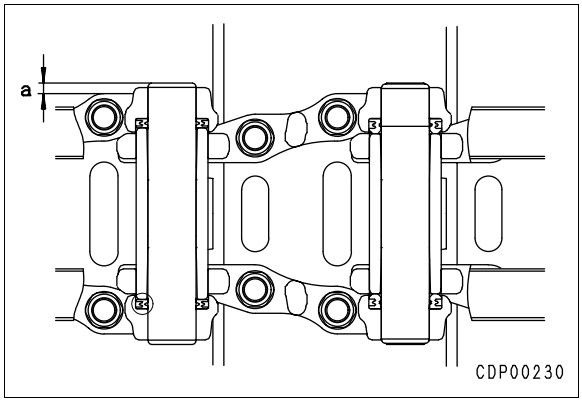


※2

N·m Road liner mounting bolt:
490 - 608 Nm (50.0 - 62 kgm)

※3

★ Press-fit the master pin, using tool M, so the master pin protrusion amount is the following dimension **a**.
Master pin protrusion amount **a**:
2.5 ± 1 mm



※4

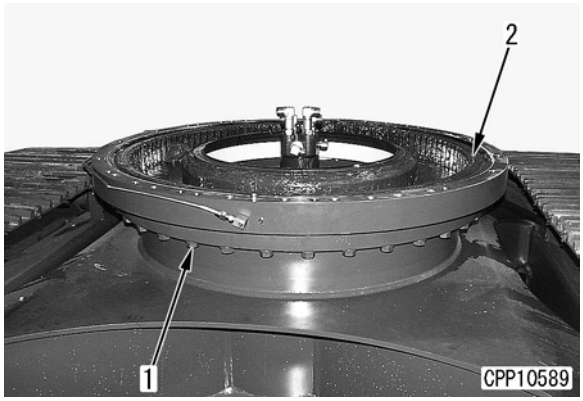
★ Before installing a dust seal, coat its contact surface with the bushing with grease (G2-LI).

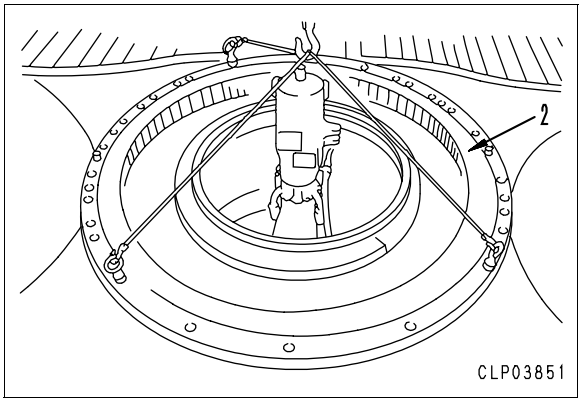
REMOVAL AND INSTALLATION OF SWING CIRCLE ASSEMBLY

REMOVAL

1. Remove revolving frame assembly. For details, see REMOVAL OF REVOLVING FRAME ASSEMBLY.
2. Remove 36 mounting bolts (1) to remove the swing circle assembly. ※1
3. Lift off swing circle assembly (2). ※2

kg Swing circle assembly: **270 kg**





INSTALLATION

- Install in reverse order of removal.

※1

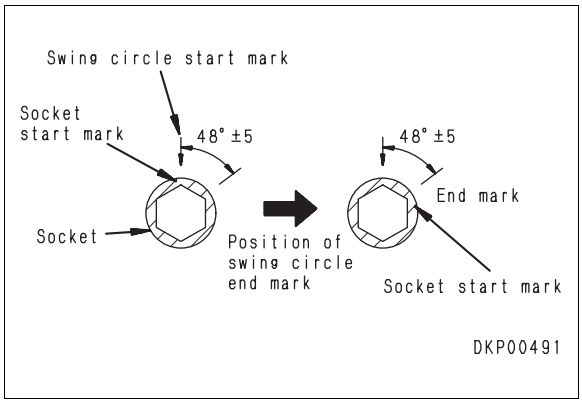
Thread of swing circle mounting bolt:
Thread tightener (LT-2)

N·m Swing circle mounting bolt:

1st pass:
Tighten to 191.2 ± 19.6 Nm {19.5 ± 2 kgm}

2nd pass:

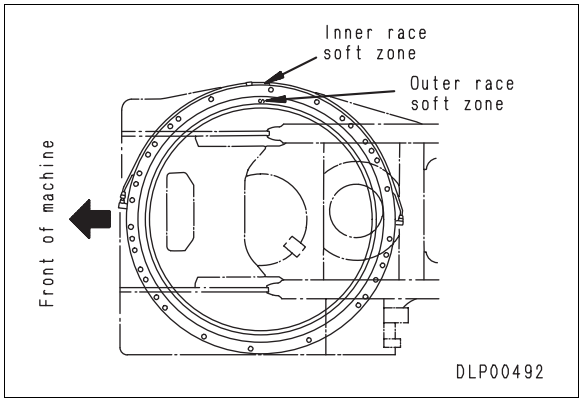
1) Using the angle of the bolt head as the base, make start marks on the swing circle and socket.
2) Make an end mark at a point (on swing circle) 48 ± 5° from the start mark.
3) Tighten so that the start mark on the socket is aligned with the end mark on the swing circle at the 48 ± 5° position.



※2

★ Set the soft zone **S** mark on the inside ring of the inner race facing the right side as shown in the diagram. Then install to the track frame.

Swing circle:
Grease (G2-L1) 14.6 l



REMOVAL AND INSTALLATION OF REVOLVING FRAME ASSEMBLY

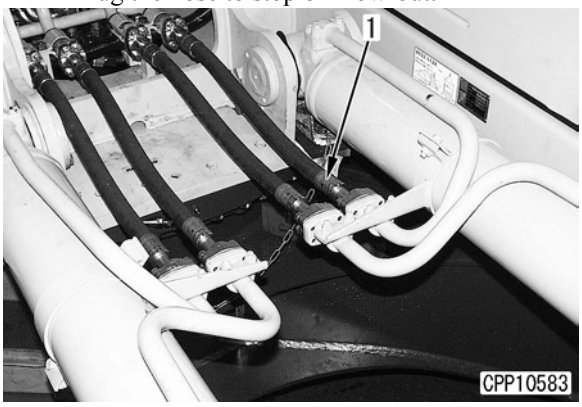
REMOVAL

⚠ . Extend the arm and bucket fully, then lower the work equipment to the ground and move the safety lock lever to the LOCK position.

1. Disassemble the work equipment assembly, refer to the Disassembling Work Equipment Assembly section in this manual.

2. Remove the counter weight assembly, refer to the Removal of Counterweight Assembly section in this manual.

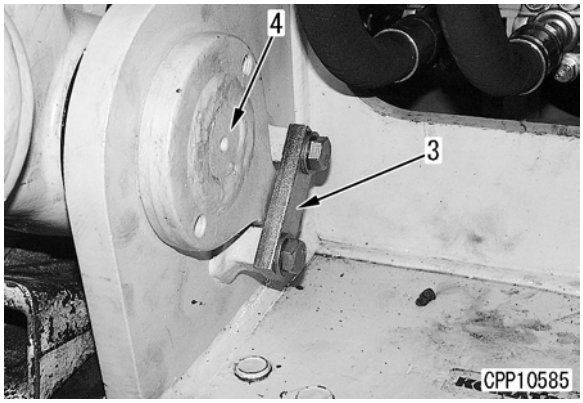
3. Disconnect four boom cylinder hoses (1).
   ★ Plug the hose to stop oil flow-out.



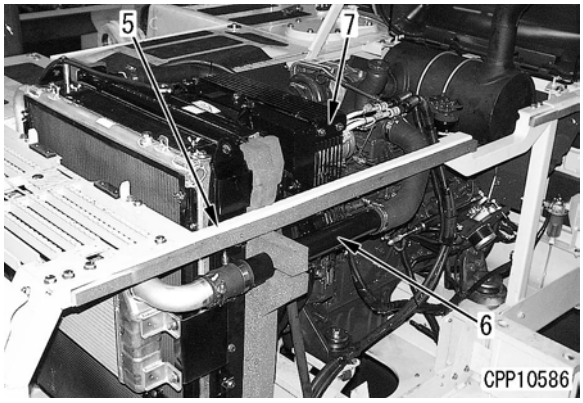
4. Sling boom cylinder assembly (2).

5. Remove plate (3) and pin (4) and lift off boom cylinder assembly (2) to remove it.
   ★ Remove the boom cylinder assembly on the opposite side in the same manner.

   kg Boom cylinder assembly: 180 kg

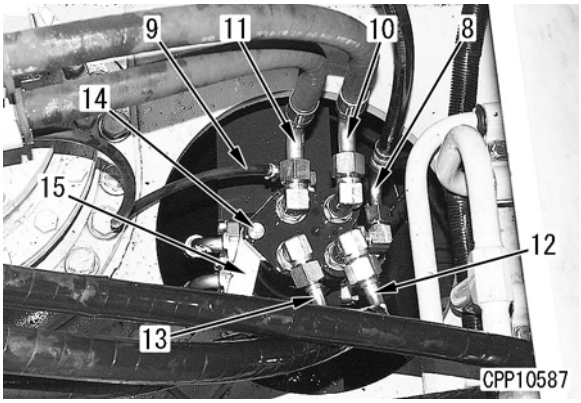


6. Remove plate (5), air intake hose (6) and fan guard (7). ※1
   ★ Remove other parts which may interfere with a sling, when removing the revolving frame.



7. Disconnect the six hoses above the swivel joint assembly at the swivel joint side.
   (8): Center swivel joint (D port) - Swing motor (T port)
   (9): Center swivel joint (E port) - Solenoid valve
   (10): Center swivel joint (B port) - Travel control valve, left (A2 port)
   (11): Center swivel joint (D port) - Travel control valve, right (B5 port)
   (12): Center swivel joint (A port) - Travel control valve, left (B2 port)
   (13): Center swivel joint (C port) - Travel control valve, right (A5 port)

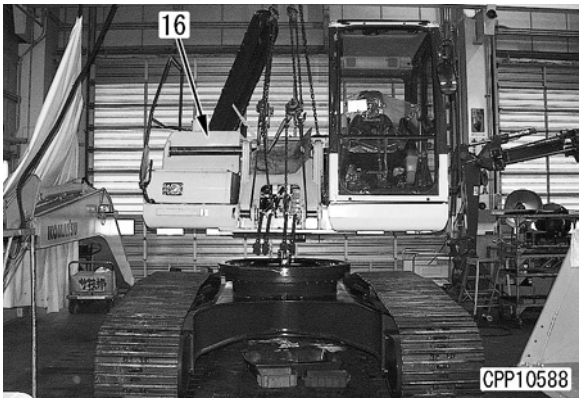
8. Pull out pin (14) to detach jam plate (15) from the swivel joint.



9. Remove the 32 revolving frame mounting bolts and remove revolving frame assembly (16) by lifting it off. ※2

★ Attain fore and aft balance and right and left balance of the revolving frame assembly without two mounting bolts at the front and rear being removed and using a lever block. Only when the right balance is obtained, remove the remaining two bolts.

⚠ When removing the revolving frame assembly, take care so that it does not hit the swivel joint assembly.



kg Revolving frame assembly

	Assembly	Revolving frame only (Reference value)
PC200-7	5,050 kg	1,729 kg

INSTALLATION

- Install in reverse order of removal.

※1

N·m Air intake hose clamp screw:
5.4 - 6.4 Nm (0.55 - 0.65 kgm)

※2

Swivel circle mating surface:
Gasket sealant (LG-1)

Threads of revolving frame mounting bolt:
Adhesive compound (LT-2)

N·m Revolving frame mounting bolt
1st step: 294.2 ± 29.4 Nm (30 ± 3 kgm)
2nd step: Retightening by 60° or
588 - 677 Nm (60 - 69 kgm)

- Refilling hydraulic oil
  Refill hydraulic oil through the oil filler port to the specified level, and let the oil circulate in the hydraulic system by starting the engine. Then check the level again.
- Air bleeding
  Bleed air from the travel motor, refer to the Air Bleeding of Various Parts section in the TESTING AND ADJUSTING chapter of this manual.

REMOVAL AND INSTALLATION OF CENTER SWIVEL JOINT ASSEMBLY

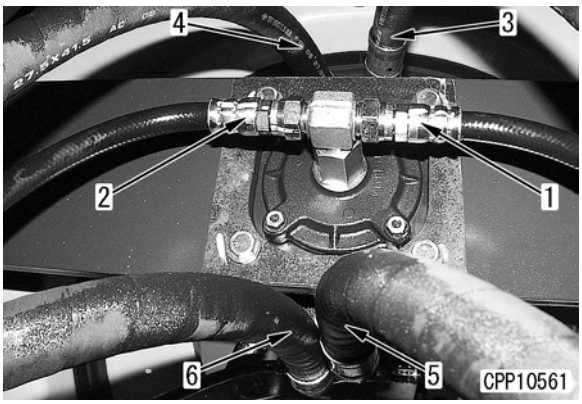
REMOVAL

Release the remaining pressure in the hydraulic circuit. For details, see TESTING AND ADJUSTING, release of remaining pressure in hydraulic circuit.

★ Mark all the piping with tags to prevent mistakes in the mounting position when installing.

1. Disconnect six hoses (1) through (6) from the travel motor center swivel joint.

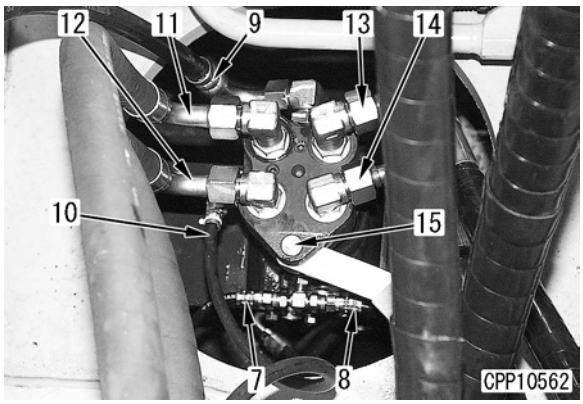
- (1): Center swivel joint (T port) - Travel motor, left (T port)
- (2): Center swivel joint (T port) - Travel motor, right (T port)
- (3): Center swivel joint (B port) - Travel motor, left (PA port)
- (4): Center swivel joint (D port) - Travel motor, right (PB port)
- (5): Center swivel joint (A port) - Travel motor, left (PB port)
- (6): Center swivel joint (C port) - Travel motor, right (PA port)



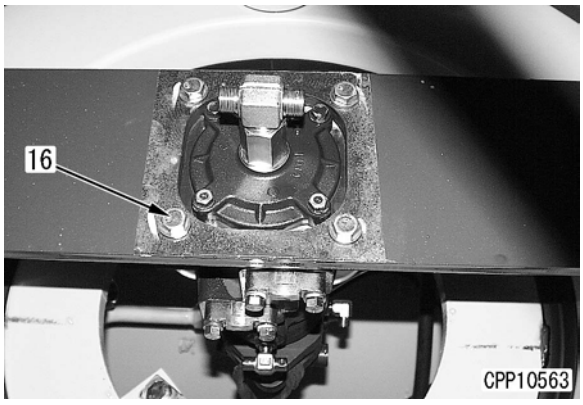
2. Disconnect eight hoses (7) through (14).

- (7): Center swivel joint (E port) - Travel motor, left (P port)
- (8): Center swivel joint (E port) - Travel motor, right (P port)
- (9): Center swivel joint (D port) - Swing motor (T port)
- (10): Center swivel joint (E port) - Solenoid valve
- (11): Center swivel joint (B port) - Travel control valve, left (A2 port)
- (12): Center swivel joint (D port) - Travel control valve, right (B5 port)
- (13): Center swivel joint (A port) - Travel control valve, left (B2 port)
- (14): Center swivel joint (C port) - Travel control valve, right (A5 port)

3. Pull out pin (15) on the side of center swivel joint and remove the jam plate from the center swivel joint.



4. Remove four mounting bolts (16).



5. Remove center swivel joint assembly (17). ※1

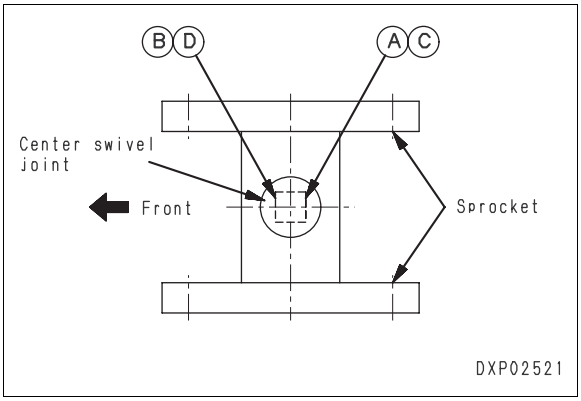
kg Center swivel joint assembly: **40 kg**

INSTALLATION

- Install in reverse order of removal.

※1

Install the center swivel joint facing in the direction shown in the diagram.
(The diagram shows the machine as seen from above)



- **Refilling with oil (hydraulic tank)**
  - ★ Add oil through the oil filter to the specified level. Run the engine to circulate the oil through the system. Then check the oil level again.
- **Bleeding air**
  - ★ Bleed the air from the travel motor. For details see TESTING AND ADJUSTING, Air Bleeding of Various Parts.

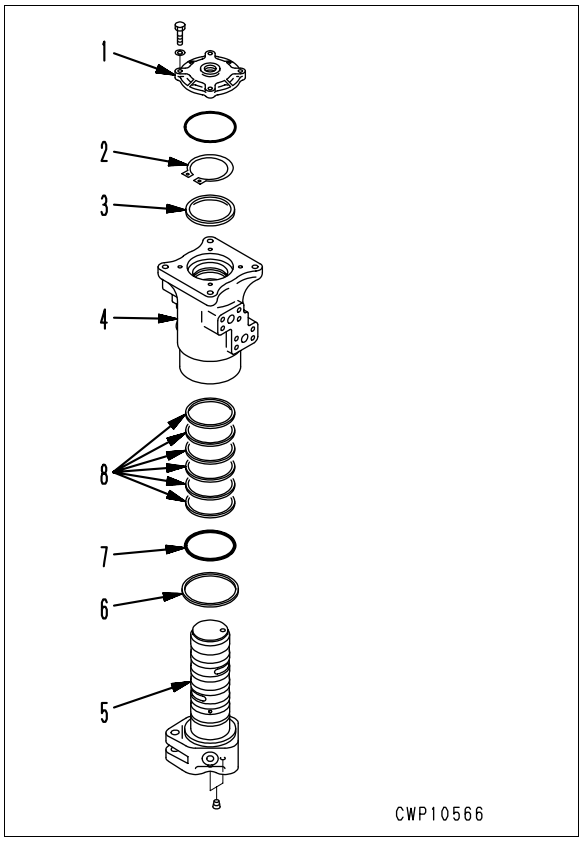
DISASSEMBLY AND ASSEMBLY OF CENTER SWIVEL JOINT ASSEMBLY

SPECIAL TOOLS

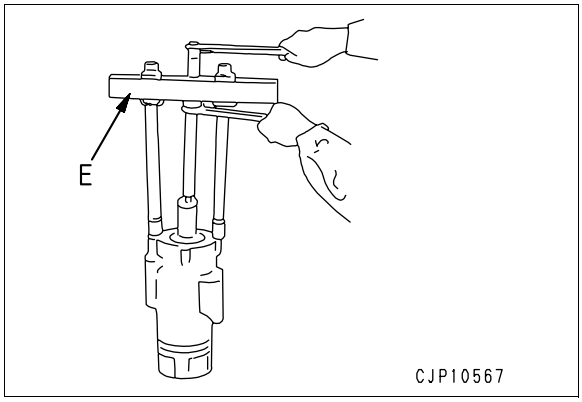
Mark		Part No.	Part Name	Necessity	Qty	Distinction*	Sketch
E		790-101-2501	Push puller	●	1		
		• 790-101-2510	• Block		1		
		• 790-101-2520	• Screw		1		
		• 791-112-1180	• Nut		1		
		• 790-101-2540	• Washer		1		
		• 790-101-2630	• Leg		2		
		• 790-101-2570	• Plate		4		
		• 790-101-2560	• Nut		2		
		• 790-101-2650	• Adapter		2		

*Distinction between new and existing part.

DISASSEMBLY



1. Remove cover (1).
2. Remove snap ring (2).
3. Using tool **E**. pull out swivel rotor (4) and ring (3) from swivel shaft (5).
4. Remove seal (6) from swivel shaft (5).
5. Remove O-ring (7) and slipper seal (8) from swivel rotor (4).



ASSEMBLY

1. Assemble slipper seal (8) and O-ring (7) to swivel rotor (4).
2. Assemble seal (6) in swivel shaft (5).
3. Set swivel shaft (5) to block, then using push tool, tap swivel rotor (4) with a plastic hammer to install.

   Contact surface of rotor, shaft: **Grease (G2-L1)**

   ★ When installing the rotor, be extremely careful not to damage the slipper seal and the O-ring.
4. Install ring (3) and secure with snap ring (2).
5. Fit O-ring and install cover (1).

   Mounting bolt: **31.4 ± 2.9 Nm {3.2 ± 0.3 kgm)**

REMOVAL AND INSTALLATION OF HYDRAULIC TANK ASSEMBLY

REMOVAL

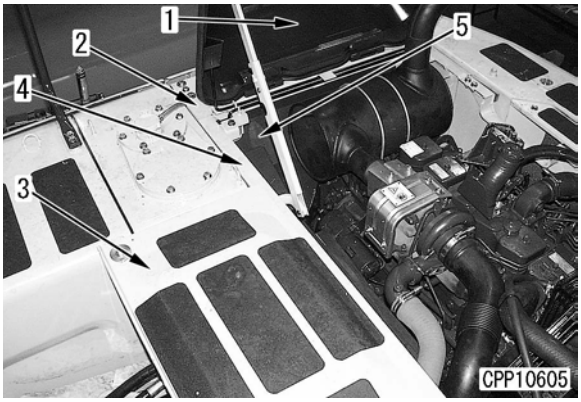
1. Drain oil from hydraulic tank ※1

   Hydraulic oil: 240 **l**

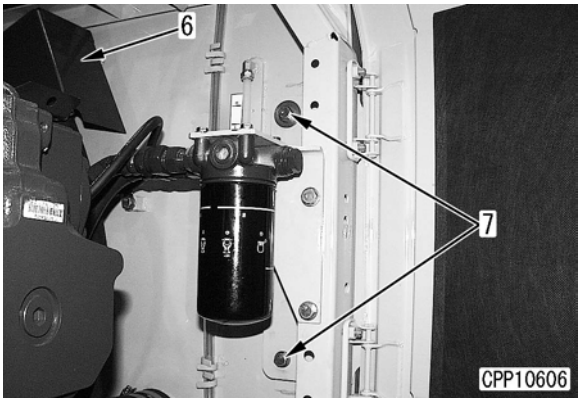
2. Open up the engine hood.

3. Remove engine hood (1), hydraulic pump upper cover (2) and control valve cover (3).

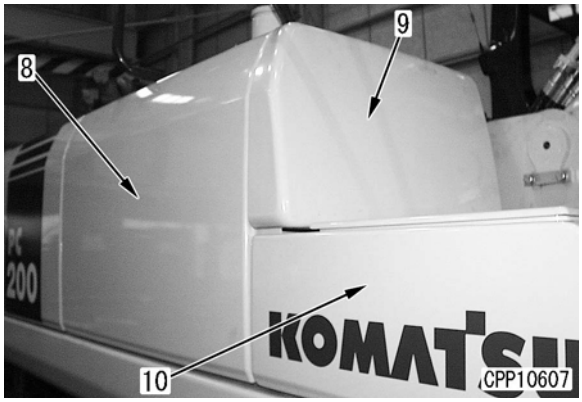
4. Remove cover mounting frame (4) and engine partition plate (5).



5. Remove engine partition plate (6) and partition bracket mounting bolts (7) on the hydraulic tank side.



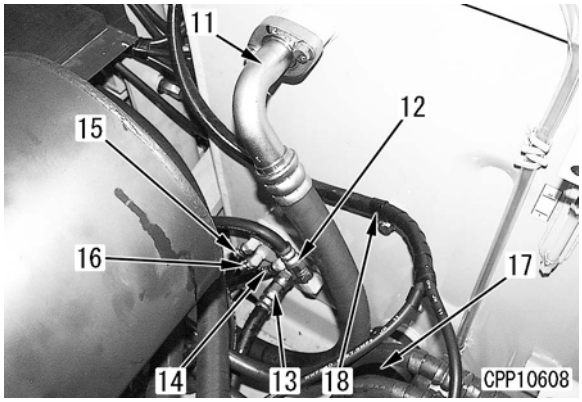
6. Remove hydraulic tank side cover (8).
   ★ Remove two cover (8) mounting bolts at the front after removing cover (9) and (10).



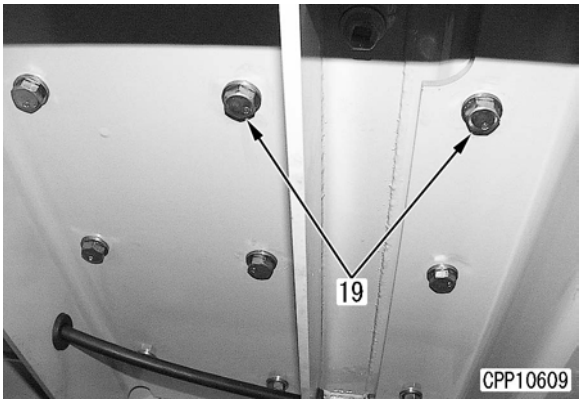
7. Disconnect the seven hoses. ※2
   - (11): Hydraulic oil return hose
   - (12): Swing motor drain hose
   - (13): Pump drain hose
   - (14): PPC drain hose
   - (15): Solenoid valve drain hose
   - (16): Main valve drain hose
   - (17): Pump suction hose

   ★ Disconnect suction hose (17) after disconnecting the sump suction tube.
   ★ Attach a tag to the hoses for identification.
   ★ Protect the fitting and the tapered seal portion of the elbow with a sleeve nut so that they may not be damaged.

8. Remove hose clamp (18).

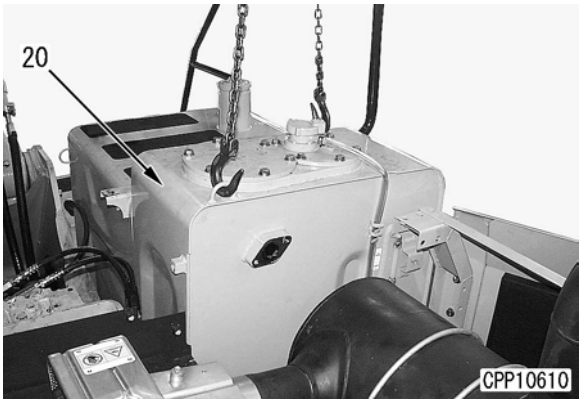


9. Sling the hydraulic tank assembly and remove six mounting bolts (19). ※3



10. Lift off hydraulic tank assembly (20) to remove it.

kg Hydraulic tank assembly: 130 kg



INSTALLATION

- Install in reverse order of removal.

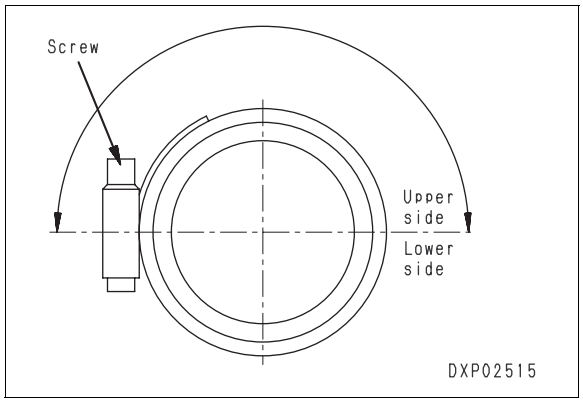
※1

N·m Hydraulic tank drain plug:
58.8 - 78.5 Nm {6.0 - 8.0 kgm}

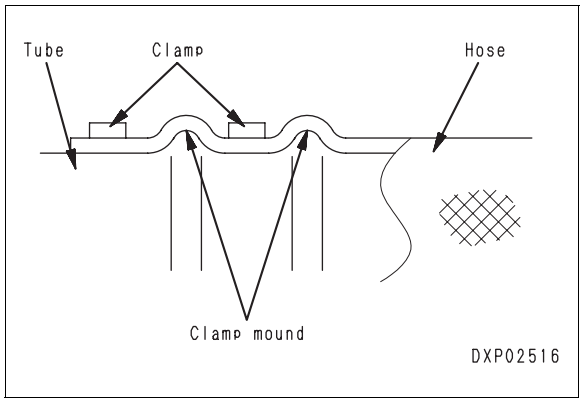
※2

★ After tightening the suction hose clamp screw, check that the screw is located within the range shown in the diagram.

N·m Hose clamp screw:
8.8 ± 0.5 Nm {90 ± 5 kgm}



★ Install the hose clamp and tighten the clamp screw as shown in the diagram below.



※3

N·m Hose clamp screw:
245.2 - 308.9 Nm {25 - 31.5 kgm}

- **Refilling with oil (hydraulic tank)**
  ★ Add oil through the oil filler to the specified level.
  Run the engine to circulate the oil through the system. Then check the oil level again.

Hydraulic tank: **Approx. 240 l**

- **Bleeding air**
  ★ Bleed the air.
  For details, see TESTING AND ADJUSTING. Air Bleeding of Various Parts.

REMOVAL AND INSTALLATION OF CONTROL VALVE ASSEMBLY

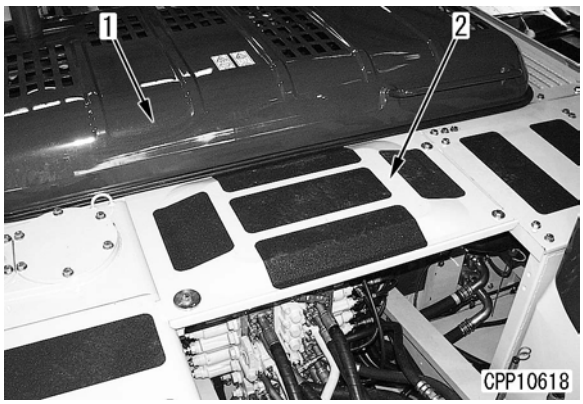
REMOVAL

⚠ Lower the work equipment to the ground for safety and stop the engine. Unscrew the oil filler cap on the hydraulic tank slowly to release pressure inside the tank. Then move the safety lock lever to the LOCK position.

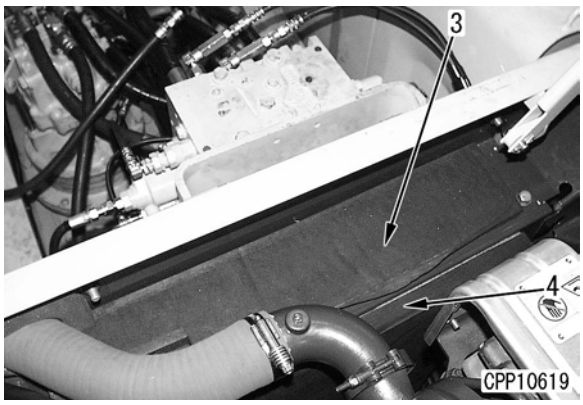
★ Attach an identification tag to each piping to avoid a mistake in the position of installation later.

1. Open up engine hood (1).

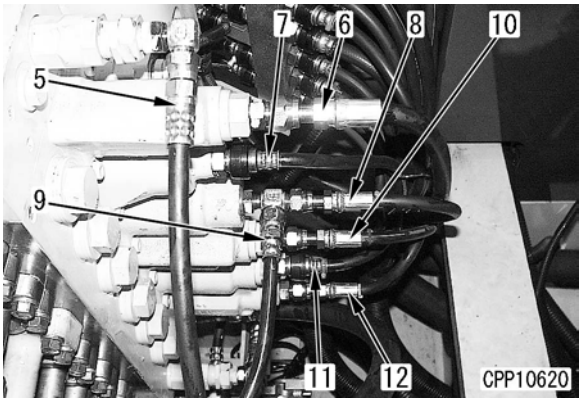
2. Remove control valve upper cover (2).



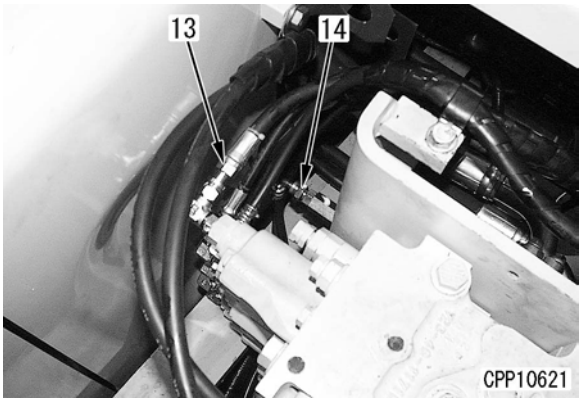
3. Remove engine partition cover (3) and control valve partition cover (4).



4. Disconnect the eight PPC hoses at left.
   - (5): Relief valve hose
   - (6): Bucket dump hose (Hose band, black)
   - (7): Travel left front and reverse hose
   - (8): Boom raise hose (Hose band, green)
   - (9): Swing LS separator valve hose
   - (10): Left swing hose (Hose band, red)
   - (11): Travel right front and reverse hose (Hose band, blue)
   - (12): Arm dump hose (Hose band, yellow)

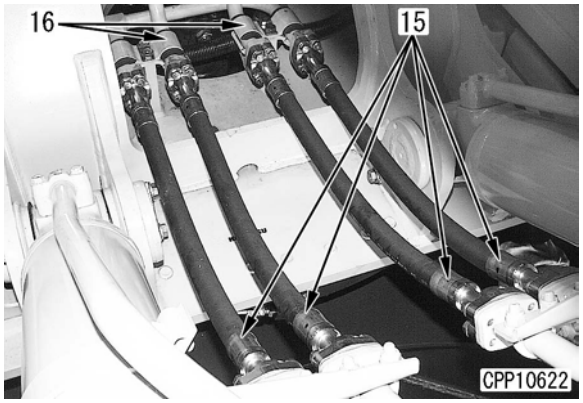


5. Disconnect the seven PPC hoses at right.
   - (13): PPC hoses from the top to bottom
     Bucket digging (Hose band, white)
     Travel left front and reverse (Hose band, red)
     Boom lower (Hose band, brown)
     Right swing
     Travel right front (Hose band, green)
     Arm digging (Hose band, blue)
   - (14): Divide/merge valve hose (Hose band, yellow blue)

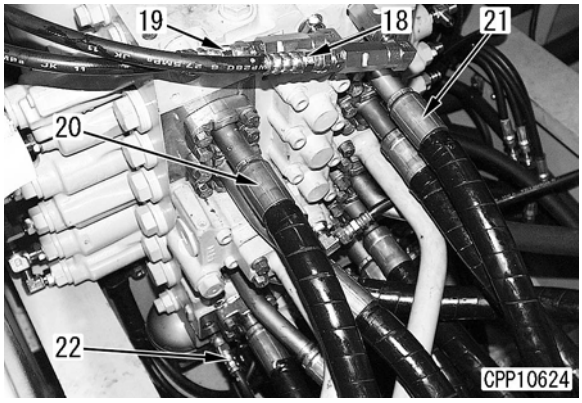


6. Disconnect four boom hoses (15).

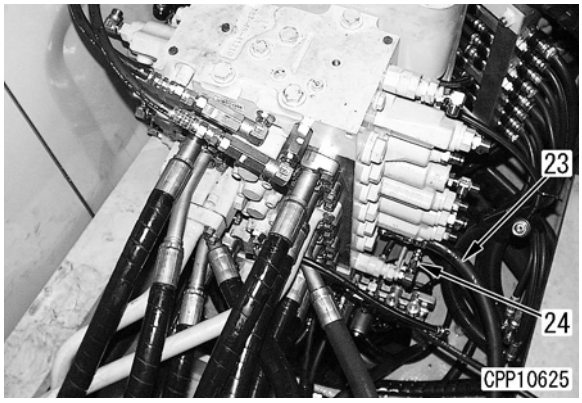
7. Remove boom tube mounting clamps (16) and (17).



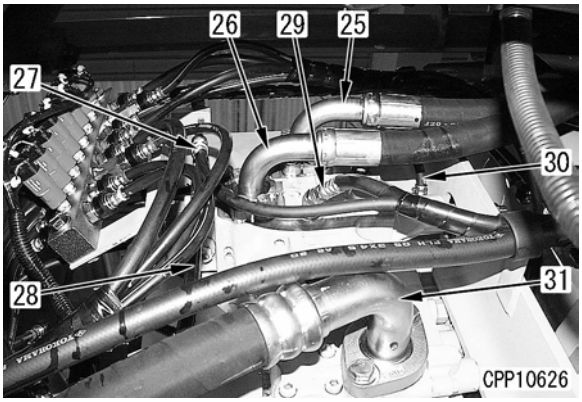
8. Disconnect the 13 control valve hoses and two tubes.
   - (18): PLS1 Hose
   - (19): PLS2 hose (hose band, red)
   - (20): From top to bottom
     A1 Port hose (Bucket head side)
     A2 Port hose (Swivel joint B port)
     A3 port tube (Boom bottom side)
     A4 port hose (Swing motor MA port)
     A5 port hose (Swivel joint C port)
     A6 port hose (Arm head side)
   - (21): From top to bottom
     B1 port hose (Bucket bottom side)
     B2 port hose (Swivel joint A port)
     B3 port tube (Boom head side)
     B4 port hose (Swing motor MB port)
     B5 port hose (Swivel joint B port)
     B6 port hose (Arm bottom side)
   - (22): Drain hose (TS port)



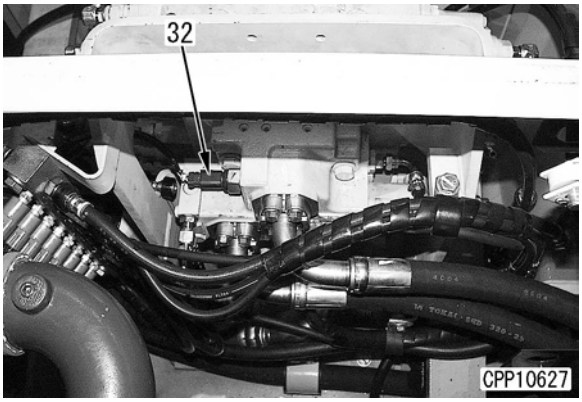
9. Disconnect hose (23) between the control valve and the swing motor as well as hose (24) between the control valve and the solenoid.



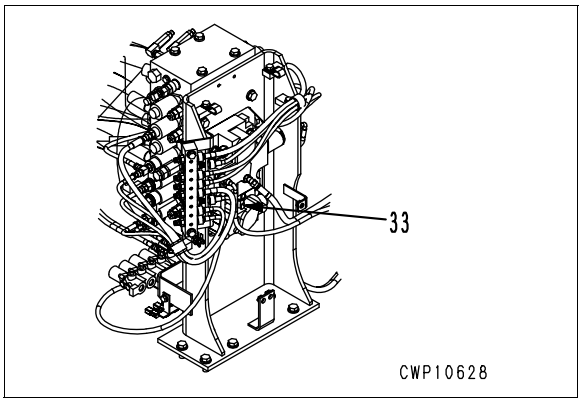
10. Disconnect the seven hoses.
    - (25): PP1 port hose (Rear pump) (Hose band, yellow)
    - (26): PP2 port hose (Front pump)
    - (27): PEPC port hose (Pump)
    - (28): P1 port hose (Solenoid)
    - (29): PPS2 port hose (Front pump)
    - (30): PST port hose (Solenoid) (Hose band, brown)
    - (31): T port hose (Oil cooler)



11. Disconnect the control valve wiring connectors at two points.
    - (32): CAN-A51 (Front pump pressure sensor)

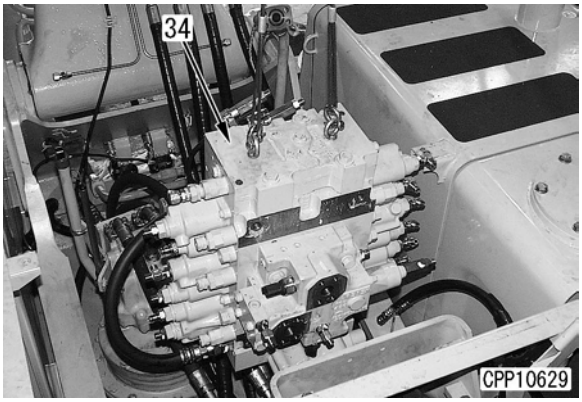


    - (33): CN-A52 (Rear pump pressure sensor)



12. Remove the three mounting bolts for control valve assembly (34) and lift it off for removal.

kg Control Valve Assembly: 220 kg



INSTALLATION

- Install in reverse order of removal.
- **Refilling with oil (hydraulic tank)**
  - ★ Add oil through the oil filler to the specified level.
    Run the engine to circulate the oil through the system. Then check the oil level again.
- **Bleeding air**
  - ★ Bleed the air from the circuit between the valve and the hydraulic cylinder.
    For details, see TESTING AND ADJUSTING, Air Bleeding of Various Parts.

DISASSEMBLY AND ASSEMBLY OF CONTROL VALVE ASSEMBLY

★ This chapter deals with only precautions to be followed when disassembling and reassembling the control valve assembly.

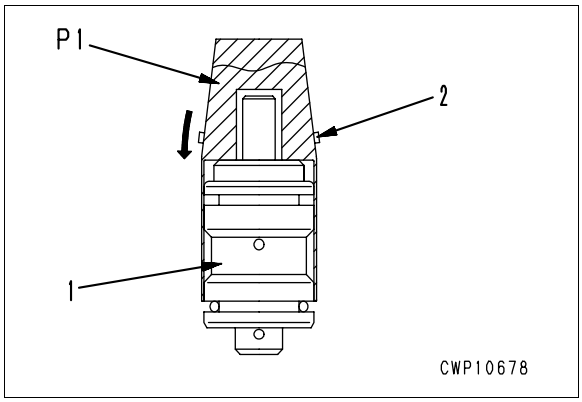
SPECIAL TOOLS

Mark		Part No.	Part Name	Necessity	Qty	Distinction*	Sketch
P	1	796-946-1310	Guide		1		
		(For 723-46-40100)					
		796-946-1610	Guide		1		
		(For 723-46-41100)					
		796-946-1810	Guide		1		
		(For 723-46-43100 & 723-46-43400)					
		796-946-2210	Guide		1		
		(For 723-46-45100)					
		796-946-1910	Guide		1		
		(For 723-46-46101 & 723-46-46300)					
	2	796-946-1320	Guide		1		
		(For 723-46-40100)					
		796-946-1620	Guide		1		
		(For 723-46-41100)					
		796-946-1520	Guide		1		
		(For 723-46-42700)					
		796-946-1820	Guide		1		
		(For 723-46-43100 & 723-46-43400)					
		796-946-2220	Guide		1		
		(For 723-46-45100)					
		796-946-1920	Guide		1		
		(For 723-46-46101 & 723-46-46300)					
	3	796-946-1330	Sleeve		1		
		(For 723-46-40100)					
		796-946-1630	Sleeve		1		
		(For 723-46-41100)					
		796-946-1430	Sleeve		1		
		(For 723-46-42700)					
		796-946-1830	Sleeve		1		
		(For 723-46-43100 & 723-46-43400)					
		796-946-2230	Sleeve		1		
		(For 723-46-45100)					
		796-946-1930	Sleeve		1		
		(For 723-46-46101 & 723-46-46300)					

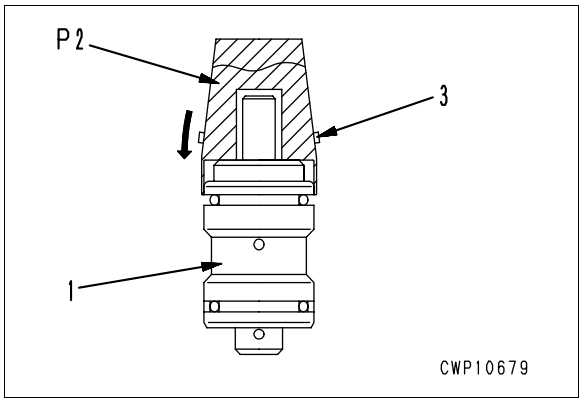
*Distinction between new and existing part.

Procedures for replacing pressure compensation valve seal

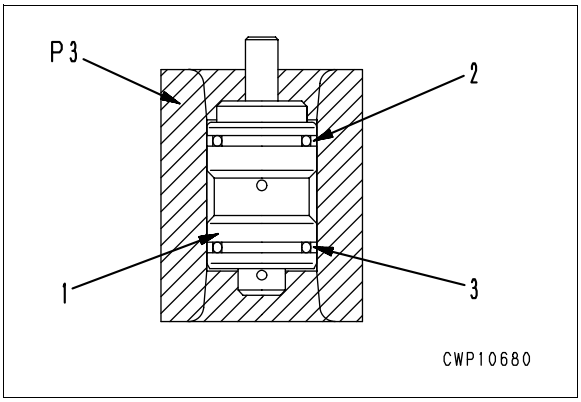
1. Remove the seal from pressure compensation valve.
   ★ Clean the pressure compensation valve thoroughly, and then assemble the seal, using a tool, as indicated in the diagram.
2. Fit an O-ring to piston (1).
3. Set tool **P1** to piston (1) and push it in slowly by hand so that seal (2) may spread out evenly.
   ★ The seal may be also fitted by pushing it down to the flat surface of the tool and then pushing it in with the tool fitted to the piston.



4. Likewise, set tool **P2** to piston (1) in the same direction and push it slowly by hand so that another seal (3) may be spread out evenly.
   ★ The seal may be also fitted by pushing it down to the flat surface of the tool and then pushing it in with the tool fitted to the piston.



5. Keep compensation tool **P3** fitted to piston (1) for about one minute so that seal (2) and (3) will become well adapted.
   ★ Check that there is no protrusion or cut on the seal.



6. Assemble the piston in the sleeve.
   ★ If its found difficult to install the sleeve, do not attempt to push it in forcibly, but try it again after repeating the same process in the Item 5. above and confirming the seals are well adapted.
   ★ After the installation, push the piston by hand and check that the piston reacts only with spring force.

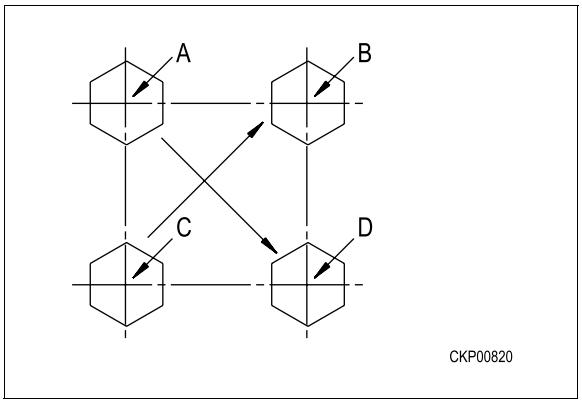
ASSEMBLY

- Coat the sliding surface with engine oil and then reassemble the control valve assembly.
- Upper and lower control valve covers

  Mating surfaces of upper and lower control covers:
  Sealant 242 or equivalent

- Tighten the mounting bolts for the upper and lower control covers in the sequence illustrated at right.

  Mounting bolt for upper and lower control covers:
  156.9 - 176.5 Nm (16 - 18 kgm)



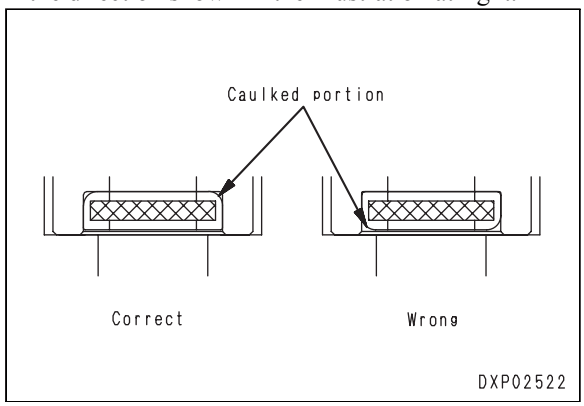
- Merge-divider valve

  Mating surfaces of merge-divider valve:
  Sealant 242 or equivalent

- Tighten the mounting bolts for the merge-divider valve in the same sequence as that for the control valve cover mounting bolts.

  Merge-divider valve mounting bolt:
  156.9 - 176.5 Nm (16 - 18 kgm)

- A filter for the valve assembly is to be assembled in the direction shown in the illustration at right.



- Tighten the boom lock valve mounting bolts and the back pressure valve mounting bolts in the same sequence as that for the control valve cover mounting bolts.

  N·m Mounting bolts for boom lock valve and back pressure valve:
  58.8 - 73.6 Nm (6 - 7 kgm)

- Pressure compensation valve
  - ★ Install each pressure compensation valve, paying attention to the counter mark that was put when removing it.
- Main relief valve assembly
  After assembling the main relief valve assembly in the control valve, refer to the section of Inspection and Adjustment of Hydraulic Oil Pressure in Hydraulic Circuit for Work Equipment, Swing and Travel in the chapter, TESTING AND ADJUSTING, in this manual.

REMOVAL AND INSTALLATION OF HYDRAULIC PUMP ASSEMBLY

SPECIAL TOOLS

Mark	Part No.	Part Name	Necessity	Qty	Distinction*	Sketch
D	796-460-1210	Oil stopper	■	1		

*Distinction between new and existing part.

REMOVAL

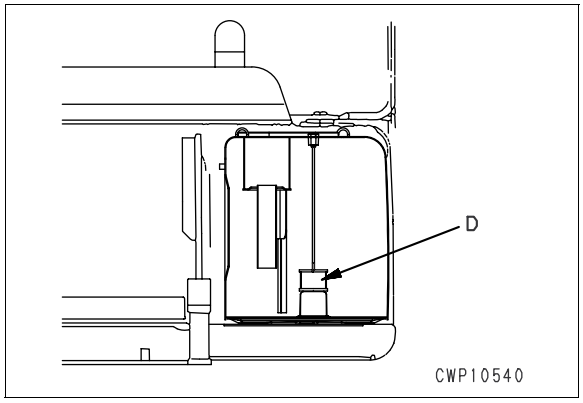
⚠ Disconnect the negative terminal (-) of the battery before starting with the work.

⚠ Lower the work equipment to the ground and stop the engine. Then loosen the oil filler cap on the hydraulic tank slowly to release pressure inside the tank.

★ Attach identification tags to all piping to avoid mistakes when installing.

1. Remove hydraulic tank strainer and stop oil flow-out using tool **D**.
   ★ If tool **D** is not used, remove the drain plug and drain oil from the hydraulic tank and piping.

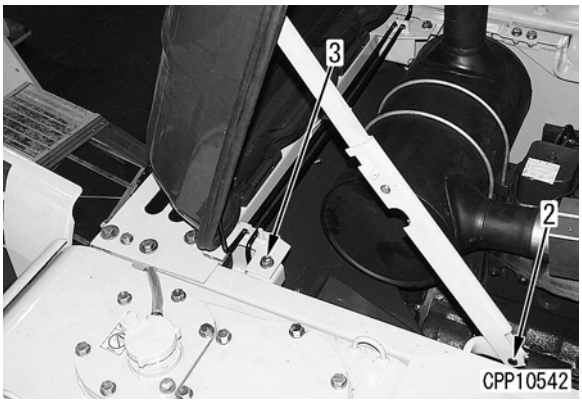
   Hydraulic tank: Approx. 240 **l**



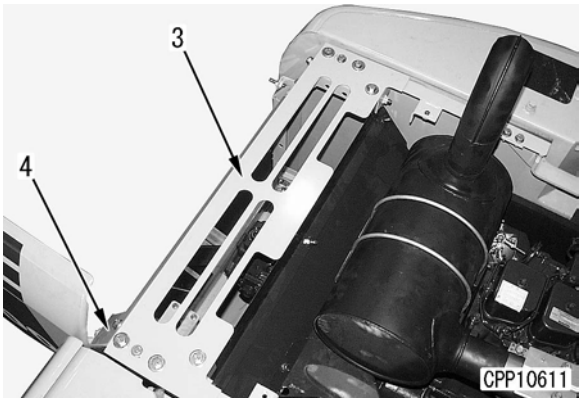
2. Drain oil from the damper case.

3. Sling engine hood (1).

4. Remove pin (2) and mounting bolt (3). Then lift off the engine hood to remove it.

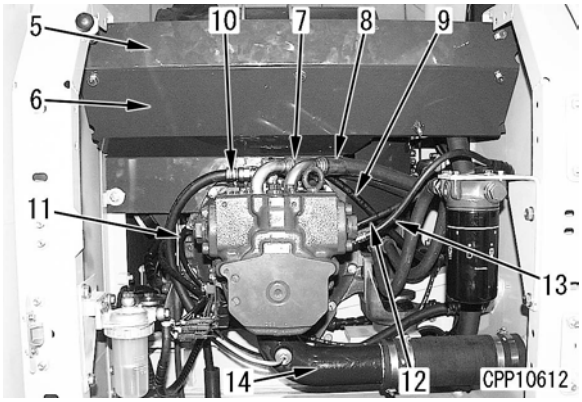


5. Remove cover (3) and plate (4).

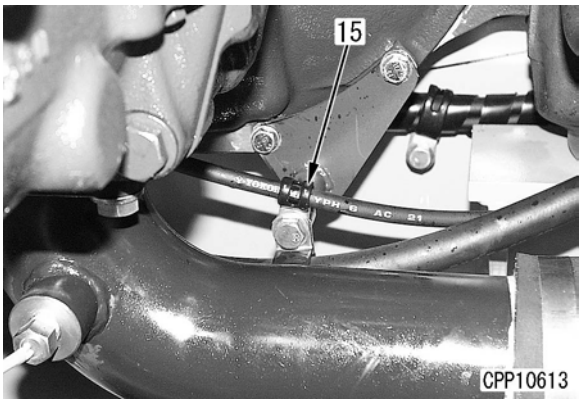


6. Remove covers (5) and (6).

7. Disconnect the following eight hoses. ※1
   - (7): Front pump discharging port hose
   - (8): Rear pump discharging port hose
   - (9): Pump pressure input port hose
   - (10): Drain port hose
   - (11): EPC source pressure port hose (Color band, yellow)
   - (12): Load pressure input port hose (Color band, red)
   - (13): Load pressure input port hose
   - (14): Suction port hose

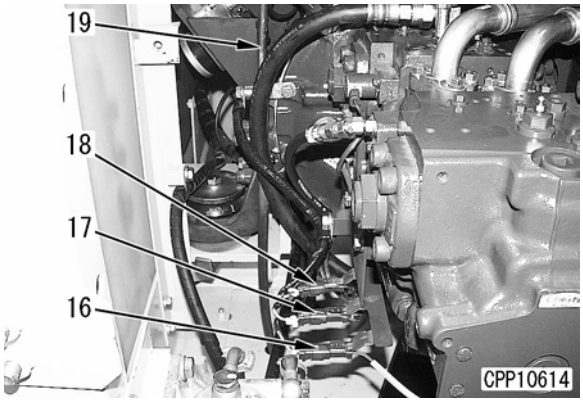


8. Remove clamp (15).



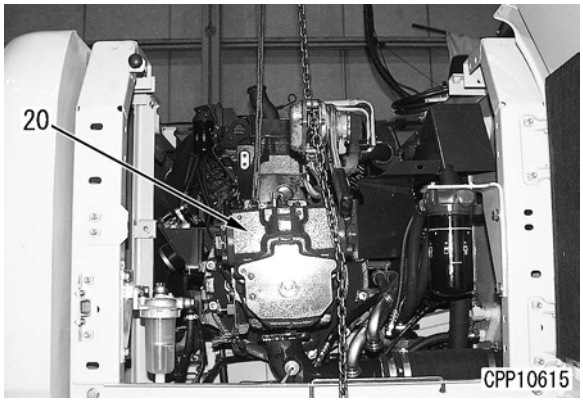
9. Disconnect the following connectors at three points.
   - (16): A61 (Hydraulic oil temperature sensor) (Color band, white)
   - (17): V21 (PC-EPC solenoid valve) (Color band, white)
   - (18): V22 (LS-EPC solenoid valve) (Color band, red)

10. Disconnect exhaust muffler drain tube (19).



11. Lift off hydraulic pump assembly (20) to remove. ※2

kg Hydraulic pump assembly: 170 kg



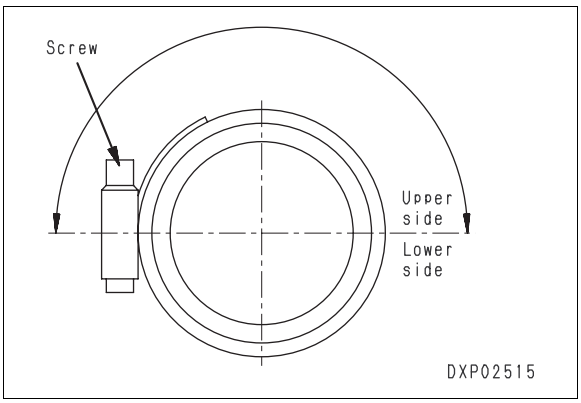
INSTALLATION

- Install in reverse order of removal.

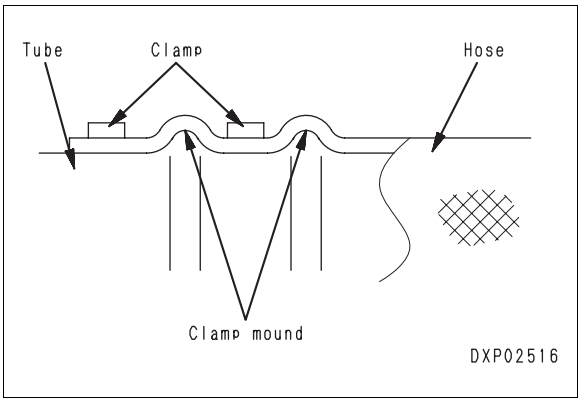
※1

★ After tightening the hose clamp screw, check that the screw is in the position shown in the diagram at right.

N·m Suction hose clamp screw:
8.8 ± 0.5 Nm (90 ± 5 kgm)



★ Install the hose clamp and tighten the clamp screw as shown in the diagram below.



※2

Hydraulic pump involute spline:
Anti-friction compound (LM-G)

Hydraulic pump case mating surface:
Gasket sealant (LG-6)

- Refilling hydraulic oil (Damper case)
  Refill hydraulic oil through the oil filler port to the specified level.

  Damper hydraulic oil : Approx. 0.75 **l**

- Refilling hydraulic oil (hydraulic tank)
  Refill hydraulic oil through the oil filler port to the specified level, and let the oil circulate in the hydraulic system by starting the engine. Then check the oil level again.

  Hydraulic tank : Approx. 240 **l**

- Air bleeding
  Refer to the Air Bleeding of Various Parts section in the TESTING AND ADJUSTING chapter in this manual.

REMOVAL AND INSTALLATION OF OIL SEAL IN HYDRAULIC PUMP INPUT SHAFT

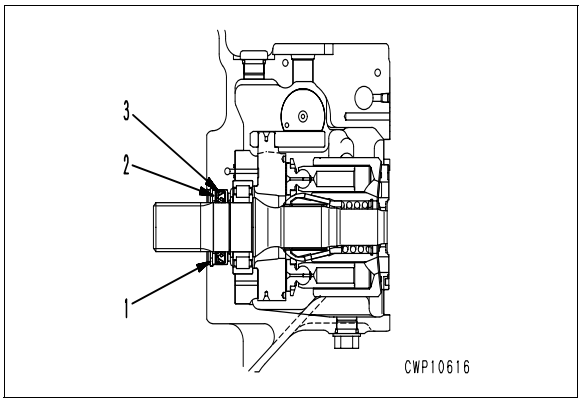
SPECIAL TOOLS

Mark	Part No.	Part Name	Necessity	Qty	Distinction*	Sketch
N	791-463-1141	Push tool	■	1		
	790-201-2740	Spacer	■	1		

*Distinction between new and existing part.

REMOVAL

1. Remove the hydraulic pump assembly, referring to the section of Removing Hydraulic Pump Assembly.
2. Remove snap ring (1) and then remove spacer (2).
3. Pry off oil seal (3) with a screwdriver. ※1
   - ★ When attempting to pry off the seal, do not damage the shaft.



INSTALLATION

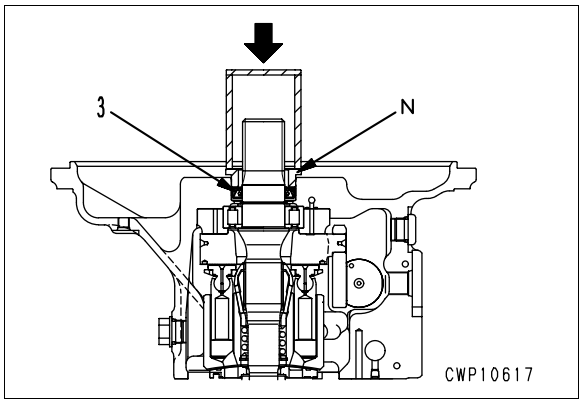
- Install in reverse order of removal.

※1

Oil seal lip portion: Grease (G2-LI)

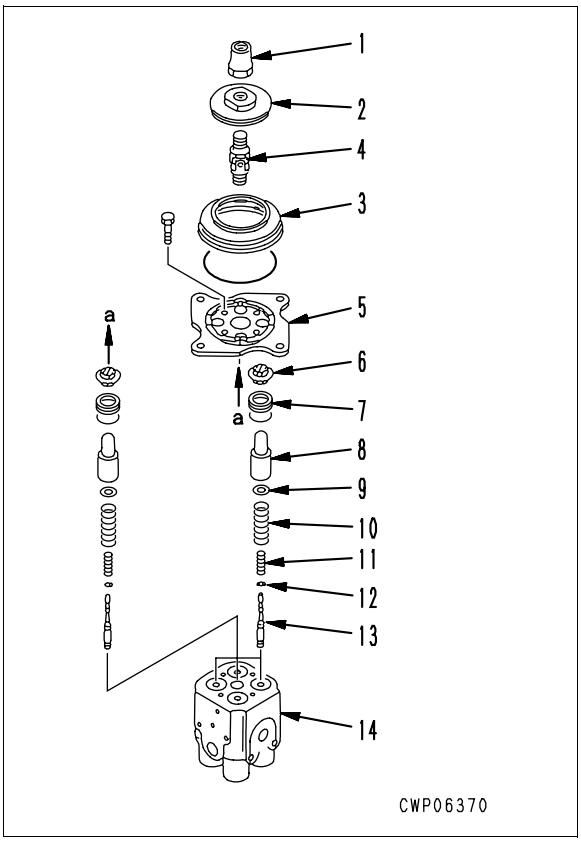
Oil seal outer circumference: Grease (G2-LI)

- ★ Coat the oil seal outer circumference thinly with grease.
- ★ Press-fit oil seal (3), using tool **N**.



DISASSEMBLY AND ASSEMBLY OF WORK EQUIPMENT PPC VALVE ASSEMBLY

★ This section deals with only precautions to be followed when reassembling the PPC valve assembly for work equipment.



ASSEMBLY

- Reassembling work equipment PPC valve reassembly
  - ★ Install spring (11) so that the end surface of smaller end coil diameter (inner diameter) will face the shim (12) side.
  - ★ Springs (10) in use differ in the number of turns according to hydraulic ports as classified in the table below. Hence take care when installing one.

Port location	Spring free length
P1, P2	44.4 mm
P3, P4	42.4 mm

  - ★ The location of each port is stamped in the lower part of the valve body.

Piston (8): Grease (G2-LI)

★ When assembling piston (8), coat the piston outer periphery and body hole inner periphery with grease.

N·m Plate (5) mounting bolt: 11.8 - 14.7 Nm (1.2 -1.5 kgm)

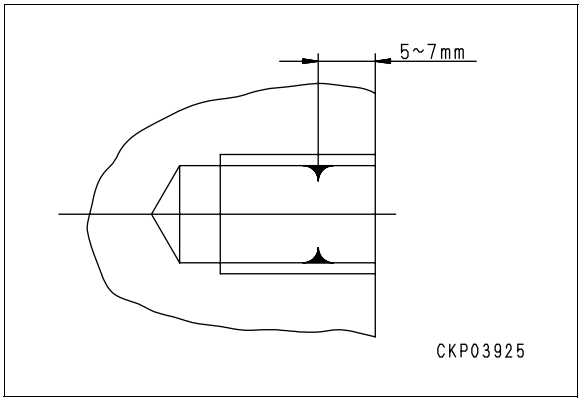
Joint (4) sliding surface: Grease 2 - 4 cc (G2-LI)

Body female screw portion: Adhesive compound (LT-2)

★ Coat the female screw body with Loctite at two spots as shown in the diagram below. Each spot is to be coated with a drop (approx. 0.02 g).

N·m Joint (4): 39 - 49 Nm (4 - 5 kgm)

★ Strictly follow the specified torque for the joint.



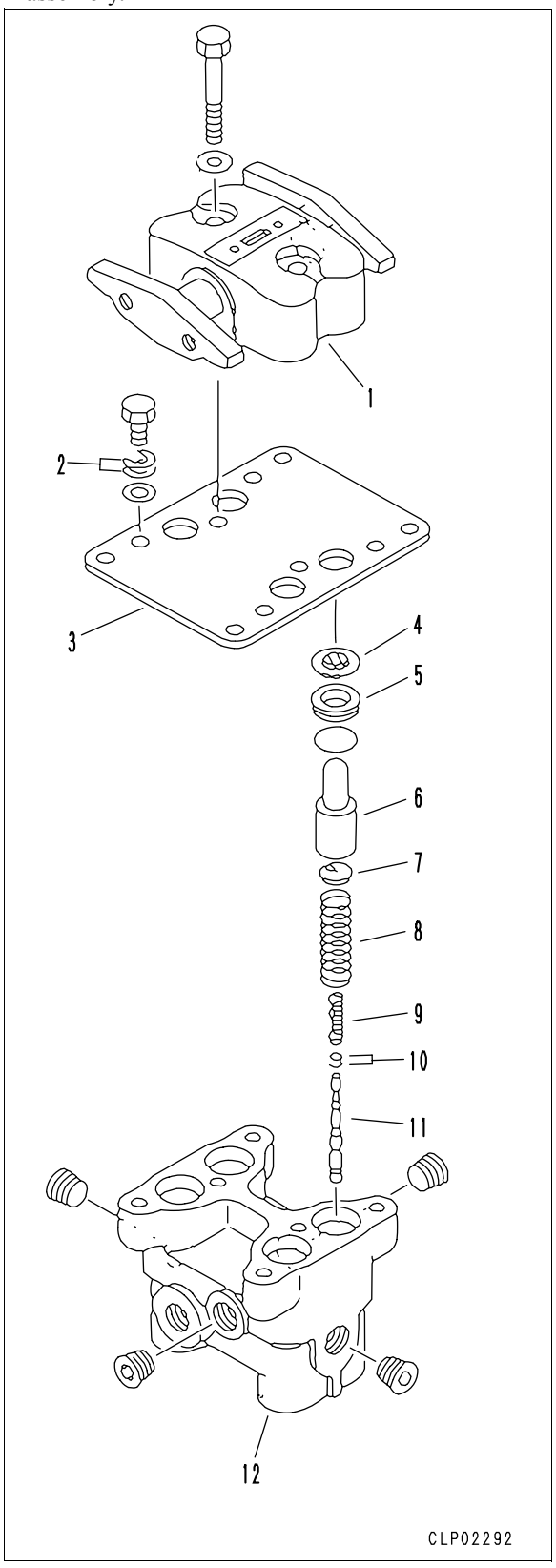
Contact surfaces of piston and disc (2): Grease 0.3 - 0.8 cc (G2-LI)

N·m Nut (1): 98 - 127 Nm (10 - 13 kgm)

★ After assembling the disc, refer to the Adjustment of Work Equipment and Swing PPC Valve section of the TESTING AND ADJUSTING chapter of this manual.

DISASSEMBLY AND ASSEMBLY OF TRAVEL PPC VALVE ASSEMBLY

★ This chapter deals with only precautions to be followed when reassembling the travel PPC valve assembly.



ASSEMBLY

- Travel PPC valve assembly
  - ★ Before fitting a shim, check its required number and thickness, then fit it to the same position as confirmed when removing it.
    Thickness of standard shim: 0.3 mm
  - ★ The spring is symmetrical between the upper and lower sides, so fit it with the side of smaller end coil diameter (inner diameter) facing the shim side.


Piston outer periphery and body hole inner periphery:
Grease (G2-LI)


Shaft sliding portion and connecting portion of piston and lever:
Grease (G2-LI)

DISASSEMBLY AND ASSEMBLY OF HYDRAULIC CYLINDER ASSEMBLY

SPECIAL TOOLS

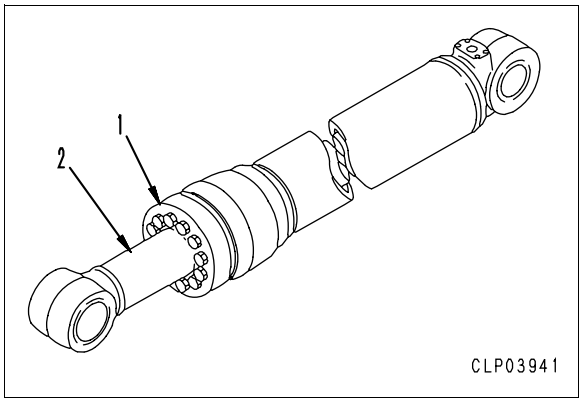
Mark		Part No.	Part Name	Necessity	Qty	Distinction*	Sketch
Q	1	790-502-1003	Cylinder repair stand	●	1		
		790-101-1102	Pump	●			
	2	790-102-4300	Wrench Assembly	■	1		
		790-102-4310	Pin	■	2		
	3	790-720-1000	Expander	●	1		
	4	796-720-1670	Rubber Band (for boom and arm)	●	1		
		07281-01279	Clamp	●	1		
		796-720-1660	Rubber band (for bucket)	●	1		
		07281-01159	Clamp	●	1		
	5	790-201-1702	Push tool kit	■	1		
		• 790-201-1830	Push tool (for bucket)		1		
		• 790-201-1930	Push tool (for arm)		11		
		• 790-201-1940	Push tool (for boom)		1		
		• 790-101-5021	Grip		1		
		• 01010-50816	Bolt		1		
	6	790-201-1500	Push tool kit (for bucket)	●	1		
		• 790-201-1640	Push tool		1		
		• 790-101-5021	Grip		1		
		• 01010-50816	bolt		1		
		790-201-1980	Plate (for boom)	●	1		
		790-201-1990	Plate (for arm)	●	1		
		790-101-5021	Grip	●	1		
		01010-50816	Bolt	●	1		

*Distinction between new and existing part.

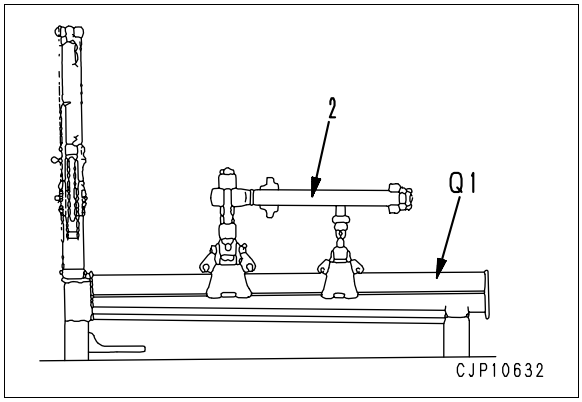
DISASSEMBLY

1. Piston rod assembly

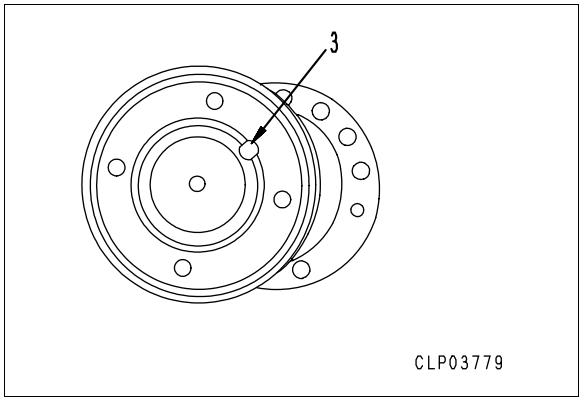
1) Remove piping from cylinder assembly.
2) Remove mounting bolts and disconnect head assembly (1).
3) Pull out piston rod assembly (2).
   ★ Place a container under the cylinder to catch the oil.



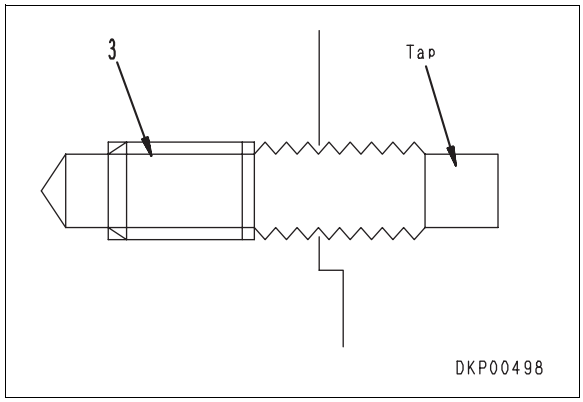
4) Disassemble piston rod assembly as follows.
   i) Set piston rod assembly (2) in tool **Q1.**



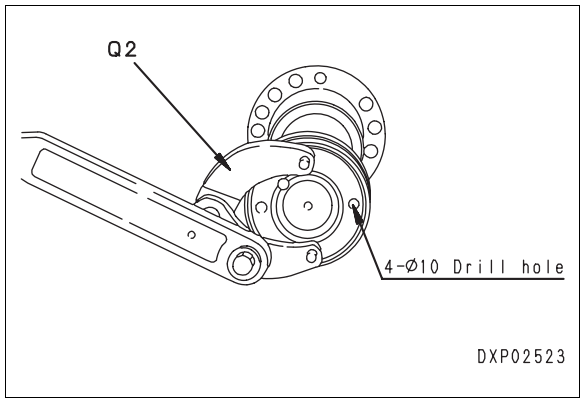
   ii) Remove stopper screw (3) of piston assembly.
   ★ Common screw size for boom, arm, and bucket cylinder: M12 x Pitch 1.75.



★ If the caulking of screw (3) is too strong and it cannot be removed, tighten the screw fully, then fit a tap to the thread and remove the screw.



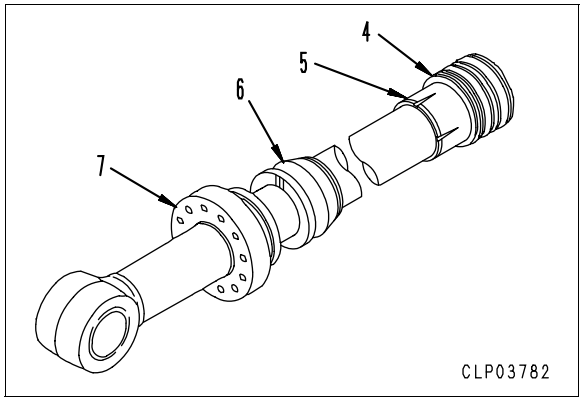
iii) Using tool **Q2**, remove piston assembly (4).
- When not using tool **Q2**, use the drill holes (∅ 10, 4 places) and loosen the piston assembly.



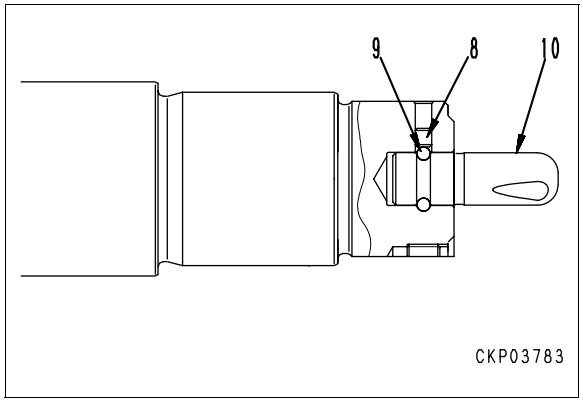
iv) Remove plunger (5).
- Boom and arm cylinder only

v) Remove collar (6).
- Boom and arm cylinder only

vi) Remove head assembly (7).

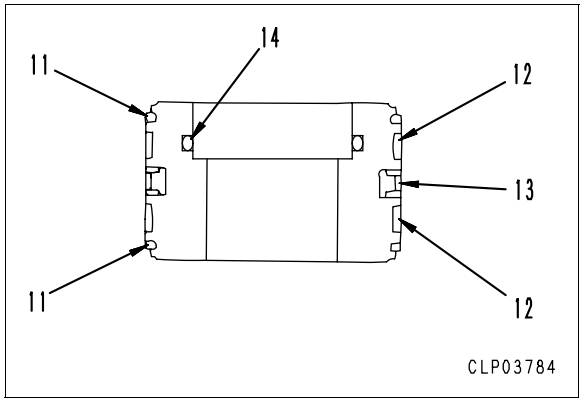


vii) Remove cap (8), and pull 12 balls (9), then remove plunger (10).
- Arm cylinder only



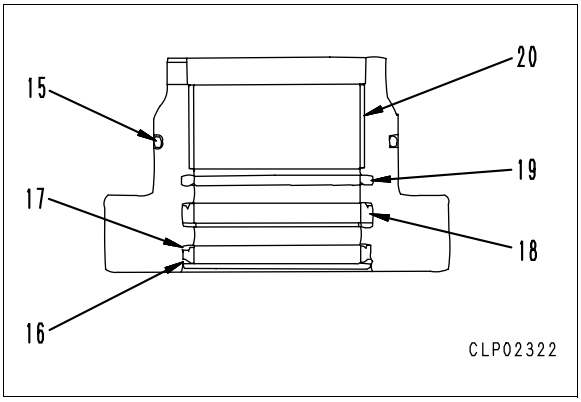
2. Disassembly of piston assembly

1) Remove rings (11).
2) Remove wear rings (12).
3) Remove piston ring (13).
4) Remove O-ring and backup ring (14).



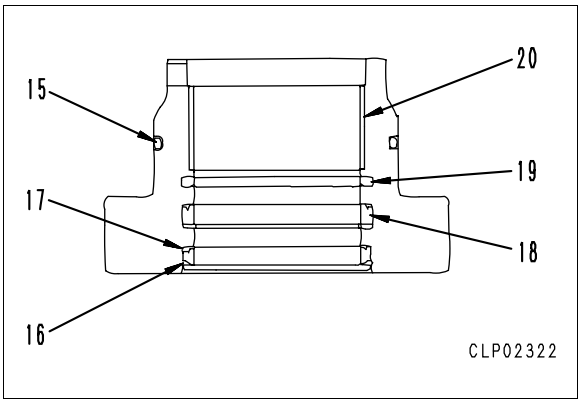
3. Disassembly of cylinder head assembly

1) Remove O-ring and backup ring (15).
2) Remove snap ring (16), then remove dust seal (17).
3) Remove rod packing (18).
4) Remove buffer ring (19).
5) Remove busing (20).



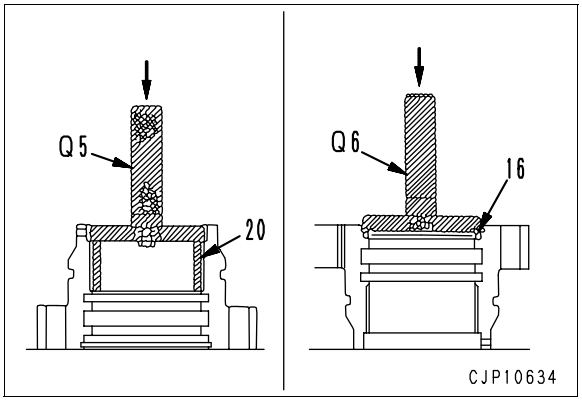
ASSEMBLY

★ Be careful not to damage the packing, dust seals, and O-rings.
★ Clean each part, then cover the piping ports and pin-inserting hole to prevent dust from entering them.
★ Do not try to force the backup ring into position. Warm it in warm water (50 - 60°C) before installing it.



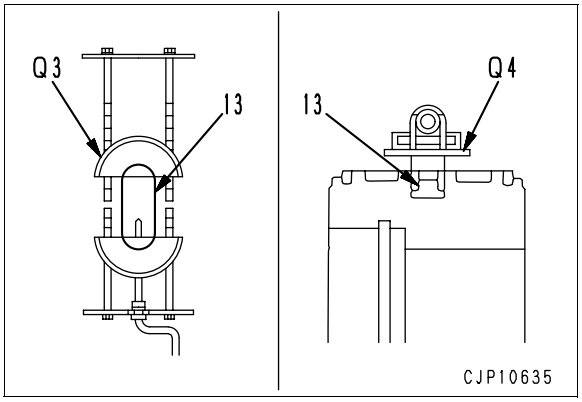
1. Assembly of head assembly

1) Using tool **Q5**, press fit bushing (20).
2) Assemble buffer ring (19).
3) Assemble rod packing (18).
4) Using tool **Q6**, install dust seal (17), and secure with snap ring (16).
5) Install backup ring and O-ring (15).



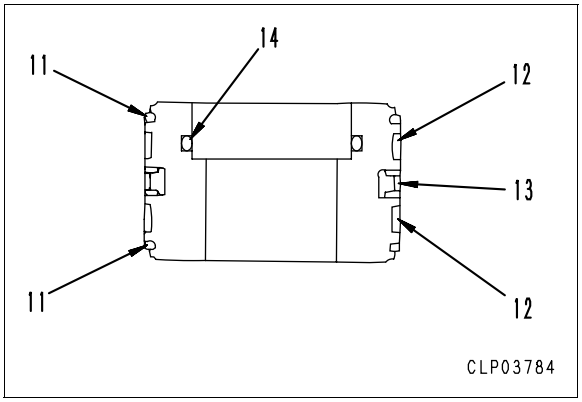
2. Assembly of piston assembly

1) Using tool **Q3**, expand piston ring (13).
   ★ Set the piston ring on tool **Q3**, and turn the handle 8 - 10 times to expand the ring.
2) Set tool **Q4** in position, and compress piston ring (13).



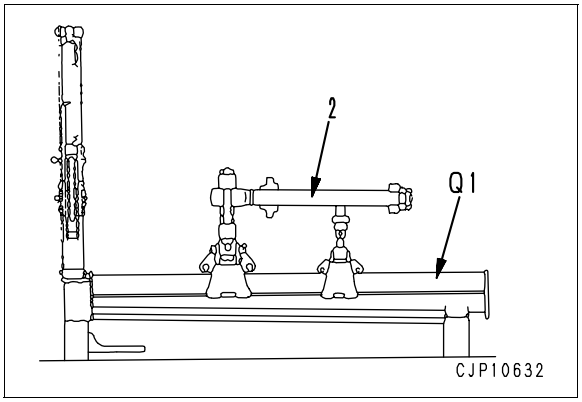
3) Install backup ring and O-ring (14).
4) Assemble wear ring (12).
5) Assemble ring (11).
   ★ Be careful not to open the end gap of the ring too wide.

Ring grove: **Grease (G2-L1)**

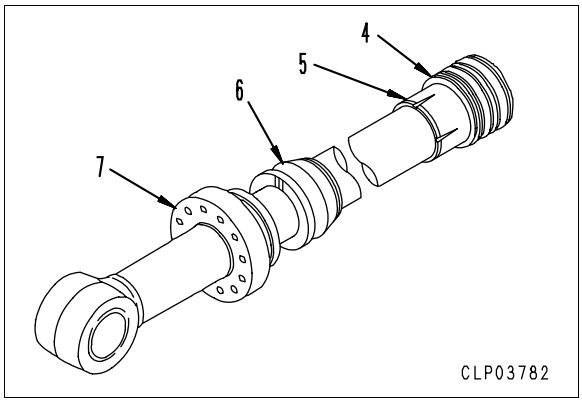


3. Piston rod assembly

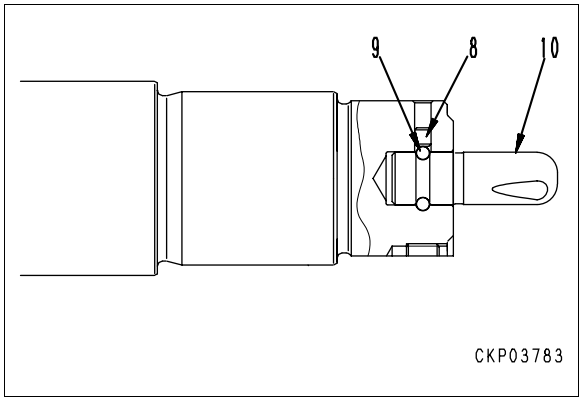
1) Set piston rod assembly (2) to tool **Q1**.



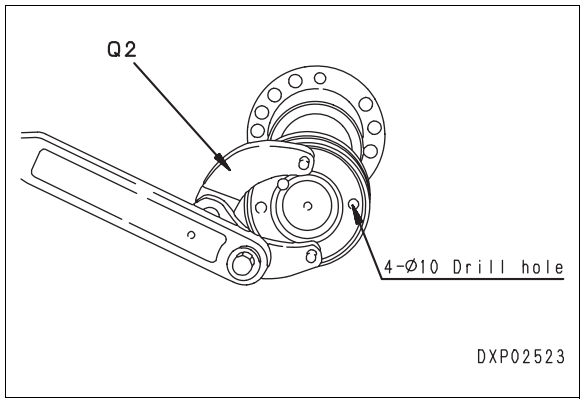
2) Assemble head assembly (7).
3) Fit O-ring and backup ring to collar (6), then assemble.
   • Boom and arm cylinder only
4) Assemble plunger (5).
   • Boom and arm cylinder only



5) Set cushion plunger (10) to piston rod, then assemble 12 balls (9) and secure with cap (8).
   ★ Check that there is a small amount of play at the tip of the plunger.
   • Arm cylinder only



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.

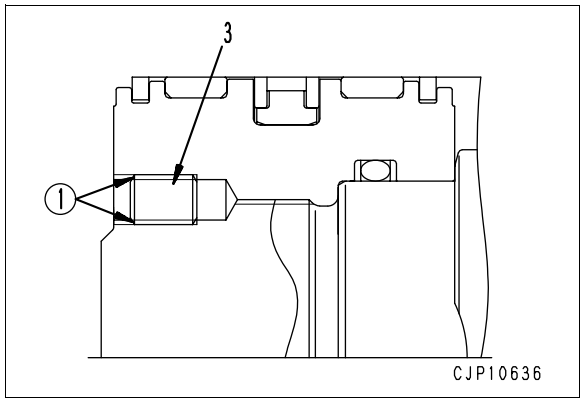


ii) Tighten screw (3).

Screw thread: Loctite No. 262

N·m Screw: 58.9 - 73.6 Nm {6 - 7.5 kgm}

iii) Caulk thread at 2 places with punch.

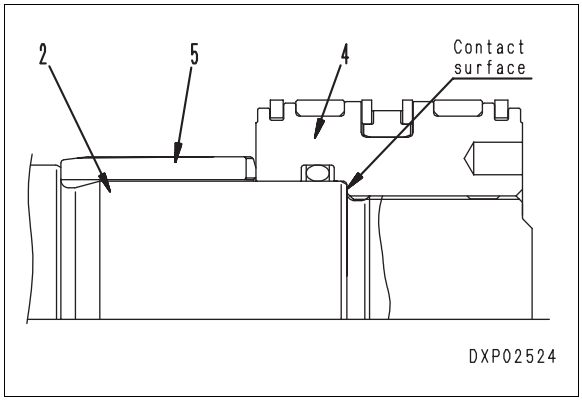


- When using a new part for either or both of rod piston assembly (2)
  - ★ For the rod with bottom cushion, mark the cushion plug position on the end of the rod.
  - Arm cylinder only

i) Screw in until piston assembly (4) contacts end face of rod, then use tool to tighten.

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

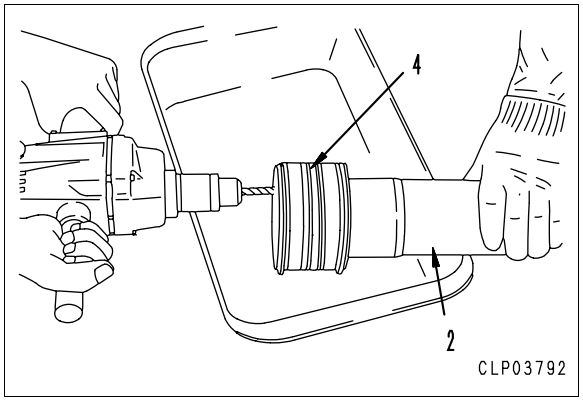
- ★ After tightening the piston, check that there is play in plunger (5).
- Boom, arm cylinder only



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

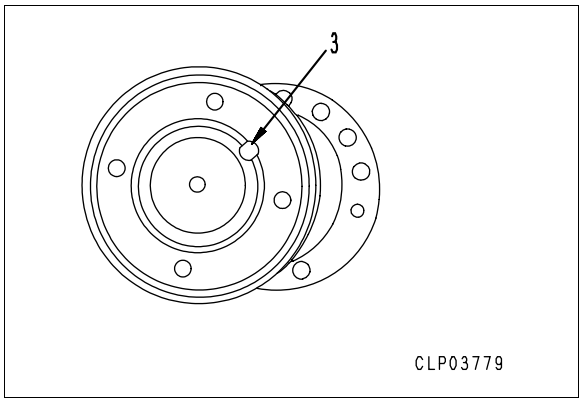
iii) After machining, wash thoroughly to remove all metal particles and dust.



iv) Tighten screw (3).

N·m Screw: 58.9 - 73.6 Nm {6 - 7 kgm}

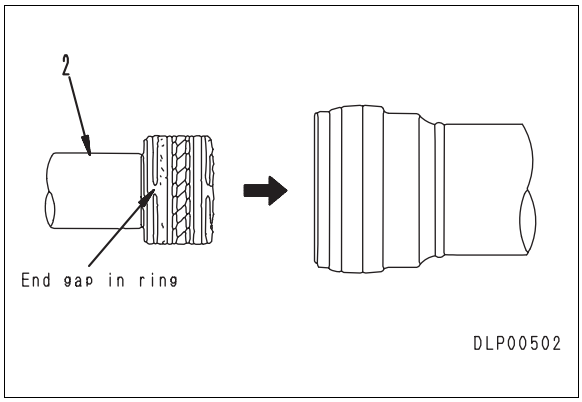
v) Caulk thread at 4 places with punch.



7) Assemble piston rod assembly (2).

★ Set the end gap of the ring horizontally (at the side position), align axial center of cylinder tube, then insert.

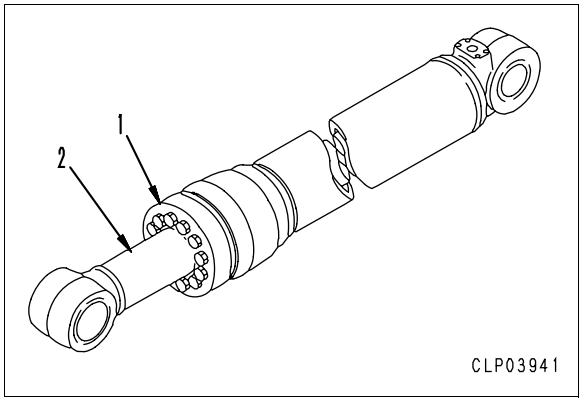
★ After inserting, check that the ring is not broken and has not come out, then push in fully.



8) Tighten head assembly (1) with mounting bolts.

N·m Mounting bolt:

Cylinder	Tightening torque
Bucket	270 ± 39 Nm {27.5 ± 4.0 kgm}
Arm	373 ± 54 Nm {38.0 ± 5.5 kgm}
Boom	270 ± 39 Nm {27.5 ± 4.0 kgm}



9) Install piping.

REMOVAL AND INSTALLATION OF WORK EQUIPMENT ASSEMBLY

SPECIAL TOOLS

Mark	Part No.	Part Name	Necessity	Qty	Distinction*	Sketch
R	796-900-1200	Remover	■	1		
	790-101-4000	Puller (490 kN 50-T-long)	■	1		
	790-101-1102	Pump (294 kN 30 T)	■	1		

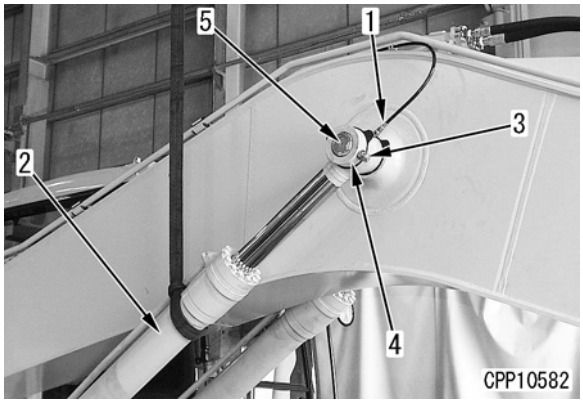
*Distinction between new and existing part.

REMOVAL

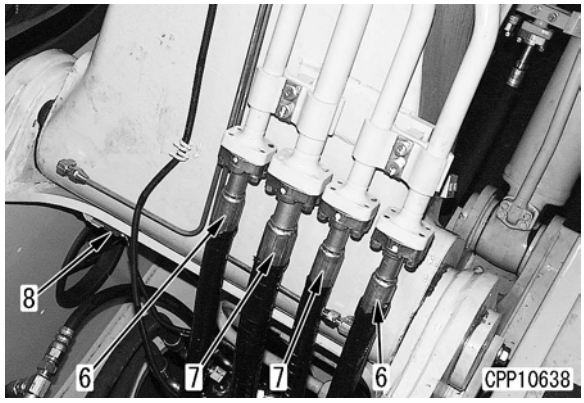
⚠ Extend the arm and bucket fully. Lower the work equipment to the ground and set the safety lock lever to the lock position.

⚠ Release the residual pressure in the hydraulic circuit. Refer to the Release of Remaining Pressure in Hydraulic Circuit section in the TESTING AND ADJUSTING chapter of this manual.

1. Disconnect grease hose (1).
2. Sling boom cylinder assembly (2), and remove lock bolt (3).
3. Remove plate (4), then remove head pin (5). ※1
   - ★ There are shims installed, so check the number and thickness, and keep them in a safe place.

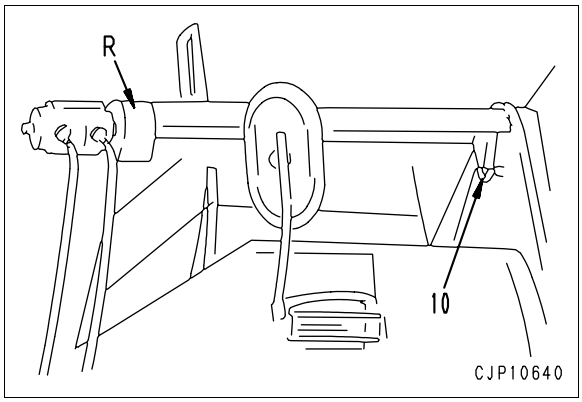


4. Start the engine and retract the piston rod.
   - ★ Fasten the piston rod with wire so that it will not slip out and lower the cylinder onto a stand, or place a support under the bottom of the cylinder to support it. In the latter case, remove the grease fitting on the bottom side first.
   - ★ Remove the boom cylinder on the other side in the same manner.
5. Disconnect bucket cylinder hoses (6) and arm cylinder hoses (7), two for each.
   - ★ Plug the hoses to prevent oil flow-out, and fasten them on the valve side.
6. Disconnect intermediate connector CN-A42 (8) for a working lamp.



7. Lift off the work equipment and remove plate (9) and then pin (10) at the foot. ※2

- When removing them, first remove plate (9) and then remove pin (10) at the foot, using Tool **R**.
- ★ Shims are installed, so do not forget to check their number and each location of installation.



8. Lift off work equipment assembly (11) and disassemble it.

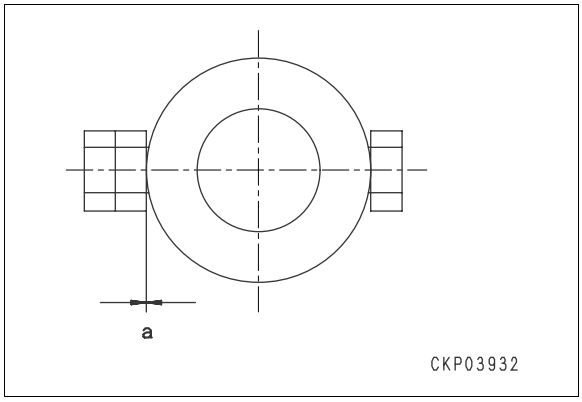
kg Work equipment assembly: 3,300 kg

INSTALLATION

- Install in reverse order of removal.

※1

★ When tightening the locknut, tighten so that clearance **a** between the plate and nut is 0.5 - 1.5 mm.



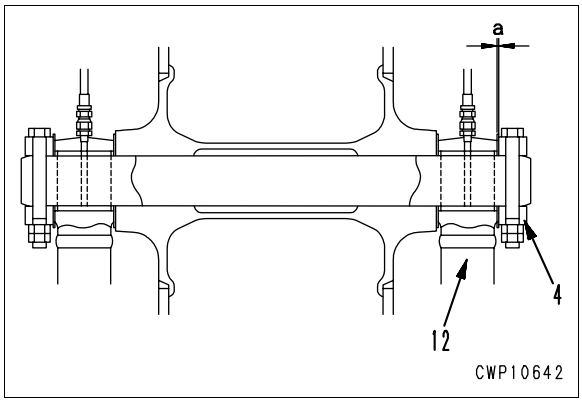
Inside surface of bushing when assembling pin:
Anti-friction compound (LM-P)

Grease after assembling pin:
Grease (LM-G)

When aligning the position of the pin hole, never insert your fingers into the pin hole.

★ Adjust the shim thickness so that clearance **a** between cylinder rod (12) and plate (4) is below 1 mm.

★ Standard shim thickness: 1.0 mm and 2.0 mm.



※2

Inside surface of bushing when assembling pin:

Anti-friction compound (LM-P)

Grease after assembling pin:

Grease (LM-G)

When aligning the position of the pin hole, never insert your fingers into the pin hole.

- **Bleeding air**
  - ★ Bleed the air from the cylinder. For details, see TESTING AND ADJUSTING, Air Bleeding of Various Parts.
- **Refilling with oil (hydraulic tank)**
  - ★ Add oil through the oil filler to the specified level. Run the engine to circulate the oil through the system. Then check the oil level again.

REMOVAL AND INSTALLATION OF AIR CONDITIONER UNIT ASSEMBLY

SPECIAL TOOLS

Mark	Part No.	Part Name	Necessity	Qty	Distinction*	Sketch
S	799-703-1200	Service tool kit	■	1		
	799-703-1100	Vacuum Pump (100 V)	■	1		
	799-703-1110	Vacuum Pump (220 V)	■	1		
	799-703-1120	Vacuum Pump (240 V)	■	1		
	799-703-1400	Gas leak tester	■	1		

*Distinction between new and existing part.

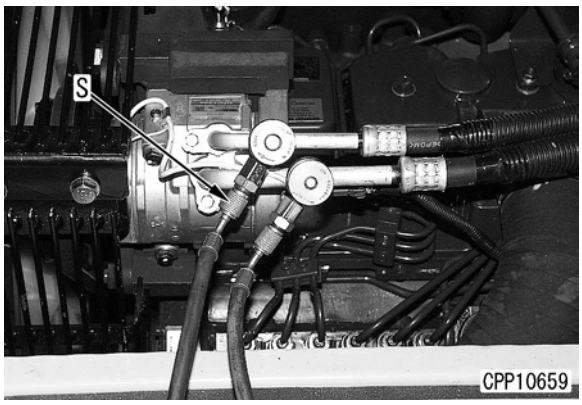
REMOVAL

⚠ First, disconnect the cable from the negative terminal (-) of the battery.

1. Drain cooling water.

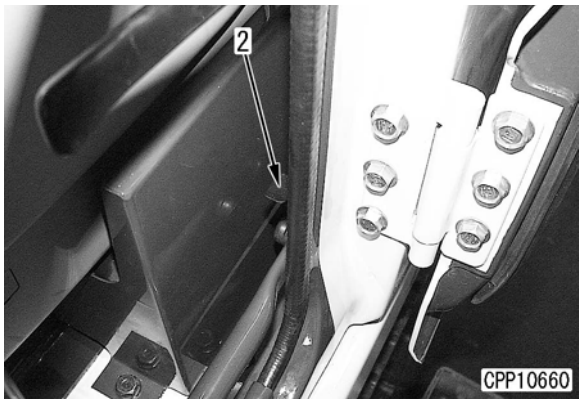
Cooling water: Approx. 22.8 **l**

2. Bleed gas from the air conditioner, using tool **S**.



3. Remove floor mat (1).

4. Pull down outside air filter cover opening-closing lever (2).

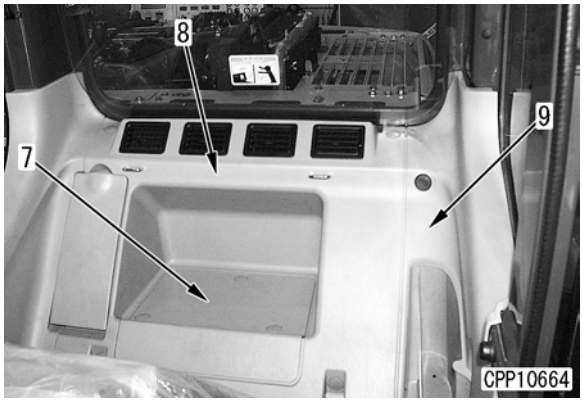


5. Remove outside air filter (3).

6. Remove monitor panel lower covers (4) and (5).
   ★ When removing cover (4), first remove the M19 wiring for cigarette lighter.

7. Remove duct (6) on the right side.

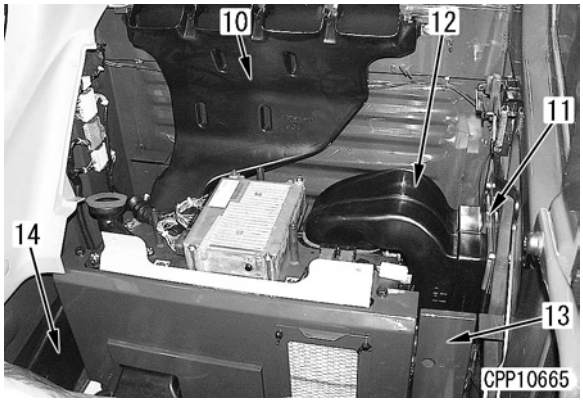
8. Remove rear covers (7), (8) and (9).



9. Remove rear duct (10).

10. Remove plate (11) and then remove duct (12).

11. Remove plate (13) and right duct (14).

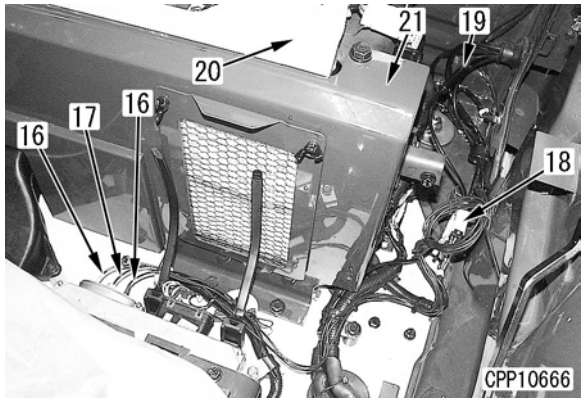


12. Remove cover (15).

13. Disconnect cab intermediate connectors (18) at the following two points.
    - H09: Upper side
    - H08: Lower side

14. Disconnect radio antenna (19).

15. Remove plate (20) and then remove cover (21).



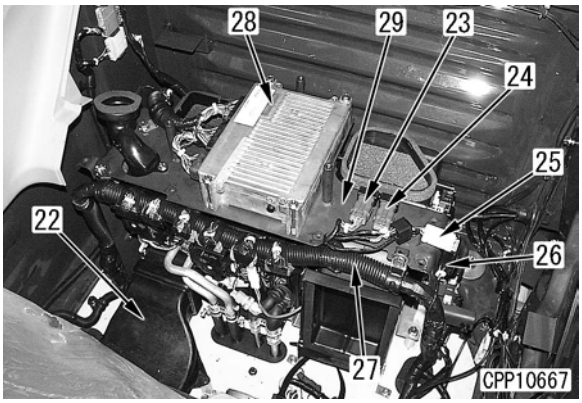
16. Remove duct (22).

17. Disconnect connectors at the following seven points.
    - (23): D01
      (Assembled-type diode connector)
    - (24): D02
      (Assembled-type diode connector)
    - (25): C09 (Model selection switch connector)
    - (26): Air conditioner unit connector
      From top to bottom, M26, M27, M28 and M33 option power source connector

18. Remove the mounting clamp and disconnect air conditioner wiring connector (27).

19. Remove the four mounting bolts and remove governor pump control assembly (28).
    ★ Put the governor pump control assembly aside.

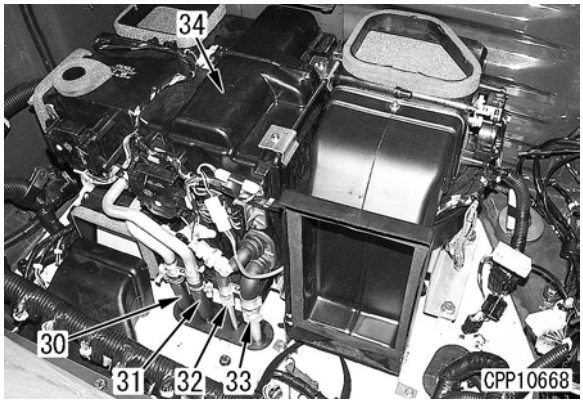
20. Remove cover (29).



21. Disconnect air conditioner hoses (30) and (31) as well as air conditioner tubes (32) and (33).

※1

22. Remove the eight mounting bolts and remove air conditioner unit assembly (34).
    ★ 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.

★ Install hoses in the air conditioner circuit with care so that dirt, dust, water, etc. may not enter them.

★ Install air conditioner hoses only after checking that an O-ring is in place at the connecting part.

★ Check that there is no damage on O-rings, or that they have not deteriorated.

※1

★ Coat the threads of the refrigerant piping at the connecting part with compressor oil (ND-OIL8), and then tighten the piping with a double-ended spanner.

N·m Hose clamp screw:
8.83 - 14.7 Nm (0.9 - 1.5 kgm)

N·m Hose screw M16 x 1.5:
11.8 - 14.7 Nm (1.2 - 1.5 kgm)

N·m Hose screw M24 x 1.5:
29.4 - 34.3 Nm (3.0 - 3.5 kgm)

- Filling air conditioner gas
  Fill the air conditioner circuit with air conditioner gas (R134a), using tool **S**.

REMOVAL AND INSTALLATION OF COUNTERWEIGHT ASSEMBLY

REMOVAL

1. Attach eyebolts b to counterweight assembly (1), and sling.
2. Remove 4 mounting bolts (2) ※1
3. Lift off counterweight (1) horizontally with wire or chain block. ※2
   ★ Be careful not to it the engine, radiator or cooler.

kg Counterweight assembly: 3,750 kg

INSTALLATION

- Install in reverse order of removal.

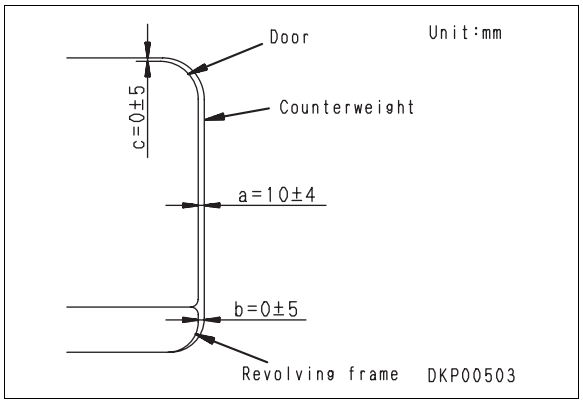
※1

Thread of counterweight mounting bolt:
Thread tightener (LT-2)

N·m Counterweight mounting bolt:
1,180 - 1,470 Nm {120 - 150 kgm}

※2

★ Installing and adjusting counterweight
1) Sling counterweight with crane and place in position on the frame.
2) Push counterweight, install mounting bolts, and adjust to the following dimensions.
   - Clearance from revolving frame:
     10 ± 5 mm (left and right)
   - Clearance from bodywork door:
     10 ± 5 mm (left and right)
   - Stepped difference **b** from revolving frame in left-to right direction:
     Max. 5 mm
   - Stepped difference **a** from bodywork door in left-to right direction:
     10 ± 4
   - Stepped difference **c** from bodywork top cover in up-down right direction: Max. 5 mm



REMOVAL AND INSTALLATION OF OPERATOR'S CAB ASSEMBLY

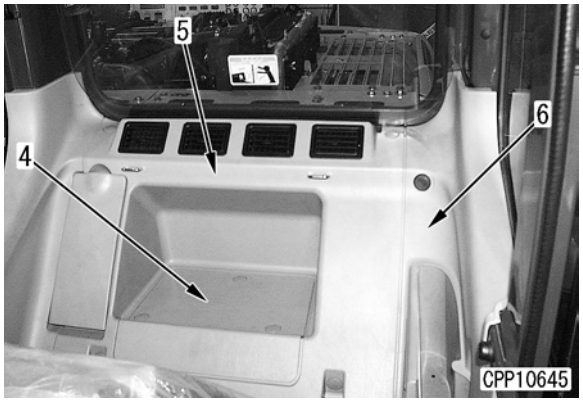
REMOVAL

⚠ First, disconnect the cable from the negative terminal (-) of the battery.

1. Remove floor mat (1).

2. Remove covers (2) and (3) under the monitor panel.
   ★ When removing cover (2), first disconnect the CN-M19 wiring for cigarette lighter.

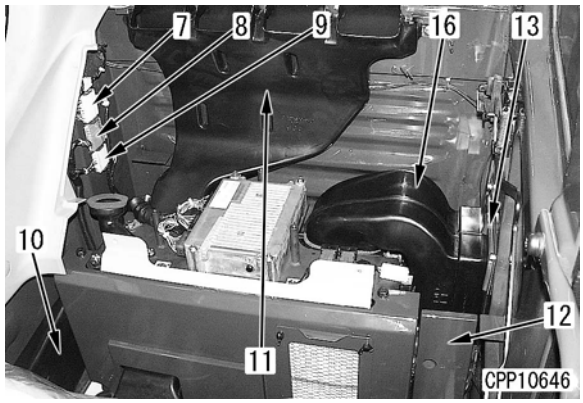
3. Remove rear covers (4), (5) and (6).



4. Disconnect cab wiring intermediate connectors H10 (7), H11 (8) and H12 (9).

5. Remove duct (10) on the right side and rear duct (11).

6. Remove left plates (12) and (13).



7. Pull down outside air filter cover opening-closing lever (14).

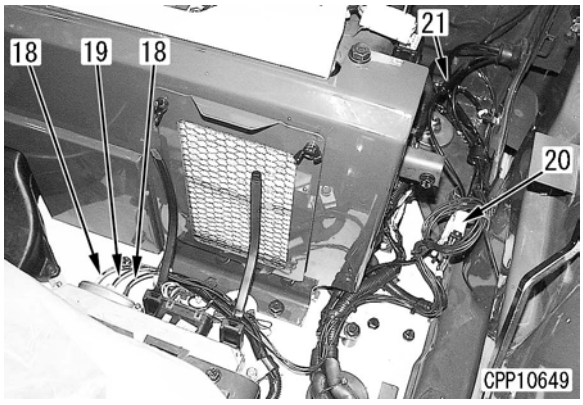
8. Remove outside air filter (15).

9. Remove duct (16).

10. Remove cover (17).

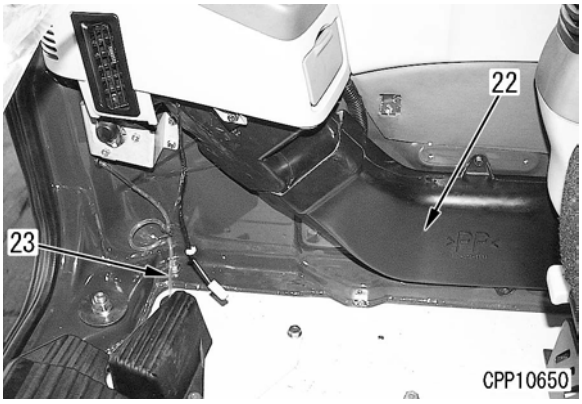
11. Disconnect cab wiring intermediate connectors (20) at the following two points.
    - H09: Upper side
    - H08: Lower side

12. Disconnect radio antenna (21).



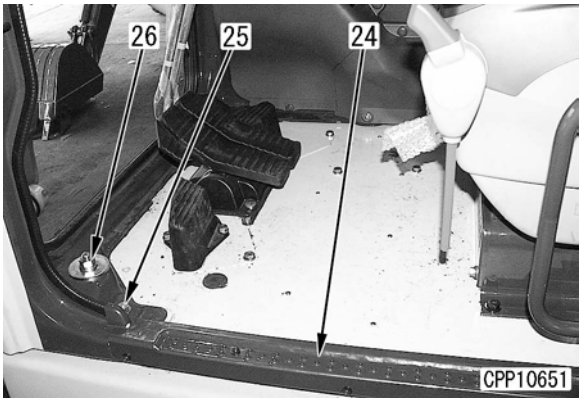
13. Remove duct (22) on the right side.

14. Remove window washer hose (23).



15. Remove step plate (24).

16. Remove five mounting bolts (25) and four mounting nuts (26).
    ★ Check the bolt length beforehand.



17. Lift off operator's cab assembly (27) to remove it.

kg Operator's cab assembly: 290 kg

INSTALLATION

- Install in reverse order of removal.

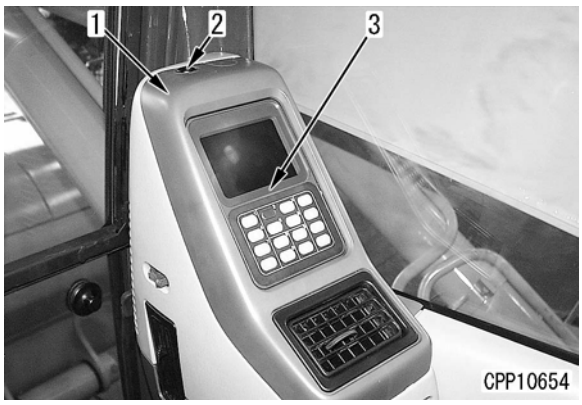
REMOVAL AND INSTALLATION OF MONITOR ASSEMBLY

REMOVAL

⚠ First, disconnect the cable from the negative terminal (-) of the battery.

1. Remove cover (1) and then disconnect the wiring connector P15 for air conditioner sunlight sensor (2).
   ★ Lift the cover up to remove it.

2. Remove the three mounting screws and remove monitor assembly (3).
   ★ Disconnect monitor panel wiring connectors P01, P02 and P03 at the three points, and then remove the monitor assembly.



INSTALLATION

- Install in reverse order of removal.

REMOVAL AND INSTALLATION OF GOVERNOR PUMP CONTROLLER ASSEMBLY

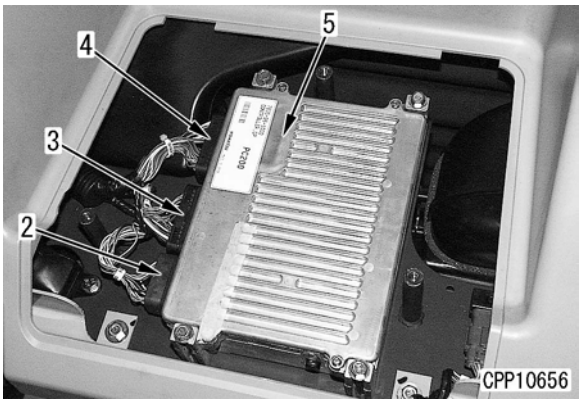
REMOVAL

⚠ First, disconnect the cable from the negative terminal (-) of the battery.

1. Remove cover (1).

2. Disconnect governor pump controller wiring connectors C01 (2), C02 (3) and C03 (4).

3. Remove the four mounting bolts and remove governor pump controller assembly (5).



INSTALLATION

- Install in reverse order of removal.

90 OTHERS

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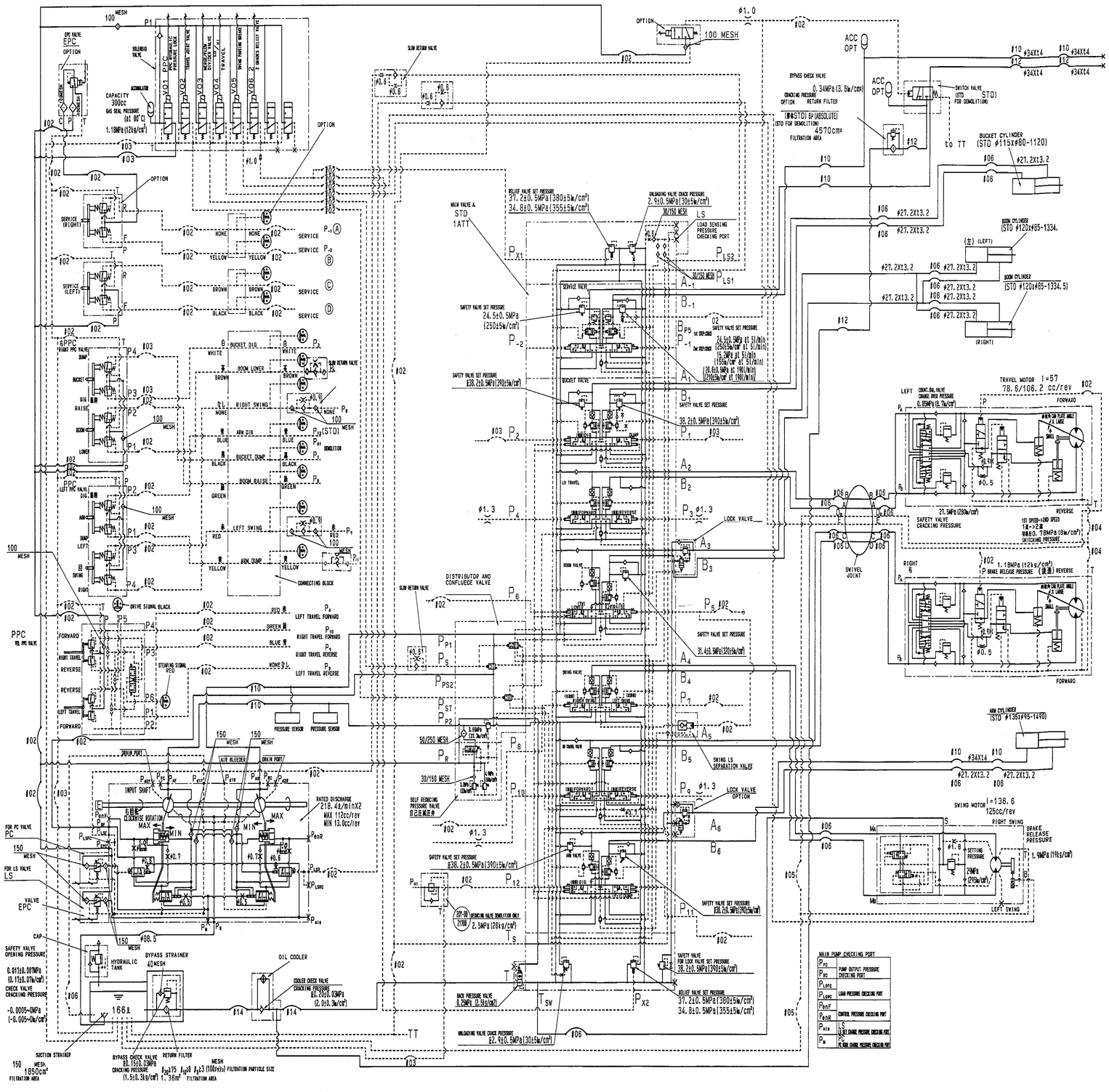
HYDRAULIC CIRCUIT DIAGRAM (1/2)

PC210-7K, PC210LC-7K, PC210NLC-7K



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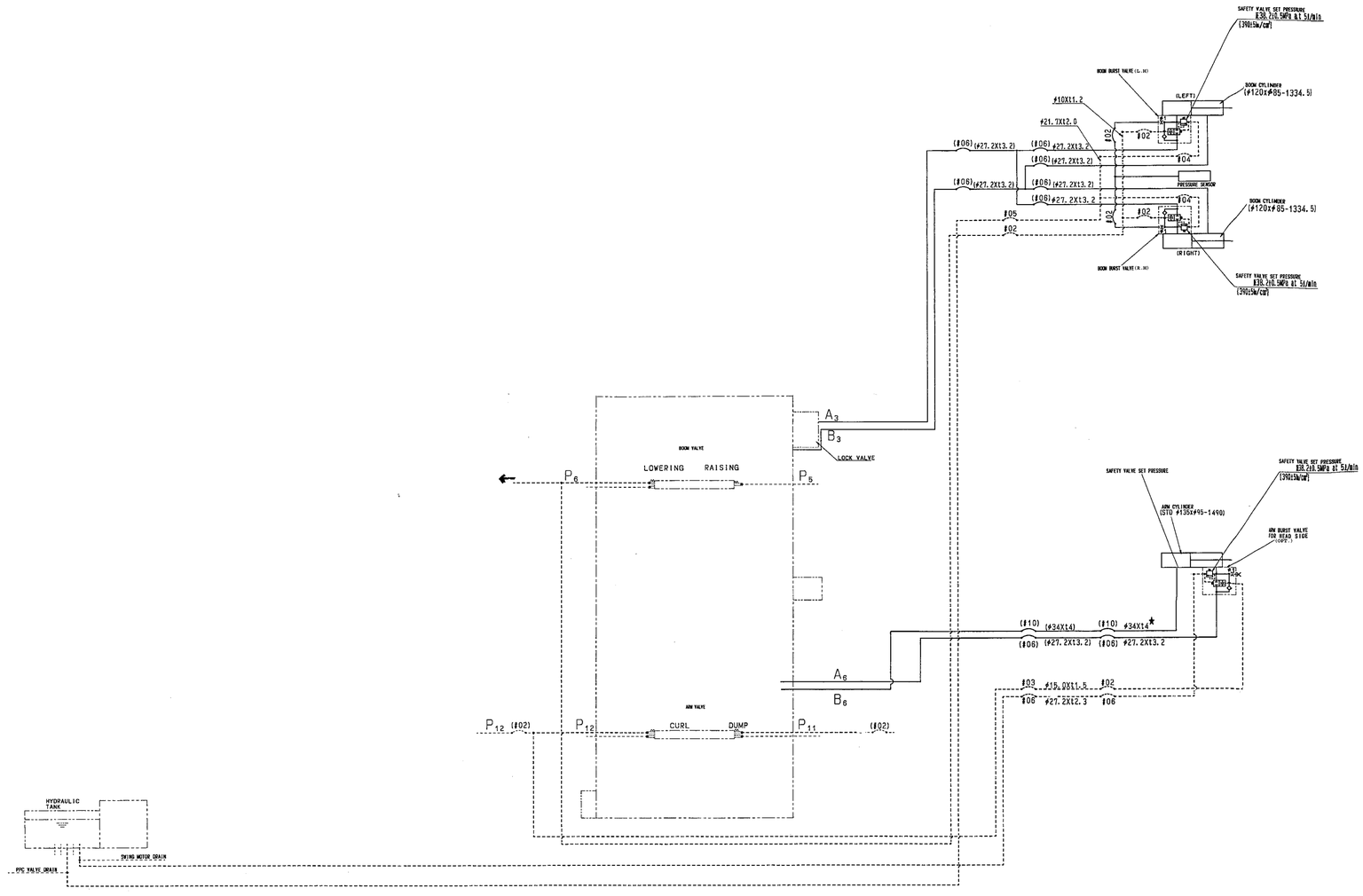
HYDRAULIC CIRCUIT DIAGRAM (2/2)

PC210-7K, PC210LC-7K, PC210NLC-7K



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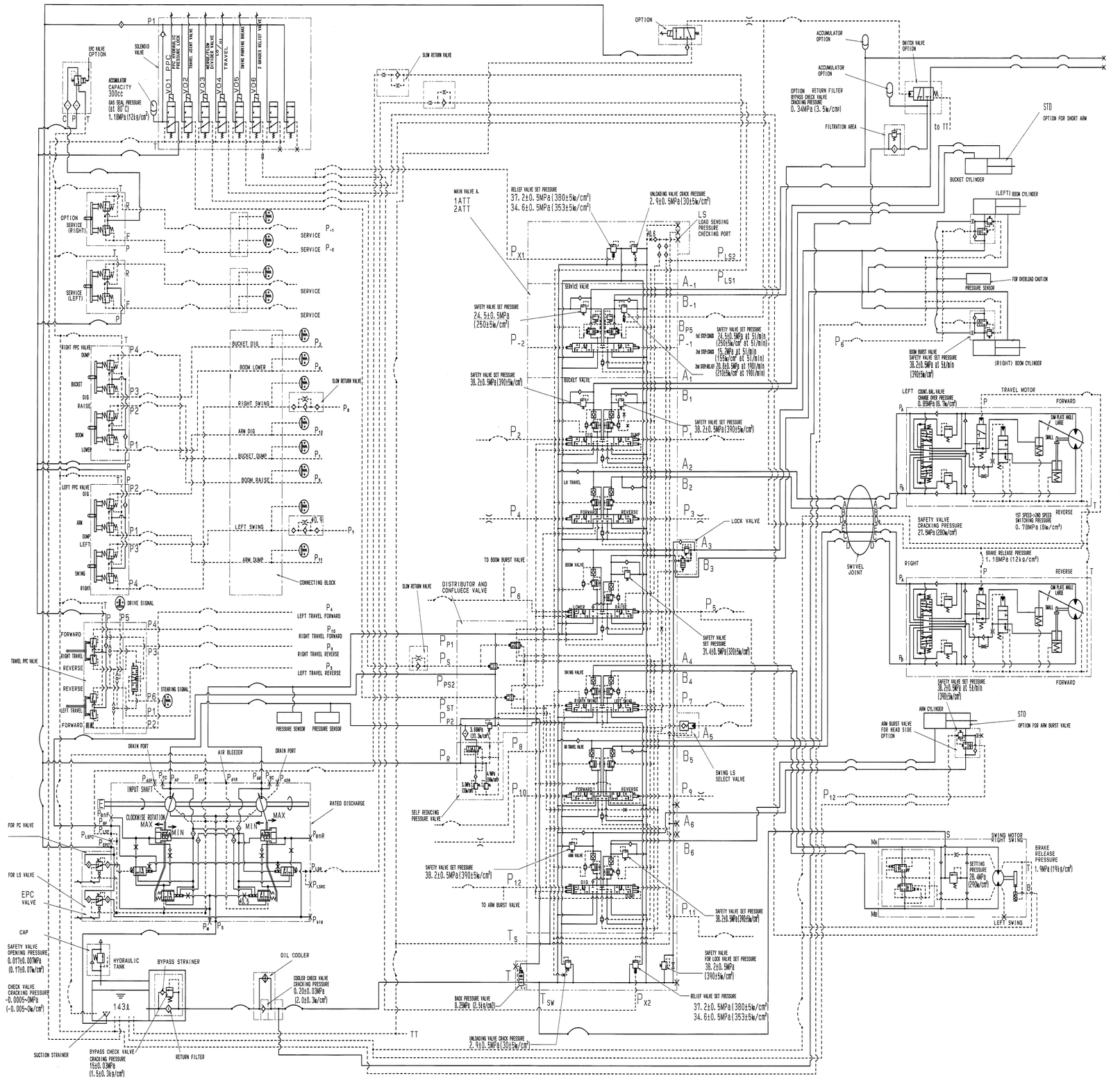
HYDRAULIC DIAGRAM (1/1)

PC240LC-7K, PC240NLC-7K



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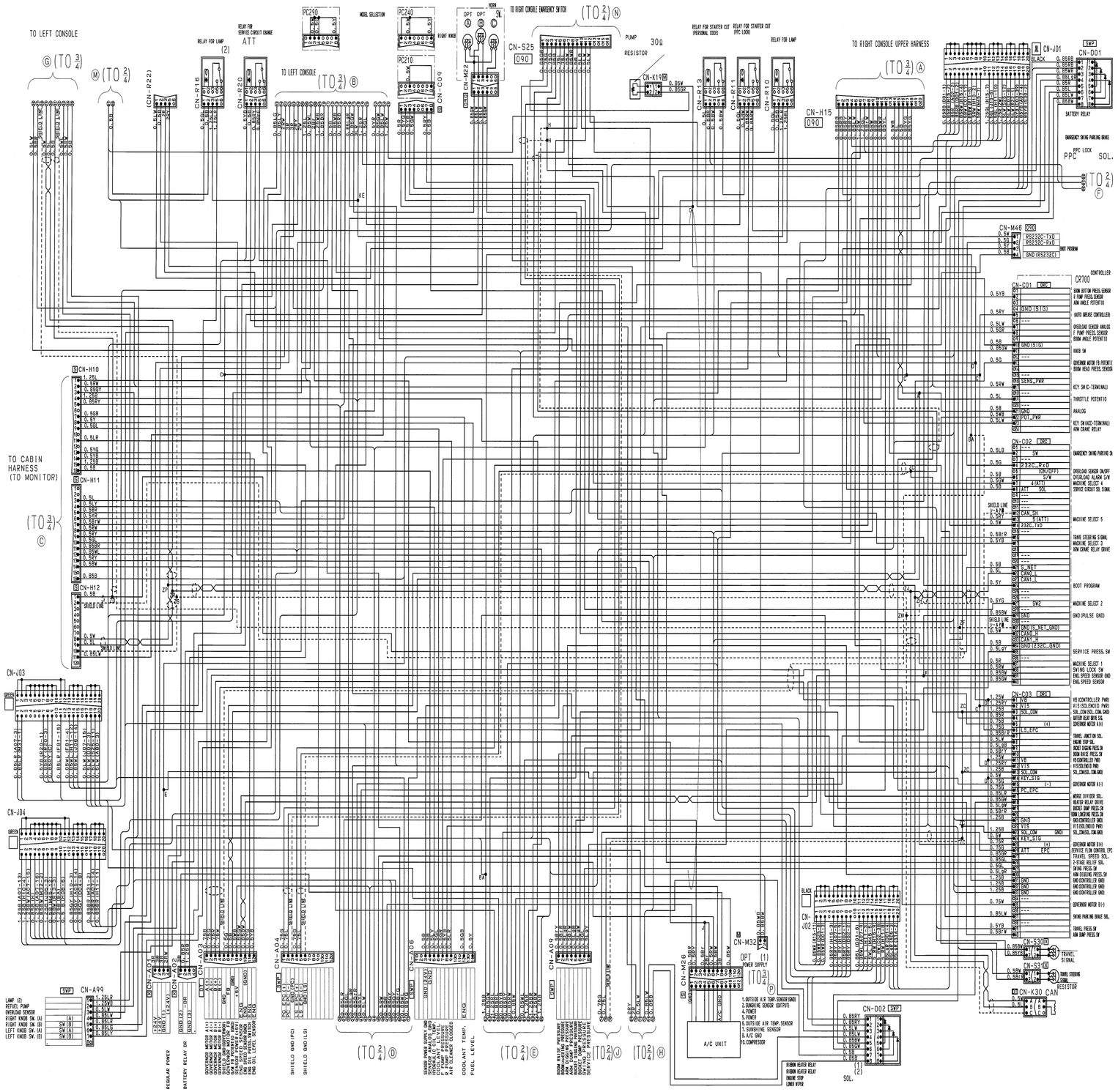
ELECTRICAL CIRCUIT DIAGRAM (1/4)

FOR MULTI MONITOR

PC210-7K, PC210LC-7K, PC210NLC-7K
PC240LC-7K, PC240NLC-7K



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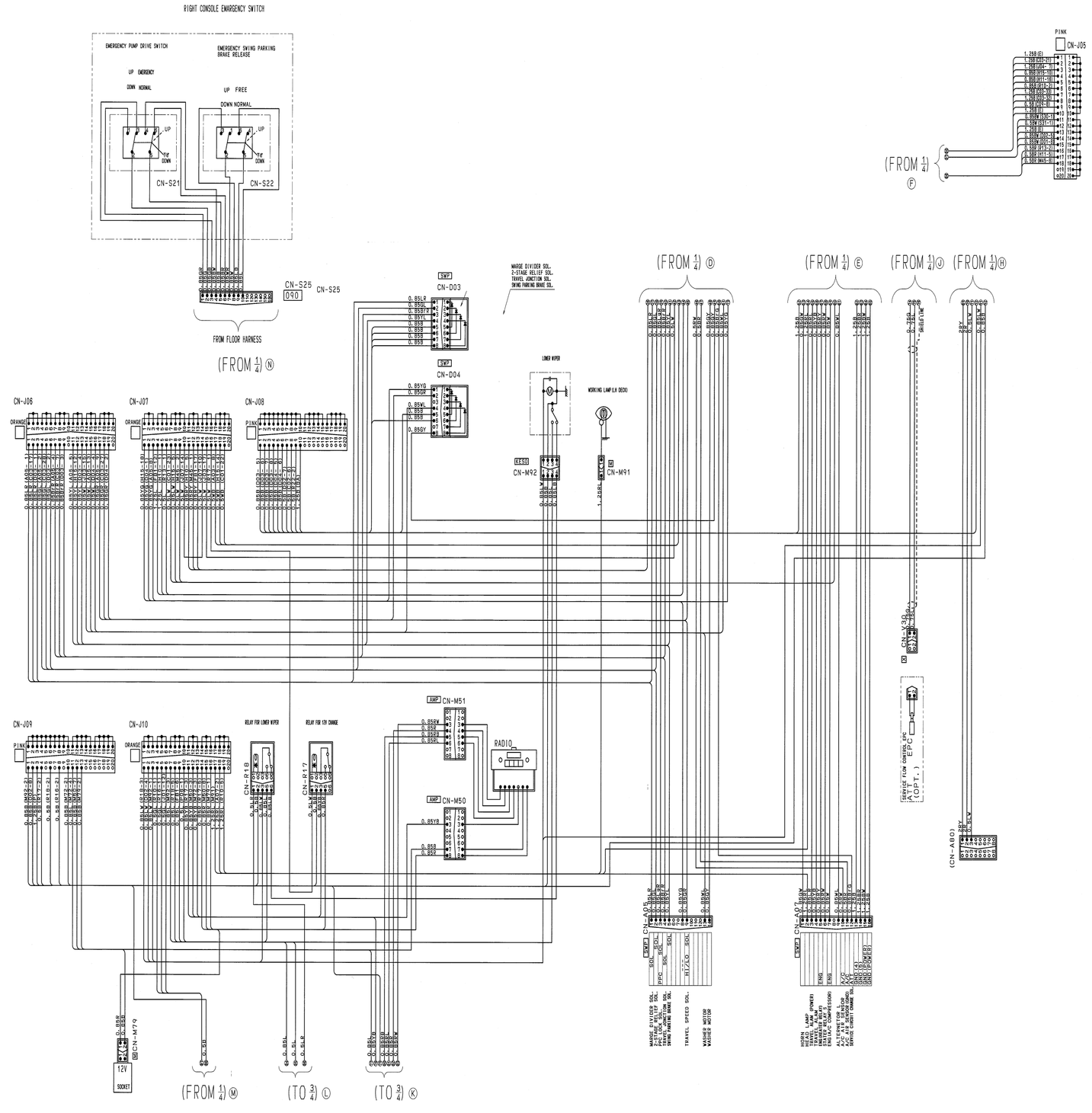
ELECTRICAL CIRCUIT DIAGRAM (2/4)

FOR MULTI MONITOR

PC210-7K, PC210LC-7K, PC210NLC-7K
PC240LC-7K, PC240NLC-7K



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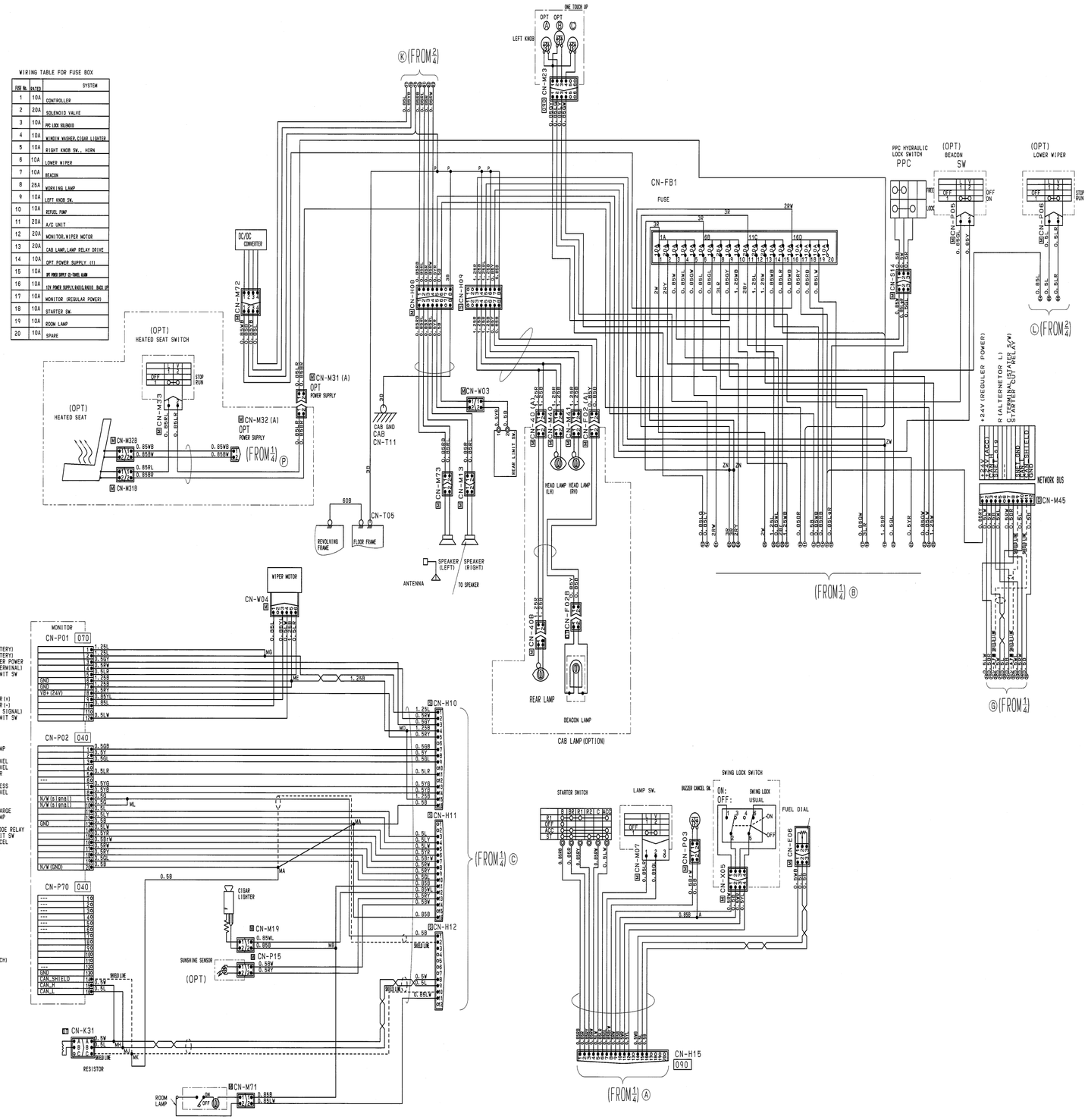
ELECTRICAL CIRCUIT DIAGRAM (3/4)

FOR MULTI MONITOR

PC210-7K, PC210LC-7K, PC210NLC-7K
PC240LC-7K, PC240NLC-7K



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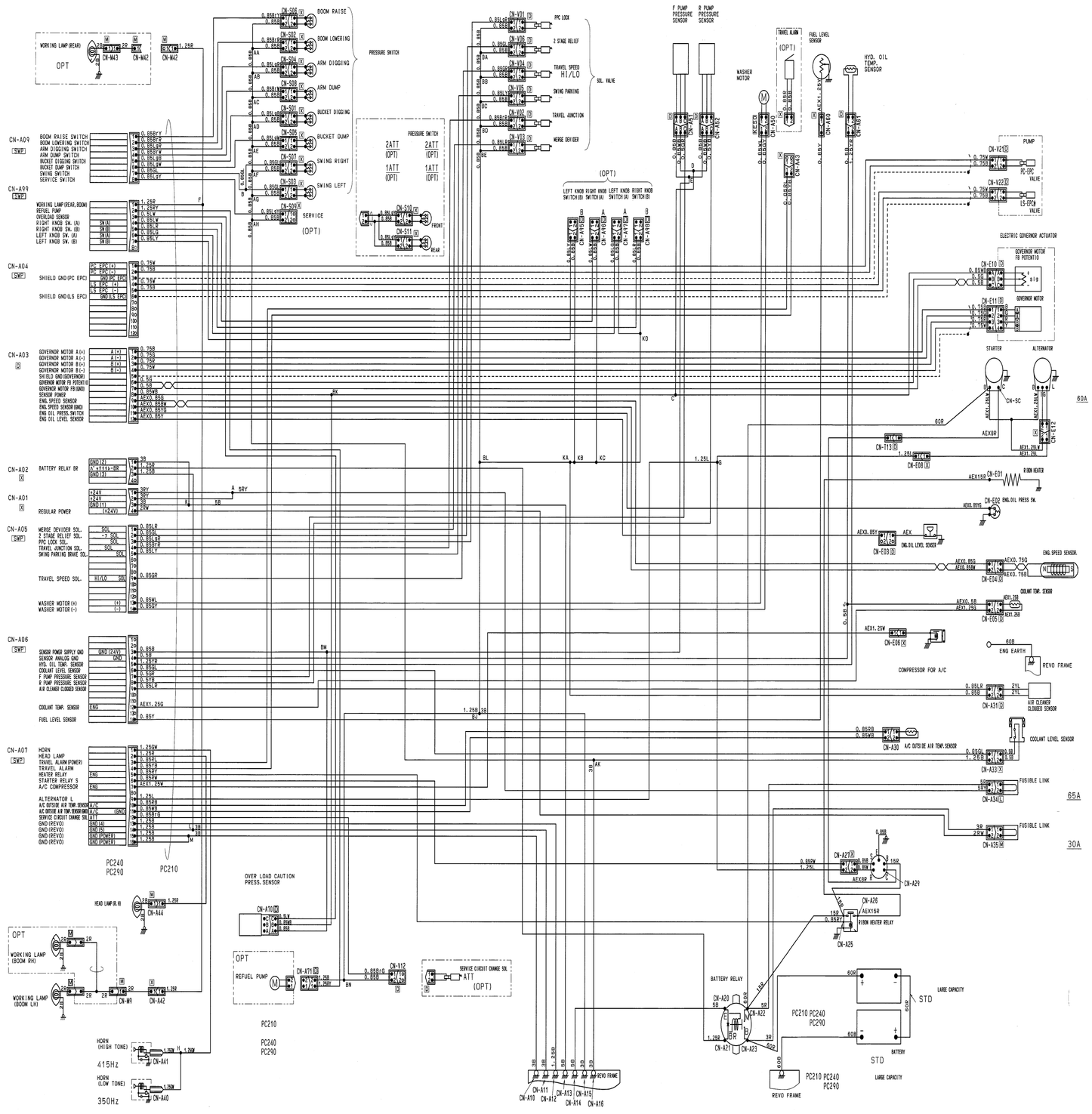
ELECTRICAL CIRCUIT DIAGRAM (4/4)

FOR MULTI MONITOR

PC210-7K, PC210LC-7K, PC210NLC-7K
PC240LC-7K, PC240NLC-7K



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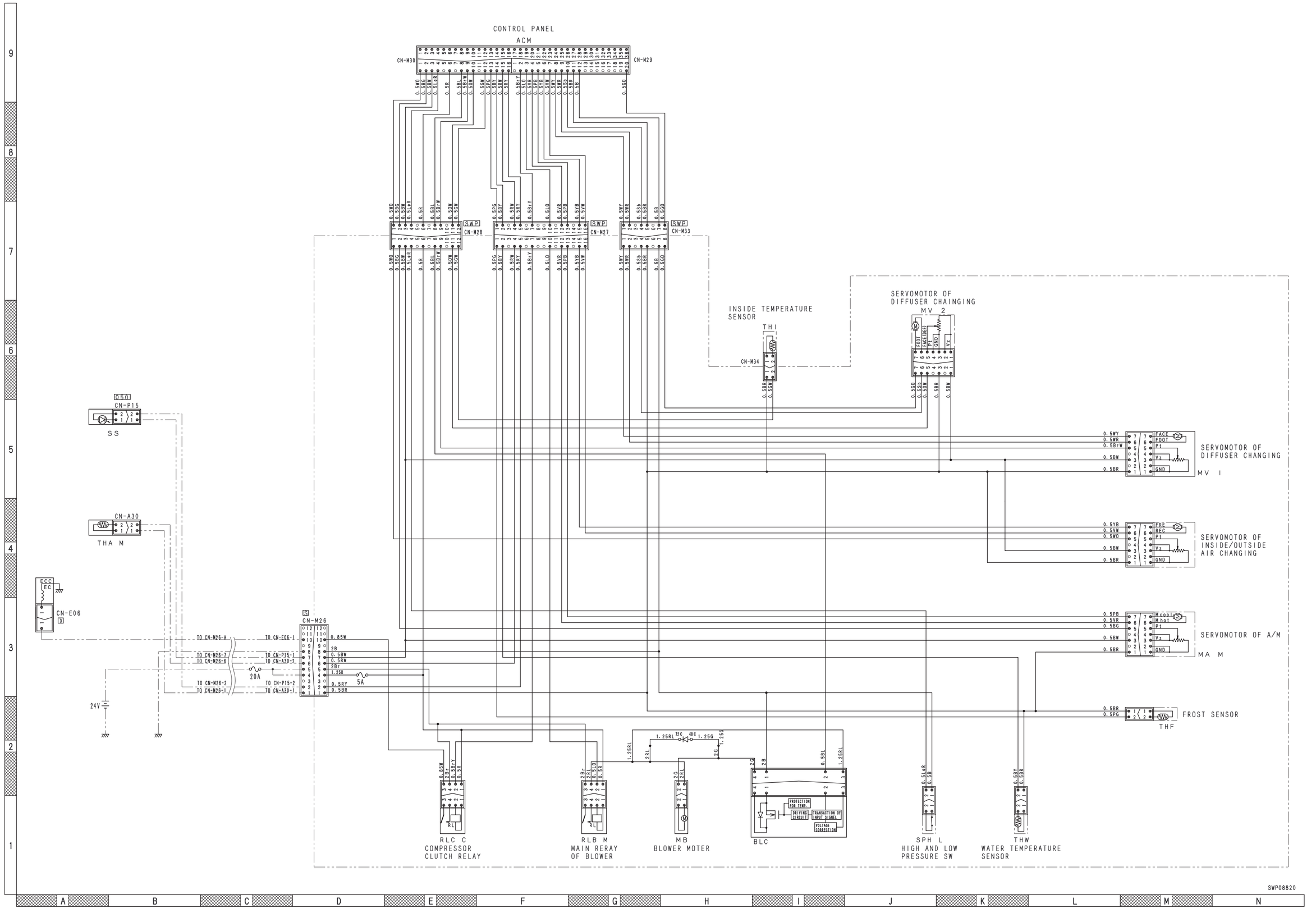
ELECTRICAL CIRCUIT DIAGRAM FOR AIR CONDITIONER



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