EEBM001902

SHOP MANUAL

KOMATSU

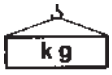
PC290LC-6K
PC290NLC-6K

MACHINE MODEL	SERIAL NUMBER
PC290LC-6K	**K30001 and up, K34001 and up**
PC290NLC-6K	**K30001 and up, K34001 and up**

- This shop manual may contain attachements 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
- PC290LC-6K, PC290NLC-6K mount the SA6D102EA-1 engine.
  for details of the engine, see the 102 Service Engine Shop Manual.

HOISTING INSTRUCTIONS

HOISTING

⚠ Heavy parts (25 kg or more) must be lifted with a hoist, etc. In the **DISASSEMBLY AND ASSEMBLY** section, every part weighing 25 kg op mroe is indicated with the symbol 

- If a part cannot be smootlhy removed from the machine by hoisting, the following checks should be made:
  1) Check for removal of all bolts fastening the part to the relative parts.
  2) Check for existence of another part causing interference with the part to be removed.

WIRE ROPES

1) Use adequate ropes depending on the weight of parts to be hoisted, referring to the table below:

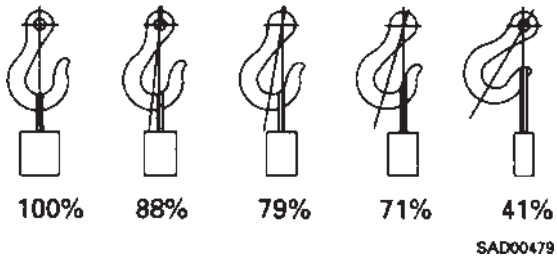
Wire ropes
(Standard "Z" or "S" twist ropes
without galvanizing

Rope diameter (mm)	Allowable load (tons)
10	1.0
11.2	1.4
12.5	1.6
14	2.2
16	2..8
18	3.6
20	4.4
22.4	5.6
30	10.0
40	18.0
50	28.0
60	40.0

★ The allowable load value is estimated to be one-sixth or one-seventh of the breaking strength of the rope used.

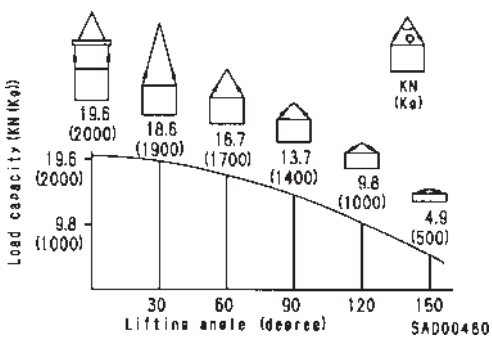
2) Sling wire ropes from the middle portion of the hook.

Slinging near the edge of the hook may cause the rope to slip off the hook during hoisting, and a serious accident can result. Hooks have a maximum strength at the middle portion.



3) Do not sling a heavy load with one rope alone, but sling with two or more ropes symmetrically wound onto the load.
   ⚠ Slinging with one rope may cause turning of the load during hoisting, untwisting of the rope, or slipping of the rope from its original winding position on the load, which can result in a dangerous accident.

4) Do not sling a heavy load with ropes forming a wide hanging angle from the hook. When hoisting a load with two or more ropes, the force subjected to each rope will increase with the nahging angles. The table below shows the variation of allowable load (kg) when hoisting is made with two ropes, each of which is allowed to sling up to 1000 kg vertically, at various hanging angles.
   When two ropes sling a load vertically, up to 2000 kg of total weight can be suspended. This weight becomes 1000 kg when two ropes make a 120° hanging angle. On the other hand, two ropes are subjected to an excessive force as large as 4000 kg if they sling a 2000 kg load at a lifting angle of 150°.



Temperature

Fahrenheit-Centigrade Conversion; a simple way to convert a Fahrenheit temperature reading into a Centigrade temperature reading or vice is to enter the accompanying table in the center or boldface column of figures. These figures refer to the temperature in either Fahrenheit or Centigrade degrees.

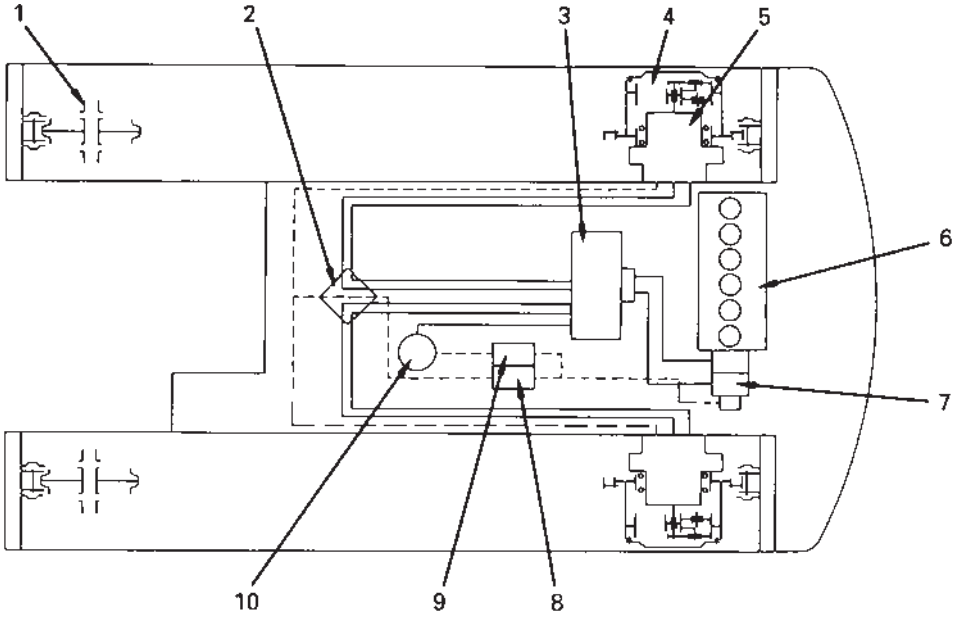
If it desired to convert from Fahrenheit to Centigrade degrees, consider the center column as a table of Fahrenheit temperatures and read the corresponding Centigrade temperature in the column at the left.

If it is desired to convert from Centigrade to Fahrenheit degrees, consider the center column as a table of Centigrade values, and read the corresponding Fahrenheit temperature on the right.

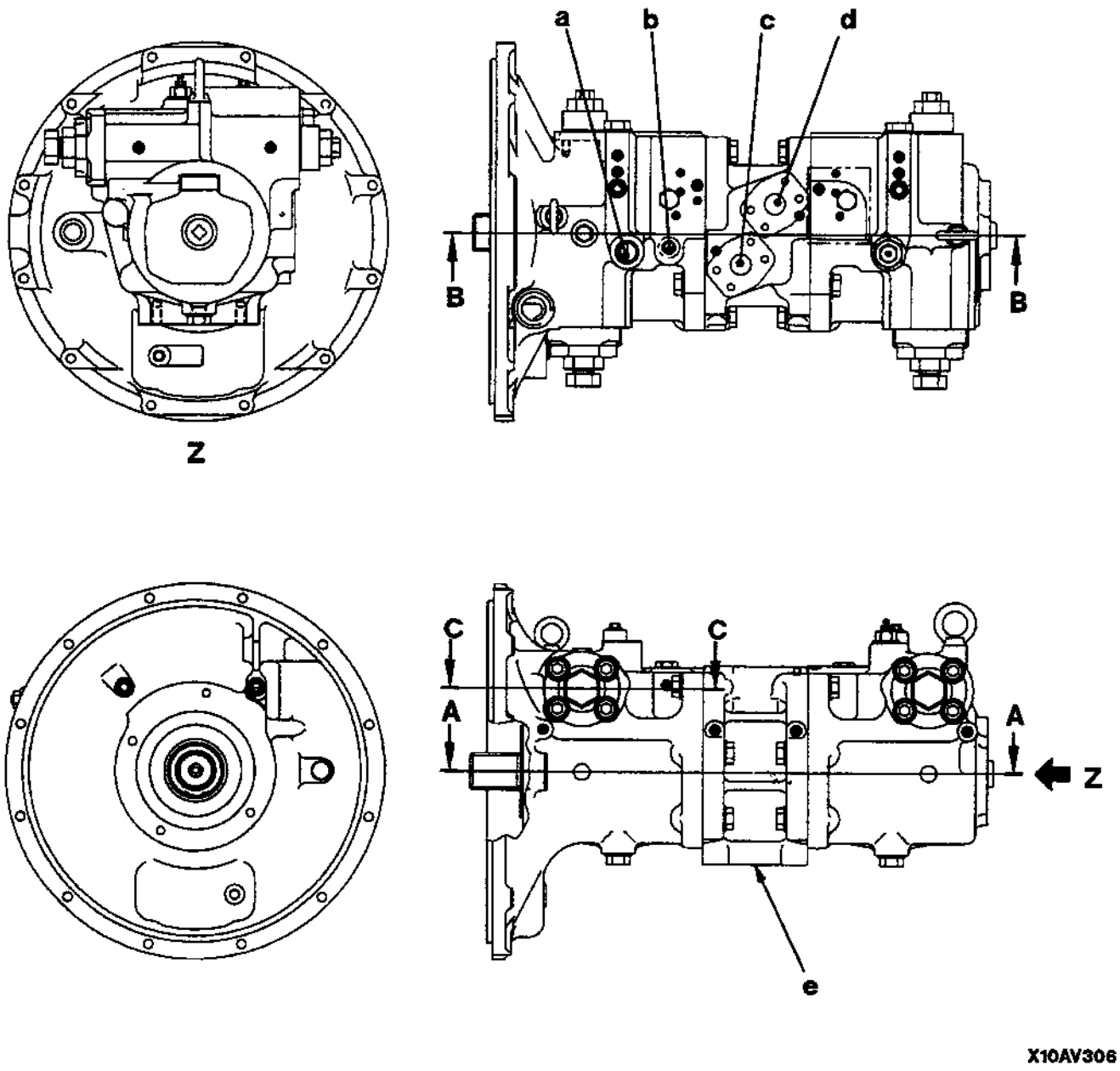
1°C = 33.8°F

°C		°F	°C		°F	°C		°F	°C		°F
-40.4	-40	-40.0	-11.7	11	51.8	7.8	46	114.8	27.2	81	117.8
-37.2	-35	-31.0	-11.1	12	53.6	8.3	47	116.6	27.8	82	179.6
-34.4	-30	-22.0	-10.6	13	55.4	8.9	48	118.4	28.3	83	181.4
-31.7	-25	-13.0	-10.0	14	57.2	9.4	49	120.2	28.9	84	183.2
-28.9	-20	-4.0	-9.4	15	59.0	10.0	50	122.0	29.4	85	185.0
-28.3	-19	-2.2	-8.9	16	60.8	10.6	51	123.8	30.0	86	186.8
-27.8	-18	-0.4	-8.3	17	62.6	11.1	52	125.6	30.6	87	188.6
-27.2	-17	1.4	-7.8	18	64.4	11.7	53	127.4	31.1	88	190.4
-26.7	-16	3.2	-7.2	19	66.2	12.2	54	129.2	31.7	89	192.2
-26.1	-15	5.0	-6.7	20	68.0	12.8	55	131.0	32.2	90	194.0
-25.6	-14	6.8	-6.1	21	69.8	13.3	56	132.8	32.8	91	195.8
-25.0	-13	8.6	-5.6	22	71.6	13.9	57	134.6	33.3	92	197.6
-24.4	-12	10.4	-5.0	23	73.4	14.4	58	136.4	33.9	03	199.4
-23.9	-11	12.2	-4.4	24	73.4	15.0	59	138.2	34.4	94	201.2
-23.3	-10	14.0	-3.9	25	75.2	15.6	60	140.0	35.0	95	203.0
-22.8	-9	15.8	-3.3	26	77.0	16.1	61	141.8	35.6	96	204.8
-22.2	-8	17.6	-2.8	27	78.8	16.7	62	143.6	36.1	97	206.6
-21.7	-7	19.4	-2.2	28	80.6	17.2	63	145.4	36.7	98	208.4
-21.1	-6	21.2	-1.7	29	82.4	17.8	64	147.2	37.2	99	210.2
-20.6	-5	23.0	-1.1	30	86.0	18.3	65	149.0	37.8	100	212.0
-20.0	-4	24.8	-0.6	31	87.8	18.9	66	150.8	40.6	105	221.0
-19.4	-3	26.6	0	32	89.6	19.4	67	152.6	43.3	110	230.0
-18.9	-2	28.4	0.6	33	91.4	20.0	68	154.4	46.1	115	239.0
-18.3	-1	30.2	1.1	34	93.2	20.6	69	156.2	48.9	120	248.0
-17.8	0	32.0	1.7	35	95.0	21.1	70	158.0	51.7	125	257.0
-17.2	1	33.8	2.2	36	96.8	21.7	71	159.8	54.4	130	266.0
-16.7	2	35.6	2.8	37	98.6	22.2	72	161.6	57.2	135	275.0
-16.1	3	37.4	3.3	38	100.4	22.8	73	163.4	60.0	140	284.0
-15.6	4	39.2	3.9	39	102.2	23.3	74	165.2	62.7	145	293.0
-15.0	5	41.0	4.4	40	104.0	23.9	75	167.0	65.6	150	302.0
-14.4	6	42.8	5.0	41	105.8	24.4	76	168.8	68.3	155	311.0
-13.9	7	44.6	5.6	42	107.6	25.0	77	170.6	71.1	160	320.0
-13.3	8	46.4	6.1	43	109.4	25.6	78	172.4	73.9	165	329.0
-12.8	9	48.2	6.7	44	111.2	26.1	79	174.2	76.7	170	338.0
-12.2	10	50.0	7.2	45	113.0	26.7	80	176.0	79.4	175	347.0

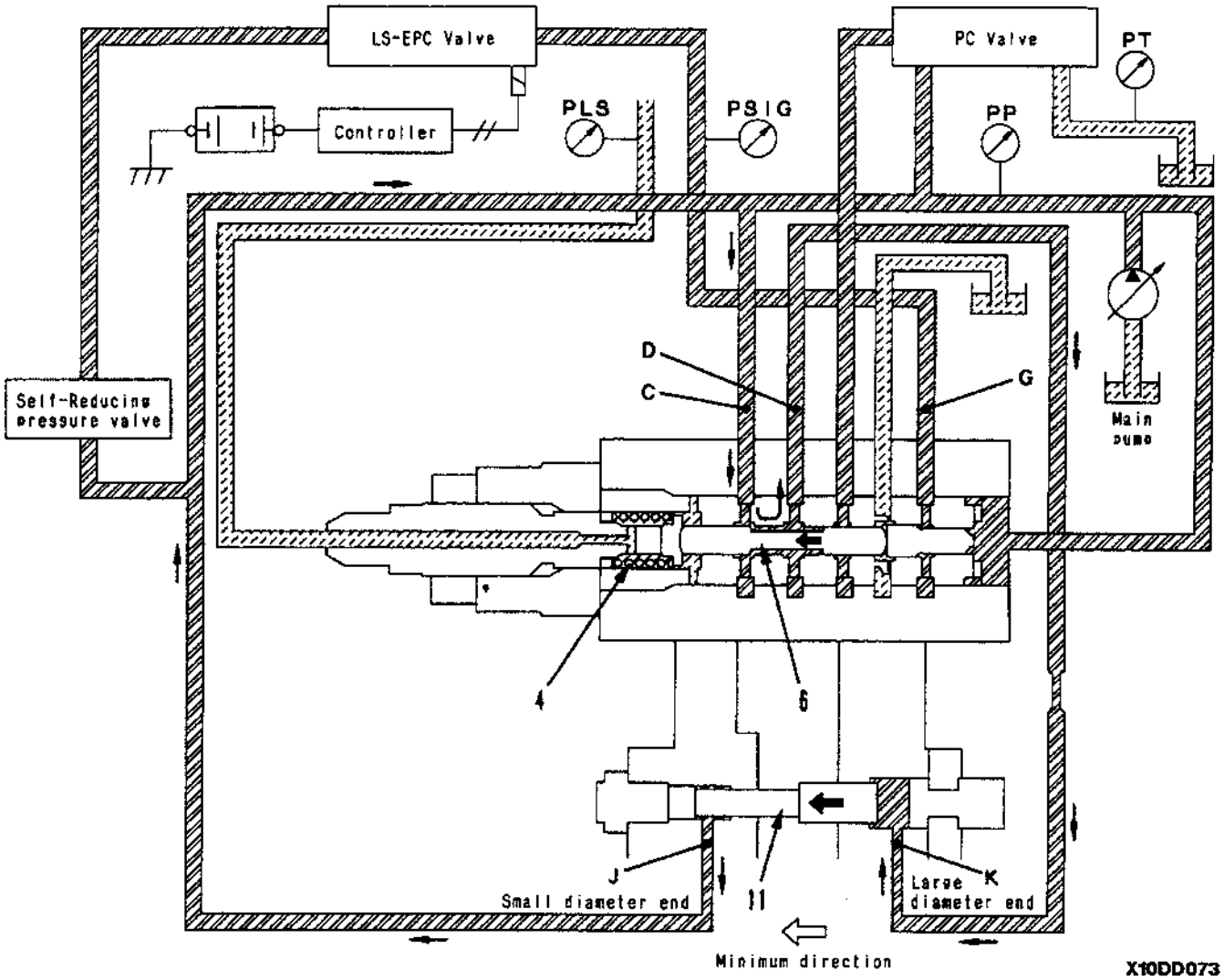
POWER TRAIN



1. Idler
2. Center swivel joint
3. Control valve
4. Final drive
5. Travel motor
6. Engine
7. Hydraulic pump
8. Travel speed solenoid valve
9. Swing brake solenoid valve
10. Swing machinery

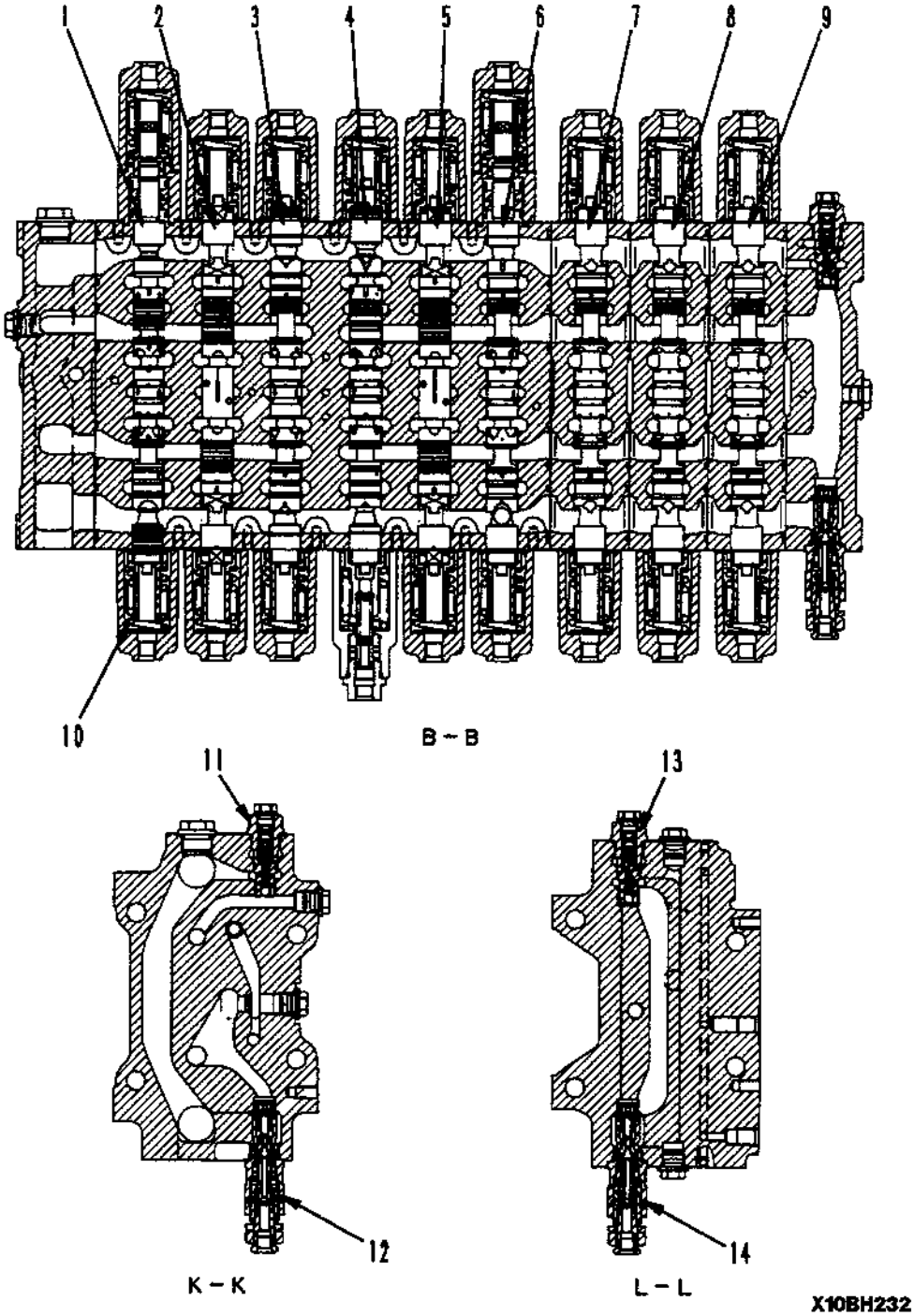


a. **Pd1F** port (pump drain)
b. **PBF** port (pump pressure input)
c. **PAF** port (rear pump delivery)
d. **PAR** port (rear pump delivery)
e. **Ps** port (suction)



3. Operation in minimum direction for pump discharge amount
   a. When LS differential pressure △**PLS** becomes larger (for example, when the area of the opening of the control valve becomes smaller and pump pressure **PP** rises), pump pressure **PP** pushes spool (6) to the left.
   b. When spool (6) moves, main pump pressure **PP** flows from port **C** to port **D**, and from port **K**, it enters the large diamter end of the piston.
   c. 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 (11), servo piston (11) is pushed to the left. As a result, the swash plate moves in the direction to make the angle smaller.
   d. If LS selection pressure **PSIG** enters port **G**, it acts to make the set pressure of spring (4) weaker.

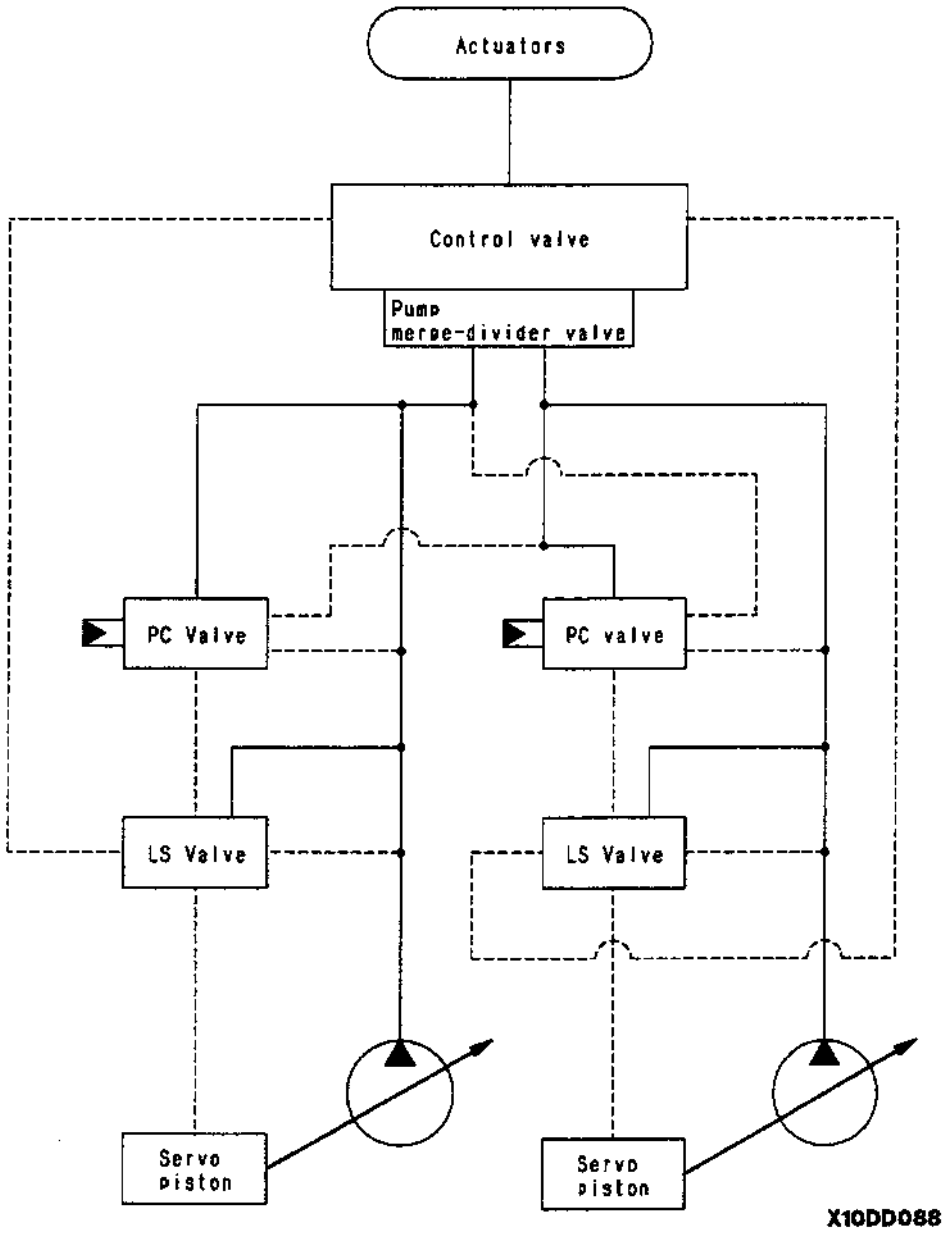
Main structure



1. Spool (arm)
2. Spool (L.H. travel)
3. Spool (swing)
4. Spool (boom)
5. Spool (R.H. travel)
6. Spool (bucket)
7. Spool (service)
8. Spool (service)
9. Spool (service)
10. Spool return spring
11. Unload valve (arm end group)
12. Main relief valve (arm end group)
13. Unload valve (bucket end group)
14. Main relief valve (bucket end group)

CLSS

Outline of CLSS



Features

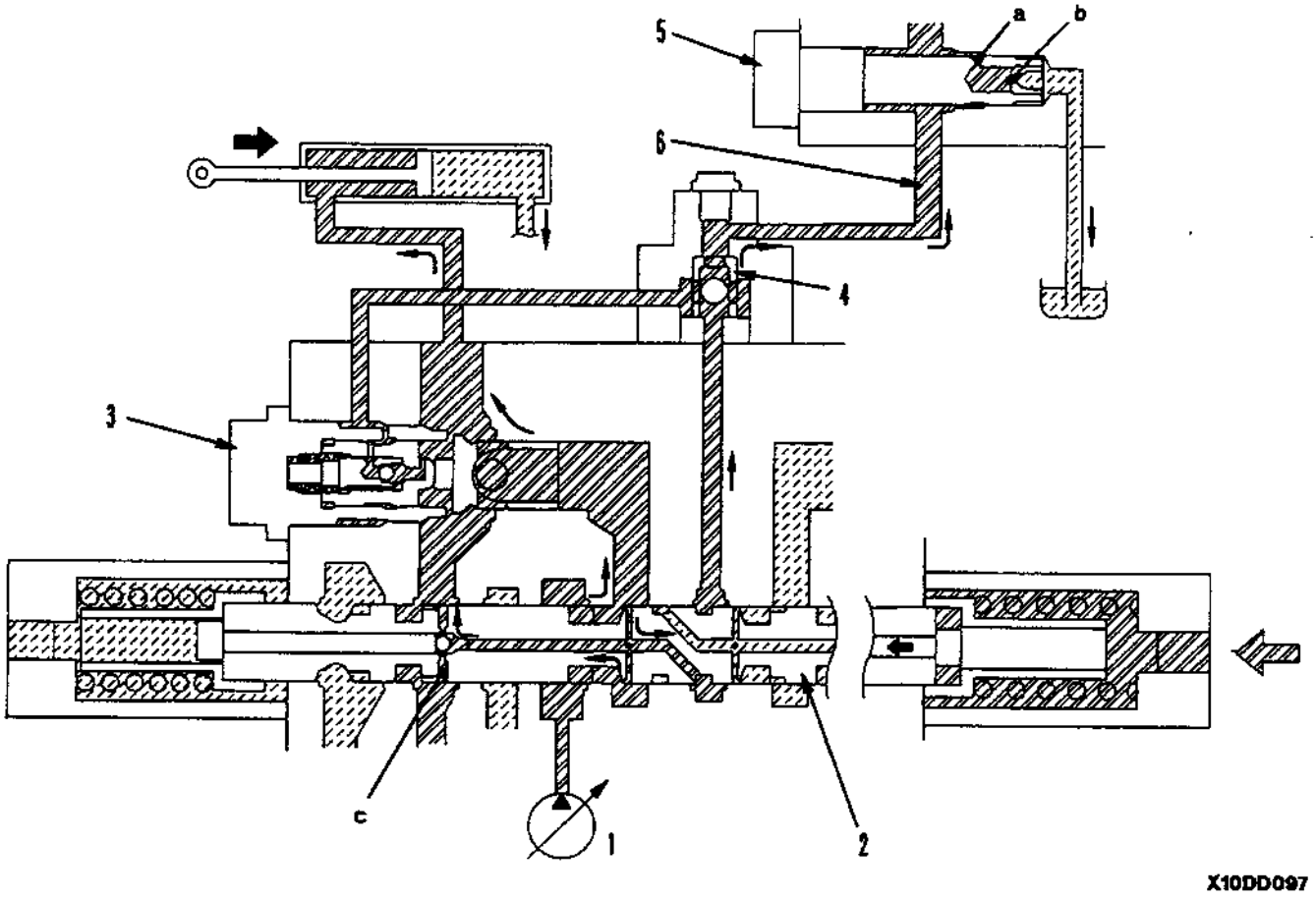
- CLSS stands for **C**losed center **L**oad **S**ensing **S**ystem, and has the following features.

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 the LS valve.

LS bypass valve

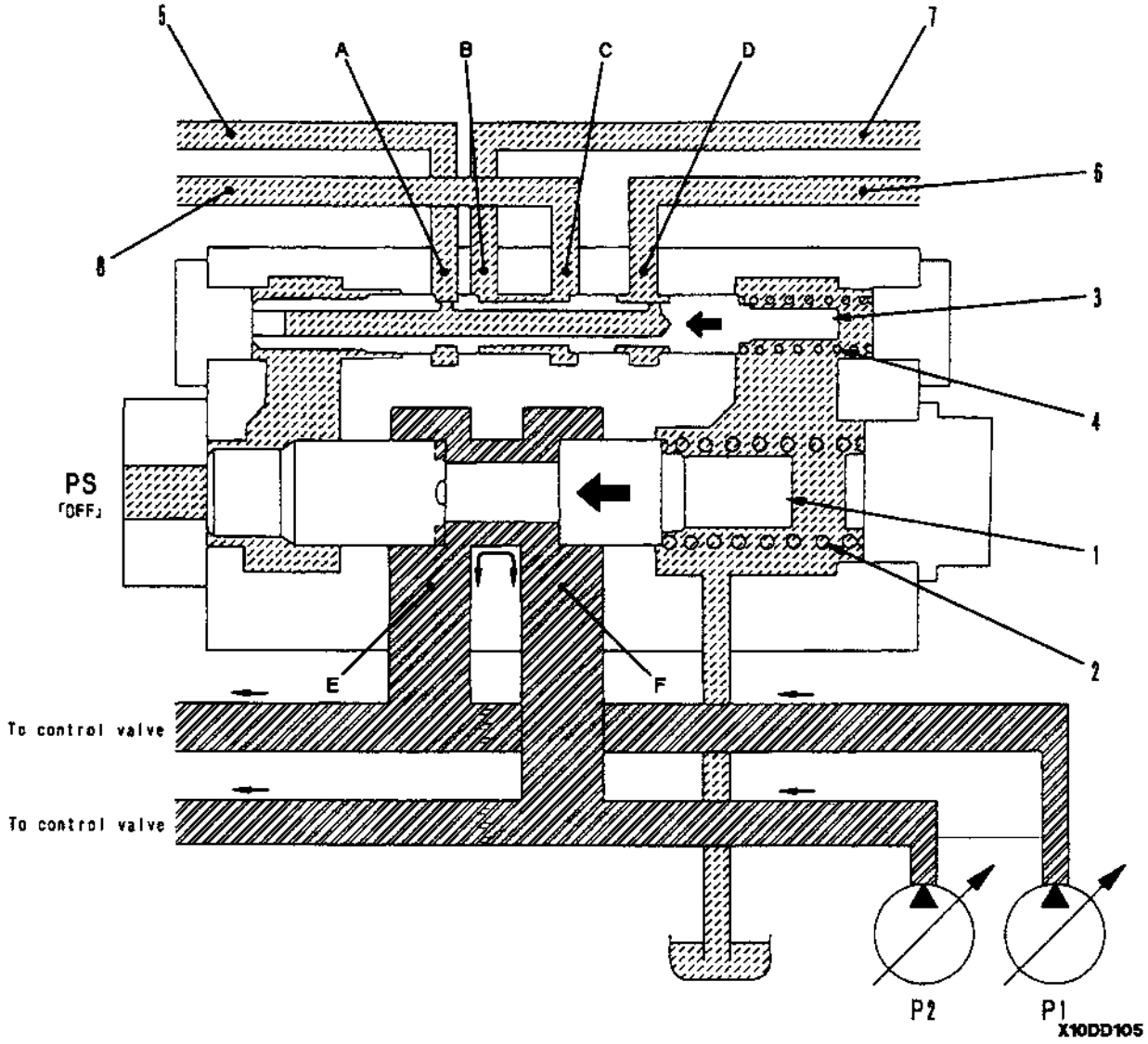


1. Main pump
2. Main spool
3. Pressure compensation valve
4. LS shuttle valve
5. LS bypass valve
6. LS circuit

Function

- The residual pressure in LS circuit (6) is released from orifices **a** and **b**.
- This reduces the speed of the rise in the LS pressure, and prevents any sudden change in the oil pressure. Furthermore, a pressure loss is generated by the circuit resistance between LS shuttle valve (4) and throttle **c** of main spool (2) according to the bypass flow from LS differential pressure drops, and the dynamic stability of the actuator is increased.

Pump merge-divider valve



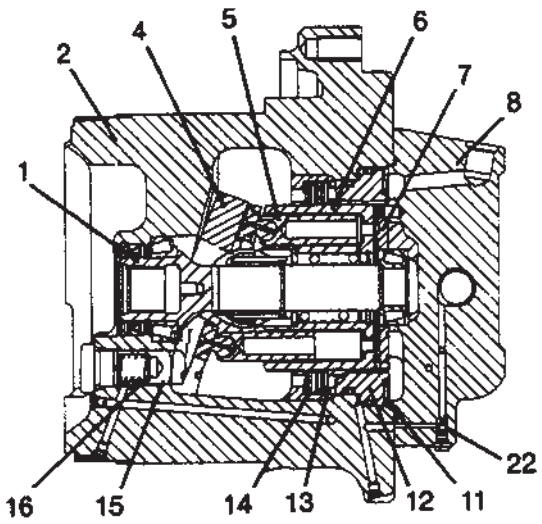
1. Main spool
2. Spring
3. LS spool
4. Spring
5. LS circuit (bucket end)
6. LS circuit (arm end)
7. LS circuit (arm end)
8. LS circuit (bucket end)

Function

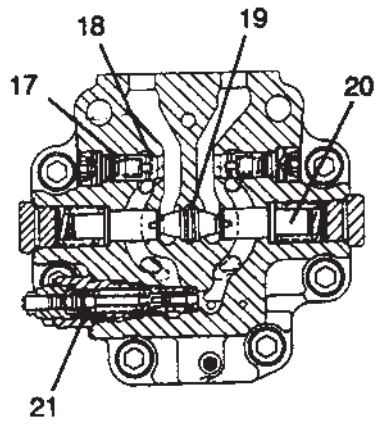
- This acts to merge or divide (send to its own control valve group) oil flows **P1** and **P2** of pressurized oil discharged from the two pumps.
- At the same time, it also carries out merging and dividing of the LS circuit pressure.

Operation

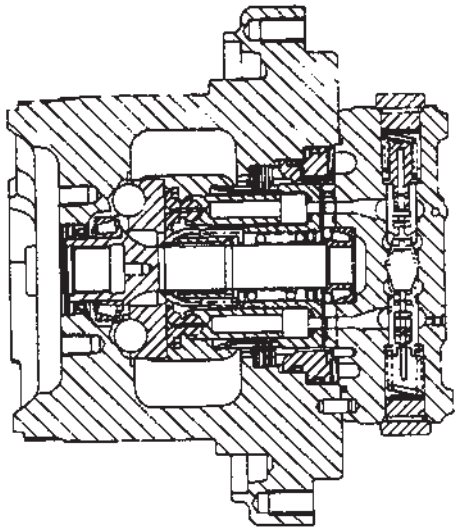
1. When merging pump flow (when pilot pressure PS is OFF)
   a. Pilot pressure **PS** is OFF, so main spool (1) is pushed to the left by spring (2), and ports **E** and **F** are interconnected. Therefore, pressurized oil **P1** and **P2** discharged from the two pumps is merged at ports **E** and **F**, and is sent to the control valve that demands the oil.
   b. In the same way, LS spool (3) is also pushed to the left by spring (4), so the ports are connected as follows.
   Connected ports: **A** ↔ **D**, **B** ↔ **C**
   c. Therefore, the LS pressure supplied from the spols of each control valve to LS circuits (5), (6), (7), and (8) are all sent to the pressure compensation valve and the other valve.



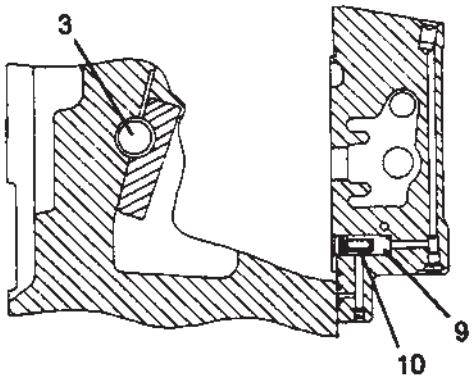
VIEW A-A



VIEW C-C



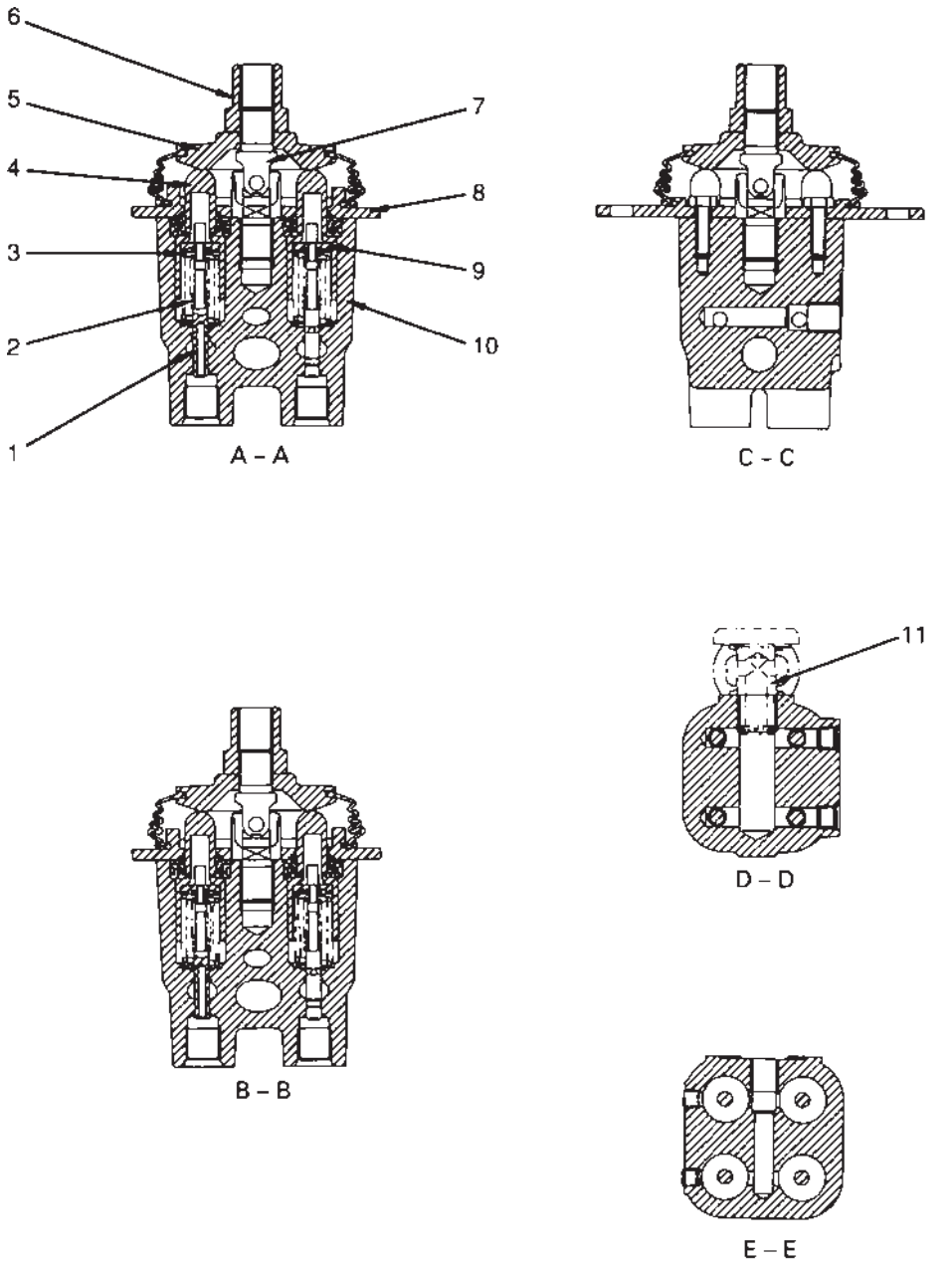
VIEW B-B



VIEW D-D

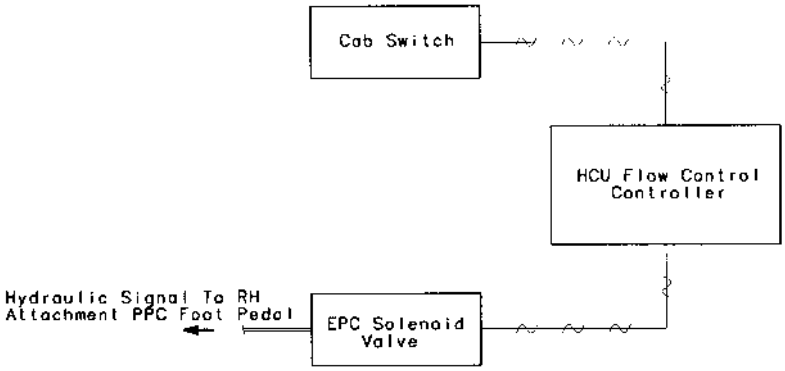
X10AV325

1. Output shaft
2. Motor case
3. Ball
4. Rocker cam
5. Piston
6. Cylinder
7. Valve plate
8. End cover
9. Regulator valve
10. Spring
11. Brake spring
12. Brake piston
13. Plate
14. Disc
15. Regulator piston
16. Spring
17. Check valve spring
18. Check valve
19. Counterbalance valve
20. Spool return valve
21. Safety valve
22. Slow return valve

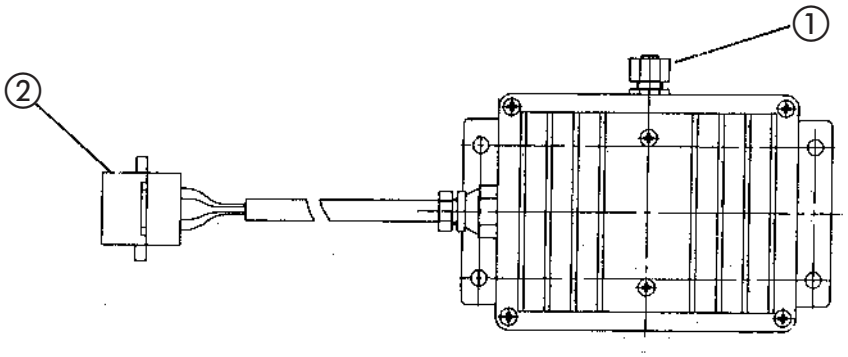


1. Spool
2. Metering spring
3. Centering spring
4. Piston
5. Disc
6. Nut (for connecting lever)
7. Joint
8. Plate
9. Retainer
10. Body
11. Filter

The purpose of the attachment flow control system is to limit the maximum flow of oil through the first attachment circuit on machines that are so equipped. The flow setting is selected by means of a thumbwheel switch fitted in the operators cab switch panel.
The layout of the system is shown as follow:

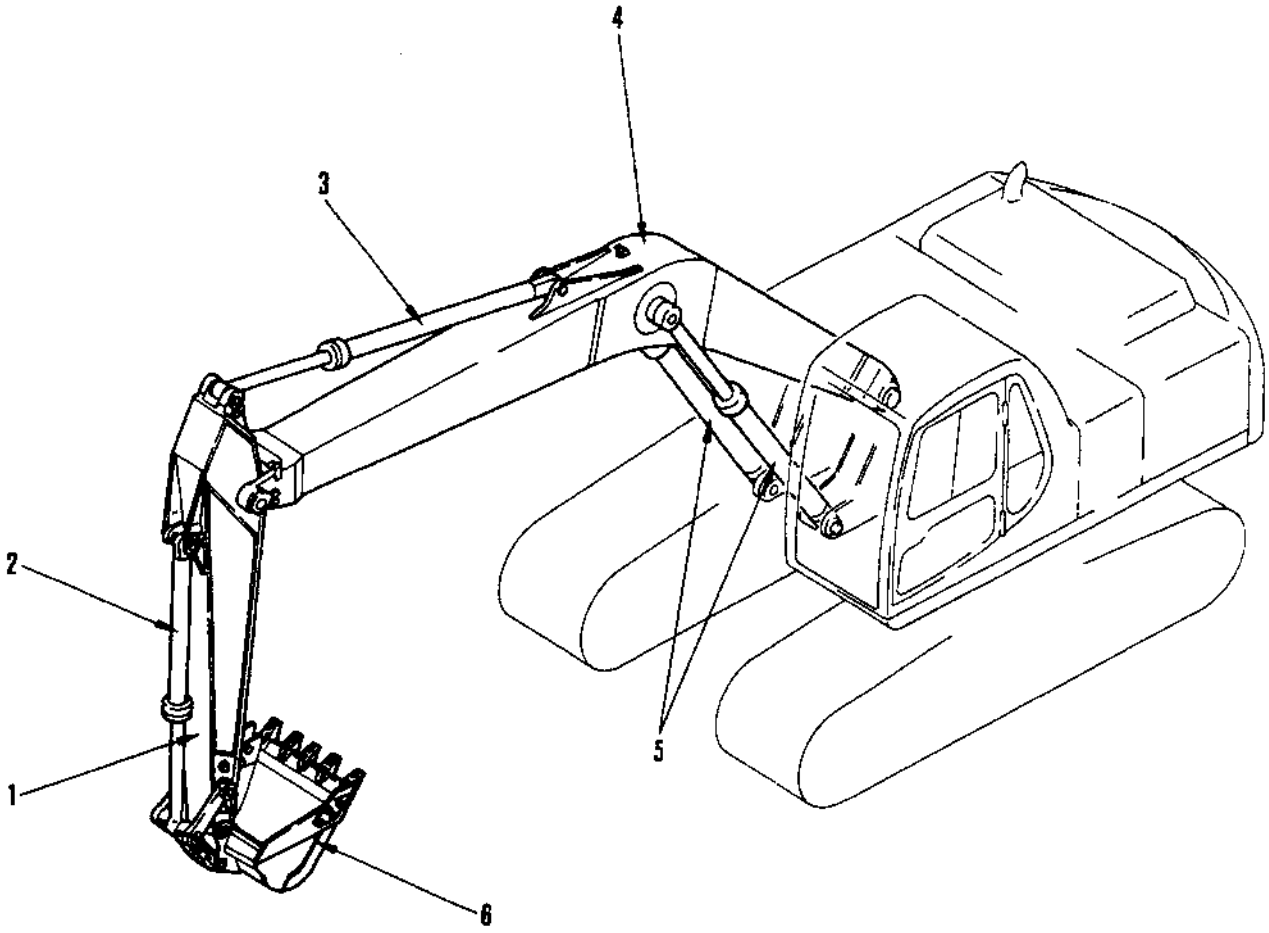


The flowcontroller sends a steady current signal to the E.P.C. solenoid valve dependent on the switch position selected at the operator's cab switch. The E.P.C. solenoid then sets the pressure of the hydraulic oil supply to the right hand attachment pedal, this limiting the maximum PPC signal pressure taht can be applied to the attachment spool.
See also page 10-114 for description of the attachement pedal)



① Adjustment knob
② Wiring connector

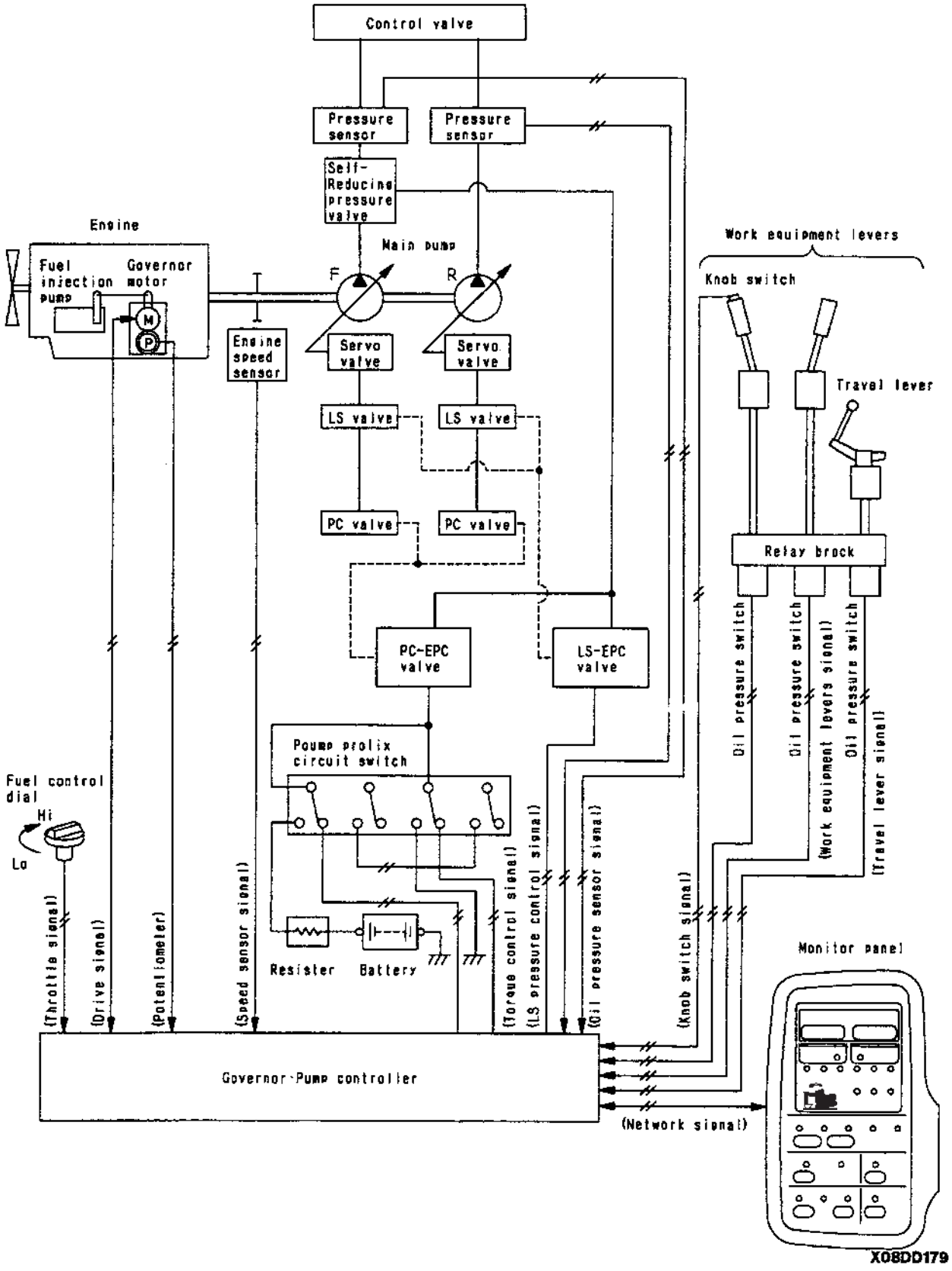
WORK EQUIPMENT



X17ZZ023

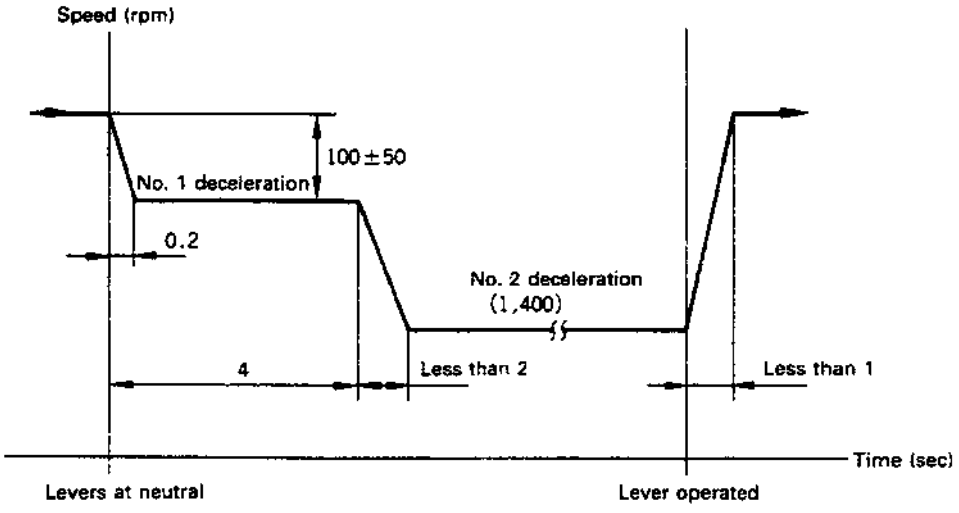
1. Arm
2. Bucket cylinder
3. Arm cylinder
4. Boom
5. Boom cylinder
6. Bucket

Pump and engine mutual control function



Function
- If all the control levers are at neutral when waiting for work or waiting for a dump truck, the engine speed is automatically reduced to a mid-range speed to reduce fuel consumption and noise.
- If any lever is operated, the engine speed returns immediately to the set speed.

Operation
1. Control levers at neutral
   a. If the engine is running at above the deceleration actuation speed (approximately 1400 rpm), and all the control levers are returned to neutral, the engine speed will drop immediately to approximately 100 rpm below the set to the No. 1 deceleration position.
   b. If another 4 seconds pass, the engine speed is reduced to the No. 2 deceleration position (approximately 1400 rpm), and is kept at that speed until a lever is operated.
2. When any control lever is operated
   a. If any control lever is operated when the engine speed is at the No. 2 deceleration position, the engine speed will immediately rise to the speed set by the fuel control dial.



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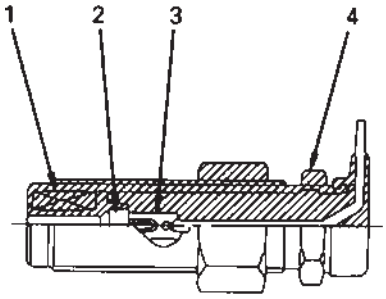
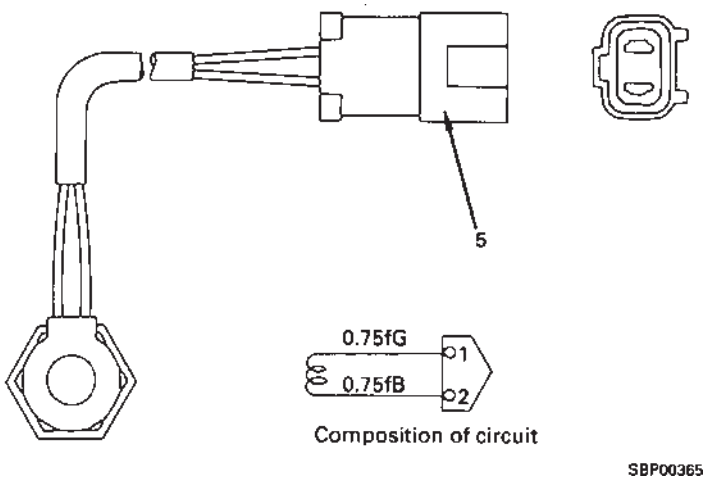
9. Components of system

1) Engine speed sensor



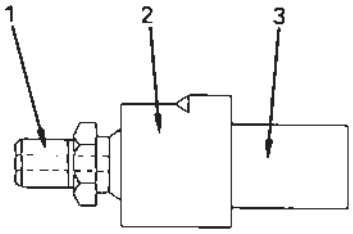


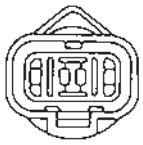
1. Wire
2. Magnet
3. Terminal
4. Housing
5. Connector

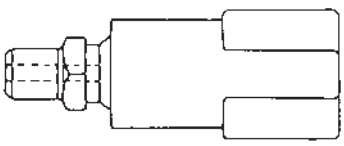
Function

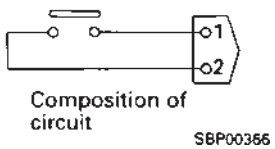
- The engine speed sensor is installed to the ring gear portion of the engine flywheel. It counts electrically the number of gear teeth that pass in front of the sensor, and sends the results to the engine throttle • pump controller.
- This detection is carried out by a magnet, and an electric current is generated every time the gear tooth passes in front of the magnet.

2) PPC hydraulic switch









1. Plug
2. Switch
3. Connector

Specifications
Composition of points :
N.O. points

Actuation (ON) pressure :
0.49 ± 0.1 MPa
5.0± 1.0 kg/cm^2

Reset (OFF) pressure: :
0.29 ± 0.05 MPa
3.0± 0.5 kg/cm^2

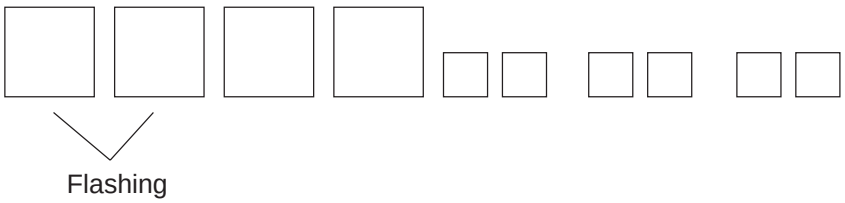
Function

- There are switches installed to the junction box. The operating condition of each actuator is detected from the PPC pressure, and this is sent to the engine throttle • pump controller.

HOW TO SET TELEPHONE NUMBER

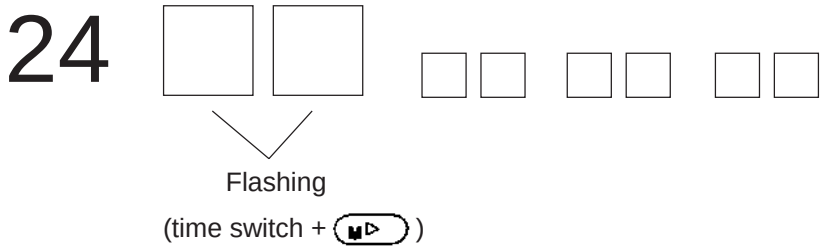
The service contact telephone number may be changed by the following procedure.

(i) Enter the telephone number change mode by keeping the time switch and the auto-decel switch pressed for 2.5 seconds. The display will change to show the current telephone number in the monitor panel memory (or ten zeros if no number is stored).



(ii) The first two digits will flash. The first digit may be set by pressing the “travel speed up” button. The second digit may be set by pressing the “travel speed down” button. Note that pressing either button once will **increase** the respective digit by 1.

(iii) The next pair of numbers be adjusted by pressing the time switch and the “working mode select M arrow” button.



Note: It is possible to move back to the previous pair of digits by pressing the time switch and the “working mode select H arrow” button (◁H).

(iv) follow the procedure given in (ii) to change the third & fourth digits. Once these have been set the fifth and sixth digits may be selected the procedure shown in (iii) above. Repeat this method until all the digits have been set successfully.

(v) To **store** the new number and return to normal monitor display, keep the time switch and auto-decel buttons pressed for 2.5 seconds.

M-23 When starting switch is at OFF and time switch is pressed, time and service meter are not displayed 20-268
M-24 Defective fuel lever sensor system 20-269
M-25 Defective coolant temperature sensor system 20-270
M-26 Defective engine oil sensor system 20-271
M-27 Defective coolant level sensor system 20-272
M-28 Defective hydraulic oil level sensor system 20-273
M-29 Wiper does not work, or switch is not being used but wiper is actuated 20-274
M-30 Washer motor does not work, or switch is not being used but washer motor is actuated 20-279

⚠ When carrying out testing, adjusting, or troubleshooting, park the machine on level ground, inset the safety pins, and blocks to prevent the machine from moving.

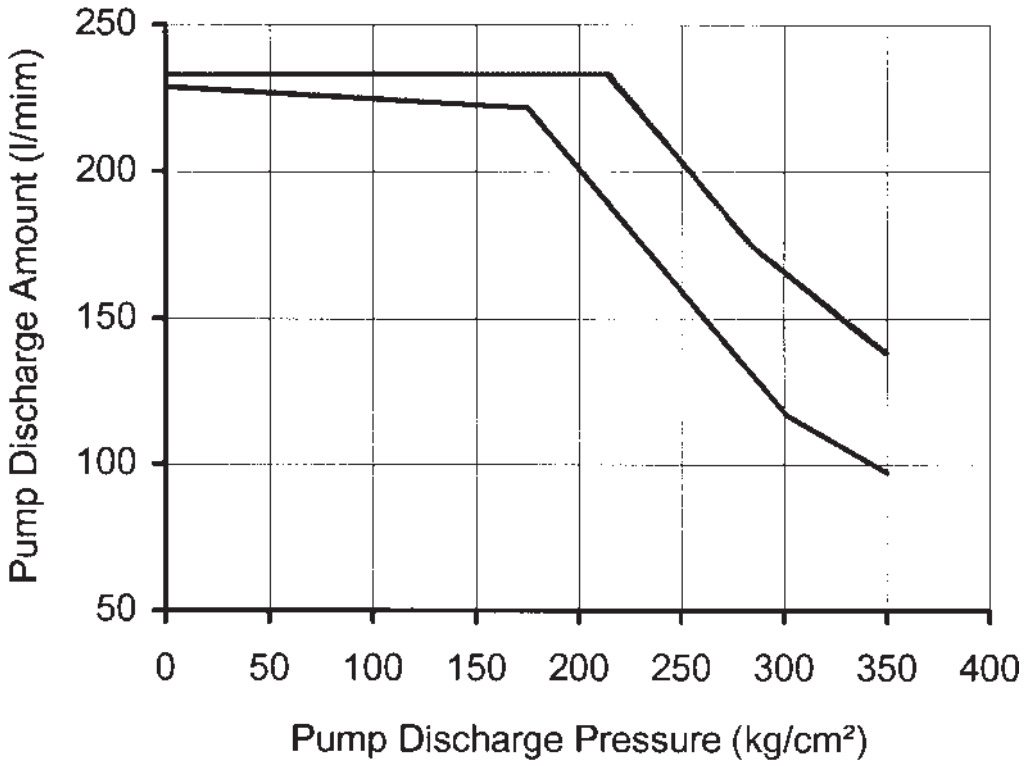
⚠ When carrying out work together with other workers, always use signals and do not let unauthorized people near the machine.

⚠ 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.

⚠ Be careful not to get caught in the fan, fan belt or other rotating parts.

Cate-gory	Discharge amount of main piston pump (in H/O mode)

Performance of hydraulic pump



- Pump speed: At 2200 rpm, PC current 180 mA

Check point	Test pump discharge pressure (kg/cm²)	Discharge pressure of other pump (kg/cm²)	Average pressure (kg/cm²)	Standard value for discharge amount Q (ℓ/min)	Judgement standard lower limit Q (ℓ/min)
As desired	P1	P2	$\frac{P_1 + P_2}{2}$	See graph	See graph

★ As far as possible, bring pump discharge pressures P_1 and P_2 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.

MEASURING ENGINE SPEED

⚠ When removing or installing the measuring equipment, be careful not to touch any high temperature parts.

★ Measure the engine speed under the following conditions.

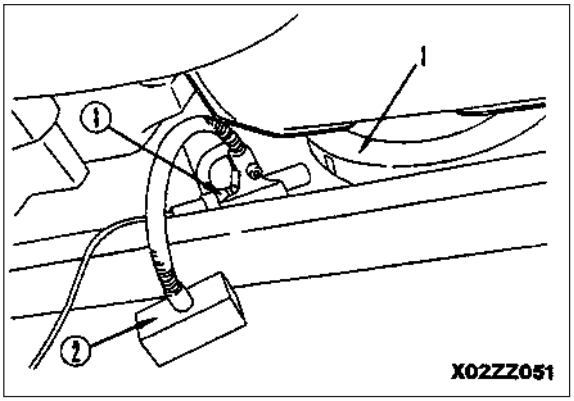
- Coolant temperature: Within operating range
- Hydraulic oil temperature: 45 – 55 °C

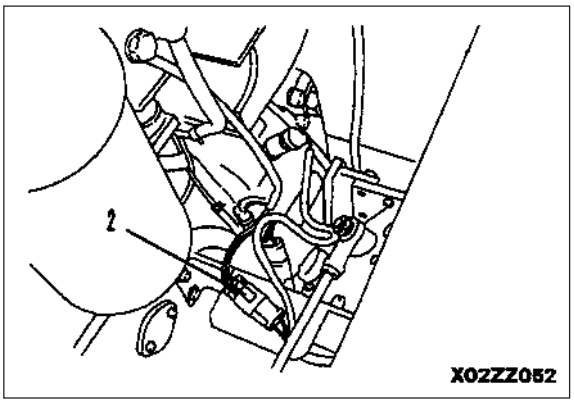
1. Installation of tachometer
   a. Mechanical meter
      i. Remove the cover under the front pulley, then set probe ① of tachometer **A** on stand ② facing pulley (1)
      ii. Stick silver paper to pulley (1).
      iii. Connect probe 1* and tachometer **A** with the cable.

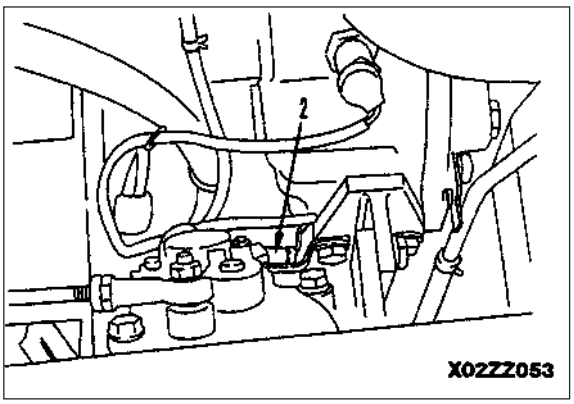
⚠ When measuring the speed, be careful not to touch any rotating or high temperature part.

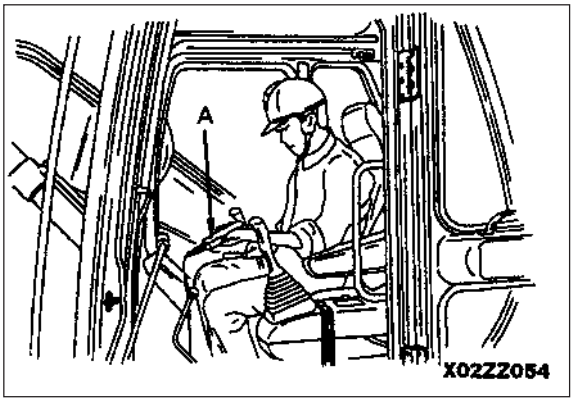
   b. Electric meter
      i. Install T-adapter **N1** to connector CN E01 (2) of the engine speed sensor.
      ii. Connect the power source cable to the battery (24V).

2. Start the engine, and measure the engine speed when it is set to the conditions for measuring.
   a. Measuring at low and high idling: Measure the engine speed with the fuel control dial set to low idling and high idling.
   b. Measuring speed at pump relief: Run the engine at full throttle and measure the engine speed when the pump is relieved.
   c. Measure speed at near the rated speed: Run the engine at full throttle, operate the arm lever, and measure the speed when the arm circuit is relieved.





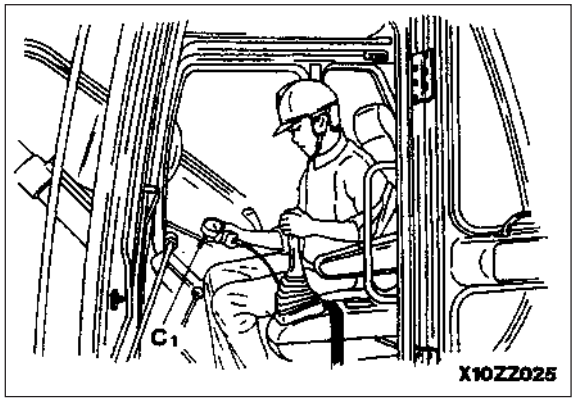




c. Measuring pump relief pressure
   i. Low setting (oil pressure: 31.9 MPa (325 kg/cm^2))
      (1) Measure the pressure when each actuator except the travel actuator is relieved in H/O mode with the engine at full throttle.

★ Note that the set pressure of the safety valve for the swing motor and head end of the boom is lower than the main relief low set pressure, so the value measured will be the relief pressure will rise, so always keep the lock switch OFF when measuring.

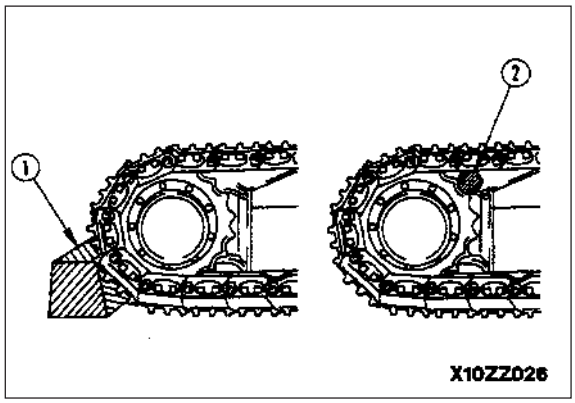
★ When measuring the swing relief pressure, measure with the swing lock turned switch ON.



   ii. High setting (oil pressure: 34.8 MPa (355 kg/cm^2)
      (1) When travel is operated. Measure the oil pressure when the travel is relieved on each side separately in H/O mode with the engine at full throttle.

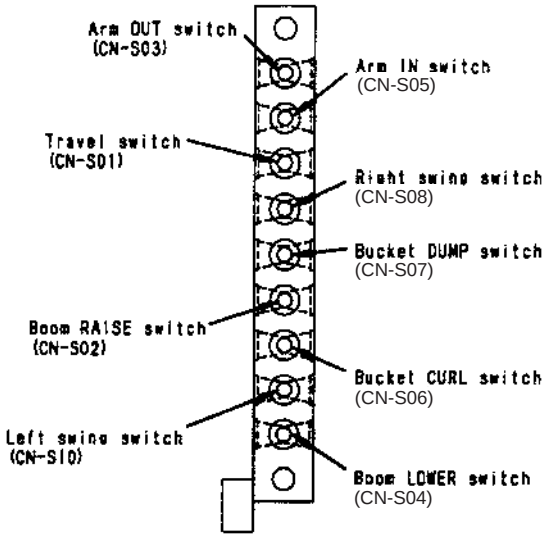
★ To relieve the travel circuit, put block 1 under the track shoe grouser, or put block 2 between the sprocket and frame to lock the track.

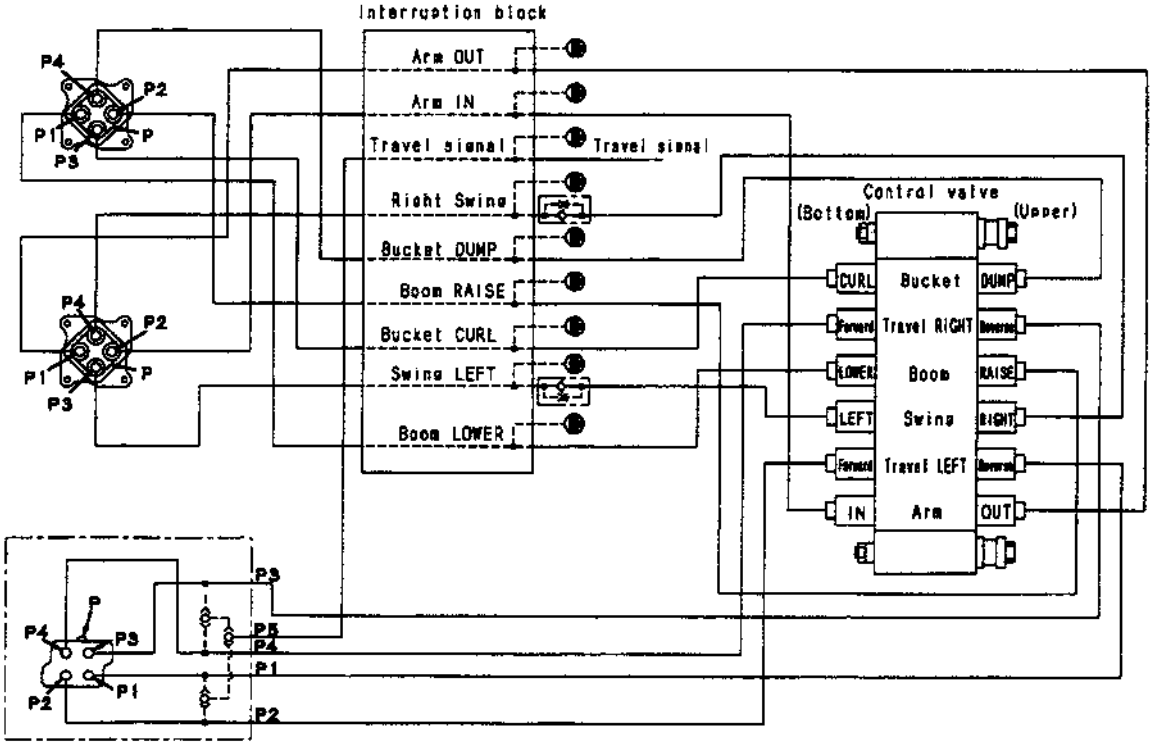
      (2) When power max. function is actuated.
      When measuring the oil pressure in G/O or H/O mode with the engine at full throttle and the power max. function actuated, relieve one of the boom, arm, or bucket circuits, and measure the oil pressure.



Pressure switch piping diagram

Interruption block seen from the rear of the machine.





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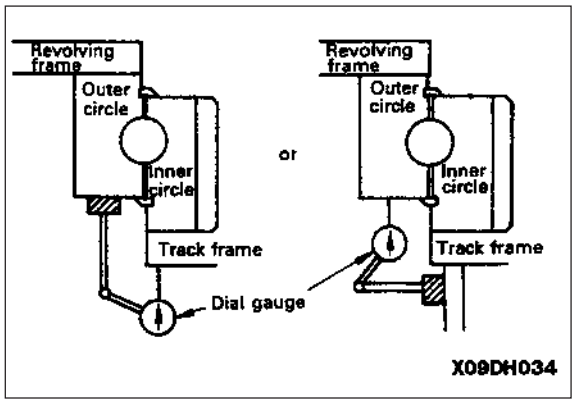
RELEASING REMAINING PRESSURE IN HYDRAULIC CIRCUIT

★ If the piping between the hydraulic cylinder and the control valve is disconnected, release the remaining pressure from the circuit as follows. The travel circuit is an open circuit, so there is no remaining pressure. It is enough to remove the oil filler cap.

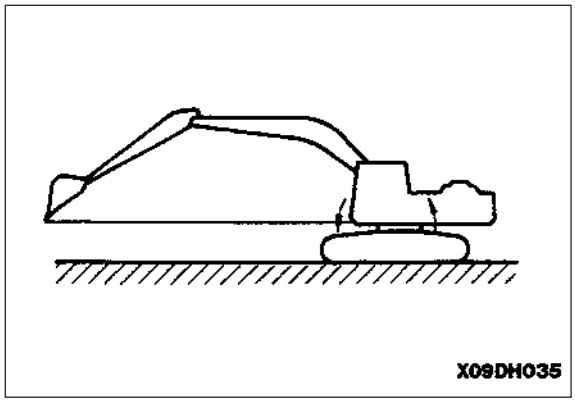
1. Loosen the oil filler cap slowly to release the pressure inside the tank.
2. Operate the control levers. When the levers are operated 2 – 3 times, the pressure stored in the accumulator is removed.
3. Start the engine, run at low idling for approximately 5 minutes, then stop the engine and operate the control levers. Repeat the above operation 2 – 3 times to release all the remaining pressure.

TESTING CLEARANCE OF SWING CIRCLE BEARING

1. Method of testing clearance of swing circle bearing when mounted on machine.
   a. Fix a magnet-type dial gauge to the outer circle (or inner circle) of the swing circle, and put the tip of the probe in contact with the inner circle (or outer circle). Set the dial gauge at the front or rear.



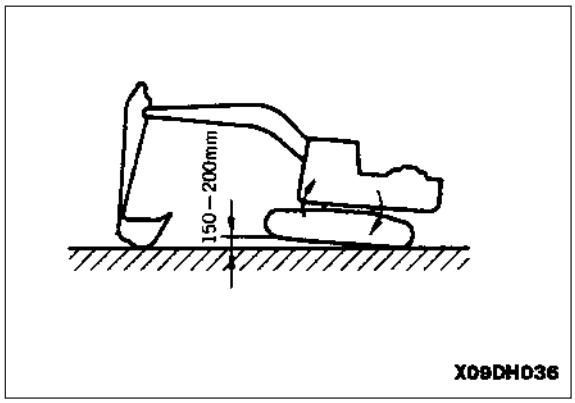
   b. Extend the work equipment to the maximum reach, and set the tip of the bucket to the same height as the bottom of the revolving frame. When this is done, the upper structure will tilt forward, so the front will go down and the rear will rise.
   c. Set the dial gauge to the zero point.



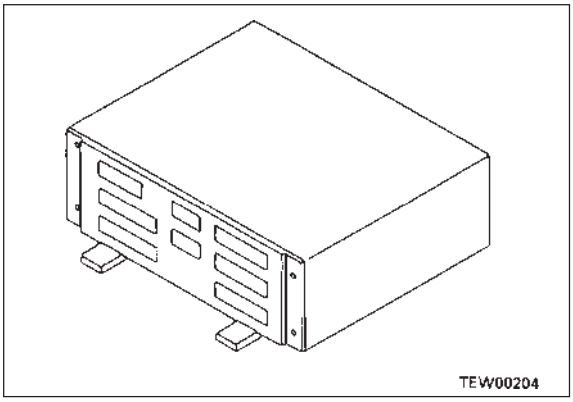
   d. Set the arm more or less at right angles to the ground surface, then lower the boom until the front of the machine comes off the ground. When this is done, the upper structure will tilt back, so the front will rise and the rear will go down.
   e. Read the value on the dial gauge at this point. The value on the dial gauge is the clearance of the swing circle bearing.

⚠ When carrying out the measurement, do not put your hand or feet under the undercarriage.

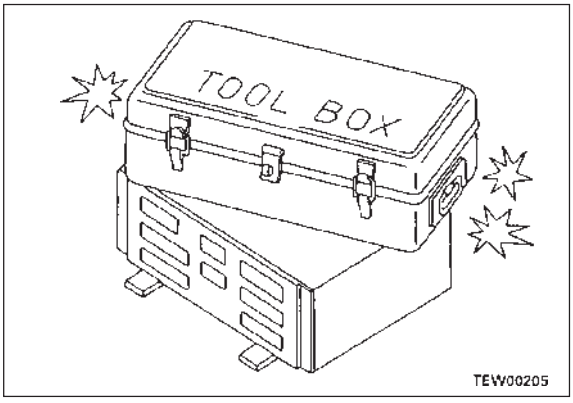
   f. Return to the condition in Step b., and check that the dial gauge has returned to the zero point. If it has not returned to the zero point, repeat Steps b. To e.



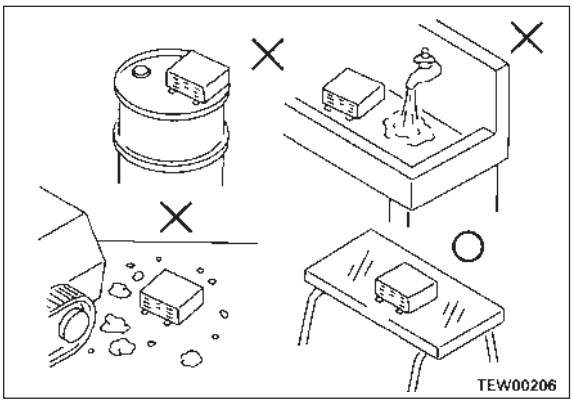
3. Handling control box
   a. The control box contains a microcomputer and electronic control circuits. These control all of the electronic circuits on the machine, so be extremely careful when handling the control box.
   b. Do not open the cover of the control box unless necessary.



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



   f. 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).
   g. 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.



Points to remember when troubleshooting electric circuits

1. Always turn the power OFF before disconnecting or connecting connectors.
2. Before carrying out troubleshooting, check that all the related connectors are properly inserted.

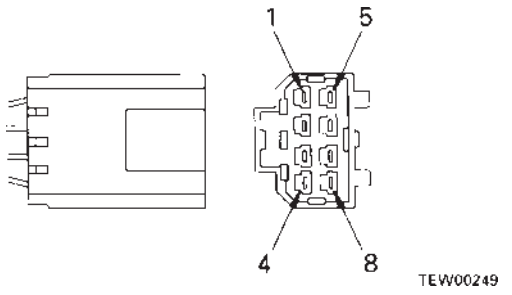
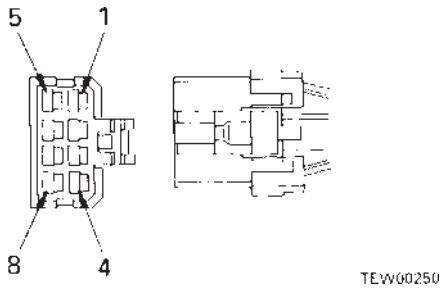
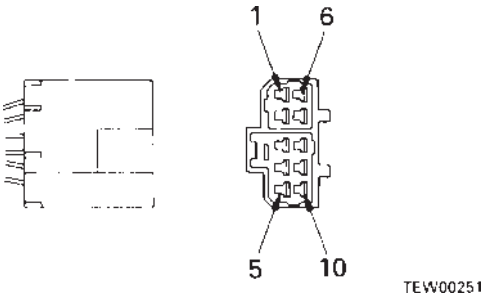
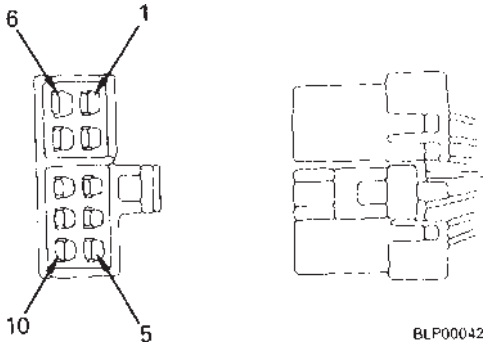
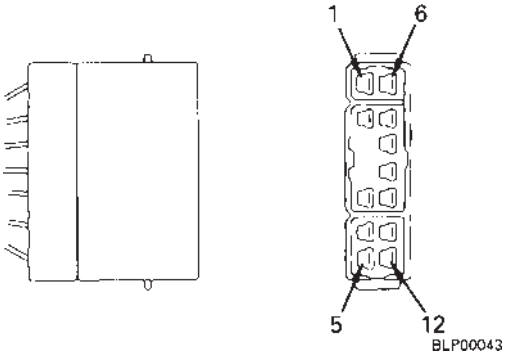
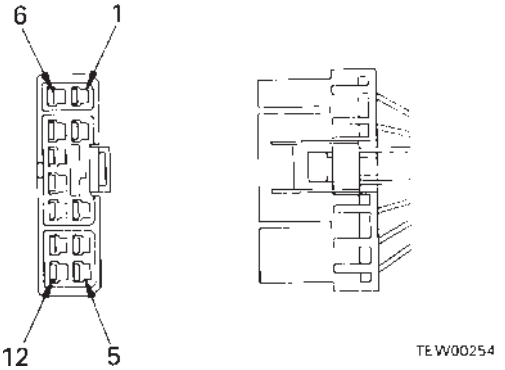
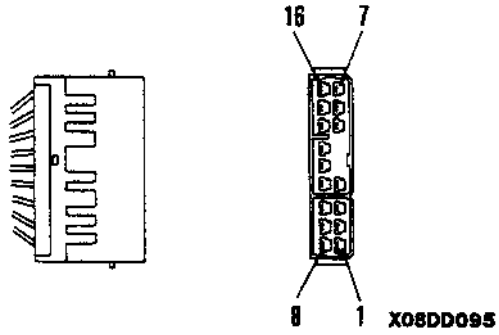
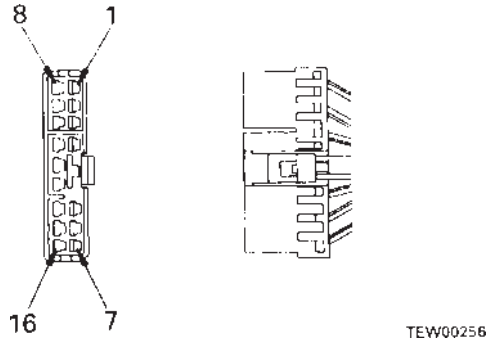
★ Disconnect and connect the related connectors several times to check.

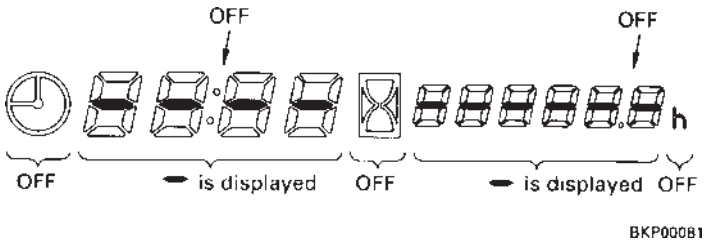
3. Always connect any disconnected connectors before going on to the next step.

★ 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.

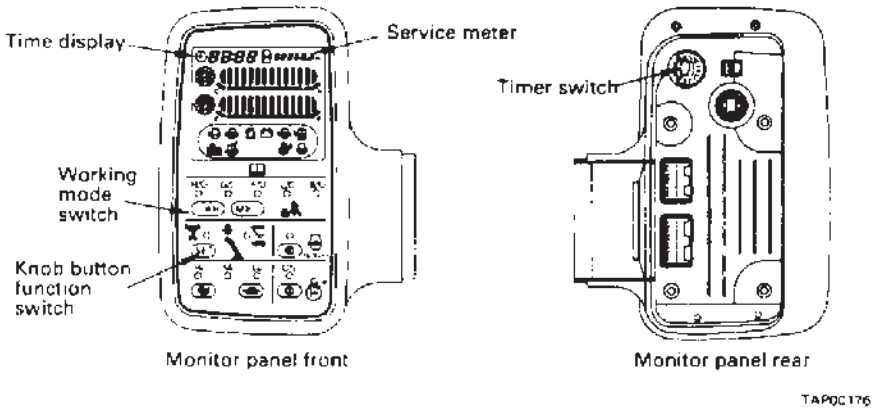
★ If there is any change, there is probably defective contact in that circuit.

No. of pins	S type connector	
	Male (female housing)	Female (male housing)
8		
10 (white)		
12 (white)		
16 (white)		

Operation	Display
4. To finish with the trouble data display mode, keep the TIME switch + L.H. travel speed switch pressed for 2.5 seconds. 5. To erase the memory, keep the time switch pressed, turn the starting switch from OFF to ON, and keep the time switch pressed for 5 seconds.	3) If there is no abnormality code in memory  BKP00081

3. Machine data monitoring function

The input signals from the sensors and the output signals to drive the solenoid are displayed on the time display and service meter display.



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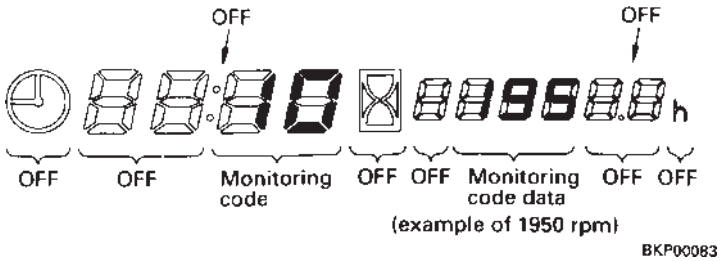
a. Method of displaying monitoring code

Operation	Display
1. To set to the machine data monitoring mode, do as follows. Keep the time switch + knob button function switch pressed for 2.5 seconds. Note:This is possible at the following times. 1) During the normal mode 2) During the user code display mode 3) During the time adjustment mode 4) During the trouble data display mode	1. On the time display and service meter display, the monitoring code and data are displayed. • Example of display 1) When engine speed is monitored (monitoring code 10)  BKP00083

<Example>

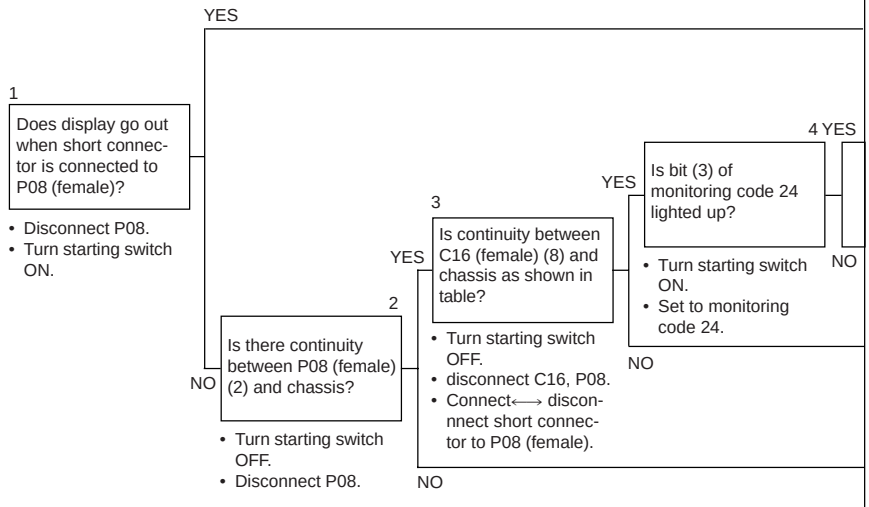
(1) **M-8 When starting switch is turned ON (engine stopped), basic check items flash**

(2) ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
★ Always connect any disconnected connectors before going on to the next step.

(3) a)  (coolant level) flashes

b)  (engine oil level) flashes

(4)



Cause	Remedy
Defective coolant level sensor system (see M-26)	-
Defective governor, pump controller	Replace
Defective monitor panel	Replace
Defective contact, or disconnection in wiring harness between C16 (female) (8) -P08 (female) (1)	Repair or replace
Defective contact, or disconnection in wiring harness between P08 (female) (2) - chassis ground	Repair or replace

Table 1

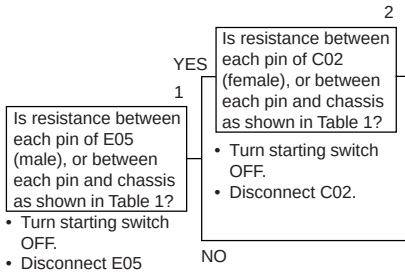
Short connector	Continuity
Connected	Yes
Disconnected	No

ACTION TAKEN BY CONTROLLER WHEN ABNORMALITY OCCURS AND PROBLEMS ON MACHINE

User code	Service code	Abnormal system	Nature of abnormality
E05	E308	Abnormality in fuel control dial input value	1. Short circuit in wiring harness between C03 (7) - (14), (7) - (17), (14) - (17) 2. Short circuit in wiring harness between E04 (1) - (2), (1) - (3), (2) - (3) 3. Short circuit in wiring harness between E06 (1) - (2), (1) - (3), (2) - (3) 4. Short circuit in wiring harness between C03 (7) - (4), (4) - (17) 5. Disconnection in wiring harness between C03 (7) - X07 (6) - E06 (1) 6. Disconnection in wiring harness between C03 (4) - X07 (5) - E06 (2) 7. Disconnection in wiring harness between C03 (17) - X07 (4) - E06 (3) 8. Defective fuel control dial 9. Defective contact of C03, X07, E06 connectors
	E317	Abnormality (disconnection) in motor drive system	1. Disconnection inside governor motor 2. Disconnection in wiring harness between C02 (2) - E05 (1) 3. Disconnection in wiring harness between C02 (4) - E05 (3) 4. Disconnection in wiring harness between C02 (3) - E05 (2) 5. Disconnection in wiring harness between C02 (5) - E05 (4) 6. Defective contact of E05 connector
	E318	Abnormality (short circuit) in motor drive system	1. Short circuit inside governor motor 2. Wiring harness between C02 (2) - E05 (1) and between C02 (4) - E05 (3) short circuiting with wiring harness between C02 (3) - E05 (2) 3. Wiring harness between C02 (4) - E05 (3) and between C02 (2) - E05 (1) short circuiting with wiring harness between C02 (5) - E05 (4) 4. Wiring harness in Items 2 and 3 short circuiting with ground

E-3 [E317] Abnormality (disconnection) in motor drive system is displayed

★ **This troubleshooting is carried out when there is still an abnormality, so when disconnecting the connector and inserting the T-adapter, or when removing the T-adapter and returning the connector to its original position, if the service code E is not displayed, the problem has been removed.**
★ During operation, if there is
1) a simultaneous disconnection in A phase and B phase:
a. the engine will run at low idling
b. the engine will not stop
2) a disconnection in either A phase or B phase, the engine speed will remain the same as before the abnormality occured
★ If the problem occurs when the engine is stopped, the engine can be started, but is stays in low idling, or it will not stop after it is started.
⚠ Check with the engine stopped (push the fuel control lever of the fuel injection pump to the NO INJECTION position).
★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
★ Always connect any disconnected connectors before going on the next step.



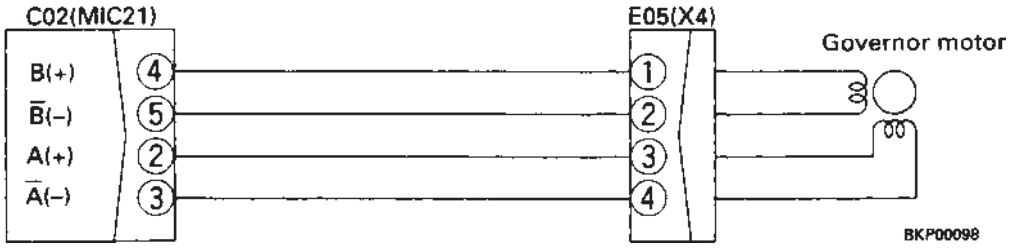
Cause	Remedy
Defective engine throttle, pump controller	Replace
Defective wiring harness in system with defective resistance	Replace
Defective governor motor	Replace

Table 1

E05 (male)	C02 (female)	Resistance value
(1) - (2)	(2) - (3)	2.5 - 7.5 kΩ
(3) - (4)	(4) - (5)	2.5 - 7.5 kΩ

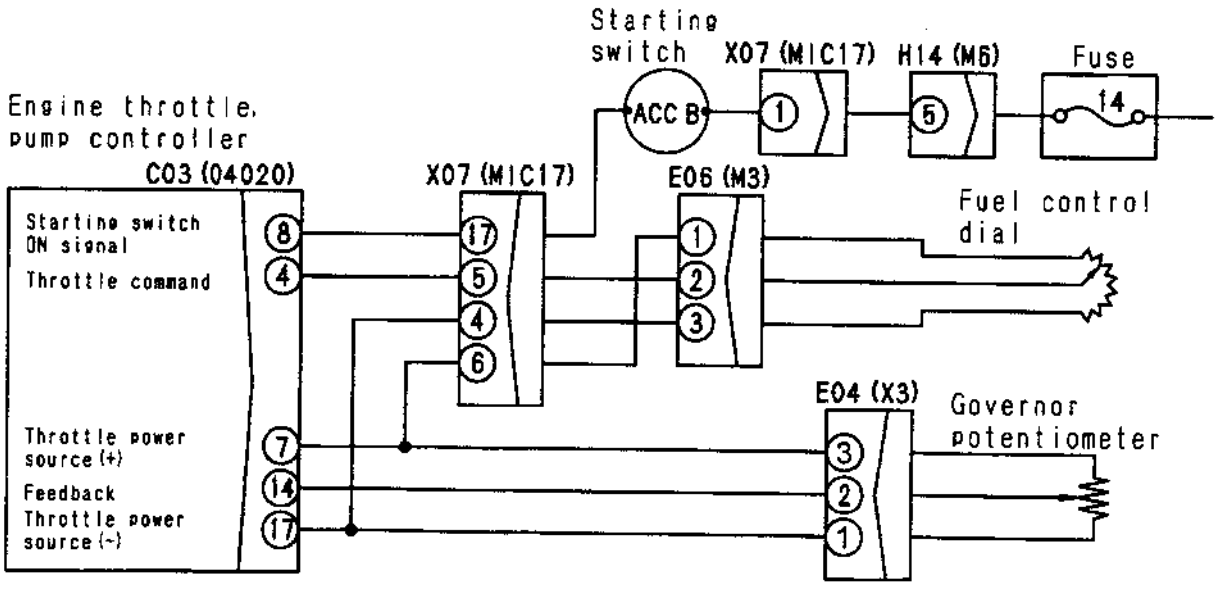
E-3 Related electric circuit diagram

Engine throttle pump controller



Cause	Remedy
See N mode	
Defective adjustment of linkage	Adjust
Defective injection pump	See S mode
Defective governor motor	Replace
Defective contract of wiring harness between starting switch ACC-X07 (17)-C03 (female) (8), or defective starting switch	Repair or replace
See E-5	-
See E-2	-
See C-20	-

E-9 Related electric circuit diagram



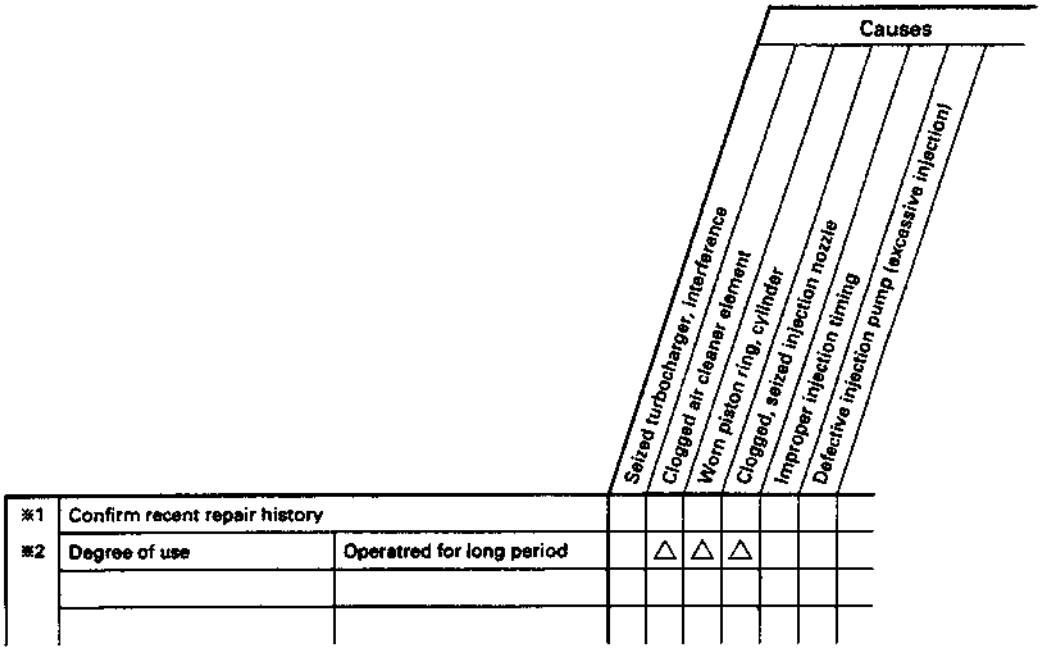
X08DD269

The basic method of using the troubleshooting chart is as follows. Items listed for Question and Check Items that have a relationship with the Cause items are marked with O, and of these, causes that have a high probability are marked with OO.

Check each of the Questions and Check items in turn, and not the O and OO in the chart for items where the problem appeared. The vertical column (Causes) that has the highest number of points is the most probable cause, so start troubleshooting for that item to make the final confirmation of the cause.

※ 1. For [Confirm recent repair history] in the Question section, ask the user, and mark the Cause column with a Œ to use as reference for locating the cause of the failure. However, do not use this when making calculation to narrow down the causes.

※ 2. Use the Œ in the Cause column as reference for [Degree of use (Operated for long period)] in the Questions section as reference. As a rule, do not use it when calculating the points for locating the cause, but it can be included in necessary to determine the order for troubleshooting.



S-4 Engine stops during operations

★ Check that the monitor panel fuel level display shows that there is still fuel remaining

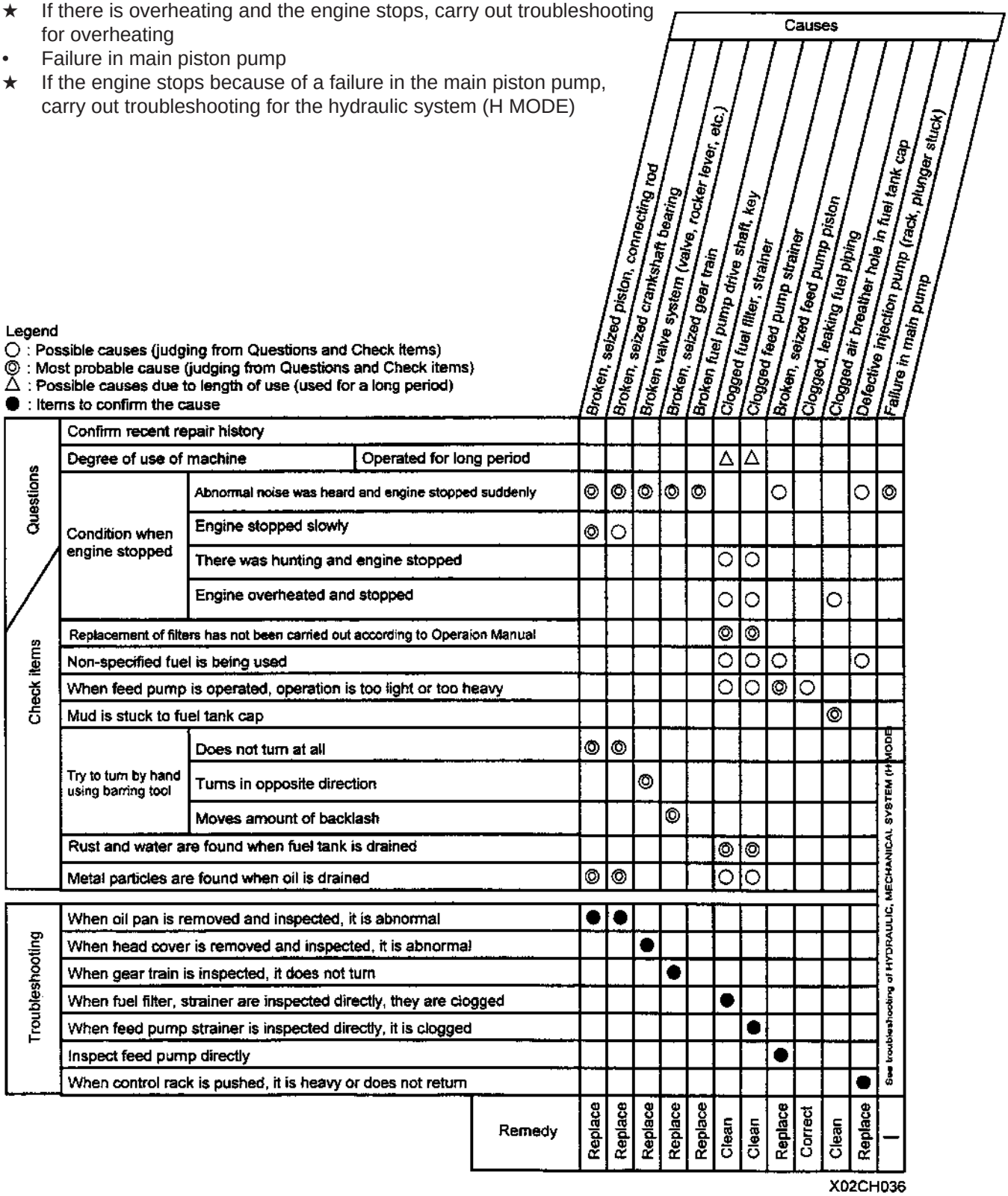
General causes why engine stops during operations

- Seized parts inside engine
- Insufficient supply of fuel
- Overheating

★ If there is overheating and the engine stops, carry out troubleshooting for overheating

- Failure in main piston pump

★ If the engine stops because of a failure in the main piston pump, carry out troubleshooting for the hydraulic system (H MODE)



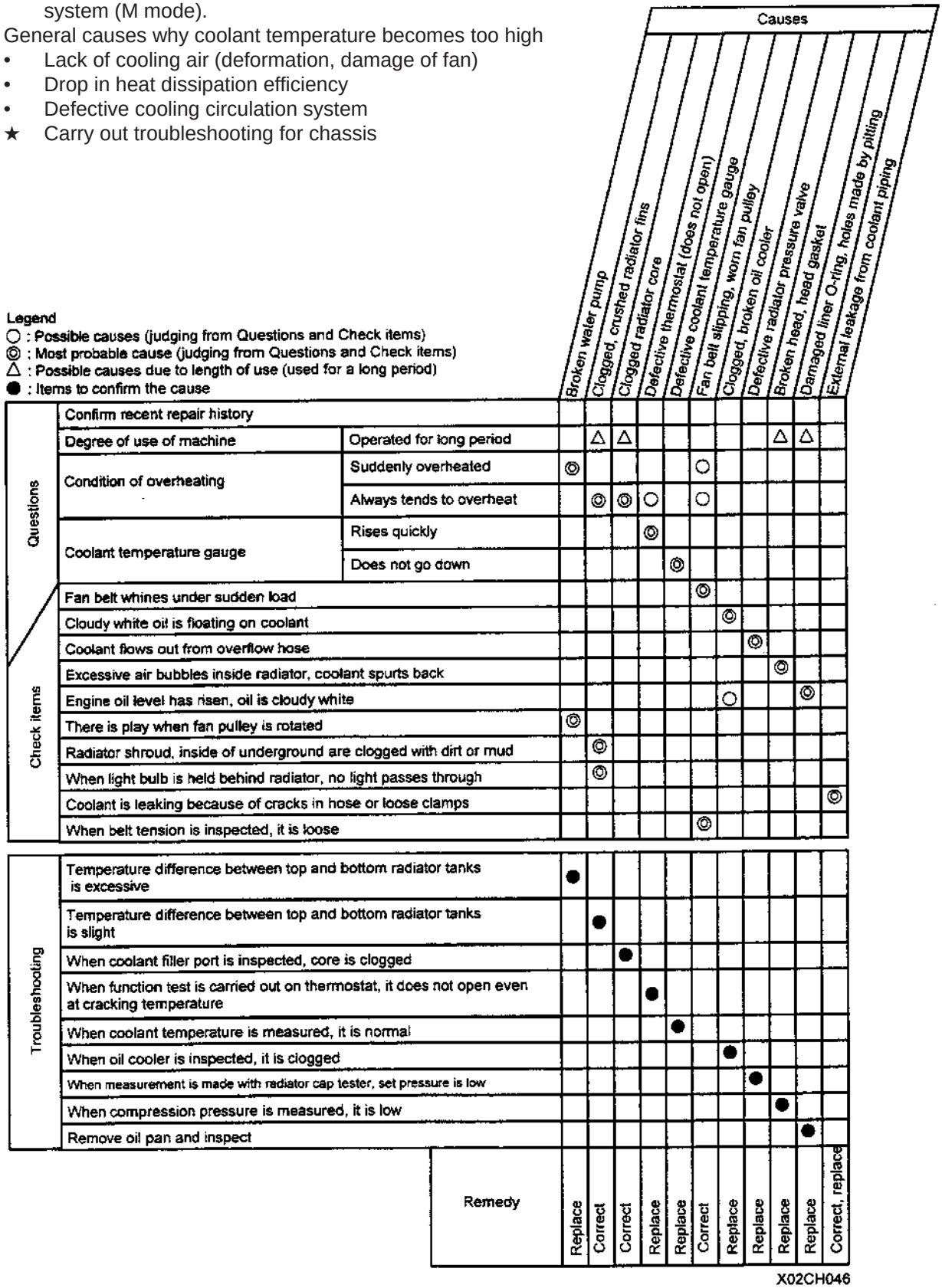
X02CH036

S-14 Coolant temperature becomes too high (overheating)

★ Check that the monitor panel coolant level caution lamp is not lit.
★ When the monitor panel coolant temperature gauge is normal, go to troubleshooting of machine monitor system (M mode).

General causes why coolant temperature becomes too high
- Lack of cooling air (deformation, damage of fan)
- Drop in heat dissipation efficiency
- Defective cooling circulation system

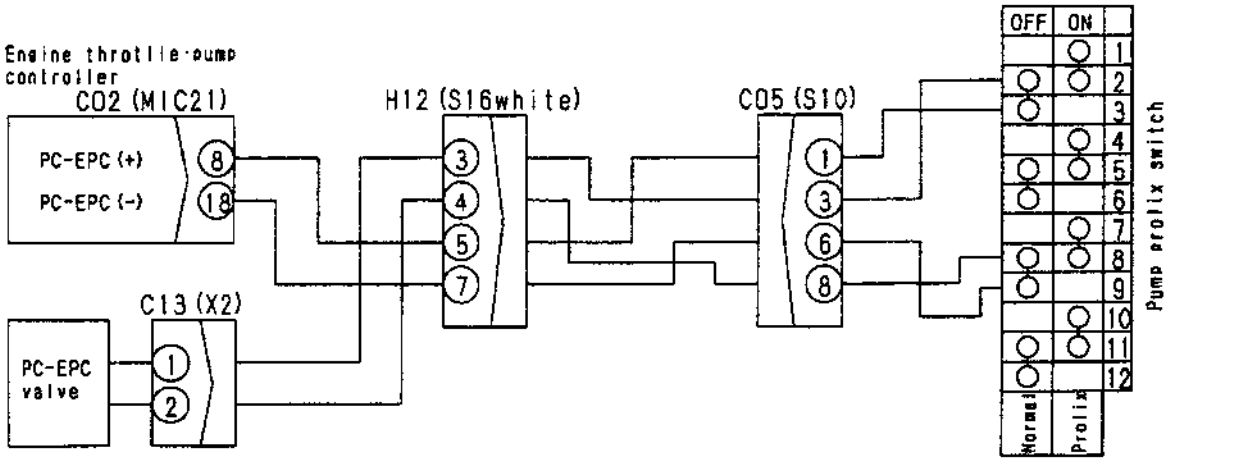
★ Carry out troubleshooting for chassis



X02CH046

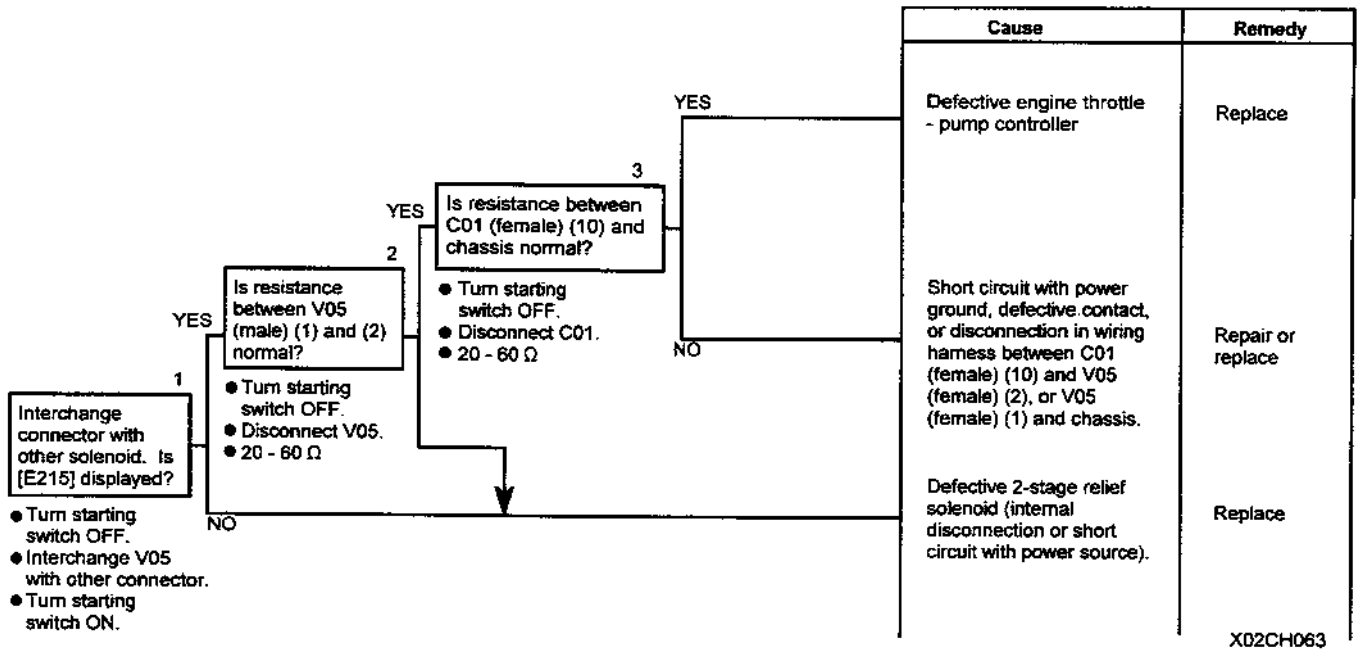
User code	Service code	Abnormal system	Nature of abnormality
-	E225	Abnormality in rear pump pressure sensor system	1. Disconnection, defective contact, short circuit, short circuit with ground inside rear pump pressure sensor 2. Disconnection, defective contact, short circuit in wiring harness between controller C03 (6) and pressure sensor C07 (2) ((+)side) 3. Disconnection, defective contact, short circuit with power source, short circuit with ground in wiring harness between controller C03 (13) and pressure sensor C07 (3) (SIG side) 4. Defective engine throttle • pump controller
-	E226	Abnormality in pressure sensor power source system	1. Short circuit, short circuit with ground inside front pump pressure sensor or rear pump pressure sensor 2. Short circuit, short circuit with ground in wiring harness between controller C03 (6) and front pressure sensor C08 (2) or rear pressure sensor C07 (2) ((+)side) 3. Defective engine throttle •pump controller
-	E227	Abnormality in speed sensor system	1. Disconnection, defective contact, short circuit inside engine speed sensor 2. Disconnection, defective contact, short circuit with ground in wiring harness between controller C16 (1) and speed sensor E07 (2) ((-) side) and between C16 (2) and E07 (1) (SIG side) 3. Defective engine throttle • pump controller

C-3 Related electric circuit diagram

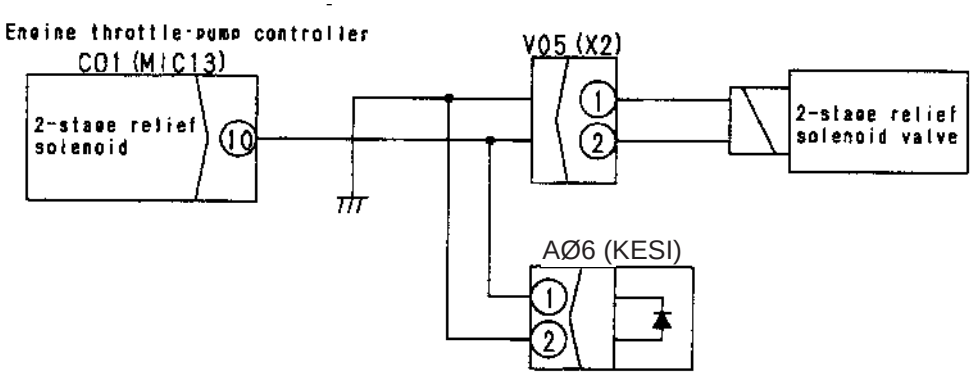


C-13 [E215] Disconnection in 2-stage relief solenoid system is displayed

★ This troubleshooting is carried out when there is still an abnormality, so when disconnecting the connector and inserting the T-adapter, or when removing the T-adapter and returning the connector to its original position, if an E service code is not displayed, the problem has been removed.
★ If the starting switch is turned OFF after an abnormality occurs, turn the starting switch ON and check if an E service is displayed. (If it is not displayed, the problem has been removed).
★ Before carrying out troubleshooting, check that all related connectors are properly inserted.
★ Always connect any disconnected connectors before going on the next step.



C-13 Related electric circuit diagram



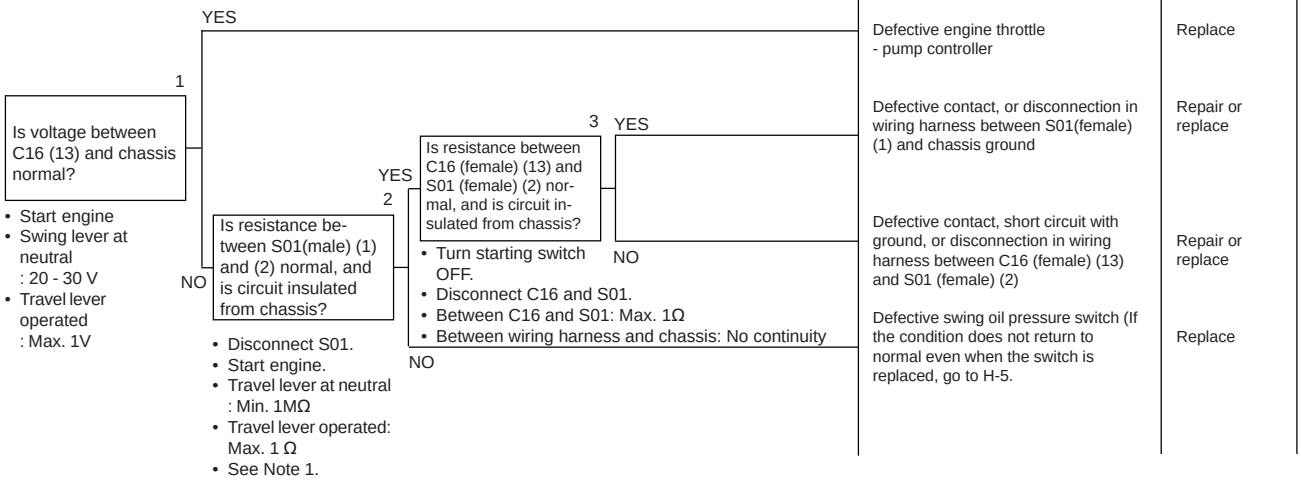
X08DD280

F-2 Bit pattern 20-(2) Travel oil pressure switch does not light up

★ This troubleshooting is carried out when there is still an abnormality, so when disconnecting the connector and inserting the T-adapter, or when removing the T-adapter and returning the connector to its original position, if an E service code is not displayed, the problem has been removed.

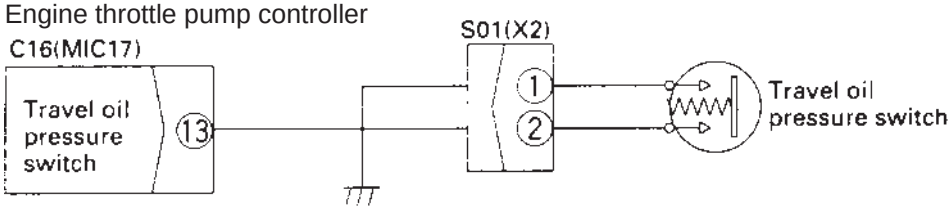
⚠ Turn swing lock switch ON before operating the swing lever.

★ If there is no display when the lever is operated on one side, the PPC shuttle valve is defective. (See H-5) (When measuring with the engine stopped, charge the accumulator first).
★ Before carrying out troubleshooting, check that all related connectors are properly inserted.
★ Always connect any disconnected connectors before going on the next step.



Note 1: It is also possible to fit a short connector and judge the condition. In this case, check the voltage between C16 (13) and the chassis.
- If it is 20-30 V: go to YES
- If it is less than 1V: Go to NO

F-2 Related electric circuit diagram



TROUBLESHOOTING OF HYDRAULIC AND MECHANICAL SYSTEM (H-MODE)

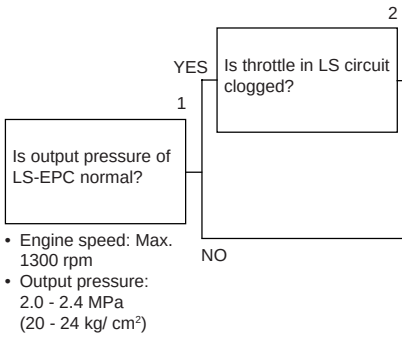
TABLE OF FAILURE MODES AND CAUSES FOR HYDRAULIC AND MECHANICAL SYSTEM

Failure mode \ Parts cusing failure			Piston pump								Self pressure reducing valve	Strainer	Damper	
			F				R							
			PC valve	LS valve	Servo piston	Pump prooper	PC valve	LS valve	Servo piston	Pump proper				
All work equipment, travel, swing	Speeds of all work equipment, swing, travel are slow or lack power		▲	▲	▲	▲	▲	▲	▲	▲	○			
	There is excessive drop in engine speed, or engine stalls		○	○	○		○	○	○					
	No work equipment, travel, swing move					△				△	○		○	
	Abnormal noise generated (around pump)					○				○		○		
	Auto-deceleration does not work													
	Fine control ability is poor or response is poor			○	○		○	○						
Work equipment	Boom is slow or lacks power													
	Arm is slow or lacks power													
	Bucket is slow or lacks power													
	Boom does not move													
	Arm does not move													
	Bucket does not move													
	Excessive hydraulic drift													
	Escessive time lag (engine at low idling)													
	Other equipment moves when single circuit is relieved													
	Lack of power when pressure rises													
Compound operations	In L/O, F/O modes, work equipment speed is faster than specified speed			○				○						
	In compound operations, work equipment with larger load is slow													
	In swing + boom (RAISE), boom is slow													
	In swing + arm, arm is slow													
	In swing + travel, travel speed drops excessively													
Travel system	Travel deviation	Deviation is excessive		○				○			○			
		Deviation is excessive when starting												
	Travel speed is slow													
	Steering does not turn or lacks power													
	Travel speed does not switch or is faster than specified speed													
	Does not move (one side only)			○				○						
Swing system	Does not swing	Both left and right												
		One direction only												
	Swing acceleration is poor or swing speed is slow	Both left and right												
		One direction only												
	Excessive overrun when stopping swing	Both left and right												
		One direction only												
	Excessive shock when stopping swing (one direction only)													
	Excessive abnormal noise when stopping swing													
	Exessive hydraulic drift of swing	When brake ON												
		When brake OFF												
	Swing speed is faster than specified swing speed			○										

In the failure modes, modes for compound operations are used when independent operations are normal

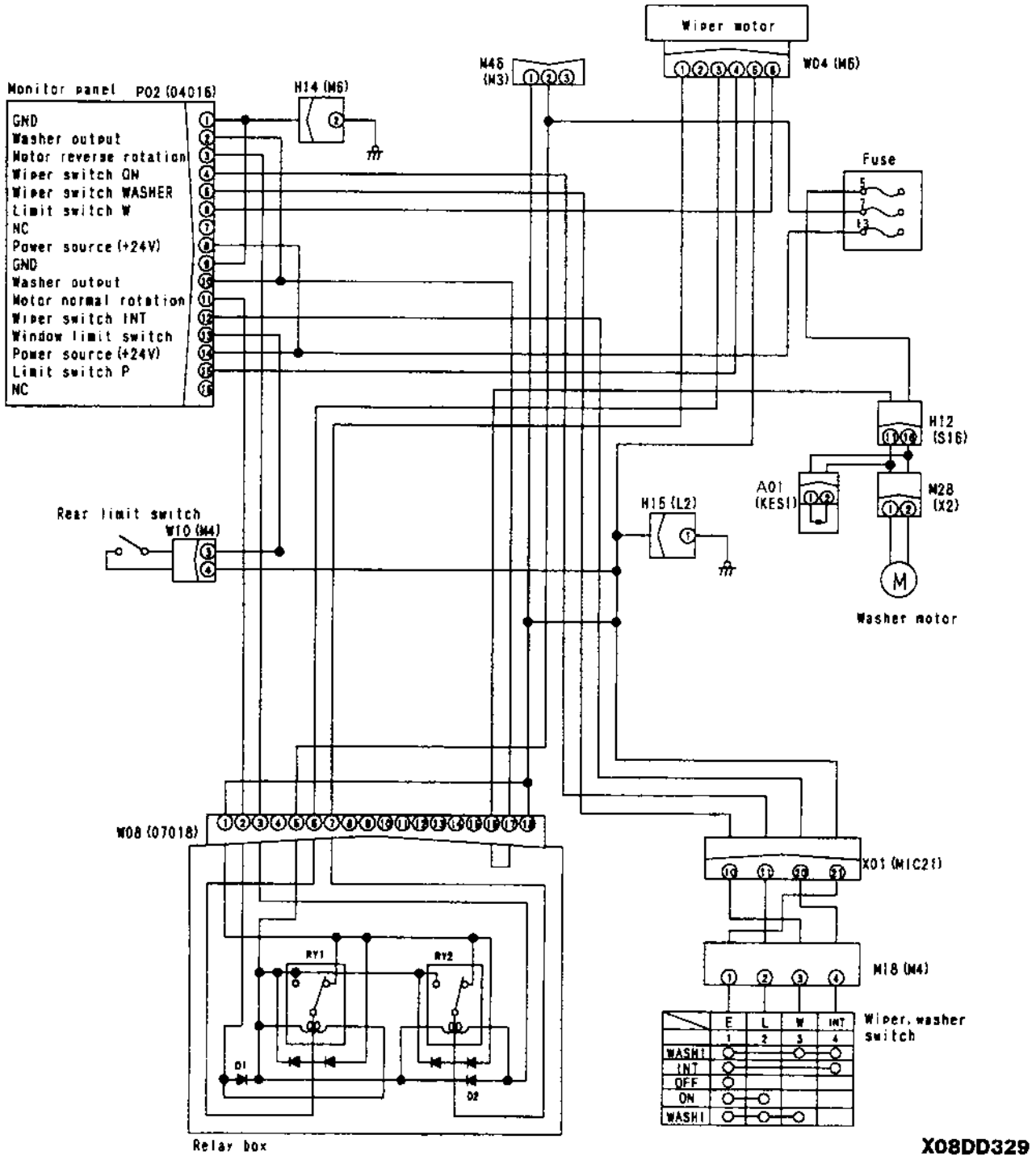
▲ When there is an abnoramlity for both front and rear

H-6 Fine control ability is poor or response is poor



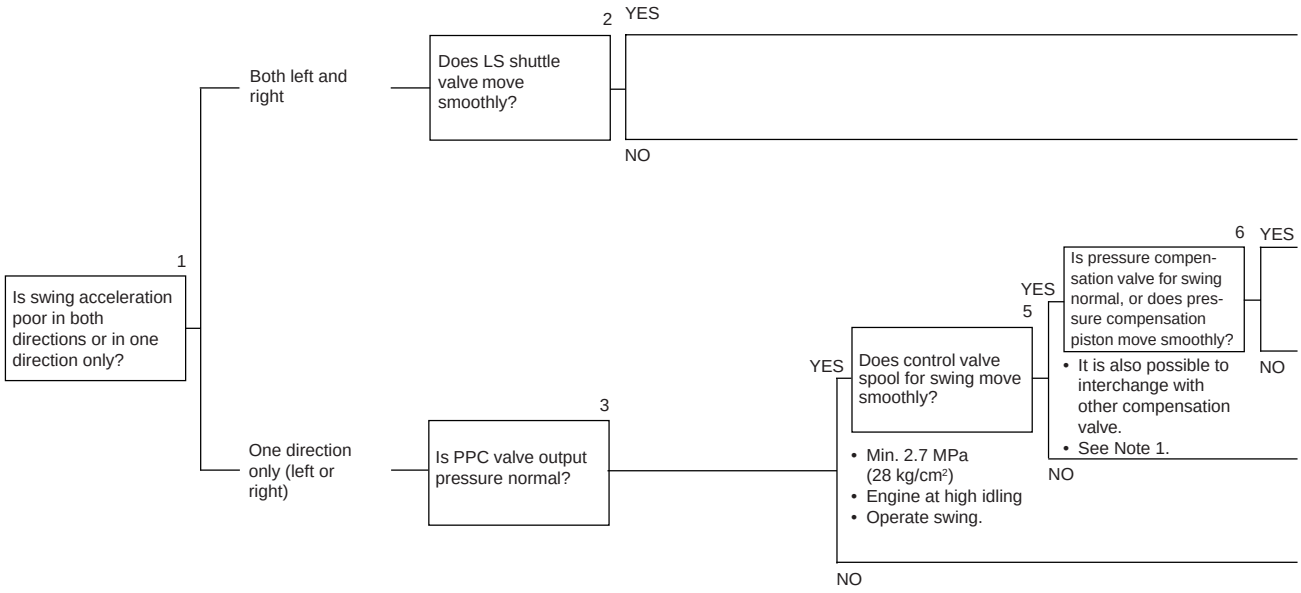
Cause	Remedy
Clogged throttle in LS circuit	Clean
Defective LS valve, or defective servo piston	Replace
Defective LS-EPC valve	Repair or replace

M-30 Related electric circuit diagram



H-25 Swing acceleration is poor or swing speed is slow

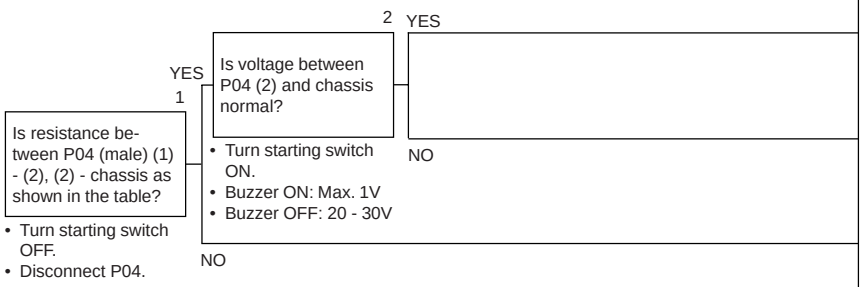
★ Carry out troubleshooting in the H/O mode.
★ When individual operation of the work equipment is normal.



Note 1: After checking, always return the interchanged valves to their original positions.

M-2 [E103] Short circuit in buzzer output or contact of 24V wiring harness with buzzer drive harness is displayed

★ If the starting switch is turned OFF after an abnormality occurs, turn the starting switch ON and check if an E service code is displayed. (If it is not displayed, the system has been reset.)
★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
★ Always connect any disconnected connectors before going on the next step.

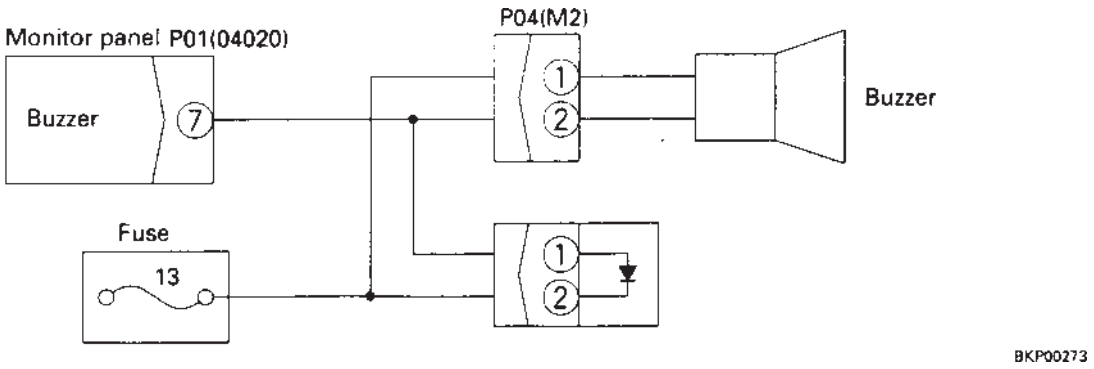


Cause	Remedy
Defective monitor panel	Replace
Short circuit with power source in wiring harness between P01 (female) (7) and P04 (female) (2) or short circuit in wiring harness between P04 (1) and (2)	Repair or replace
Defective buzzer	Replace

Table

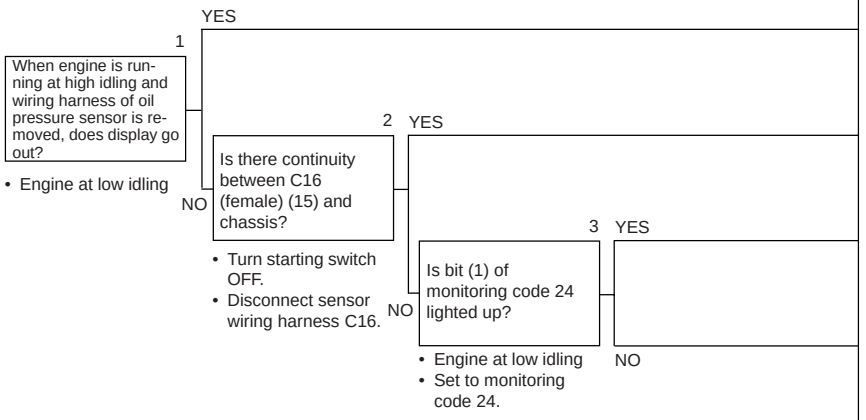
P04 (male)	Resistance value
Between (1) and (2)	200 - 300 Ω
Between (2) and chassis	Min. 1 MΩ

M-2 Related electric circuit diagram



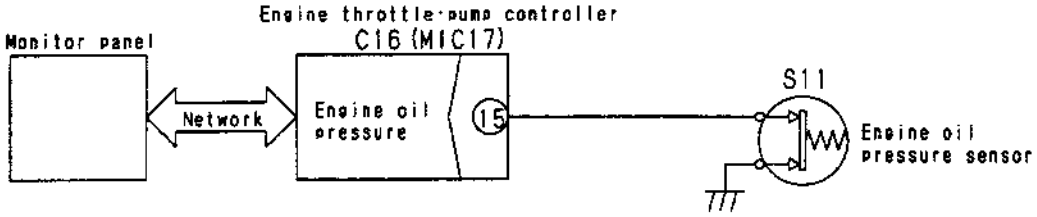
b) Engine oil pressure system

★ When engine oil pressure is normal



Cause	Remedy
Defective oil pressure sensor (for low pressure)	Replace
Contact of chassis ground with wiring harness beteen C16 (female) (15) - E08 (8) - sensor	Repair or replace
Defective engine throttle - pump controller	Replace
Defective monitor panel	Replace

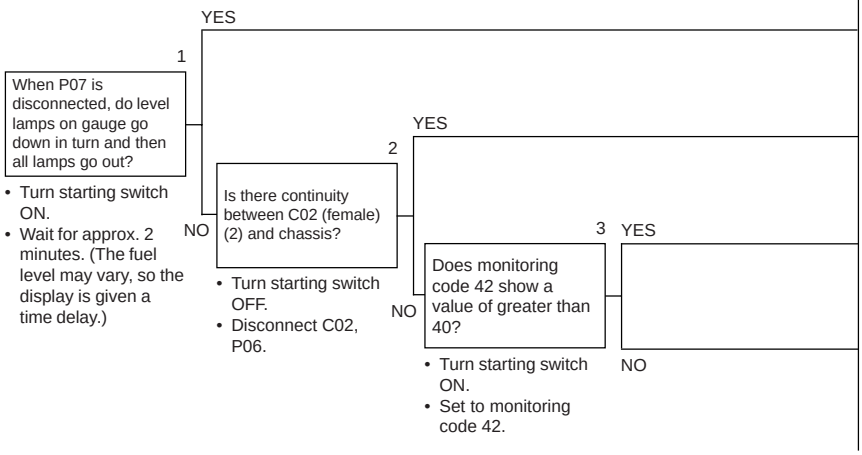
M-10 b) Related electric circuit diagram



X08DD312

M-18 Fuel level gauge always displays FULL

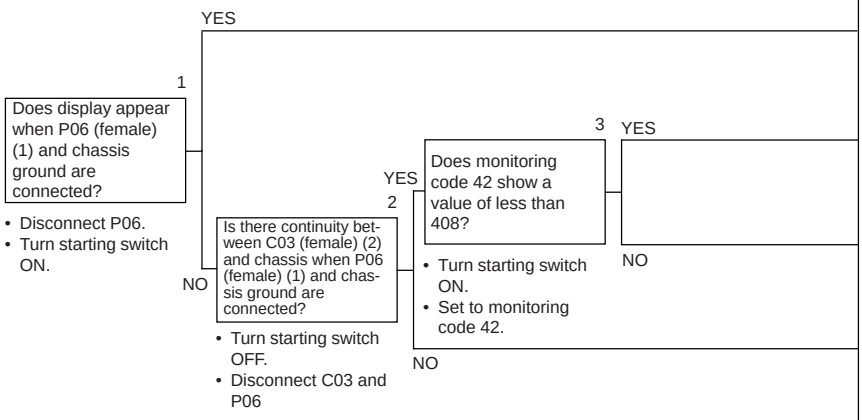
★ Check if the tank is actually full before carrying out troubleshooting.
★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
★ Always connect any disconnected connectors before going on the next step.



Cause	Remedy
Defective fuel level senor system (see M-25)	-
Contact of chassis ground with wiring harness between C03 (female) (2) and P06 (female) (1)	Repair or replace
Defective monitor panel	Replace
Defective engine throttle - pump controller	Replace

M-19 Fuel level gauge does not give display

★ Check that there is actually no fuel before carrying out troubleshooting
★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
★ Always connect any disconnected connectors before going on the next step.



Cause	Remedy
Defective fuel level sensor system (see M-25)	-
Defective engine throttle - pump controller	Replace
Defective monitor panel	Replace
Defective contact, or disconnection in wiring harness between C03 (female) (2) and P06 (female) (1)	Repair or replace

Cause	Remedy
Defective wiper motor	Replace
Defective relay box	Replace
Defevtive contact or disconnection in wiring harness with defective resistance	Repair or replace
Short circuit with power source in wiring harness between P02 (female) (3) and W08 (female) (3), or between P02 (female) (11) and W08 (female) (2)	Repair or replace
Defective contact or disconnection in above wiring harness	Repair or replace
Defective monitor panel	Replace
Defective monitor panel	Replace
Defective contact or disconnection in wiring harness with defective resistance	Repair or replace
Defective wiper, washer switch	Replace
Defective monitor panel	Replace
Defective contact or disconnection in wiring harness between P02 (female) (13) and W10 (male) (3), or between P02 (female) (1) - H14 (2) - chassis, or between W10 (male) (4) - H15 (1) - chassis?	Repair or replace
Defective rear limit switch, or front window is open	Inspect or replace

X02CH161

PC, LS-EPC VALVE 30-102
Removal 30-102
Installation 30-102

SOLENOID VALVE 30-103
Removal 30-103
Installation 30-103

WORK EQUIPMENT - SWING PPC VALVE 30-104
Removal 30-104
Installation 30-104
Disassembly 30-105
Assembly 30-106

TRAVEL PPC VALVE 30-107
Removal 30-107
Installation 30-107
Disassembly 30-108
Installation 30-108

BOOM CYLINDER 30-109
Removal 30-109
Installation 30-110

ARM CYLINDER 30-111
Removal 30-111
Installation 30-112

BUCKET CYLINDER 30-113
Removal 30-113
Installation 30-114

HYDRAULIC CYLINDER 30-115
Disassembly 30-115
Assembly 30-117

WORK EQUIPMENT 30-121
Removal 30-121
Installation 30-122

BUCKET 30-123
Removal 30-123
Installation 30-124

ARM 30-125
Removal 30-125
Installation 30-126

BUCKET-ARM 30-127
Removal 30-127
Installation 30-128

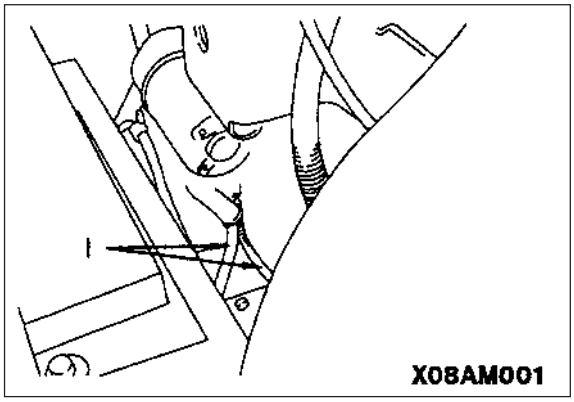
BOOM 30-129
Removal 30-129
Installation 30-130

STARTING MOTOR

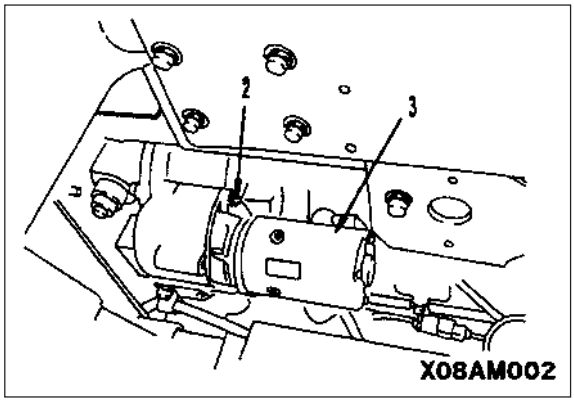
Removal

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

1. Open engine hood.
2. Disconnect 3 wires (1).



3. Remove 2 bolts (2) and mounting nut. ※ 1
4. Remove starting motor assembly (3). ※ 2



Installation

- Carry out installation in the reverse order to removal. ※ 1

kgm Starting motor mounting bolt: 43 ± 6 Nm (4.38 ± 0.61 kgm) ※ 2

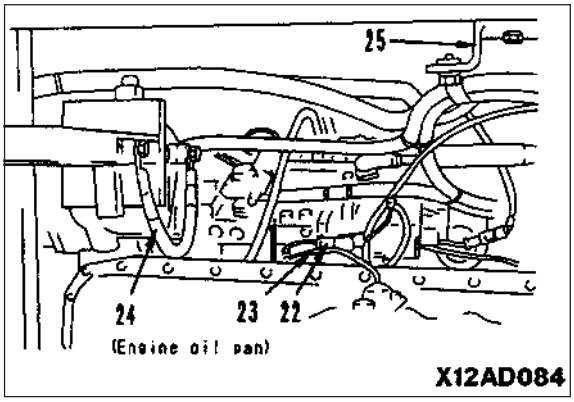
Both faces of starting motor gasket: Gasket sealant (LG-1)

Installation

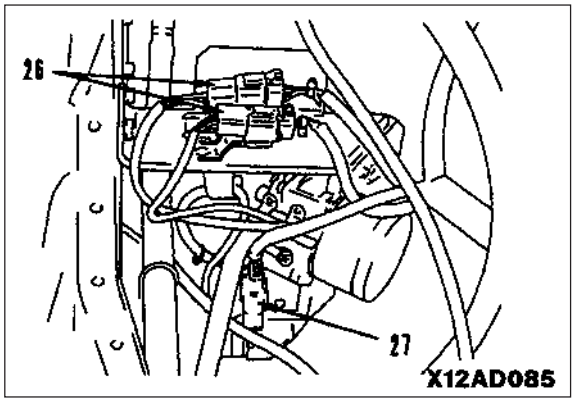
- Carry out installation in the reverse order to removal.

★ Add coolant through the coolant filter to the specified level. Run the engine to circulate the coolant through the system. Then check the coolant level again.

12. Disconnected oil level sensor connector (22) of oil pan, wiring (23) for oil pressure sensor, and ground connection (24)
13. Remove intermediate clamp (25) of heater hose.

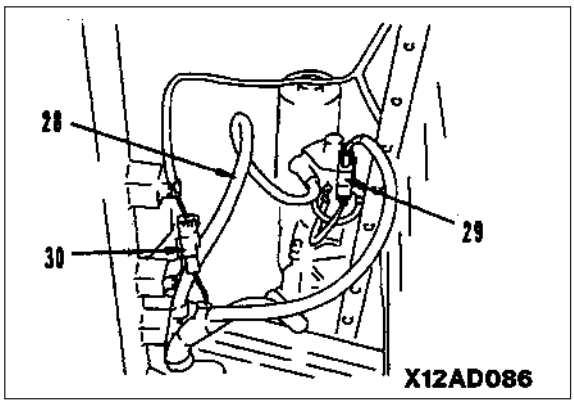


14. Disconnect governor motor connectors (26) (2 places) and speed sensor connector (27).



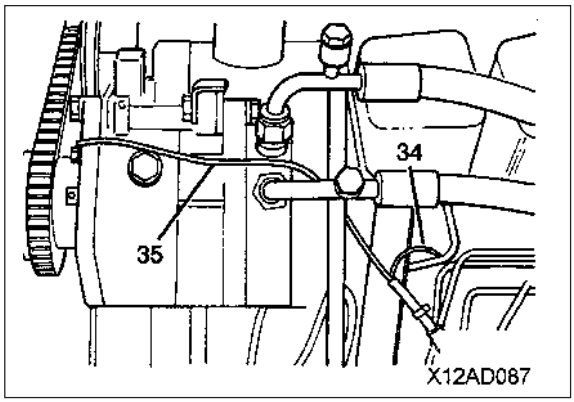
15. Disconnect starting motor wiring (28) and starting motor connectors (29) and (30), and remove from clamp.

16. Disconnect fuel supply hose and fuel return hose. For details, see engine shop manual.



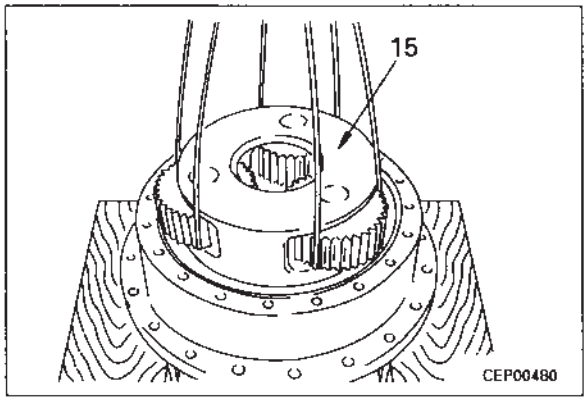
17. Disconnect electrical intake air heater wiring (34).
18. For machines with air conditioning , disconnect air conditioner connector (35), remove compressor assembly (356). For details, see AIR CONDITIONER COMPRESSOR, Removal.

★ After removing the compressor assembly, put it on top of the counterweight.

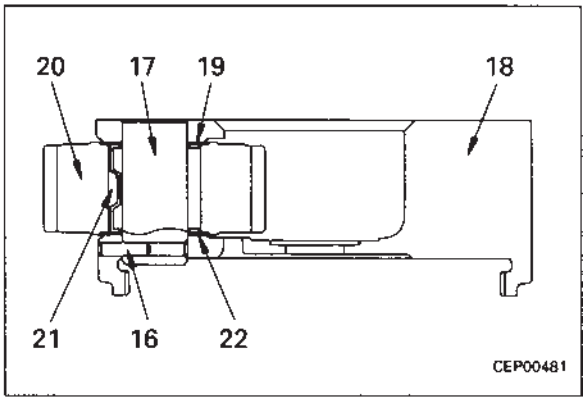


9. No. 2 carrier assembly.

1) Remove No. 2 carrier assembly (15).

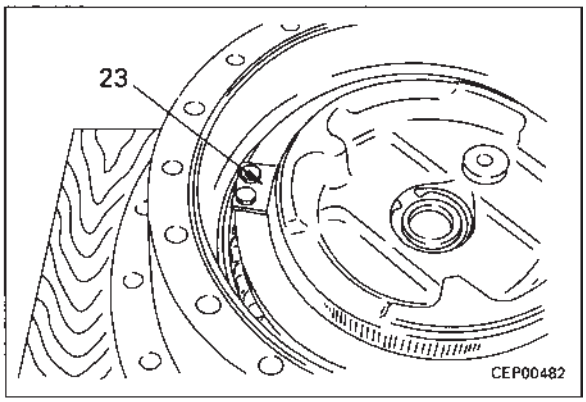


2) Disassemble No. 2 carrier assembly as follows.
   i) Push in pin (16) and pull out shaft (17) from carrier (18).
      ★ After removing the shaft, remove pin (16).
   ii) Remove thrust washer (19), gear (20), bearing (21), and thrust washer (22).

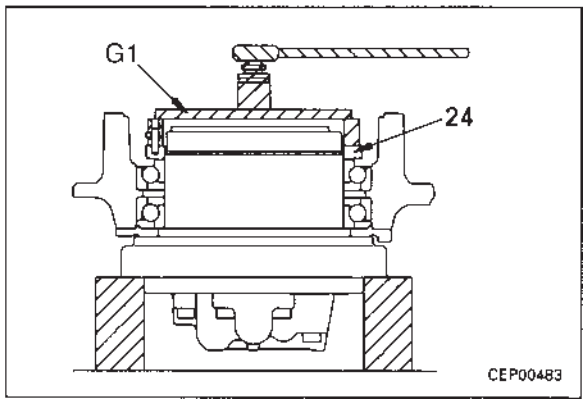


10. Nut

1) Remove lock plate (23).



2) Using tool G1, remove nut (24).



Installation

- Carry out installation in the reverse order to removal.

※1

Swing machinery mounting bolt: 549 ± 59 Nm (56 ± 6 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. There check the oil level again.

- Bleeding air

★ Bleed the air from swing motor. For details, see TESTING AND ADJUSTING, Bleeding air.

Installation

- Carry out installation in the reverse order to removal.

※ 1


Mating surface of swing circle: Gasket sealant (LG-1)


Thread of revolving frame mounting bolt: Thread tightener (LT-2)

Revolving frame mounting bolt:

Mounting bolt		Mounting bolt Tightening torque
Size (mm)	Q'ty	Nm (kgm)
24 x 135	35	927 ± 103 (94.0 ± 10.5)

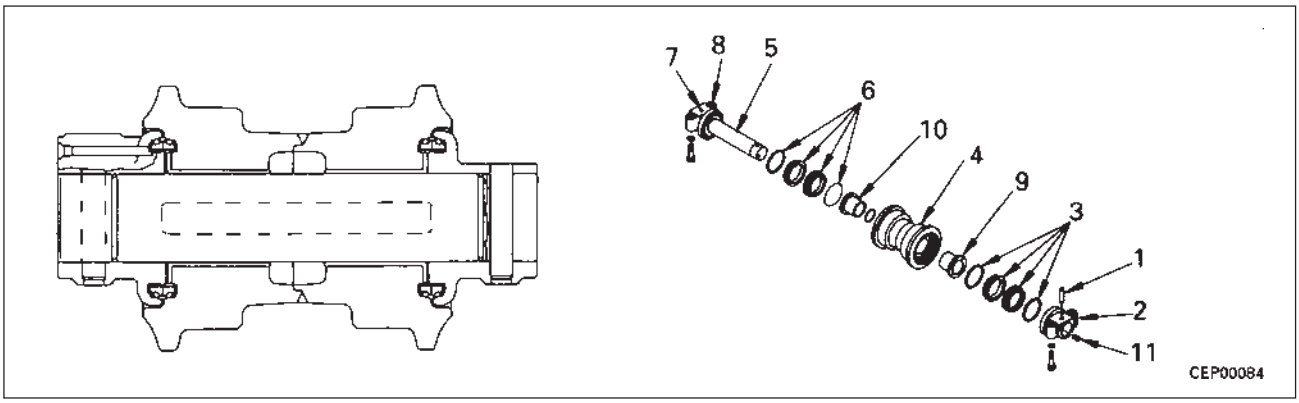
- Refilling with oil (hydraulic tank)

★ Add oil through the oil filler to the specified level. Run the engine to circulate the oil through the system. There check the oil level again.

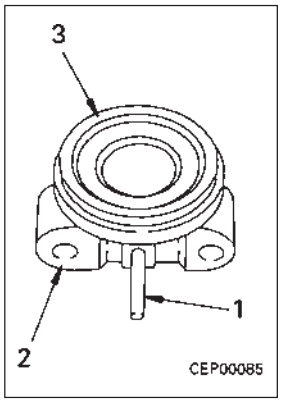
- Bleeding air

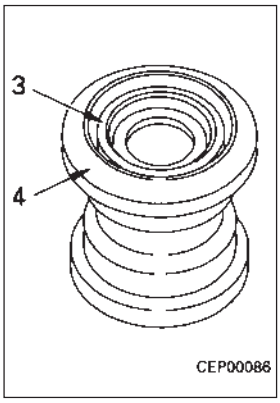
★ Bleed the air from swing motor. For details, see TESTING AND ADJUSTING

DISASSEMBLY OF TRACK ROLLER ASSEMBLY

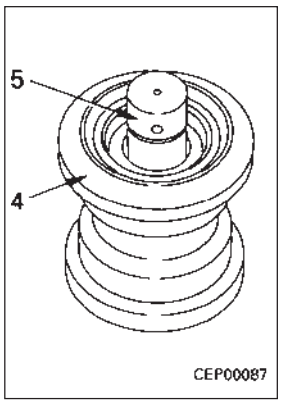


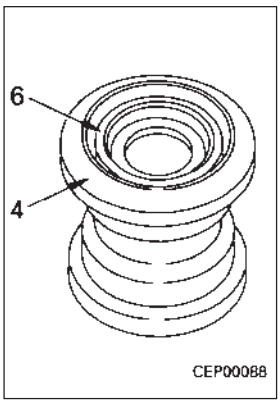
1. Remove pin (1), then remove collar (2).
2. Remove floating seal (3) from collar (2) and roller (4).
3. Pull out roller (4) from shaft (5).
   ★ It is filled with 250 - 280 cc. of oil, so drain the oil at this point or lay a cloth to prevent the area from becoming dirty.



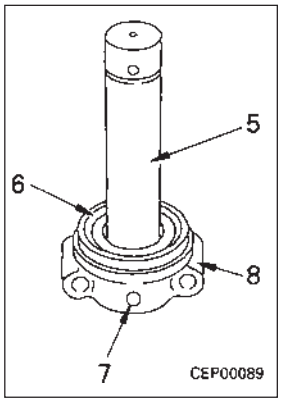


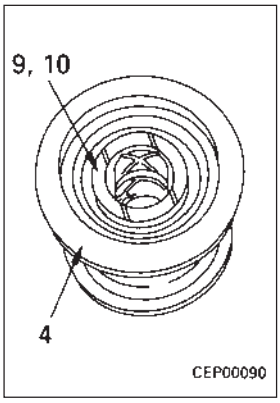
4. Remove floating seal (6) on opposite side from roller (4) and collar (8).





5. Remove pin (7), then remove collar (8) from shaft (5).
6. Remove bushings (9) and (10) from roller (4).





Installation

- Carry out installation in the reverse order to removal.

※ 1

Hydraulic tank drain plug: 68.5 ± 10 Nm (6.98 ± 1.01 kgm)

※ 2

Hydraulic tank mounting bolt: 277 ± 32 Nm (28.3 ± 3.2 kgm)

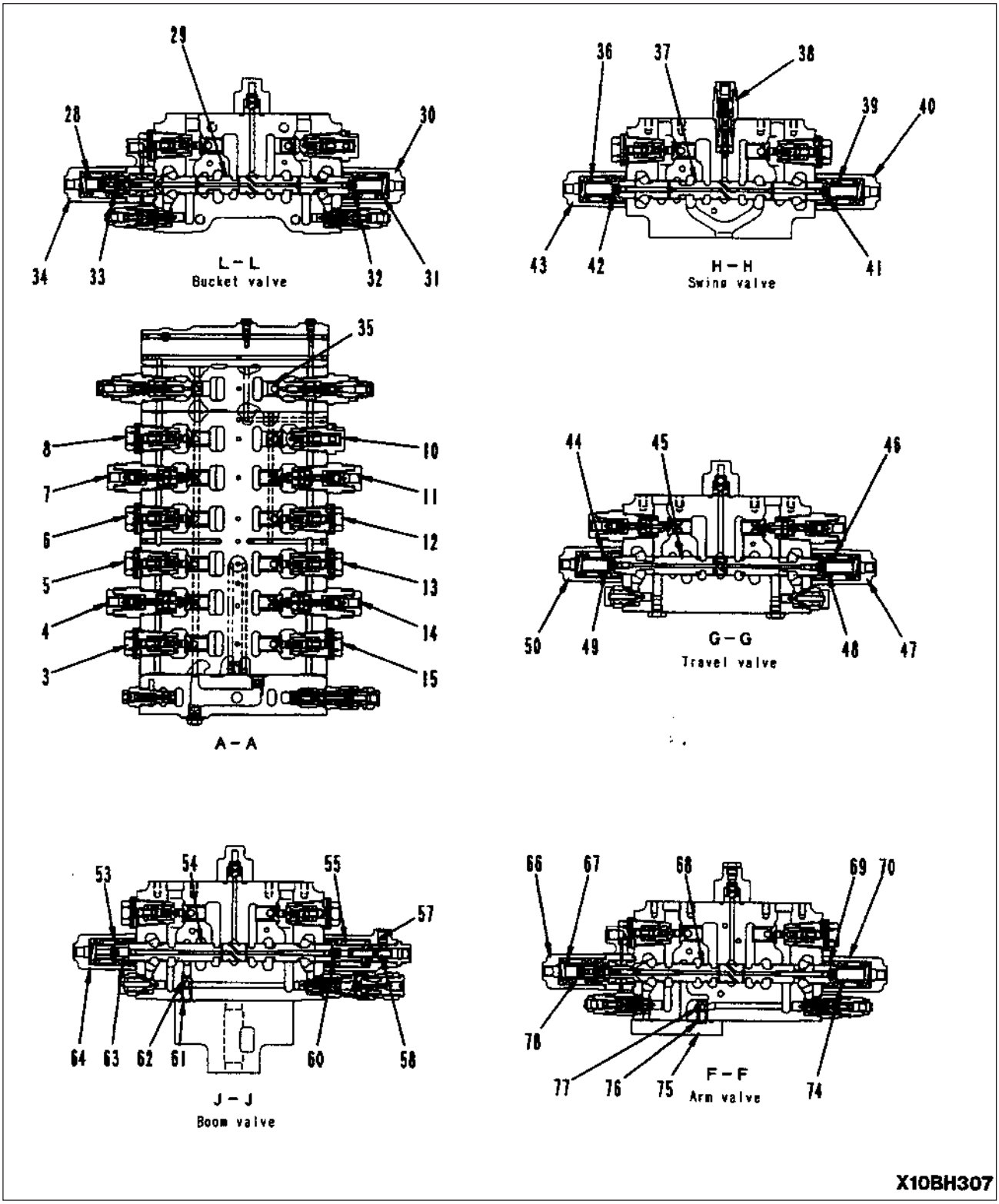
- Refilling with oil (hydraulic tank)

★ Add oil through the oil fillter to the specified level. Run the engine to circulate the oil through the system . Then check the oil level again.

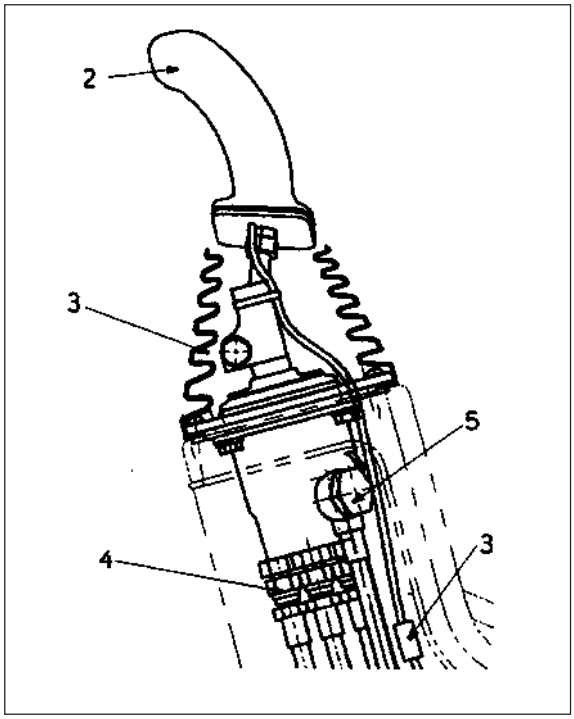
Hydraulic tank: Approximately 170 l.

- Bleeding air

★ Bleed the air. For details, see TESTING AND ADJUSTING, Bleeding air.


29
28
30
34
33
32
31
L – L
Bucket valve
36
37
38
39
40
43
42
41
H – H
Swing valve
35
8
10
7
11
6
12
5
13
4
14
3
15
A – A
44
45
46
50
49
48
47
G – G
Travel valve
53
54
55
57
64
63
62
61
60
58
J – J
Boom valve
66
67
68
69
70
78
77
76
75
74
F – F
Arm valve
X10BH307

REMOVAL OF WORK EQUIPMENT • SWING PPC VALVE ASSEMBLY



⚠ Lower the work equipment completely to the ground and stop the engine. Then loosen the oil filler cap slowly to release the pressure inside the hydraulic tank.

1. Remove boot (1) from cover, raise boot, then remove lever (2).

2. Remove mounting bolts.

3. Disconnect hoses (4) + (5) x 6 + remove valve ass'y.

★ Mark the connecting position of the hoses before disconnecting.

INSTALLATION OF WORK EQUIPMENT • SWING PPC VALVE ASSEMBLY

• Carry out installation in the reverse order to removal.

※ 1

kgm Hose mounting joint bolt: 29.4 ± 4.9 Nm (3.0 ± 0.5 kgm)

※ 2

kgm Hose mounting joint bolt: 39.2 ± 4.9 Nm (4.0 ± 0.5 kgm)

★ If there is excessive play in the control levers, adjust the PPC valve, for details, see TESTING AND ADJUSTING, Adjusting PPC valve.

INSTALLATION OF BUCKET CYLINDER ASSEMBLY

- Carry out installation in the reverse order to removal.

  ★ When tightening the locknut, tighten so that the clearance between the plate and nut is 0.5 - 1.5 mm.

  Inside surface of bushing when assembling pin: anti-friction compound (LM-P)

  Greasing after assembling pin: Grease (LM-G)

  When aligning the position of the pin hole, never insert your fingers in the pin hole.

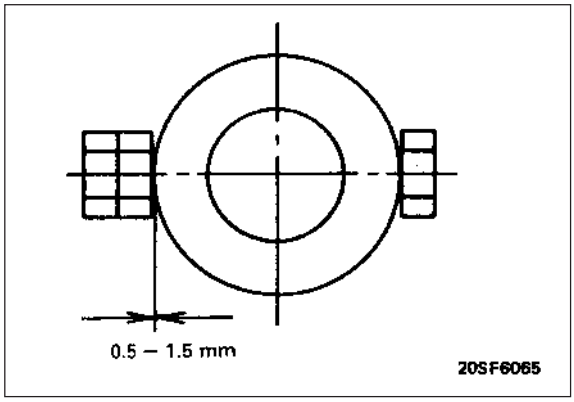
  ★ Adjust the shim thickness so that the clearance between cylinder bottom (6) and bracket (7) is below 1 mm.
    ★ Standard shim thickness: 0.8 mm, 1.5 mm.

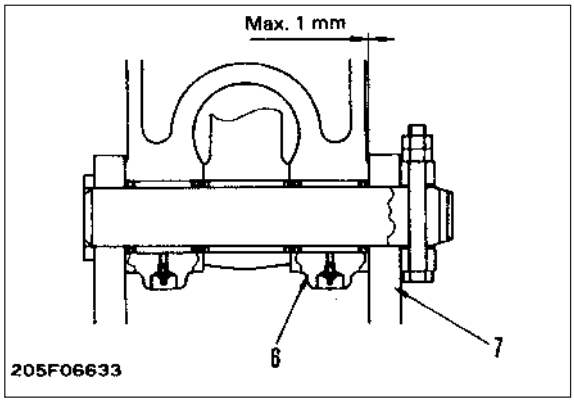
  Inside surface of bushing when assembling pin: anti-friction compound (LM-P)

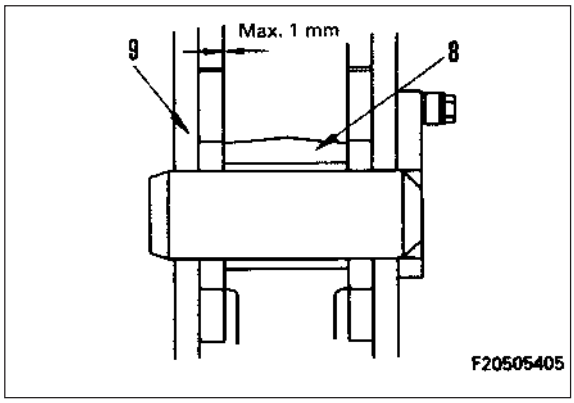
  Greasing after assembling pin: Grease (LM-G)

  When aligning the position of the pin hole, never insert your fingers in the pin hole.

  ★ Adjust the shim thickness so that the clearance between cylinder bottom (6) and bracket (7) is below 1 mm.
    ★ Standard shim thickness: 0.8 mm, 1.5 mm.
- 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 cylinder. For details, see TESTING AND ADJUSTING, Bleeding air from hydraulic cylinder.





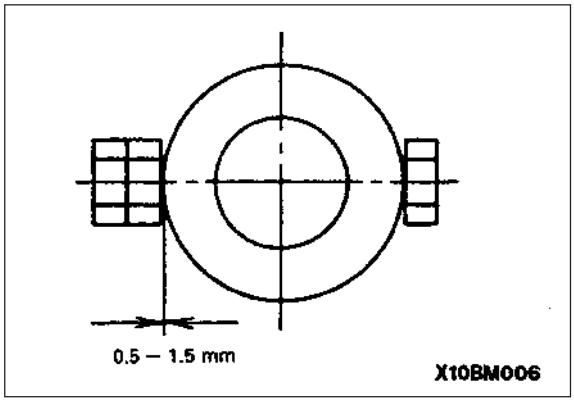


Installation

- Carry out installation in the reverse order to removal.

※ 1 ※ 3

★ When tightening the locknut, tighten so that the clearance between the plate and nut is 0.5 - 1.5 mm.



※ 2

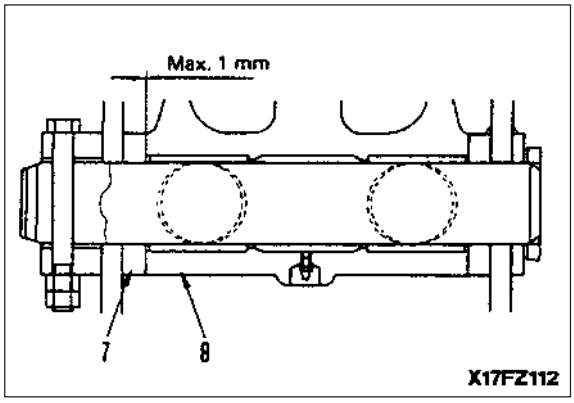
Inside surface of bushing when assembling pin: anti-friction compound (LM-P)

Greasing after assembling pin: Grease (LM-G)

When aligning the position of the pin hole, never insert your fingers in the pin hole.

★ Adjust the shim thickness so that the clearance between bucket boss (7) and link (8) is below 1 mm.

★ Standard shim thickness: 0.8 mm, 1.5 mm.



※ 4

Inside surface of bushing when assembling pin: anti-friction compound (LM-P)

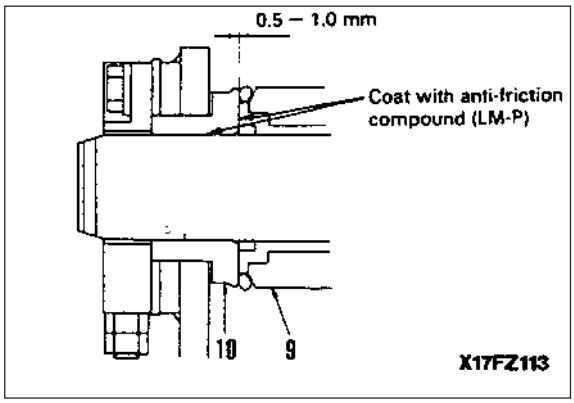
Greasing after assembling pin: Grease (LM-G)

When aligning the position of the pin hole, never insert your fingers in the pin hole.

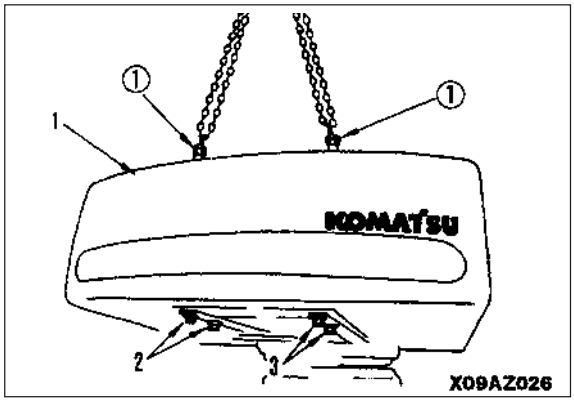
★ Set the O-ring at the end face of the bucket boss securely.

★ Adjust the shim thickness so that the clearance between arm top (9) and spacer (10) is 0.5- 1.0 mm.

★ Standard shim thickness: 0.5 mm, 1.0 mm.



COUNTERWEIGHT



Removal

1. Set eyebolts ① to counterweight assembly (1), and sling.
2. Remove mounting bolts (2) and (3). ※ 1
★ Be careful not to lose the shims when removing.
3. Lift off counterweight (1) horizontally with wire or chain block. ※ 2
★ Be careful not to hit the engine, radiator and cooler assembly.

kg Counterweight assembly: 5.800 kg

Installation

• Carry out installation in the reverse order to removal.

※ 1

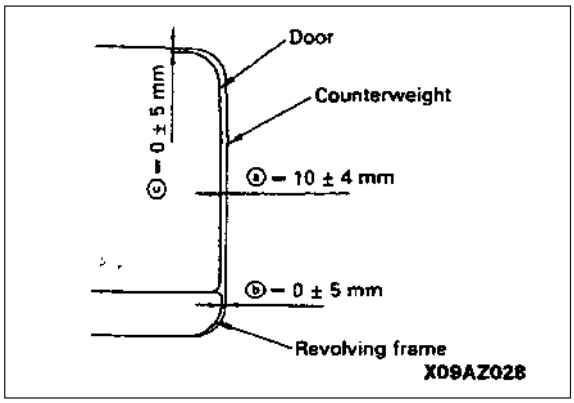
Thread of counterweight mounting bolt: Thread tightener (LT-2)

kgm Counterweight mounting bolt: 1.323 ± 147 Nm (135 ± 15 kgm)

※ 2

★ Installing and adjusting counterweight

1. Sling counterweight with crane and set in position on frame.
2. Push counterweight and install shim and mounting bolts (2) and (3), and adjust to following dimensions.
   a. Clearance from revolving frame: 10 ± 5 mm (left and right)
   b. Clearance from bodywork door: 10 ± 5 mm (left and right)
   c. Stepped difference **b** from revolving frame in left-to-right direction: Max. 5 mm
   d. Stepped difference **a** from bodywork door in left-to-right direction: 10 ± 4 mm
   e. Stepped difference **c** from bodywork top cover in updown direction: Max. 5 mm



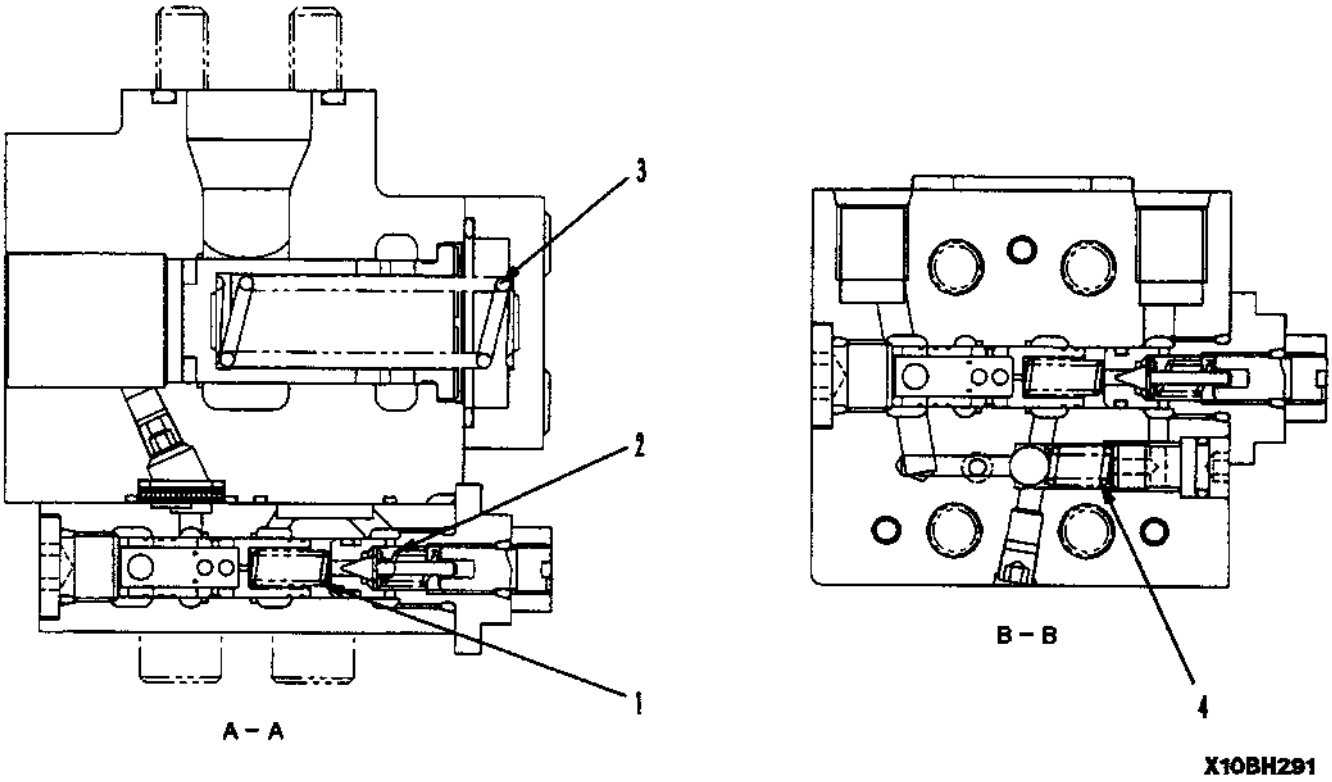
Unit: mm

No.	Check item	Criteria		Remedy
		Standard clearance	Clearance limit	
1	Backlash between swing motor shaft and No. 1 sun gear	0.18 - 0.29	-	Replace
2	Backlash between No. 1 sun gear and No. 1 planetary gear	0.15 - 0.47	1.00	
3	Backlash between No. 1 planetary gear and ring gear	0.17 - 0.55	1.10	
4	Backlash between No. 1 planetary carrier and No.2 sun gear	0.36 - 0.63	1.20	
5	Backlash between No. 2 sun gear and No. 2 planetary gear	0.14 - 0.44	0.90	
6	Backlash between No. 2 planetary gear and ring gear	0.16 - 0.51	1.00	
7	Backlash between No. 2 planetary carrier and swing pinion	0.09 - 0.20	-	
8	Backlash between swing pinion and swing circle	0.22 - 1.32	2.00	
9	Clearance between plate and planetary carrier	0.90 ± 0.22	-	
10	Wear of swing pinion surface contacting with oil seal	Standard size	Repair limit	Apply hard chrome plating, recondition, or replace
	Wear of swing pinion surface contacting with oil seal	$125\ ^{0}_{-0.100}$	124.7	

Unit: mm

<table>
<tr><th>No.</th><th>Check item</th><th colspan="5">Criteria</th><th>Remedy</th></tr>
<tr><td rowspan="2">1</td><td rowspan="2">Link pitch</td><td colspan="2">Standard size</td><td colspan="3">Repair limit</td><td rowspan="3">Replace</td></tr>
<tr><td colspan="2">216.3</td><td colspan="3">219.3</td></tr>
<tr><td>2</td><td>Outside diameter of bushing</td><td colspan="2">66.9</td><td colspan="3">61.9</td></tr>
<tr><td>3</td><td>Height of grouser</td><td colspan="2">36</td><td colspan="3">24</td><td rowspan="2">Carry out lug welding or rebuild if it is possible within repair-able limit</td></tr>
<tr><td>4</td><td>Height of link</td><td colspan="2">116</td><td colspan="3">107</td></tr>
<tr><td rowspan="2">5</td><td 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="2">Interference limit</td><td rowspan="4">If it is lower than interfer-ence limit, replace with oversize</td></tr>
<tr><td>Shaft</td><td>Hole</td></tr>
<tr><td>66.5</td><td>+0.464
+0.424</td><td>+0.074
0</td><td>0.35 - 0.464</td><td>0.10</td></tr>
<tr><td>6</td><td>Interference between regular pin and link</td><td>44.6 (Shaft)
44.35 (Hole)</td><td>+0.235
+0.085</td><td>+0.062
0</td><td>0.273 - 0.485</td><td>0.14</td></tr>
<tr><td>7</td><td>Interference between master pin and link</td><td>44.6 (Shaft)
44.35 (Hole)</td><td>+0.03
0</td><td>+0.062
0</td><td>0.188 - 0.28</td><td>0.14</td></tr>
<tr><td>8</td><td>Protrusion of bushing</td><td colspan="5">5.25 ± 0.3</td><td></td></tr>
<tr><td>9</td><td>Tightening torque for shoe bolt</td><td colspan="5">After tightening to initial torque: 196.1 ± 19.6 Nm (20 ± 2 kgm), tighten a further 120° ± 10°</td><td>Replace</td></tr>
</table>

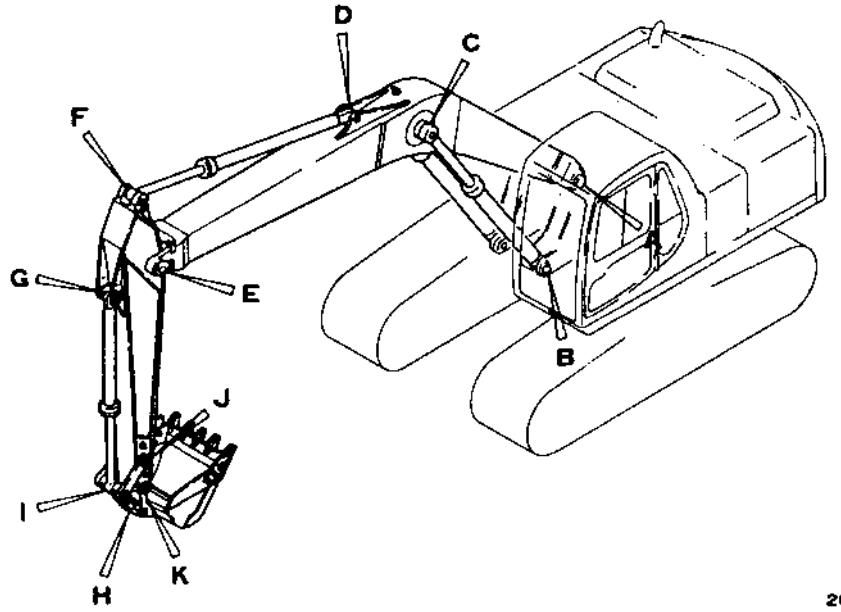
SELF-REDUCING PRESSURE VALVE



Unit: mm

No.	Check item	Criteria					Remedy
		Standard size			Repair limit		
1	Spring (reducing pressure valve, main)	Free length X OD	Installed length	Installed load	Free length	Installed load	Replace spring if any damages or deformations are found.
		19.2 X 7.2	16.1	19.6 N (2 kg)	-		
2	Spring (reducing pressure valve, pilot)	16.5 X 7.2	12.7	20.6 N (2.1 kg)	-		
3	Spring	71 X 18	59	199.8 N (20.4 kg)	-		
4	Spring (safety valve)	16.1 X 7.8	13.4	61.7 N (6.3 kg)	-		

WORK EQUIPMENT



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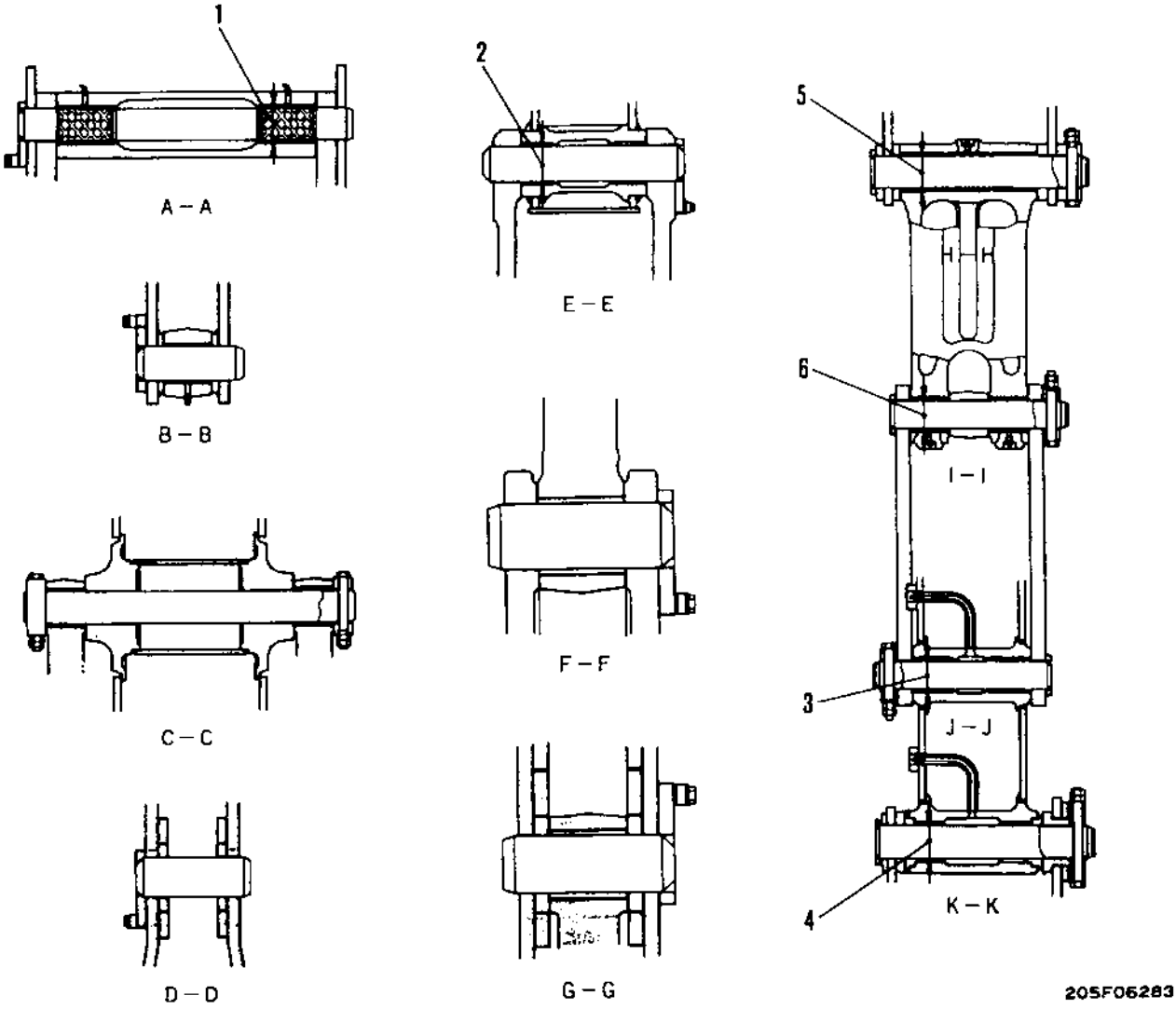

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