SHOP MANUAL

KOMATSU

LW250-5

MACHINE MODEL	SERIAL NUMBER
LW250-5	
X-shaped outrigger specification	**50001 and up**
H-shaped outrigger specification	**53001 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.
- LW250-5 mounts the S6D125-2 engine.
  For details of the engine, see the 6D125-2 Series Engine Shop Manual.

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TIGHTENING TORQUE FOR 102 ENGINE SERIIES (BOLT AND NUTS)

Use these torques for bolts and nuts (unit: mm) of Cummins Engine.

Thread diameter	Tightening torque	
mm	Nm	kgm
6	10 ± 2	1.02 ± 0.20
8	24 ± 4	2.45 ± 0.41
10	43 ± 6	4.38 ± 0.61
12	77 ± 12	7.85 ± 1.22

TIGHTENING TORQUE FOR 102 ENGINE SERIIES (EYE JOINTS)

Use these torques for eye joints (unit: mm) of Cummins Engine.

Thread diameter	Tightening torque	
mm	Nm	kgm
6	8 ± 2	0.81 ± 0.20
8	10 ± 2	1.02 ± 0.20
10	12 ± 2	1.22 ± 0.20
12	24 ± 4	2.45 ± 0.41
14	36 ± 5	3.67 ± 0.51

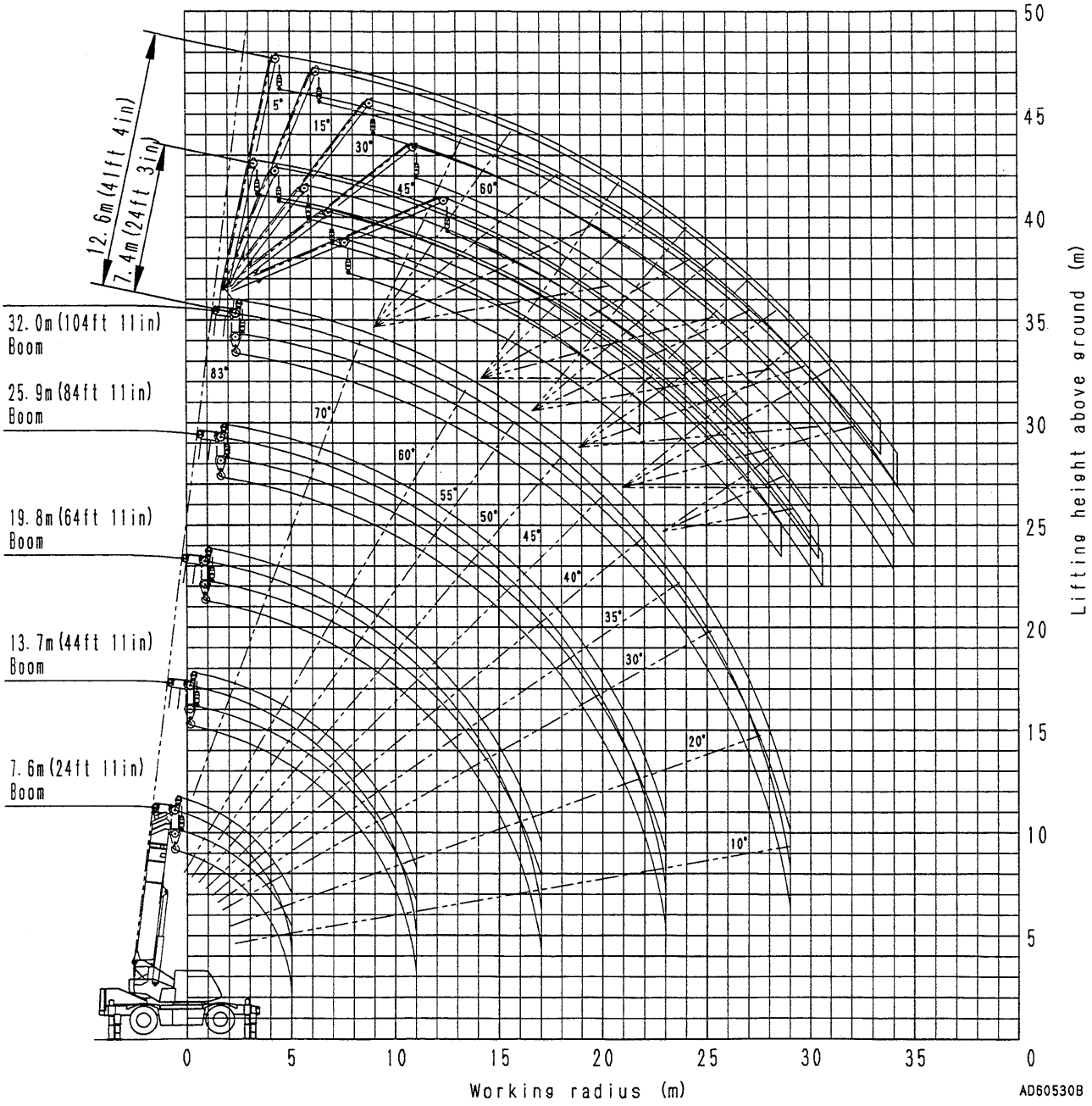
TIGHTENING TORQUE FOR 102 ENGINE SERIIES (TAPERED SCREWS)

Use these torques for tapered screws (unit: inch) of Cummins Engine.

Thread diameter	Tightening torque	
inch	Nm	kgm
1 / 16	3 ± 1	0.31 ± 0.10
1 / 8	8 ± 2	0.81 ± 0.20
1 / 4	12 ± 2	1.22 ± 0.20
3 / 8	15 ± 2	1.53 ± 0.41
1 / 2	24 ± 4	2.45 ± 0.41
3 / 4	36 ± 5	3.67 ± 0.51
1	60 ± 9	6.12 ± 0.92

WORKING RADIUS - LIFTING HEIGHT CHART

AUXILIARY JIB (POWER TILT TYPE)



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* The chart above shows the relationship between the working radius and lifting height when the outriggers are fully extended. The values do not include the deflection of the boom.

WEIGHT TABLE

Unit: kg

Machine model	LW250-5	
	H-shaped outrigger specification	X-shaped outrigger specification
Serial No.	53001 and up	50001 and up
Engine	1138	1138
Radiator	119	119
Fuel tank	33	33
Damper assembly	91	91
Torque converter assembly	90	90
Transmission assembly (including torque converter assembly)	530	530
Upper drive shaft	16.0	16.0
Front drive shaft	36.7	36.7
Rear drive shaft	14.2	14.2
Front axle assembly	1,062	1,062
Rear axle assembly	972	972
Rear steering lock cylinder assembly	17	17
Steering cylinder	18	18
Parking brake cylinder	7.7	7.7
Swing motor assembly	99	99
Swing circle	360	360
Steering unit	6.6	6.6
Swing valve	6.8	6.8
Tire	148	148
Wheel	88.2	88.2
Cab	276	276
Swivel joint assembly	130.5	130.5
Slip ring assembly	9.4	9.4
Hydraulic tank	129	129
Hydraulic pump (swing, steering, transmission)	20.3	20.3
Hydraulic pump (boom, winch, PPC)	34.2	34.2
Bodywork	671	671
Chassis (including swing circle)	3,521	3,521
Outrigger assembly (including cylinder)	3,165	2,920
Outrigger jack cylinder	85	120
Outrigger slide cylinder	55	50.5
Outrigger control valve	15	15

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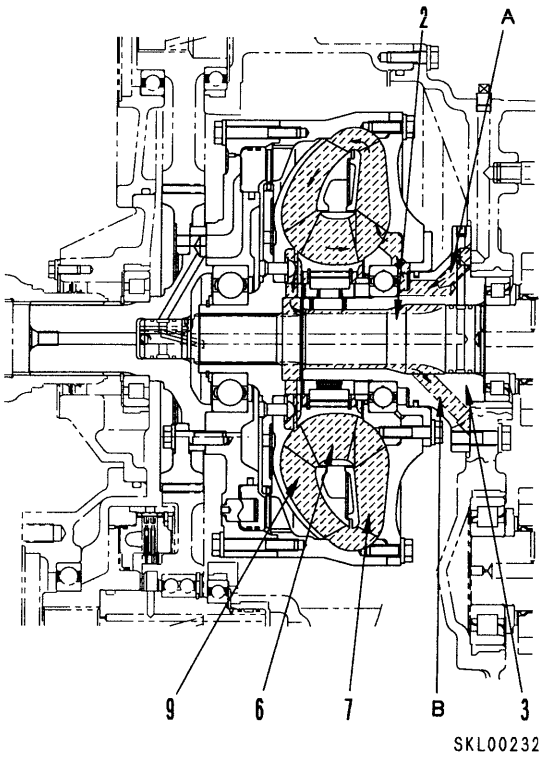
FLOW OF OIL

- The oil flows from port **A** through the oil hole inside stator shaft (3), and enters pump (7), which is always being rotated by the power from the engine.
- The oil entering the pump is given centrifugal force, enters turbine (9), and the turbine is rotated by the centrifugal force of the oil. The turbine forms one unit with output shaft (2), so the power received by the turbine is transmitted to the transmission.
- The oil leaving the turbine is sent to stator (6) and enters the pump again, but some of the oil passes from the stator through port **B** and is sent to the oil cooler.



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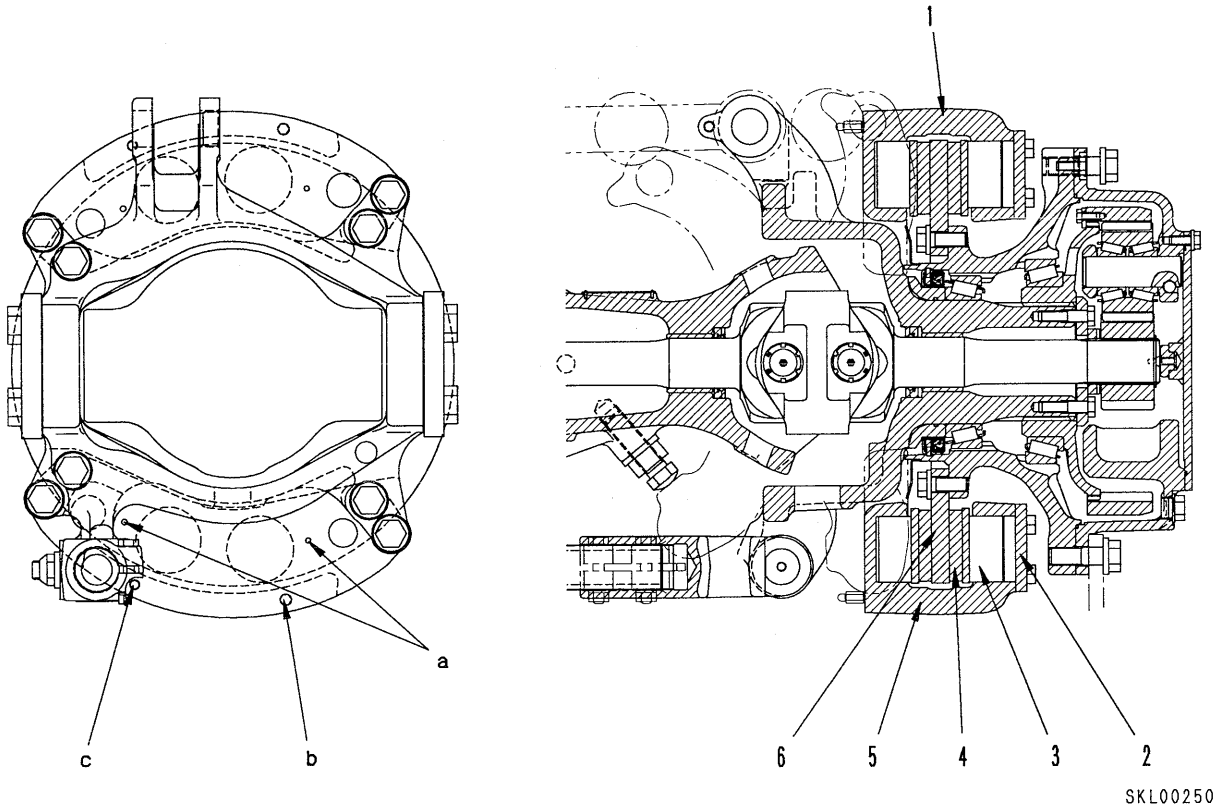
BRAKE



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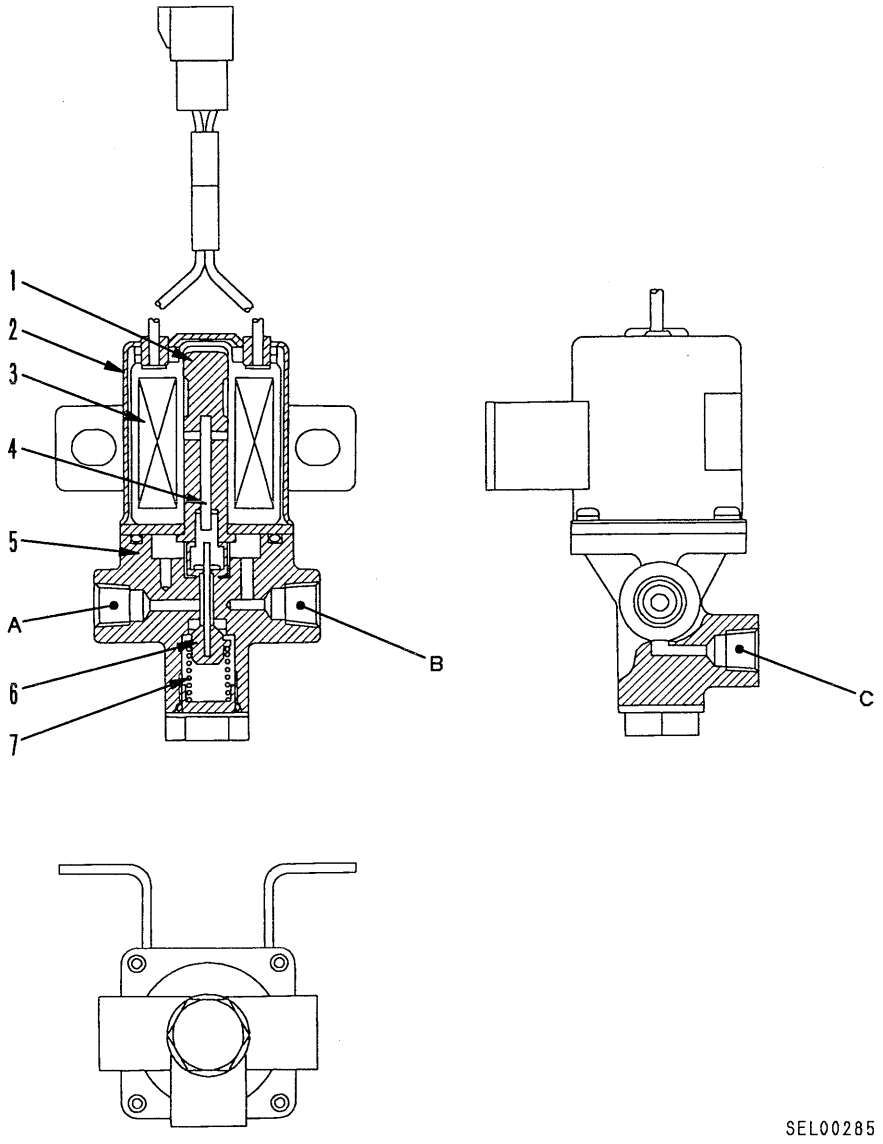
1. Caliper assembly
2. Cover
3. Piston
4. Pad
5. Cylinder
6. Disc

a. Pad inspection hole
b. Bleeder
c. Oil supply port

Outline

- The wheel brake is an air-over-hydraulic, dry, disc type, which applies braking force to all wheels. It has two independent circuits for the front and rear.
- Brake disc (6) is tightened with bolts to the wheel hub, and caliper assembly (1) is tightened with bolts to the knuckle arm.
  The rear wheel caliper assembly consists of one set each on the left and right; the front wheel caliper assembly consists of two sets each on the left and right.
- To actuate the brake, the brake pedal is depressed to send compressed air from the dry tank to the air-over-hydraulic booster. This raises the pressure of the brake oil inside the booster to actuate the brake piston (3) and push brake pad (4) against disc (6).

EXHAUST BRAKE SELECTOR VALVE



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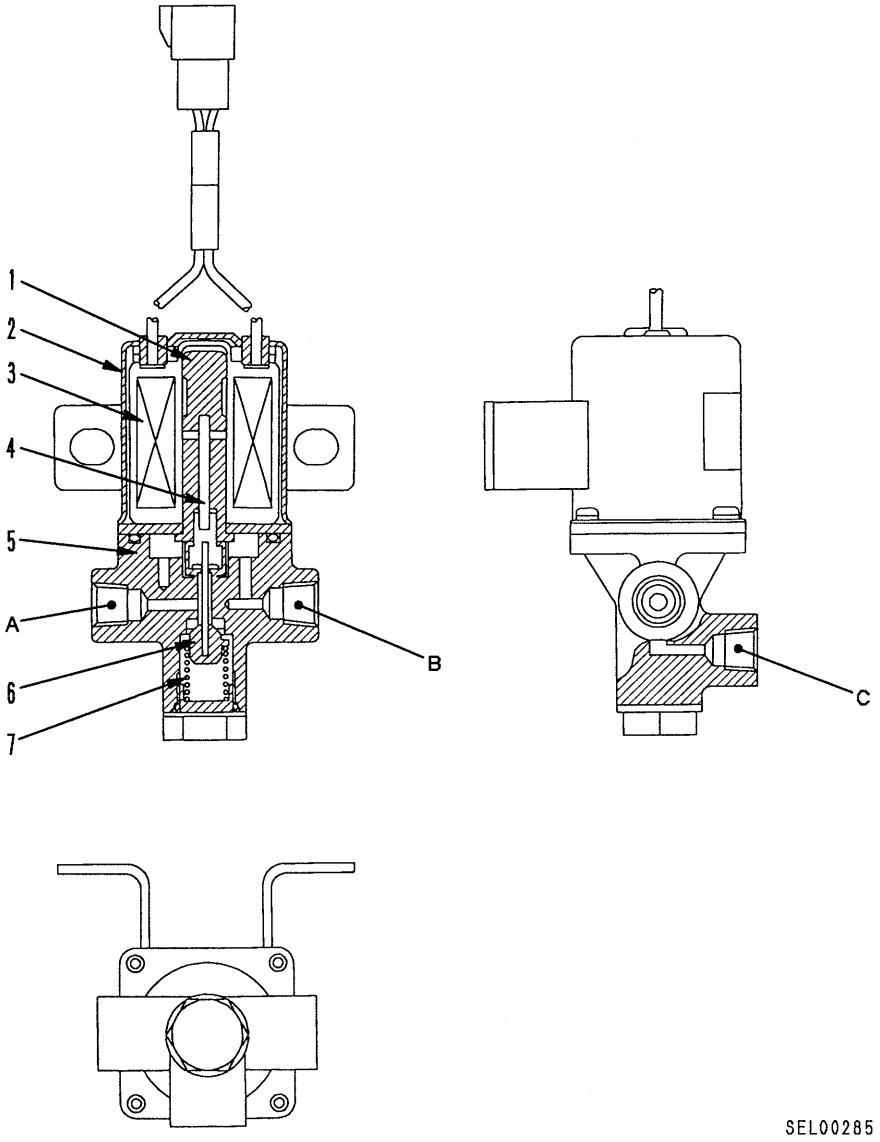
1. Plunger
2. Cover
3. Coil
4. Core
5. Valve body
6. Valve
7. Spring

A. To butterfly valve
B. Exhaust
C. From dry tank

Outline

- The exhaust brake selector valve is in the circuit between the wet tank and the butterfly valve. When the exhaust brake switch in the operator's compartment is operated, air from the wet tank is switched to actuate the butterfly valve and actuates the exhaust brake.

PARKING BRAKE VALVE



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1. Plunger
2. Cover
3. Coil
4. Core 5. Valve body
6. Valve
7. Spring

A. Exhaust
B. To parking brake chamber
C. From dry tank

Outline

- The parking brake valve is in the circuit between the dry tank and the parking brake chamber. It is actuated by the operation of the parking brake switch, and switches the air from the dry tank to actuate the parking brake chamber.

1. Swing control valve
   1A. Spool
2. Swing FREE/LOCK selector valve
3. Swing brake
4. Swing motor
5. Swing holding brake valve
6. Steering unit
7. Check valve
8. Line strainer
9. Priority valve
10. Center swivel
11. No. 1 telescope cylinder
12. No. 2 telescope cylinder
13. Telescope hose reel
14. No. 1/No. 2 cylinder selector valve
15. Boom hoist cylinder
16. Boom shaft weight sensor
17. Main control valve
    5-spool : (Machine with power tilt jib)
    4-spool : (Machine with manual tilt jib)
    17A. Auxiliary winch valve
    17B. Main winch valve
    17C. Boom telescope valve
    17D. Boom hoist valve
    17E. Flow control valve
    17F. Power tilt valve
    (Machine with power tilt jib)
    17G. Flow control valve
18. Unload pilot valve
19. Jib unload valve
    (Machine with power tilt jib)
20. Max. flow control valve
21. Charge valve
22. Overrun prevention valve
23. Air conditioner drive motor
24. Accumulator
25. Pressure switch
26. Winch clutch valve
27. Free wheel clutch
28. Brake cylinder
29. Brake master
30. Counterbalance valve
31. Main winch motor
32. Auxiliary winch motor
33. Counterbalance valve
34. Power tilt hose reel
    (Machine with power tilt jib)
35. Swivel joint
    (Machine with power tilt jib)
36. Power tilt cylinder
    (Machine with power tilt jib)
37. Pilot valve
    (boom hoist, main winch, auxiliary winch)
38. Pilot valve (boom telescope)
39. Pilot valve
    (auxiliary winch and boom telescope)
40. Pilot valve (power tilt jib, swing)

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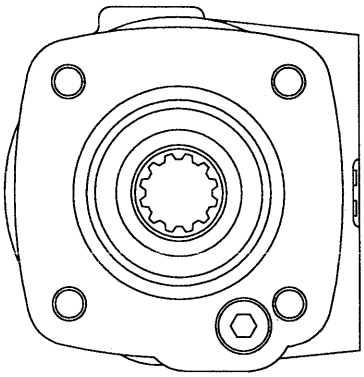
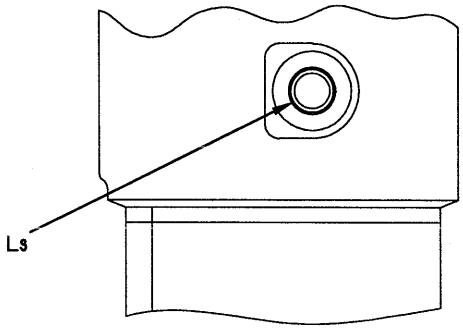
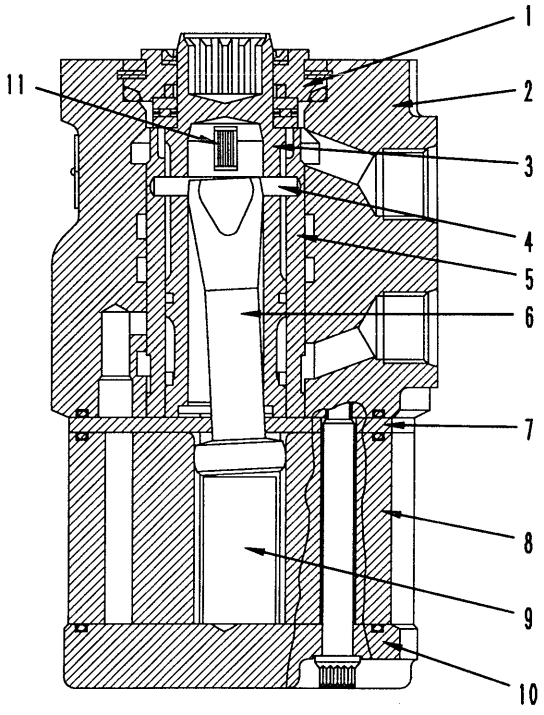
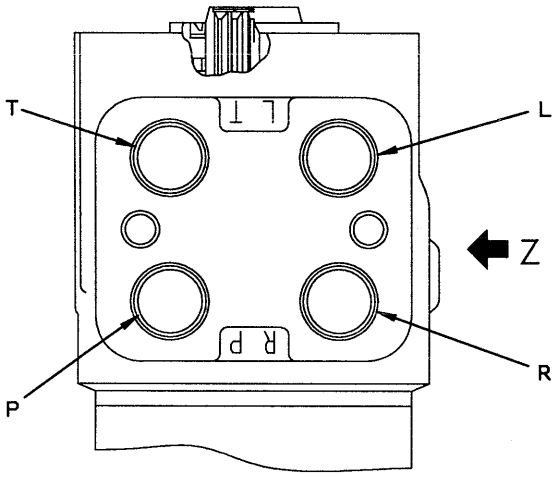
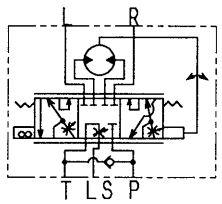
STEERING UNIT (ORBIT ROLL UNIT)











Hydraulic circuit diagram

SKL01105

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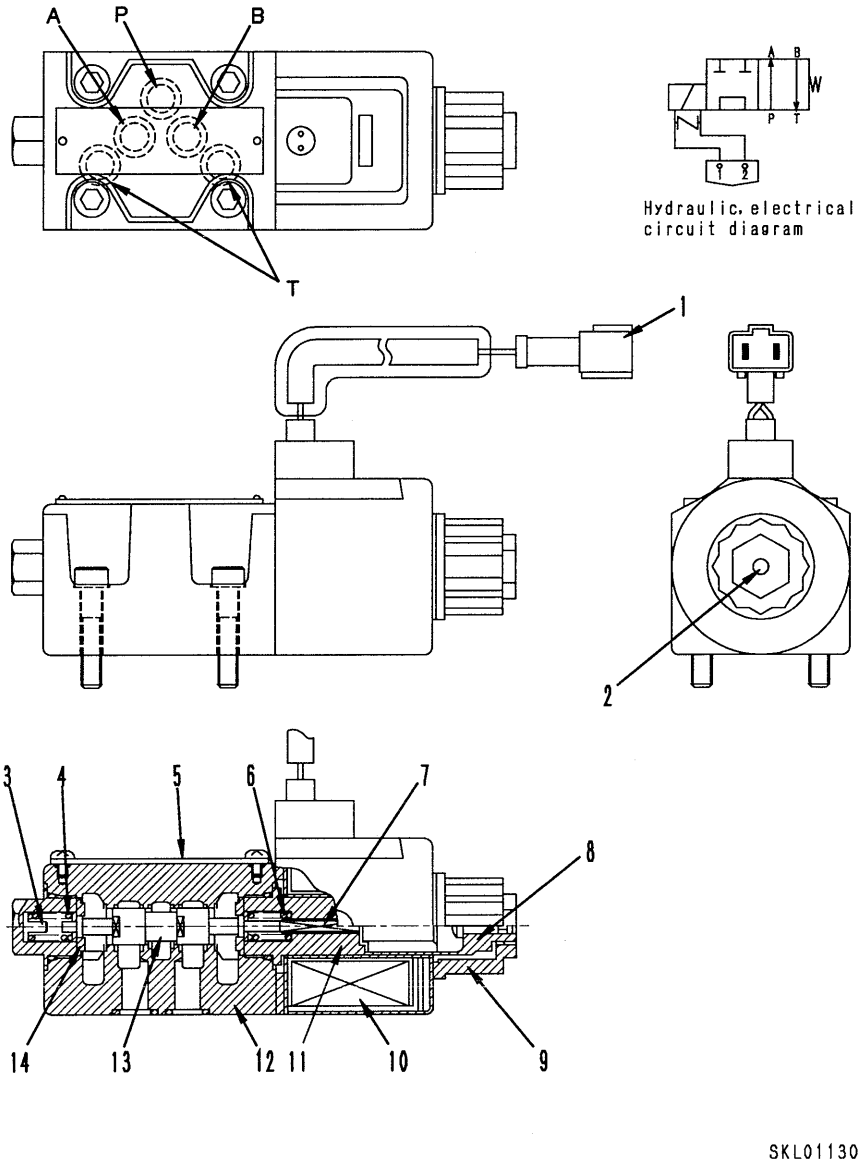
1. Gland
2. Housing
3. Spool
4. Center pin
5. Sleeve
6. Drive shaft
7. Spacer
8. Gerotor
9. Spacer
10. End cover
11. Centering spring

L. To left steering cylinder
R. To right steering cylinder
P. From steering pump
T. To tank
LS. Load sensing port

REVERSE STEERING COMPENSATION VALVE



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1. Connector
2. Manual push pin
3. Stopper
4. Spring
5. Cover
6. Spring
7. Push pin
8. Solenoid assembly
9. Nut
10. Coil assembly
11. Core assembly
12. Valve body
13. Spool
14. Spacer

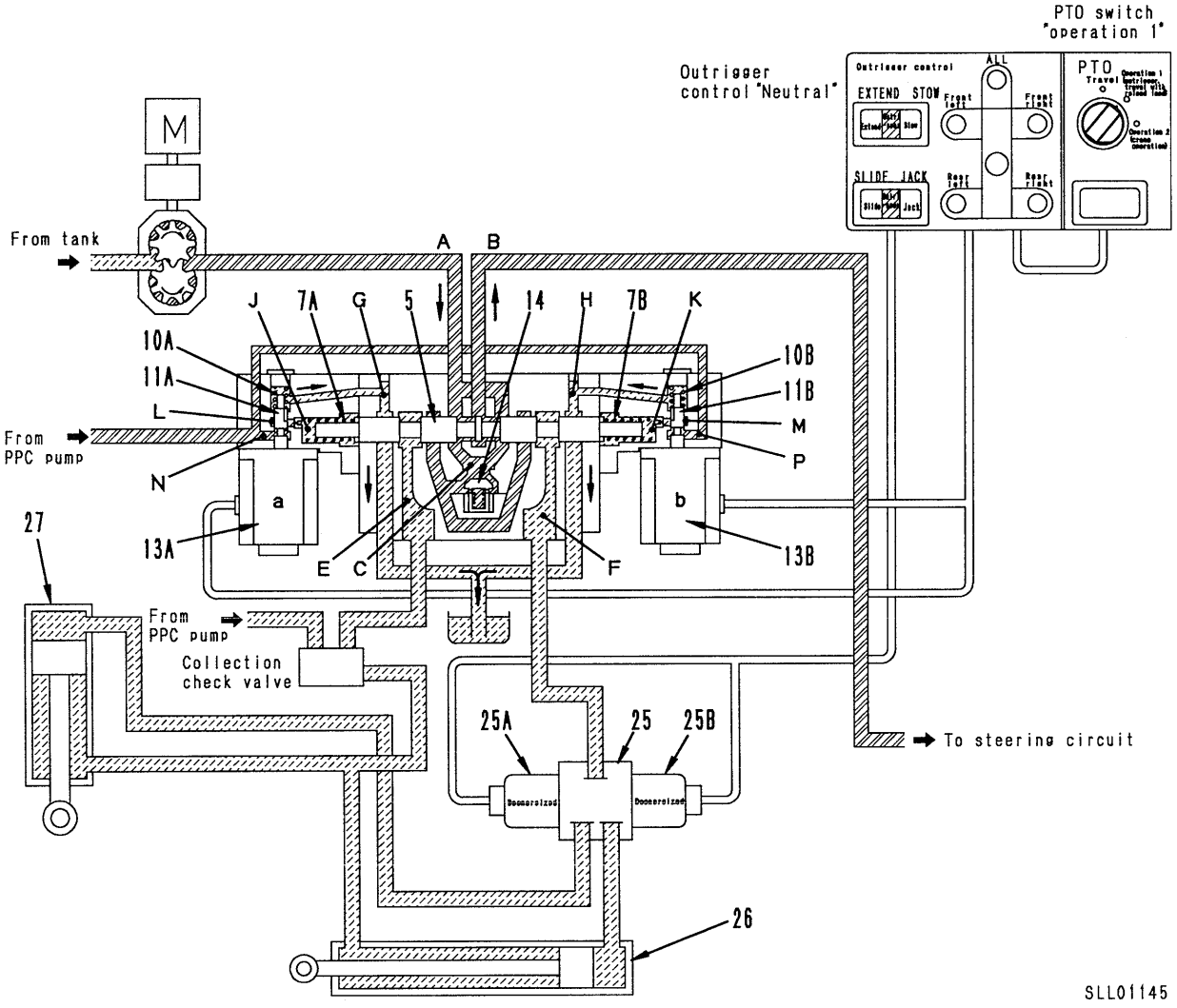
A. Port **A** (cylinder port)
B. Port **B** (cylinder port)
P. Port **P** (pump port)
T. Port **T** (tank port)

Outline

- The reverse steering compensation valve is in the circuit between the steering unit and steering mode selector valve and front right steering cylinder. If the upper structure is swung to face the rear, the steering can be changed by pressing the reverse steering compensation switch in the operator's compartment (the pilot lamp inside the switch lights up). This allows the machine to turn in the same direction as the direction in which the steering wheel is turned, thereby giving the same feeling as when traveling forward. However, this can only be actuated when using front wheel steering or 4-wheel coordinated steering. Be careful when operating crab steering because the direction of travel is the reverse of the direction in which the steering wheel is turned.
  Reverse steering can only be used when the upper structure is within a range of 10° at the rear of the machine. Outside that range it is not actuated.

OPERATION

1. Extending outriggers



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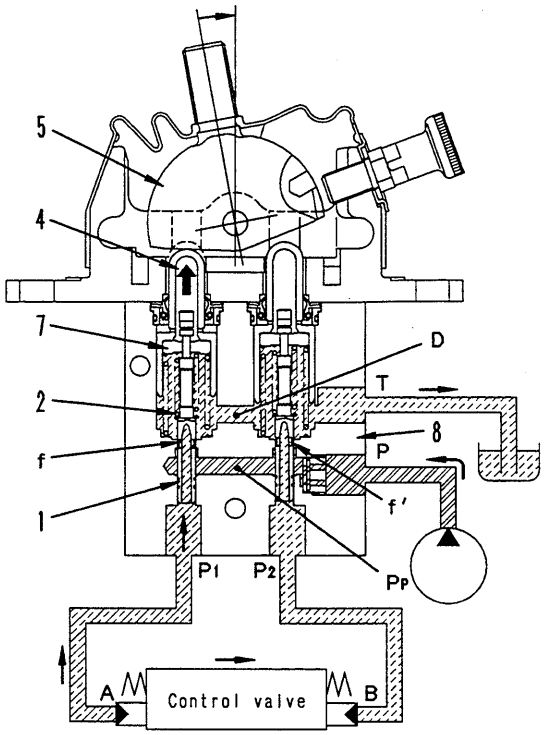
★ When extending the outriggers, carry out the operation in the following order. (For details, see the Operation and Maintenance Manual.)

1) Set the PTO switch to "OPERATION 1".
2) Set the JACK/SLIDE switch on the outrigger control panel to the SLIDE position.
3) Set the EXTEND/STOW switch to the EXTEND position.
4) Press the ALL switch.
5) Check that the slide operation for the outrigger is completed, then set the JACK/SLIDE switch to the JACK position.
6) Press the ALL switch.

- The engine runs, the steering and outrigger pump rotates, sucks up oil from the hydraulic tank, and sends it to port **A** of the selector valve.
  Some of the oil entering port **A** flows from port **B** to the steering circuit. The rest of the oil flows from port **C**, pushes open check valve (14), and enters port **D**. The circuit is shut off by spool (5).

3. **At 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**.
As a result, fine control hole **f** is connected to drain chamber **D** and the pressure at port **P1** is relieved.
If the pressure at port **P1** becomes too low, spool (1) is pushed down 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**, and pump pressure is supplied until the pressure at port **P1** recovers to a pressure equivalent to the position of the lever.
When the control valve spool returns, the oil from fine control hole **f'** of the valve that is not moving flows into drain chamber **D**, and from drain chamber **D** it passes through port **P2** to chamber **B** to fill the chamber.



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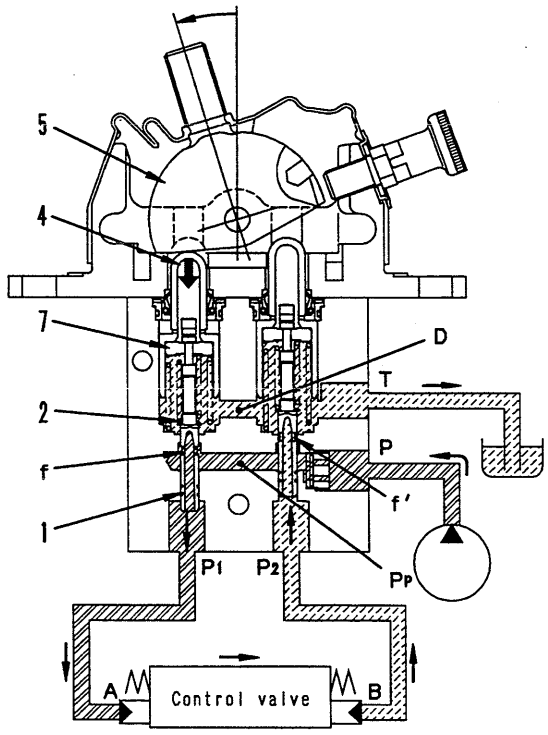
4. **Lever fully operated**
When lever (5) pushes down piston (4) and retainer (7) pushes down spool (1), fine control hole f is shut off from drain chamber **D** and is connected with pump pressure chamber **PP**. Therefore, the pilot pressure oil from the control pump passes through fine control hole f, flows from port **P1** to chamber **A**, and pushes 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**.



SKL01173

1. Counterbalance valve assembly
2. Piston rod
3. Cylinder head
4. Bushing
5. Retainer
6. Bushing
7. Cylinder
8. Tube
9. Piston
10. Wear ring

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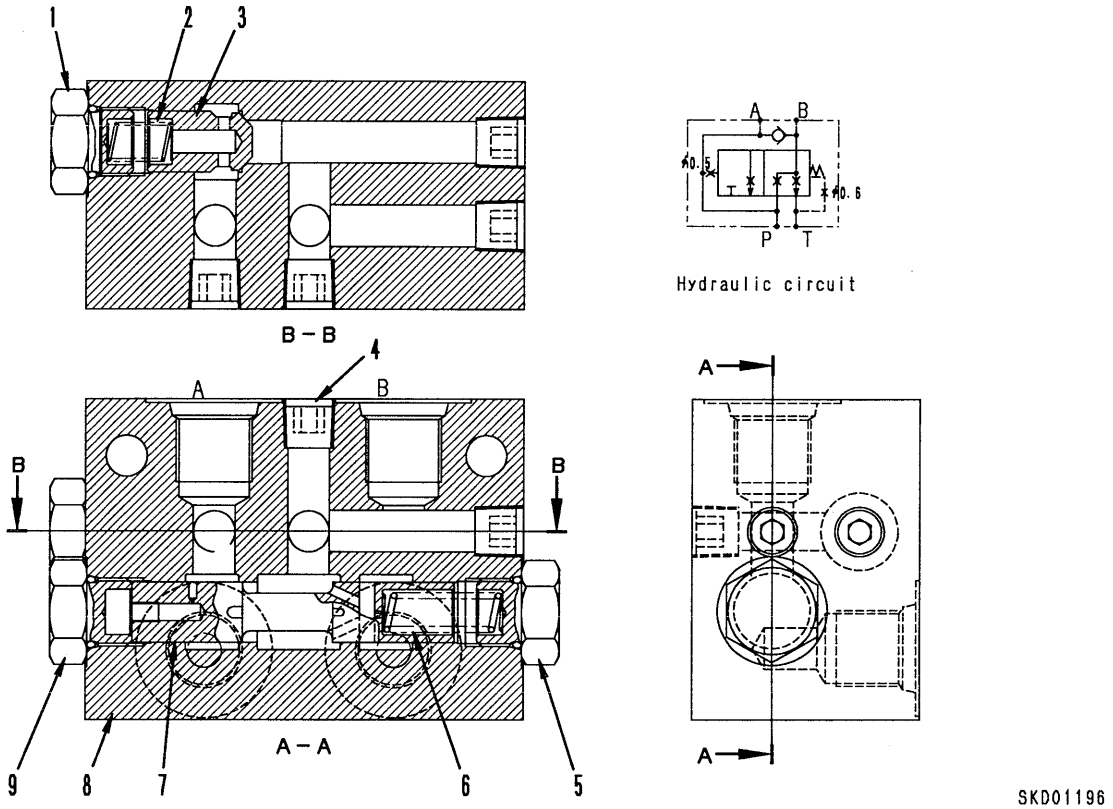
Outline

- The boom telescope cylinder is a double-acting piston type, and it consists of two cylinders: the No. 1 and No. 2 cylinders.
  The head end of the No. 1 cylinder is installed to the base boom, and the cylinder itself is installed to the 2nd boom. It extends and retracts the 2nd boom.
  The head end of the No. 2 cylinder is installed to the 2nd boom, and the cylinder itself extends and retracts the 3rd boom.
  There is a roller installed to the bottom end of the No. 2 cylinder. This rotates inside the top boom and supports the weight of the cylinder as it extends or retracts.
  Counterbalance valve (1) acts to prevent the boom from falling suddenly if there should be a failure in the cylinder circuit.
  Cylinder tube (8) is assembled inside piston rod (2) and makes it possible for the cylinder to be stowed inside the boom.
  The stroke and dimensions of the cylinder are as shown in the table below.

Unit: mm

Item	Standard value	
	No.1 cylinder	No.2 cylinder
Outside diameter of piston rod	110	135
Cylinder bore	130	160
Piston stroke	6,114	6,114
Max. distance between pins	6,440	6,319
Min. distance between pins	326	205

OVERRUN PREVENTION VALVE



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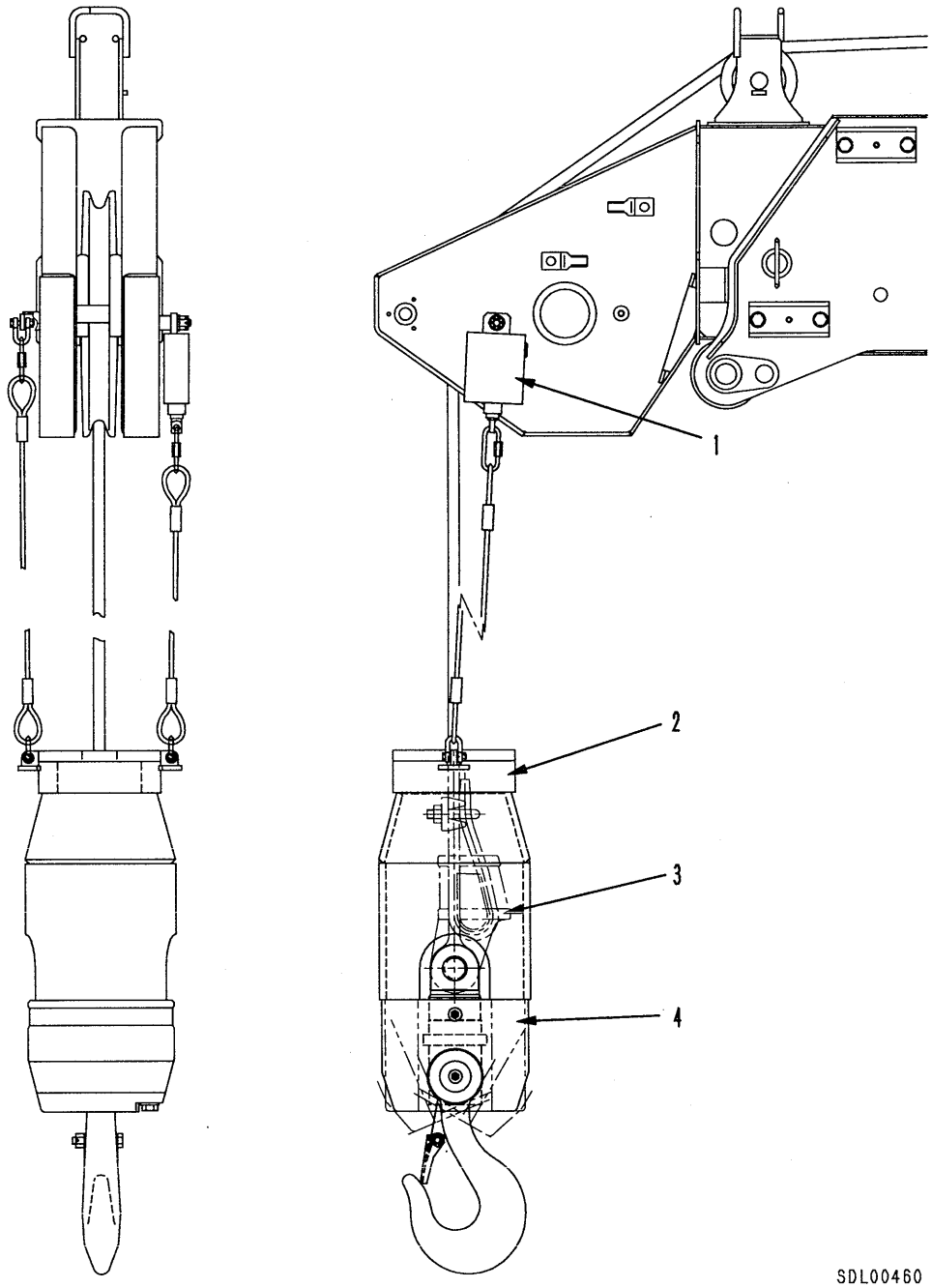
1. Plug
2. Spring
3. Check valve
4. Plug
5. Plug
6. Spring
7. Spool
8. Valve body
9. Plug

Outline

- The overrun prevention valve uses the steering and outrigger pump as the source of hydraulic power and is installed to the air conditioner compressor drive hydraulic motor.
- It has check valve (3) built in to prevent cavitation of the hydraulic motor if the supply of oil to the air conditioner compressor drive hydraulic motor should stop when the outriggers or steering are being operated.
- It also acts to prevent rotation impact noise from the hydraulic motor or overrun of the motor after sudden increase of speed caused by oil suddenly flowing to the hydraulic motor from the hydraulic pump when the operation of the outrigger or any other operation is stopped.

AUXILIARY HOOK



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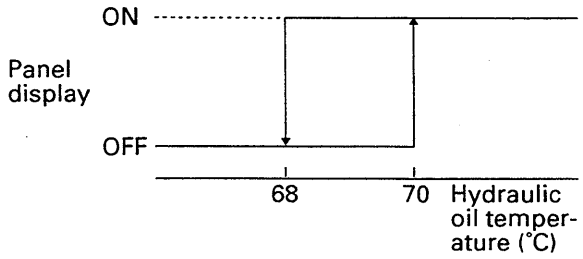
1. Overwind detection switch
2. Overwind weight
3. Rope clamp
4. Auxiliary hook assembly

Outline

- The auxiliary hook is used for operations with the auxiliary jib or single top. The maximum lifting weight is 3 tons, including the weight of the lifting equipment and the auxiliary hook.

Hydraulic oil temperature
- If the hydraulic oil temperature goes above 70°C, [hydraulic oil temperature 70°C] is displayed on the control panel. If the hydraulic oil temperature goes below 68°C, the display goes out.



Brake oil level
- If the brake oil level goes down, the brake oil level lamp lights up and the panel central buzzer sounds. Once a drop in the brake oil level is detected, even if the brake oil level is restored, the brake oil level lamp and panel central buzzer condition is maintained. When the starting switch is turned off, the warning is canceled.

Accumulator pressure drop
- If the accumulator pressure drops, the panel central buzzer sounds and [Accumulator pressure drop] is displayed on the control panel.

6) Starting, charging, preheating function
   Engine oil pressure
   - When the starting switch is ON, if the engine oil pressure drops, the engine oil pressure lamp lights up and the panel central buzzer sounds.

   Battery charge
   - If the voltage at alternator terminal R becomes less than 10V, the battery charge lamp lights up and the panel central buzzer sounds.

   Hourmeter
   - When the starting switch is on, if the engine oil pressure is normal, the hourmeter is actuated.

   Preheating
   . If the starting switch is set to R1, the preheating (heater relay) is turned on and the preheating pilot lamp lights up.

7) Transmission control function
   Travel mode
   - The travel mode based on the travel mode switch input is transmitted to the automatic gearshift system and control is carried out by the automatic gearshift system.

   Shift position
   - The shift position based on the shift lever input is transmitted to the automatic gearshift system.

8) Brake function
   Parking brake/auxiliary brake
   - When the parking brake switch is set to PARKING, the parking brake is applied, and the parking brake pilot lamp lights up.
   - When the parking brake switch is set to AUXILIARY, the auxiliary brake is applied.
   - If the shift lever is not at N and the parking brake is applied, the panel centralized buzzer sounds to warn that the parking brake is dragging.

   Exhaust brake
   - If the accelerator is not being used and the exhaust brake & retarder combination switch is set to EXHAUST BRAKE, the exhaust brake is actuated.
   - If the accelerator is being depressed, the exhaust brake is not actuated.

   Retarder
   - If the accelerator is not being used and the exhaust brake & retarder combination switch is set to RETARDER, the retarder is actuated. Note that the retarder is not actuated independently; it is used together with the exhaust brake.
   - If the accelerator is being depressed, the retarder is not actuated.

9) Steering function
   Special steering selector control
   (1) As a rule, travel operations are carried out in the front-wheel mode (rear steering locked).
   (2) If the rear steering is locked, the mode is always the front-wheel mode, regardless of the operation of the steering mode selector.
   (3) The rear steering lock/cancel operation is permitted only in the front-wheel mode. If the selector operation is not permitted, the panel central buzzer sounds intermittently (2 Hz).

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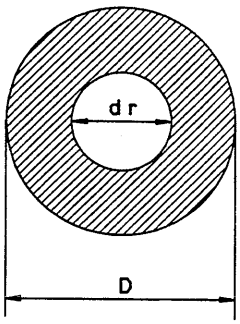
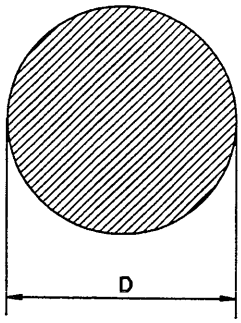
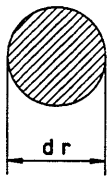
Table 2 Cross-sectional shape of portions of cylinder

	Cross section A – A	Cross section B – B	Cross section C – C
details of cross section	 SKL00869 Portion receiving head pressure (hatched portion)	 SKL00870 Portion receiving bottom pressure (hatched portion)	 SKL00871 Axial force
Pressures	$Fh = Ah \times Ph$ $= \frac{\pi}{4}(D^2 - dr^2) \cdot Ph$	$Fh = Ah \times Ph$ $= \frac{\pi}{4} D^2 \cdot Ph$	$F = Fb - Fh$

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Second boom extension detection value (for automatic telescope selection)
The boom length sensor and boom telescope PPC pressure switch are used to judge if the second boom is completely extended, and the value is determined according to the condition.

Setting condition value (second boom fully extended):
Judgment is carried out from 13 cm or less from the point where the second boom is fully extended.

Boom EXTEND PPC pressure switch input (CNC13-2): 24V
and
Boom RETRACT PPC pressure switch input (CNC13-10): GND
(EXTEND operation)
and
Boom telescope selector solenoid output (CNC11-17): GND (second boom telescope)
and
Boom length sensor input deviation (CNC16-4): θ (No change in boom length sensor)

Resetting condition value (second boom starting to retract)

Boom EXTEND PPC pressure switch input (CNC13-2): GND
and
Boom RETRACT PPC pressure switch input (CNC13-10): 24V
(RETRACT operation)
and
Boom telescope selector solenoid output (CNC11-17): 24V (second boom telescope)
and
Top boom stowing limit switch input (CNC14-2): GND (Top boom stow detected)

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PTO input
The PTO is switched between the Travel mode and the Operation mode according to the condition of the PTO input (CNC 14-8, 18).

Travel mode	Operation mode	
CNC14-8	24V	0V
CNC14-18	0V	24V

Over-front detection
In the on-tire mode or running hang mode, if the swing angle sensor detects +_1o to the front, it judges that the boom is in the over-front range and switches the rated load. In addition, if the display mode on the control panel is the outrigger mode, it
displays the over-front indicator on top of the chassis display.

Lever stand LS
If the PTO is in the Operations mode, and the lever stand LS input (CNC 14-12) is 24 V, the automatic stop solenoid output (CNC11-5) and the jib condition PPC solenoid output (CNC11-6) are set to 0V. (Work equipment stopped)
When this happens, the monitor displays the LEVER STAND LOWERED message.

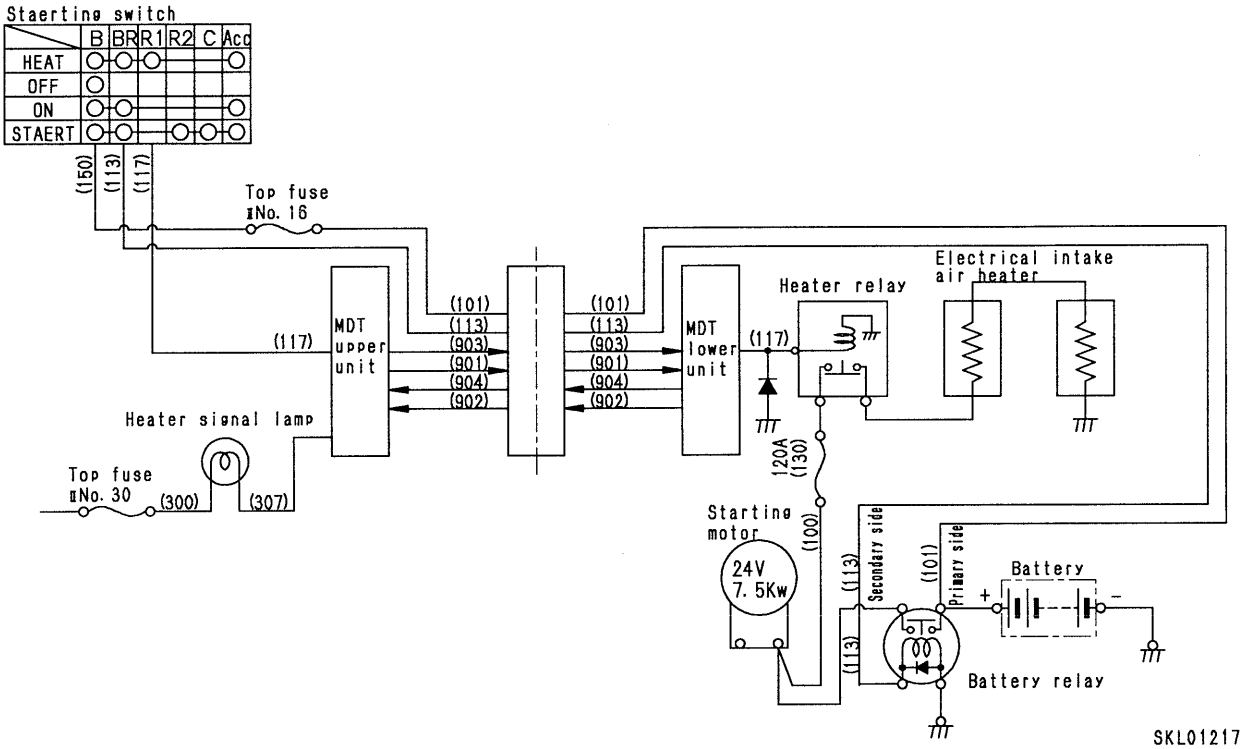
Preparatory mode (jib extension/stow operation mode)
When the upper working mode switch on the panel is set to PREPARATORY, the system enters the preparatory mode, and is different from the normal operation in the jib extension operation, so the error that is generated (boom angle sensor lower limit error,
etc.) and automatic stop caused when there is overwinding are canceled. In addition, the red external display lamp lights up, and [**Warning!**] and [**No overwind automatic stop**] are displayed in turn.

For the extend/stow operation, the signals in the following table are output. (Power tilt specification only)

Conditions	Output
Panel upper working mode preparatory	CNC11-20 : 24V (jib extend/stow permitted)
Jib tilt angle ≧ 70° and Boom angle ≦ 30°	CNC11-20 : 24V (swing out permitted)

If the work equipment is not in the correct posture, the automatic stop and alarm and message are generated. (For details, see automatic stop chart and warning output chart.)

4. PREHEATING CIRCUIT



023S05

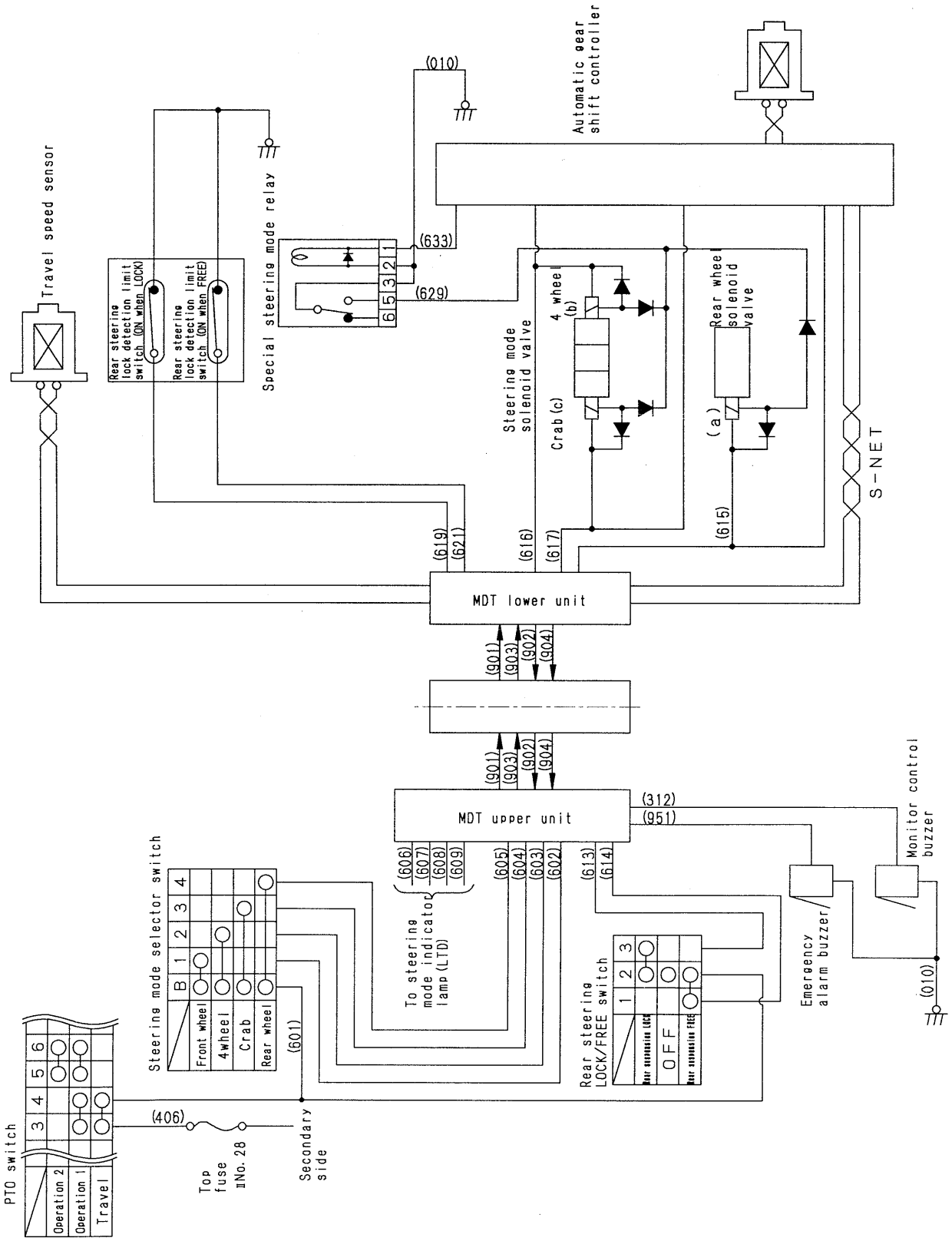
Outline

- The preheating circuit is a circuit which makes it easier to start the engine in cold weather by heating the air inside the engine intake manifold. It consists of a preheating ribbon and coil heater using an electrical heater and a heater relay which turns the large current flowing to the heater ON/OFF.

Operation

- When the starting switch is turned to the HEAT position, terminal **B** and terminal R1 are connected, so the electricity from the battery flows from terminal **B** to terminal **R1**. (Terminal **B** and terminal **BR** are connected at every position except OFF.)
  Some of the electricity leaving terminal **R1** flows to the MDT unit, and flows to the coil of the heater relay to turn the contacts of the heater relay ON.
  At the same time, it flows to the heater signal lamp to turn it ON.
  The electricity leaving terminal **BR** of the starting switch passes through the swivel joint, flows to the coil of the battery relay, and turns the contacts of the battery relay ON.
  When the contacts of both the heater relay and battery relay are turned ON, electricity flows from the battery, through each relay, and flows to the electrical intake air heater in the intake manifold to warm up the air.

13. STEERING MODE SELECTOR CIRCUIT



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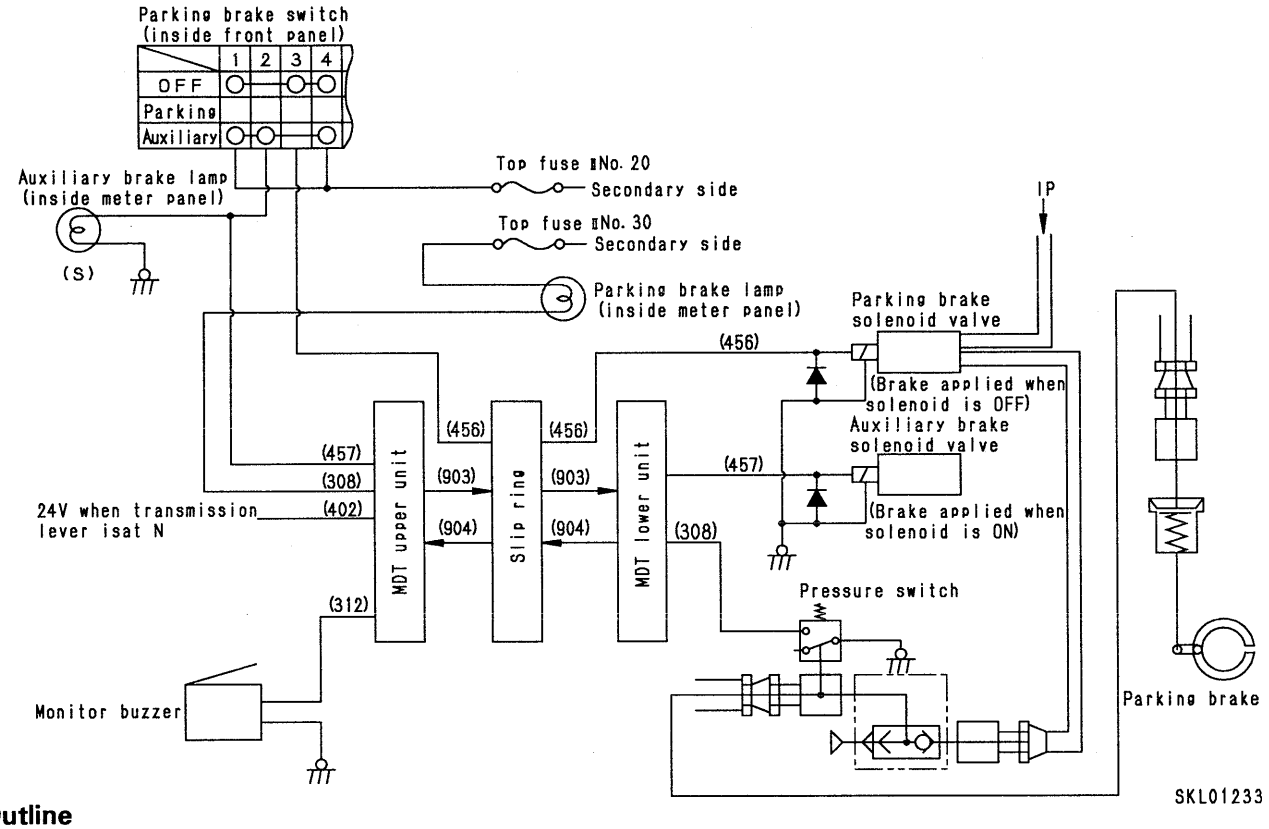
20. PARKING BRAKE CIRCUIT



023S05

Outline

- When the parking brake switch is operated, the parking brake circuit actuates two sets of solenoid valves to switch the air circuit and apply the parking brake and rear brake.

Operation

1. **When parking brake switch is at OFF**
   When the switch is turned OFF, terminals 3 and 1 are connected, and the electricity from top fuse II No. 20 flows from terminal 1 to terminal 3.
   The electricity leaving terminal 3 passes through the swivel joint and flows to the parking brake solenoid to actuate the valve. This switches the air circuit and sends high-pressure air to the brake chamber to release the parking brake.
   In other words, when the parking brake solenoid is excited, the brake is released; when it is de-energized, the brake is applied.
2. **When parking brake switch is at PARKING**
   If the switch is set to the PARKING position, electricity from top fuse II No. 20 stops flowing to terminal 2. The parking brake solenoid valve is turned OFF, and the parking brake is applied.
   When this happens, a pressure switch detects that the pressure in the air pressure line of the parking brake has been cut, so the parking brake lamp on the top meter panel lights up.
   No electricity flows to the parking brake solenoid valve, so the parking brake is applied.
3. **When parking brake switch is at AUXILIARY BRAKE**
   When the switch is set to the AUXILIARY BRAKE position, the parking brake is applied in the same way as in Item 2. At the same time, terminals 1 and 2 are connected, and the electricity from top fuse II No. 20 flows to terminals 1 and 2.
   Some of the electricity leaving terminal 2 flows to the auxiliary brake lamp (S) and lights up the lamp. The rest flows to the MDT unit, then flows to the auxiliary brake solenoid and actuates the valve. This switches the air circuit and sends high-pressure air to the rear brake booster to apply the rear brake.
4. When the bottom pressure switch is actuated (closed) and the parking brake lamp is lighted up, if the transmission lever is set to any position other than **N**, the monitor buzzer will sound to prevent the brakes from dragging.

Outline

- In the overwind prevention circuit, if the winch wire is wound in too far, the wire (hook) actuates the overwind detection switch installed to the tip of the boom or jib. When the OSS controller receives this signal, it lights up the overwind warning lamp and sounds the overload alarm buzzer to inform the operator. At the same time, it cuts the electricity flowing to the work equipment unload solenoid valve and lowers the hydraulic pressure in the winch hydraulic circuit to make it impossible to operate the winch.
- The automatic stop cancel circuit cancels the automatic stop condition that occurs when there is overwinding of the winch.
  It also cancels the automatic stop caused by overloading.

Operation

When the PTO switch is set to the PTO1 or PTO2 position, terminals 5 and 6 are connected, and electricity at top fuse I No. 4 flows from terminal 5 to terminal 6.

Some of the electricity leaving terminal 6 excites work equipment control lever stand hoist relay if the work equipment control lever stand limit switch is at RAISE. The electricity from top fuse I No. 4 goes to the terminal of the automatic stop cancel switch, and the rest of the electricity passes through wire No. 712, enters the OSS controller and informs that the machine is in the working mode condition.

1. **When there is overwinding during winch operations**
   If the winch is wound in too far and causes an overwind condition, all of the overwind detection switches become OPEN, and the connection of the electricity from the controller to the ground is disconnected.
   When this happens, if the work equipment is being operated in the danger direction (boom EXTEND, boom LOWER, jib LOWER, winch WIND IN) or all the work equipment control levers are at the neutral position, the controller is actuated and shuts off the flow of electricity to the main unload solenoid. This actuates the valve, switches the winch hydraulic circuit, and connects the pilot pressure in the relief valve to the drain circuit. As a result, the pressure is reduced, and this makes it impossible for the winch motor to turn.
   At the same time, the controller displays the OVERWIND message on the moment limiter monitor and sends electricity to the buzzer to sound the buzzer. If an external display lamp is installed, it lights up the external display lamp (red).
2. **Canceling automatic stop**
   When an overwind condition occurs, the overwind detection limit switch cuts the connection of wire No. 795 with the ground, so the moment limit controller detects that there is an overwind condition. It cuts off the flow of electricity through wire No.844 to the main unload solenoid valve and automatically stops the winch operation. The same happens when there is an overload condition. The flow of electricity to the main unload solenoid valve is cut off and the operation automatically stops.
   If the automatic stop cancel switch is set to **AUTOMATIC STOP CANCEL**, terminal 2 and terminal 1 of the switch are connected, and the electricity from top fuse I No.4 passes through the work equipment control lever stand hoist relay and automatic stop cancel switch, and enters terminal 3 of the automatic stop cancel prohibition relay.
   When this happens, if the automatic stop cancel prohibition relay is not being excited, the electricity entering terminal 3 of the relay goes out from terminal 6, actuates the main unload solenoid valve, and cancels the automatic stop condition.
   In addition, the electricity leaving terminal 1 of the automatic stop cancel switch lights up the indicator lamp, and if an external display lamp is installed, it lights up the external display lamp (red).
3. **When there is automatic stop cancel prohibition**
   If the moment limiter controller is in either of the following conditions:
   - Work equipment control lever stand at LOWER
   - Over-rear stability stop condition fulfilled

   the automatic cancel prohibition relay is excited through wire No. 844. Therefore, the electricity from top fuse I No. 4 cannot flow to the main unload solenoid valve because the connection of terminals 3 and 6 of the relay is cut. For this reason, even if the automatic stop cancel switch is set to CANCEL, the automatic stop condition is maintained.
   - If the lever stand is lowered, LEVER STAND LOWERED is displayed on the moment limiter monitor.

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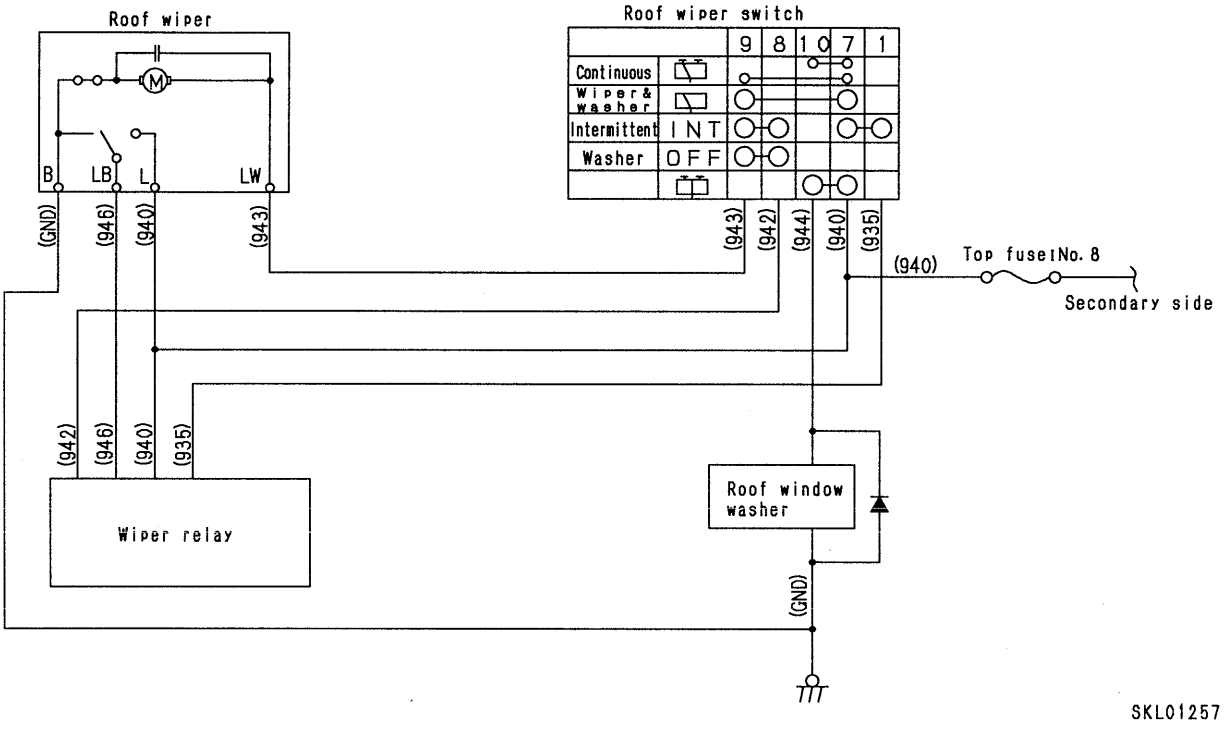
36-2 ROOF WIPER CIRCUIT



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Operation

(1) When wiper switch is at INT (intermittent)
Electricity from top fuse I No.8 flows from terminal 7 to terminal 1, passes through wire 935, and is input to the wiper relay.
When the wiper switch is turned to INT, the wiper relay sends electricity to wire No.942 at the same time, and electricity flows from terminal 3 to terminal 5 to actuate the wiper. After the wiper carries out one return movement, it waits for 4 – 7 seconds before repeating the operation.

(2) When wiper switch is at CONTINUOUS
Electricity from top fuse I No.8 flows from terminal 7 to terminal 9, flows to wire No. 943, and actuates the wiper continuously.

(3) When wiper and washer switch is ON
Electricity from top fuse I No. 8 flows from terminal 7 to terminal 10, actuates the roof window washer, and also flows from terminal 7 to terminal 9 to actuate the wiper.

(4) When washer switch is ON
Electricity from top fuse I No. 8 flows from terminal 7 to terminal 10, and actuates the roof window washer.

⚠ Check carefully that there is no one in the surrounding area before starting inspection.
★ When carrying out operations during inspection, raise the work equipment control lever stand for operations, and lower it when traveling.
★ Operate the winch under no load.
★ Turn the starting switch OFF before inserting the T-adapter or making any connections.

System	Name of component	Connector No.	Inpsection method	Judgement table	Measurement conditions
Controller – Upper MDT	Hi beam pilot	C03	Measure voltage	If the condition is as shown in the table below, it is normal Lamp switch stage 2 ON, dimmer switch (pressed odd number of times, head lamp Hi): Between (6) – chassis: 17 – 30 V Lamp switch OFF: Between (6) – chassis: Max. 1 V	1) Insert T-adapter.
	Left turn pilot		Measure voltage	If the condition is as shown in the table below, it is normal Turn signal lever: Left: Between (16) – chassis: 17 – 30 V Turn signal lever: OFF: Between (16) – chassis: Max. 1 V	1) Insert T-adapter.
	Right turn pilot		Measure voltage	If the condition is as shown in the table below, it is normal Turn signal lever: Right: Between (8) – chassis: 17 – 30 V Turn signal lever: OFF: Between (8) – chassis: Max. 1 V	1) Insert T-adapter.
	Retarder lamp (opt)		Measure voltage	If the condition is as shown in the table below, it is normal Exhaust brake switch: Retarder: Between (13) – chassis: Max. 1 V Exhaust brake switch: OFF: Between (13) – chassis: 20 – 30 V	1) Insert T-adapter. 2) Turn starting switch ON. 3) Accelerator pedal: OFF (not depressed)
	Travel or PTO 1 (Travel or Operation 1)	C04	Measure voltage	If the condition is as shown in the table below, it is normal PTO switch: Travel or Operation 1: Between (1) – chassis: 20 – 30 V PTO switch: Operation 2: Between (1) – chassis: Max. 1 V	1) Insert T-adapter. 2) Turn starting switch ON.
	PTO 1 or PTO 2 (Operation 1 or Operation 2)		Measure voltage	If the condition is as shown in the table below, it is normal PTO switch: Operation 1 or Operation 2: Between (2) – chassis: 20 – 30 V PTO switch: Travel: Between (2) – chassis: Max. 1 V	1) Insert T-adapter. 2) Turn starting switch ON.
	Rear steering lock switch		Measure voltage	If the condition is as shown in the table below, it is normal Rear steering lock/ cancel switch: LOCK: Between (3) – chassis: 20 – 30 V Rear steering lock/ cancel switch: CANCEL or Neutral: Between (3) – chassis: Max. 1 V	1) Insert T-adapter. 2) Turn starting switch ON. 3) PTO switch: Travel or Operation 1

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⚠ Check carefully that there is no one in the surrounding area before starting inspection.
★ When carrying out operations during inspection, raise the work equipment control lever stand for operations, and lower it when traveling.
★ Operate the winch under no load.
★ Turn the starting switch OFF before inserting the T-adapter or making any connections.

System	Name of component	Connector No.	Inpsection method	Judgement table	Measurement conditions
Controller – Moment limiter	NSW power source	C12	Measure voltage	If the condition is as shown in the table below, it is normal Between (5) – chassis: 20 – 30 V	1) Insert T-adapter.
	SW power source		Measure voltage	If the condition is as shown in the table below, it is normal Between (8), (16) – chassis: 20 – 30 V	1) Insert T-adapter. 2) Turn starting switch ON.
	S-NET (communication between upper MDT - moment limiter)	C15	Measure voltage	If the condition is as shown in the table below, it is normal Between (3), (11) – (1), (9): 4 – 8 V	1) Insert T-adapter. 2) Turn starting switch ON. 3) PTO switch: Operation 1 or Operation 2
	S-NET (communication between jib - moment limiter)		Measure voltage	If the condition is as shown in the table below, it is normal Between (5), (13) – (1), (9): 9 – 13 V	1) Insert T-adapter. 2) Turn starting switch ON. 3) PTO switch: Operation 1 or Operation 2
	S-NET (communication between moment limiter controller - moment limiter monitor)	C12	Measure voltage	If the condition is as shown in the table below, it is normal Between (11), (21) – (8), (18): 4 – 8 V	1) Insert T-adapter. 2) Turn starting switch ON.
	Main unload solenoid	C11	Measure voltage	If the condition is as shown in the table below, it is normal Work equipment lever stand raised: Between (5) – chassis: 20 – 30 V Work equipment lever stand lowered Max. 1 V: Between (5) – chassis: Max. 1 V	1) Insert T-adapter. 2) Turn starting switch ON. 3) PTO switch: Operation 1 or Operation 2 4) Automatic stop cancel switch: Automatic 5) No error or warning message displayed
	PPC unload solenoid (jib LOWER)		Measure voltage	If the condition is as shown in the table below, it is normal Top mode: Jib mode: Between (6) – chassis: 20 – 30 V Top mode: Boom mode Max. 1 V: Between (6) – chassis: Max. 1 V	1) Insert T-adapter. 2) Turn starting switch ON. 3) PTO switch: Operation 1 or Operation 2 4) Work equipment lever stand raised (operated)
	Boom telescope (order selector) solenoid		Measure voltage	If the condition is as shown in the table below, it is normal Boom select switch: Top: Between (17) – chassis: 20 – 30 V Boom Select switch: 2nd Max. 1 V: Between (17) – chassis: Max. 1 V	1) Insert T-adapter. 2) Turn starting switch ON. 3) PTO switch: Operation 1 or Operation 2 4) No error or warning message displayed

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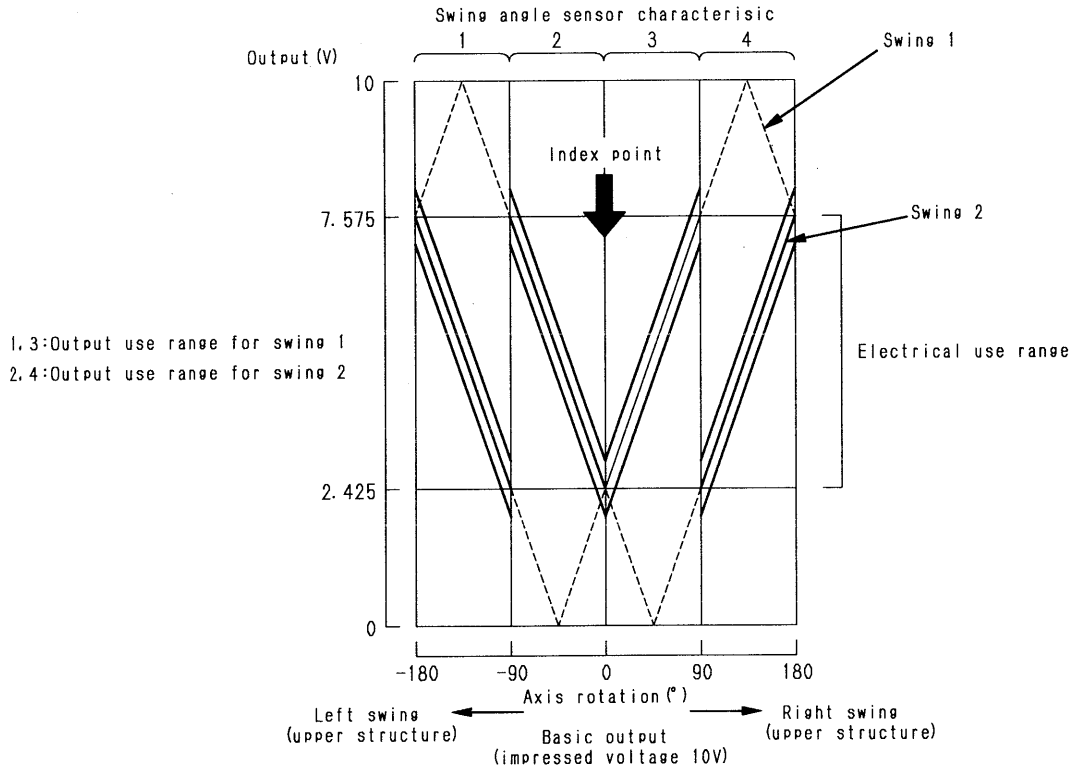
(44/44)

Remarks



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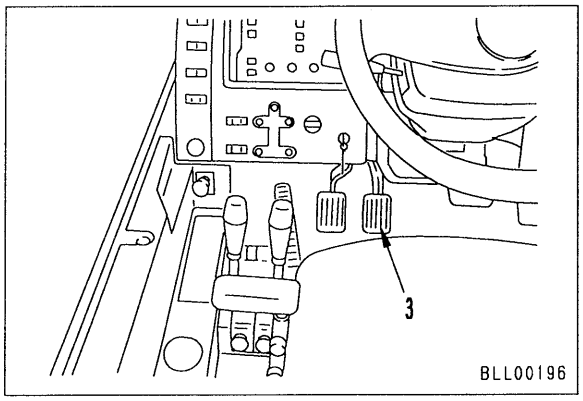
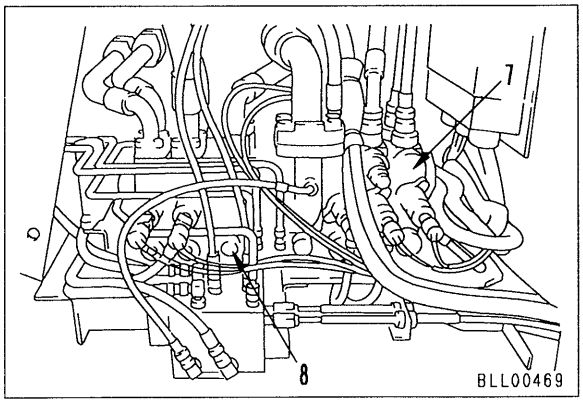
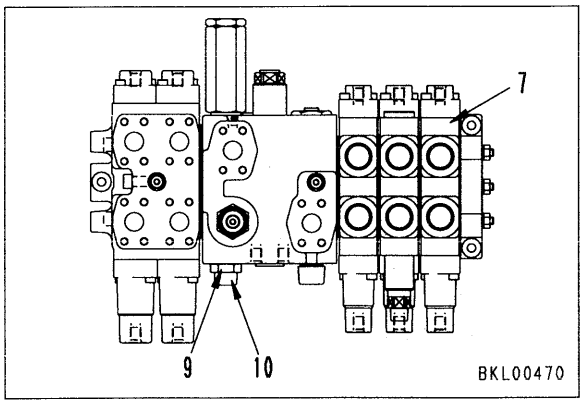
ii) Start the engine and set PTO switch (2) to the "OPERATION 1" or "OPERATION 2" position.
iii) In this condition, depress winch brake pedal (3).
iv) Operate main winch lever (4) to the WIND IN position and relieve the circuit.
v) Depress the accelerator pedal, raise the engine speed to high idling, and measure the set pressure.
Plug: **Gasket sealant (LG-1)**
★ If the set pressure exceeds $20.6^{+2.5}_{0}$MPa {210^{+25}_{0} kg/cm²}, adjust as follows.



Adjusting
1) Adjust winch relief valve (8) of main control valve (7).
2) Loosen locknut (9), then turn adjustment screw (10) to adjust.
★ Turn the adjustment screw to adjust as follows.
To INCREASE pressure, turn CLOCKWISE
To DECREASE pressure, turn COUNTER-CLOCKWISE
★ One turn of the adjustment screw adjusts the pressure by 14.7 MPa {150 kg/cm²}.
3) After adjusting, tighten locknut (9).
kgm Locknut:
9.8 ±1.0 Nm {1 ± 0.1 kgm}
★ After tightening the locknut, check the pressure again.





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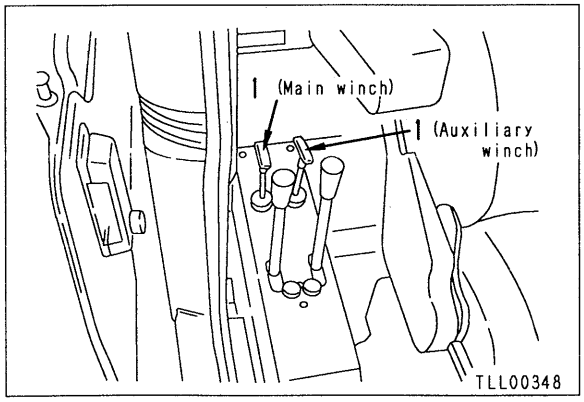
12. Accumulator charge pressure
★ Set the hydraulic oil temperature to 45 – 55°C.
★ Set winch drum lock lever (1) to the LOCK position.
★ Turn the air conditioner switch OFF.
Measuring
1) With the starting switch at the ON position, depress the winch brake pedal and operate winch clutch lever (2) repeatedly between the ON and OFF positions to release the pressure from the accumulator.

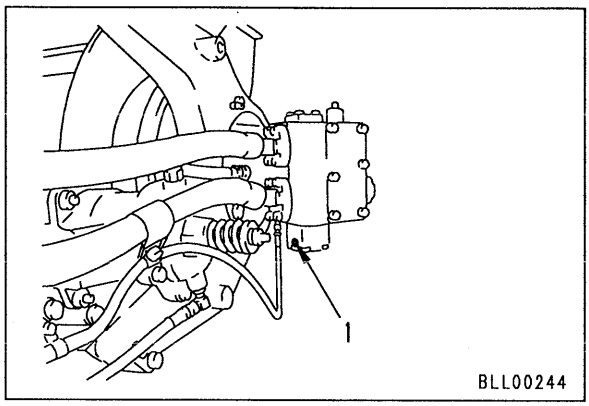


8. Bleeding air from winch motor (main, auxiliary motor)

⚠ Extend the outriggers and set securely so that the machine cannot move, then swing the revolving frame to face the front.

⚠ Set the swing lock pin to the LOCK position.

1) Remove the side cover from the winch motor where the air is to be bled.
2) Set the PTO switch to the "OPERATION 1" or "OPERATION 2" position.
3) Run the engine at low idling, wind in and wind out the hook with no load, then loosen air bleed plug (1) of the winch motor, and bleed the air until no more bubbles come out with the oil.
4) After completely bleeding the air, tighten plug (1).
   - ★ If the piping has been disconnected, always bleed the air.
   - ★ When replacing the winch motor, fill the drain case with hydraulic oil before installing.



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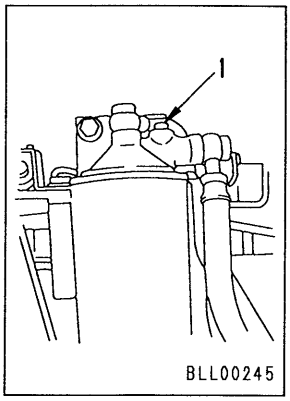
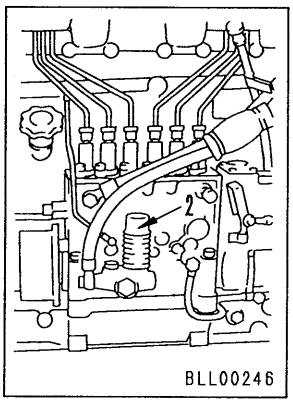
9. Bleeding air from fuel system

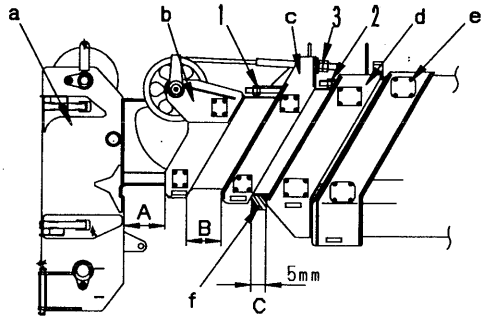
1) Loosen air bleed plug (1) on the fuel filter, operate priming pump (2), and when no more bubbles come out with the fuel, tighten the plug.
2) Operate the priming pump a further 10 – 15 times to bleed the air from the fuel injection pump.

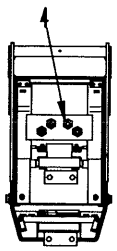
★ There is no air bleed plug installed to the pump. When the priming pump is operated, the check ball inside the joint bolt in the return circuit opens and releases the air to the tank.





ADJUSTING TELESCOPE WIRE ROPE





BKL00309

a : Top boom
b : 4th boom
c : 3rd boom
d : 2nd boom
e : Base boom

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⚠ Extend the outriggers and set securely so that the machine cannot move, then swing the revolving frame to face the front, and set the boom horizontal.

- Start the engine, set the PTO switch to the "OPERATION 1" or "OPERATION 2"position
- Set the boom select switch to the TOP position, then extend the boom to make dimension **A** approx. 300 mm.

1. Adjusting retraction wire rope

1) Insert 5-mm stopper (**f**) between 2nd boom (**d**) and 3rd boom (**c**), then retract the boom. When doing this, make sure that dimensions **A** and **B** are at least 10 mm.
   ★ Retract the boom slowly.
   ★ If the clearance at **A** and **B** cannot be maintained, loosen adjustment nuts (1) and (2), then extend the boom and carry out the retraction operation again.
2) Tighten top boom retraction adjustment nut (1) and 4th boom retraction adjustment nut (2) so that dimensions **A** and **B** are 0 mm.
3) Extend the boom again approx. 300 mm, then retract it slowly, and check that dimension **C** is 5 mm when dimensions **A** and **B** are 0 mm.
   ★ Repeat this operation 5 – 6 times to check, then tighten the locknut.

4) Method of adjusting swing angle
   ★ Adjust the 0 point so that the over-front position of the swing angle detection sensor matches the front of the machine.
   • MIN setting
      i) Set to the service mode, then set top switch (2) to position **2** and bottom switch (3) to position **10**.
      ii) Swing the upper structure to face the front, then insert the swing lock pin.
      iii) Keep set switch (6) pressed for at least 1 sec.
      iv) When the setting is completed, the calculated value display becomes 0 when top switch (2) is set to 1 and bottom switch (3) is set to **10**.
      • Adjust the swing lock position as swing angle 0°.

SWING ANGLE MONITOR CODE CONVERSION TABLE

Conversion formula for monitoring code (A/D value) voltage

A/D value = V/5 x 1023

V : Sensor output voltage

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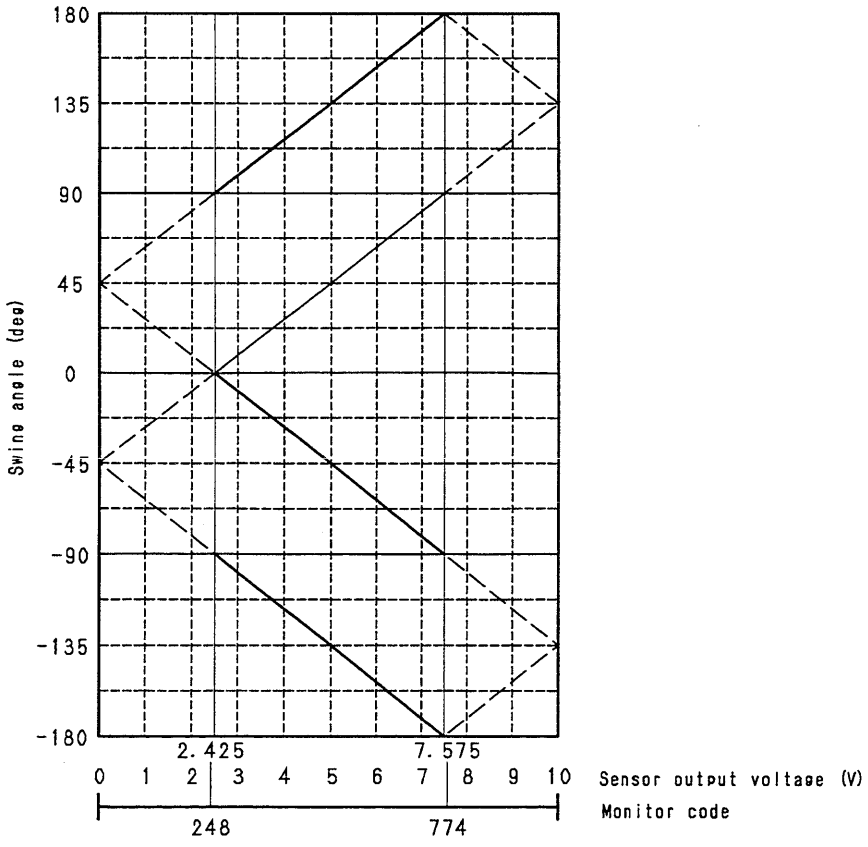
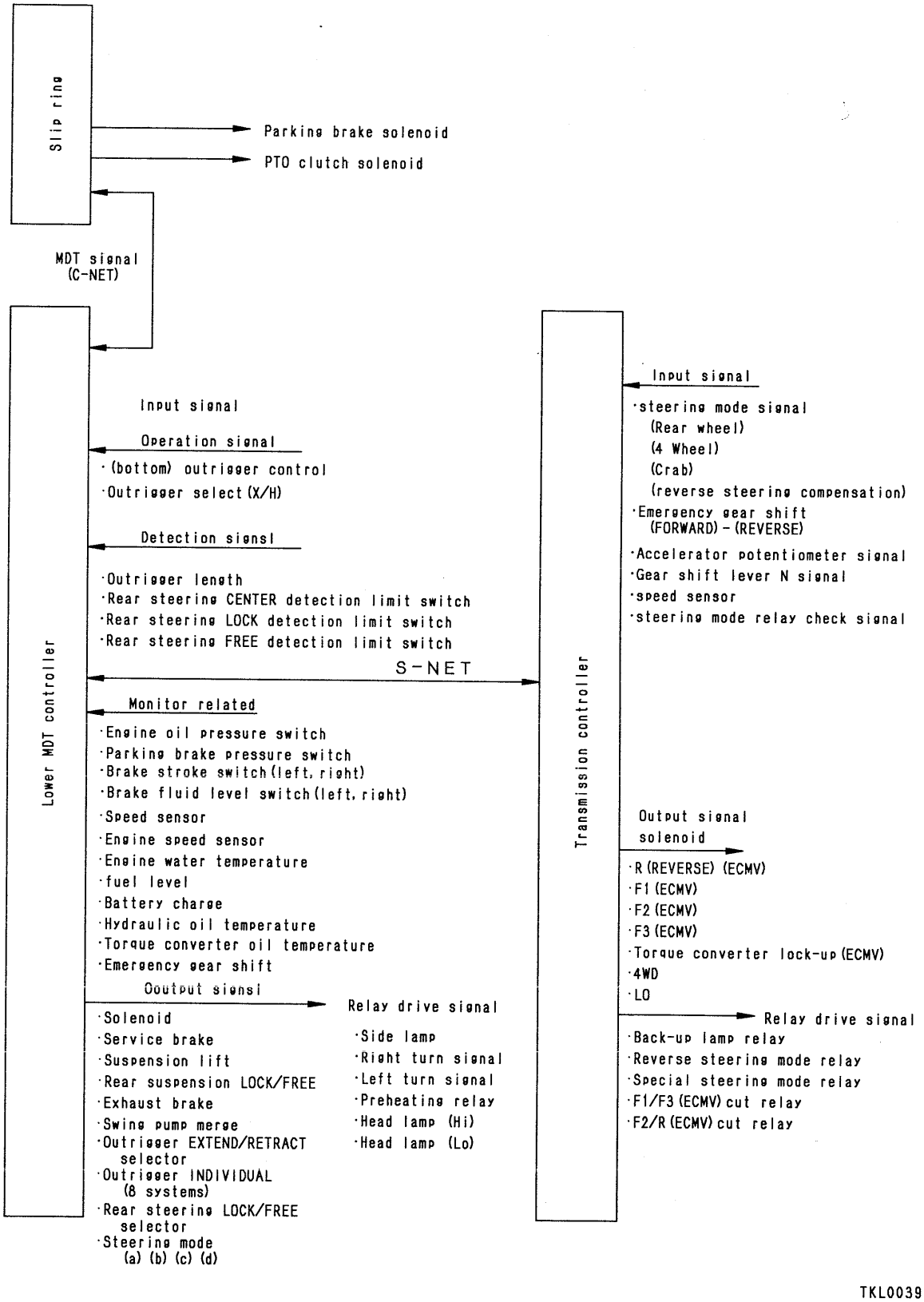


Connector No.	Type	No. of pins	Mounting location	Address
J16	SWP	6	Proximity sensor	–
J17-1	Hirose Denki	4	Intermediate connector	–
J17-2	Hirose Denki	4	Intermediate connector	K-6
J17-3	Hirose Denki	4	Intermediate connector	H-7
J18	X	2	Intermediate connector	K-7
J19	X	3	Signal top overwind switch	K-6
L01	L	2	Intermediate connector (slip ring)	o-1
L02	X	2	Intermediate connector (slip ring)	i-1
L03	SWP	8	Intermediate connector (slip ring)	i-1
L04	SWP	14	Intermediate connector (slip ring)	i-1
L05	SWP	14	Intermediate connector	o-6
L06	X	2	Intermediate connector	o-6
L08	X	2	Swing pump merge selector solenoid	g-7
L09	KES 1	2	Diode	–
L10	X	3	Rear suspension sensor detection limit switch	j-9
L11	X	4	Rear steering lock cylinder	j-9
L12	X	2	Rear steering solenoid	i-8
L13	X	2	Rear steering solenoid	h-8
L14	KES 1	2	Diode	–
L15	KES 1	2	Diode	–
L16	X	2	Outrigger selector valve assembly	g-1
L18	X	2	Parking brake air pressure switch	d-5
L19	X	2	Steering mode selector solenoid	d-5
L20	X	2	Steering mode selector solenoid	d-4
L21	KES 1	2	Diode	–
L22	KES 1	2	Diode	–
L23	X	2	Rear wheel steering solenoid	d-4
L24	KES 1	2	Diode	–
L25	X	2	Reverse steering compensation solenoid	d-5
L26	KES 1	2	Diode	–
L27	X	2	Suspension lock front solenoid	j-9

Connector No.	Type	No. of pins	Mounting location	Address
L28	KES 1	2	Diode	–
L29	X	2	Suspension lock rear solenoid	j-9
L30	KES 1	2	Diode	–
L31	X	2	Suspension lift solenoid	d-4
L32	KES 1	2	Diode	–
L33	X	4	Outrigger RL	k-9
L34	X	2	Outrigger individual solenoid	k-9
L36	X	4	Outrigger RR	o-7
L37	X	2	Outrigger individual solenoid	o-7
L39	X	4	Outrigger FR	g-1
L40	X	2	Outrigger individual solenoid	f-2
L42	X	4	Outrigger FL	d-3
L43	X	2	Outrigger individual solenoid	e-3
L45	S(White)	12	Intermediate connector	–
L46	CN	4	Front combination lamp assembly	d-4
L48	M	3	Passing beam, travel beam	d-3
L49	M	3	Passing beam, travel beam	f-2
L51	CN	4	Front combination lamp assembly (left)	g-2
L52	M	6	Rear combination lamp (left)	o-7
L53	1-pin connector	1	License lamp	n-8
L54	1-pin connector	1	Back-up buzzer	n-8
L55	M	6	Rear combination lamp (right)	m-9
L57	X	2	Exhaust brake air solenoid	–
L58	KES 1	2	Diode	–
L59	X	2	Sub engine control solenoid	i-8
L60	KES 1	2	Diode	–
L61	Terminal	–	GND	–
L62	KES 1	2	Diode	–
L63	Terminal		Battery relay	o-5
L64	Terminal		Battery relay	o-5
L65	Terminal		Emergency relay	d-3

023S02

023S02



TKL00399

METHOD OF USING JUDGEMENT TABLE

This judgement table is a tool to determine if the problem with the machine is caused by an abnormality in the electrical system or by an abnormality in the hydraulic or mechanical system. The symptoms are then used to decide which troubleshooting
table (E-O O, H-O O, etc.) matches the symptoms. The judgement table is designed so that it is easy to determine from the self-diagnostic display which troubleshooting table to go to.

★ The abnormality display (warning) given by the monitor panel leads directly to troubleshooting of the machine monitor (M-O O). (See troubleshooting of the machine monitor system)

[Method of using judgement table]

- A ○ mark is put at the places where the failure mode and self-diagnostic display match, so check if there is an error code shown on the graphic display of the monitor panel.
  - If an error code is displayed, go to the troubleshooting code at the bottom of the judgement table (EU-○○).
  - If there is a problem but no error code is displayed, go to the troubleshooting code at the right side of the judgement table (H-○○).
  - For failure modes where there is no ○ mark, go directly to the troubleshooting code at the right side.

19ME02

S-9 Oil becomes contaminated quickly

General causes why oil becomes contaminated quickly

- Intake of exhaust gas due to internal wear
- Clogging of lubrication passage
- Improper fuel
- Improper oil used
- Operation under excessive load

			Causes: Worn piston ring, cylinder liner	Clogged breather, breather hose	Clogged oil filter	Worn valve, valve guide	Clogged oil cooler	Clogged turbocharger drain pipe	Defective seal at turbocharger turbine end	Defective oil filter safety valve	Exhaust smoke is black
Questions	Confirm recent repair history										
	Degree of use of machine	Operated for long period	△			△			△		
	Engine oil must be added more frequently		◎								
	Non-specified oil is being used				○						
Check items	Color of exhaust gas	Blue under light load	◎								
		Black									◎
	Amount of blow-by gas is excessive		◎			○		○	○		
	Area around engine is dirty with oil			○							
	When oil filter is inspected, metal particles are found		○		◎	○					
	When exhaust pipe is removed, inside is found to be dirty with oil					◎					
	Engine oil temperature rises quickly						◎				
Troubleshooting	When compression pressure is measured, it is found to be low		●			●					
	When breather element is inspected directly, hose is found to be clogged with dirt or dirty oil			●							
	When oil filter is inspected directly, it is found to be clogged				●						
	When oil cooler is inspected directly, it is found to be clogged						●				
	Turbocharger drain tube is clogged							●			
	Excessive play of turbocharger shaft								●		
	When oil filter safety valve is directly inspected, spring is found to be catching or broken									●	
		Remedy	Replace	Clean	Replace	Replace	Clean	Clean	Replace	Replace	—

Carry out troubleshooting for "Exhaust smoke is black".

023S02

ACTION OF CONTROLLER AND CONDITION OF MACHINE WHEN ABNORMALITY OCCURS

Error code	Abnormal system	Nature of abnormality
MDTU error E00	MDT system error	1) System error inside upper MDT (internal defect)
MDTU error E10	Shut off when low voltage	1) Drop in battery voltage
MDTU error E11	Shut off when high temperature	1) Rise in temperature inside upper MDT
MDTU error E20	Top, bottom don't match (application stopped)	1) Defective contact or disconnection in wiring harness between C04 (female) (8) – CR3 (14),(13) – R03 (1),(2) – (slip ring) – L03 (1),(2) 2) Contact of C04 (female) (18) with GND 3) Defective contact or disconnection in wiring harness between M03 (female) (18) and connecting point of M02 (11),(21) and LM04 (male) (13), LM03 (female) (10) 4) Contact of M03 (female) (8) with GND 5) Defective upper MDT 6) Defective lower MDT (If problem occurs when starting)
MDTU error E21	Top, bottom selection warning	1) Defective contact or disconnection in wiring harness between C04 (female) (8) – CR3 (14),(13) – R03 (1),(2) – (slip ring) – L03 (1),(2) 2) Contact of C04 (female) (18) with GND 3) Defective contact or disconnection in wiring harness between M03 (female) (18) and connecting point of M02 (11),(21) and LM04 (male) (13), LM03 (female) (10) 4) Contact of M03 (female) (8) with GND 5) Defective upper MDT 6) Defective lower MDT (If problem occurs after starting)
MDTU error E24	Model doesn't match (application stopped)	1) Defective contact or disconnection in wiring harness between C04 (female) (9),(10) – C02 (11),(21) – CR3 (14),(13) – R03 (1),(2) – (slip ring) – L03 (1),(2) and connecting point of L03 (male) (1),(2) and LM04 (female) (10), LM03 (male) (10) 2) Contact of C04 (female) (19),(20) with GND 3) Defective contact or disconnection in wiring harness between M03 (female) (9),(10) and connecting point of M02 (11),(21) and LM04 (male) (13), LM03 (female) (10) 4) Contact of M03 (female) (19),(20) with GND 5) Defective upper MDT 6) Defective lower MDT (If problem occurs when starting)

023S02

★ Troubleshooting codes E-107 and 108 are for the free-fall system (does not switch to free-fall or remains in free-fall condition).
★ Troubleshooting codes E-2 – 4 are for the engine starting system.

Self-diagnostic display(abnormality display)																																		Troubleshooting code when there is no abnormality display
Winch rotation buzzer (auxiliary winch) short circuited with ground	Monitor central buzzer short circuited with ground	Tachometer signal output short circuited	Speedometer signal output short circuited	Fuel level signal output short circuited	Engine water temperature signal output short circuited	Torque converter oil temperature signal output short circuited	Engine oil pressure signal output short circuited	Preheating pilot signal output short circuited	Parking brake lamp output short circuited	Option (Retarder lamp output short circuited)	Hi beam pilot output short circuited with ground	Hourmeter output short circuited with ground	Charge lamp output short circuited with ground	Brake fluid level output short circuited with ground	Right turn pilot output short circuited with ground	Left turn pilot output short circuited with ground	LED dimmer 1 short circuited with ground	LED dimmer 1 short circuited with power source	LED dimmer 2 short circuited with ground	LED dimmer 2 short circuited with power source	Swing flasher output short circuited with power source	Outrigger mode power source short circuited with power source	Disconnection in outrigger mode power source	PTO mode doesn't match	Abnormality in 2WD Hi/4WD Hi/4WD Lo input	Abnormality in service brake input	Abnormality in suspension lift switch	Abnormality in outrigger control switch	Outrigger EXTEND + RETRACT input simultaneously, JACK + SLIDE input simultaneously	Abnormality in steering mode switch input	Rear steering LOCK + FREE command input simultaneously	
MDTU errors																																		
E 4E	E 4F	E 50	E 51	E 52	E 53	E 55	E 56	E 57	E 58	E 59	E 5A	E 5B	E 5C	E 5D	E 5E	E 5F	E 72	E 73	E 74	E 75	E 80	E 83	E B3	E E0	E E1	E E3	E E4	E E5	E E6	E EA	E EC			
																																		E-1,5,EM-101,102,104,H-1
																																		H-2
																																		EM-106-1,EM-131, H-3
																																		EM106,131, H-4
																																		H-5
																																		H-6
																																		EM-103,109 – 124, H-7
																						○							○	○				EM-201 – 224, H-8
																																		H-9
																																		H-101
																																		H-102
																																		E-6, H-103
																																		H-104
																																		H-105
																																		H-106
																																		H-107
																																		H-108
																									○									H-109
																															○			H-110
																																		H-111
																																		H-112
																																		E-7, H-113
																																		E-8, H-114
																											○							H-115
○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○		○					○					○			E9 – 27,EM125 – 128,139 – 140
EU	EU	EU	EU	EU	EU	EU	EU	EU	EU	EU	EU	EU	EU	EU	EU	EU	EU	EU	EU	EU	EU	EU	EU	EU	EU	EU	EU	EU	EU	EU	EU			
-24	-25	-26	-27	-28	-29	-30	-31	-32	-33	-34	-35	-36	-37	-38	-39	-40	-41	-42	-43	-44	-16	-47	-48	-49	-50	-51	-52	-53	-54	-55	-56			

In positions other than Operation 1, it is possible to operate the outriggers using the bottom outrigger panel. Even when the outriggers are extended, the over-rear stability stop is carried out during operations.

Travel possible in 4WD Hi
Possible to carry out travel and operations in Operation 1 (however, the outrigger does not move)

023S02

EU-3 MDTU error E11 (Shut off when high temperature) is displayed

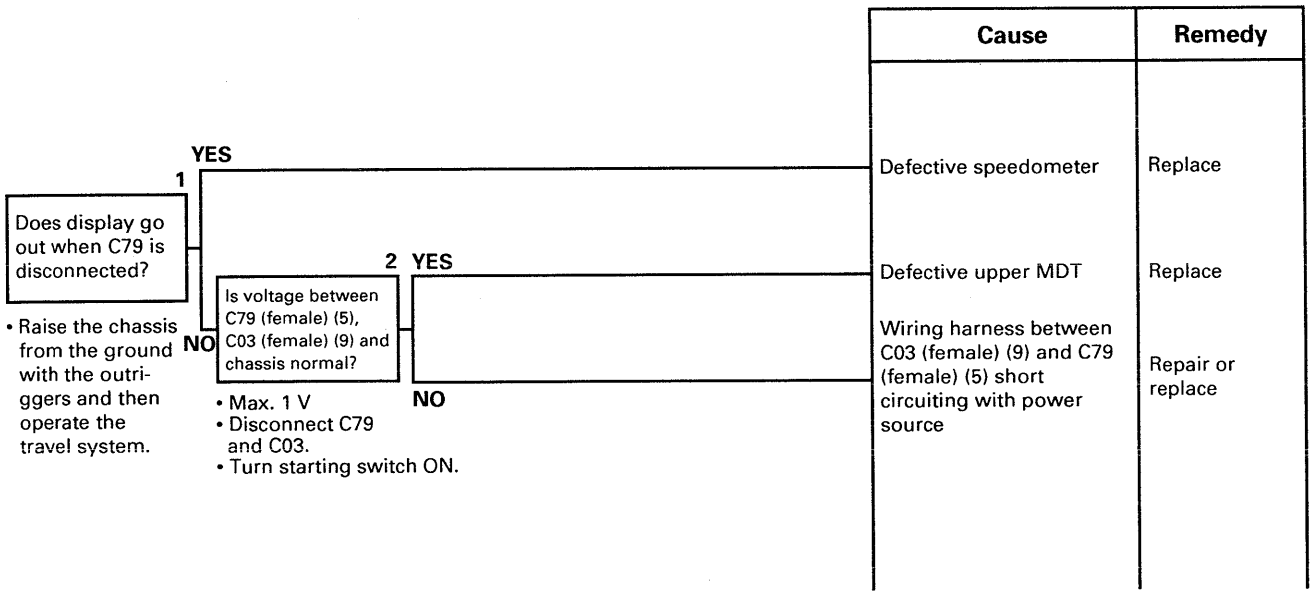
★ Troubleshooting is carried out while the abnormality is being generated, so when the connector is disconnected and the T-adapter is inserted, or when the T-adapter is removed and the connector is connected again to its original position, if the error code is not displayed on the monitor, the system has been reset.
★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
★ Always connect any disconnected connectors before going on to the next step.

Cause	Remedy
Overheat inside upper MDT	Stopoperations (wait for temperature inside lower MDT to go down)

023S02

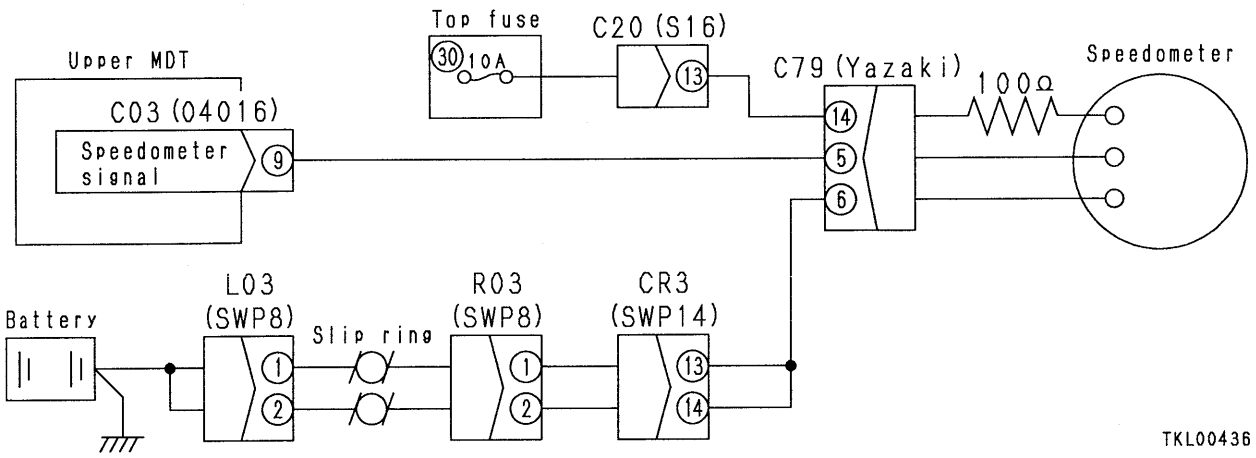
EU-27 MDTU error E51 (Speedometer signal output system short circuited) is displayed

★ 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.

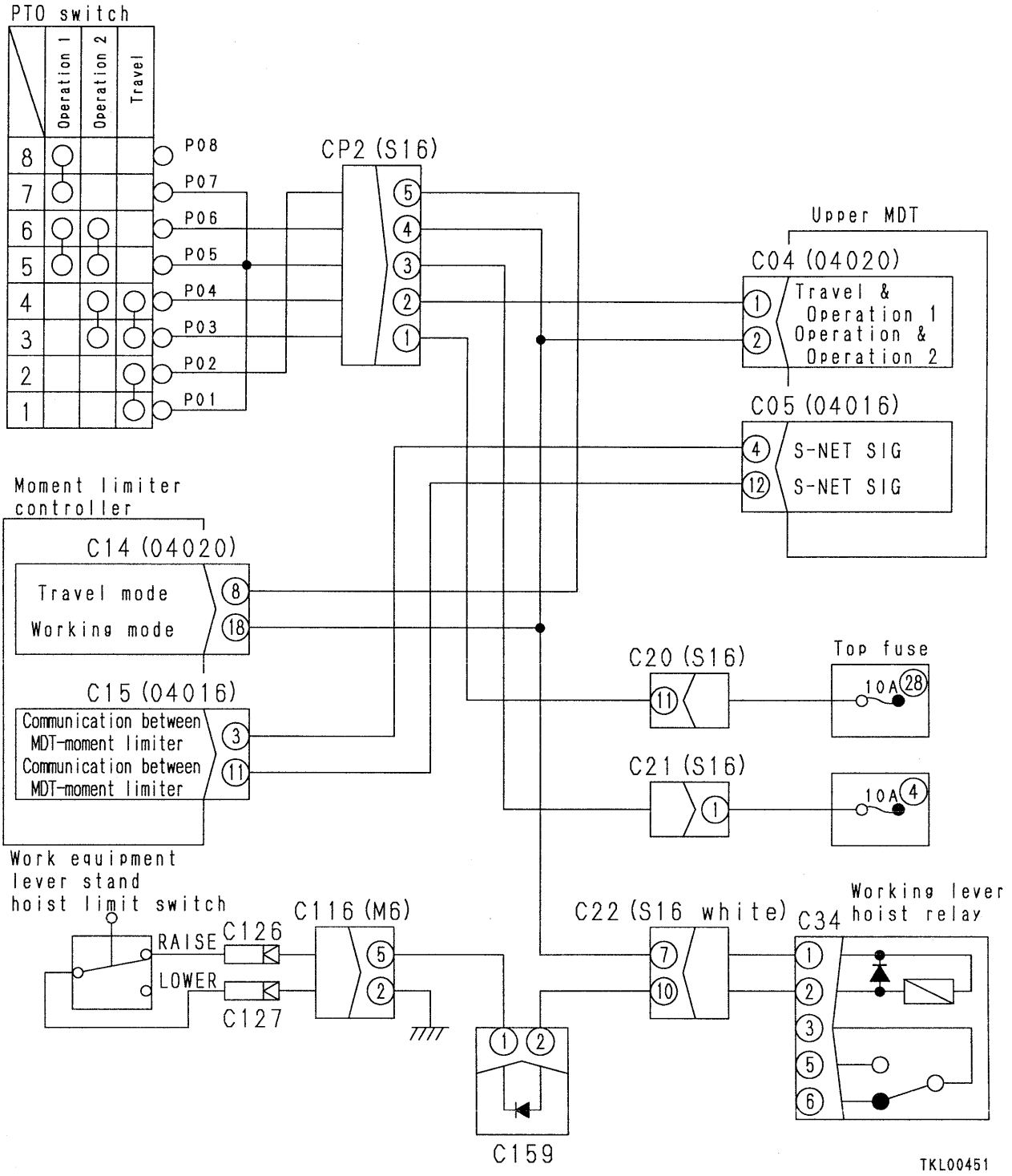


023S02

EU-27 Related electric circuit diagram



EU-49 Related electric circuit diagram



023S02

Displayed code	Abnormal system and detail of abnormality	Problem on machine	Trouble-shooting code
MDTL error EB4	Disconnection in outrigger slide RL	Top outrigger cannot be operated (in some cases, bottom outrigger also cannot be operated)	EL- 88
MDTL error EB5	Disconnection in outrigger slide FL	Top outrigger cannot be operated (in some cases, bottom outrigger also cannot be operated)	EL- 89
MDTL error EB6	Disconnection in outrigger slide RR	Top outrigger cannot be operated (in some cases, bottom outrigger also cannot be operated)	EL- 90
MDTL error EB7	Disconnection in outrigger slide FR	Top outrigger cannot be operated (in some cases, bottom outrigger also cannot be operated)	EL- 91
MDTL error EB8	Disconnection in outrigger selector EXTEND	Top outrigger cannot be operated (in some cases, bottom outrigger also cannot be operated)	EL- 92
MDTL error EB9	Disconnection in outrigger selector RETRACT	Top outrigger cannot be operated (in some cases, bottom outrigger also cannot be operated)	EL- 93
MDTL error EBA	Disconnection in rear steering LOCK solenoid	Impossible to set rear steering to LOCK (when at LOCK, impossible to rear steering to FREE)	EL- 94
MDTL error EBB	Disconnection in rear steering FREE solenoid	Impossible to set rear steering to FREE	EL- 95
MDTL error EBC	Disconnection in service brake	Impossible to operate auxiliary brake	EL- 96
MDTL error EBD	Disconnection in exhaust brake	Impossible to operate exhaust brake	EL- 97
MDTL error EBF	Disconnection in preheating	Impossible to operate preheating	EL- 98
MDTL error ECA	Disconnection in head lamp Hi relay	Impossible to operate Hi beam	EL- 99
MDTL error ECB	Disconnection in head lamp Lo relay	Impossible to operate Lo beam	EL-100
MDTL error ECC	Disconnection in side lamp relay	Impossible to operate side lamp	EL-101
MDTL error ECE	Disconnection in right turn relay	Impossible to operate turn signal	EL-102
MDTL error ECF	Disconnection in left turn relay	Impossible to operate turn signal	EL-103
MDTL error ED0	Disconnection in steering mode solenoid a	Rear steering set to LOCK, travel with front 2-wheel steering	EL-104
MDTL error ED1	Disconnection in steering mode solenoid c	Rear steering set to LOCK, travel with front 2-wheel steering	EL-105
MDTL error ED2	Disconnection in steering mode solenoid b	Rear steering set to LOCK, travel with front 2-wheel steering	EL-106
MDTL error ED3	Disconnection in steering mode solenoid d	Rear steering set to LOCK, travel with front 2-wheel steering	EL-107
MDTL error ED4	Disconnection in pump merge solenoid	Lack of speed when outrigger ALL switch is operated	EL-108
MDTL error ED7	Disconnection in suspension lift	Impossible to use suspension lift	EL-109
MDTL error EE7	Outrigger control signal short circuited with power source	Immediately stops travel, impossible to operate steering, actuates emergency steering	EL-110
MDTL error EE8	Outrigger control signal short circuited with ground, disconnection	Takes no particular action, impossible to detect occurrence of secondary problem	EL-111
MDTL error EE9	Disconnection in fuel sensor	Fuel level unknown	EL-112
MDTL error EEB	Abnormality in rear steering LOCK limit switch/ FREE limit switch	Rear steering set to LOCK, travel with front 2-wheel steering	EL-113
MDTL error EEE	Failure of both speedometer sensors	No speedometer display, rear steering set to LOCK, travel with front 2-wheel steering	EL-114
MDTL error EEF	MDT speedometer sensor failure	Rear steering set to LOCK, travel with front 2-wheel steering	EL-115
MDTL error EF0	Special steering failure (emergency stop mode)	Immediately stops travel	EL-116
MDTL error EF1	Reverse steering failure (emergency stop mode)	Immediately stops travel	EL-117
MDTL error EF2	Special steering failure	Immediately stops travel, rear steering set to LOCK, travel with front 2-wheel steering	EL-118
MDTL error EF3	Reverse steering failure 1	Travels with normal steering, cannot set to reverse steering	EL-119
MDTL error EF4	Reverse steering failure 2	Immediately stops travel, rear steering set to LOCK, travel with normal steering	EL-120

023S02

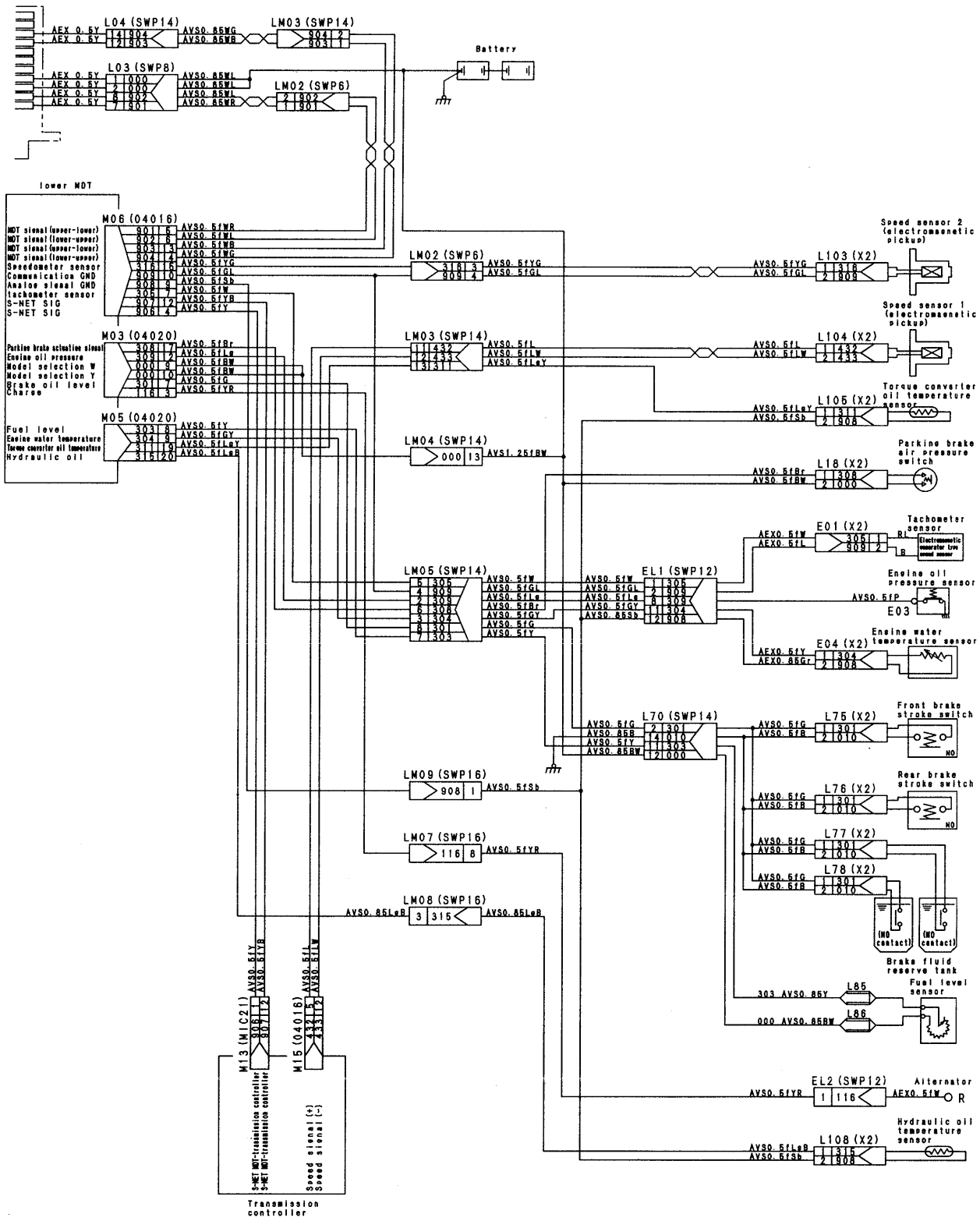
Error code	Abnormal system	Nature of abnormality
MDTL error E84	Outrigger slide RL short circuited with power source	1) Wiring harness between M01 (female) (5) – LM10 (8) – L154 (female) (1) or intermediate connecting point of L154 (female) (1) and LM10 (male) (8) – L05 (female) (2) short circuiting with power source 2) Defective bottom outrigger control panel 3) Defective lower MDT
MDTL error E85	Outrigger slide FL short circuited with power source	1) Wiring harness between M01 (female) (16) – LM10 (10) – L152 (female) (1) or intermediate connecting point of L152 (female) (1) and LM10 (male) (8) – L05 (female) (4) short circuiting with power source 2) Defective bottom outrigger control panel 3) Defective lower MDT
MDTL error E86	Outrigger slide RR short circuited with power source	1) Wiring harness between M01 (female) (7) – LM10 (12) – L153 (female) (1) or intermediate connecting point of L153 (female) (1) and LM10 (male) (12) – L05 (female) (6) short circuiting with power source 2) Defective bottom outrigger control panel 3) Defective lower MDT
MDTL error E87	Outrigger slide FR short circuited with power source	1) Wiring harness between M01 (female) (17) – LM10 (14) – L151 (female) (1) or intermediate connecting point of L151 (female) (1) and LM10 (male) (14) – L05 (female) (8) short circuiting with power source 2) Defective bottom outrigger control panel 3) Defective lower MDT
MDTL error E88	Outrigger selector EXTEND short circuited with power source	1) Wiring harness between M01 (female) (8) – M21 (2) – M37 (female) (1) short circuiting with chassis ground 2) Wiring harness between M02 (female) (7) – LM10 (5) – L16 (female) (1), between intermediate connecting point of M02 (female) (7) and LM10 (female) (5) – M21 (3) – M37 (female) (2), or between intermediate connecting point of LM10 (male) (5) and L16 (female) (1) - L05 (female) (9) short circuiting with chassis ground 3) Defective bottom outrigger control panel 4) Defective lower MDT
MDTL error E89	Outrigger selector stow (RETRACT) short circuited with power source	1) Wiring harness between M01 (female) (18) – M21 (1) – M37 (female) (3) short circuiting with chassis ground 2) Wiring harness between M02 (female) (8) – LM10 (6) – L140 (female) (1), between connecting point of M02 (female) (8) and LM10 (female) (6) – M21 (4) – M37 (female) (4), or between connecting point of LM10 (male) (6) and L140 (female) (1) – L05 (female) (10) short circuiting with chassis ground 3) Defective bottom outrigger control panel 4) Defective lower MDT

023S02

Condition when normal (voltage, current, resistance)	Action by controller when abnormality is detected	Problem that appears on machine when there is abnormality	Trouble-shooting code
See error code for same nature of abnormality.	1) Stops output to steering mode solenoids a, b, c (sets to front wheel mode) 2) Stops output to rear steering LOCK/FREE solenoid 3) Displays emergency stop mode ⚠ 4) Actuates emergency alarm buzzer, monitor central buzzer	1) Steering mode does not switch (front wheel mode) 2) Rear steering cannot be canceled 3) Rear steering LOCK cannot be operated	EL-116
See error code for same nature of abnormality.	1) Stops output to steering mode solenoid d (sets to front wheel mode) 2) Displays emergency stop mode ⚠ 3) Actuates emergency alarm buzzer, monitor central buzzer	1) Failure causes steering mode to switch from normal steering to reverse steering, and it is impossible to switch to normal steering 2) Failure causes steering mode to switch from reverse steering to normal steering	EL-117
See error code for same nature of abnormality.	1) When rear steering is set to LOCK, it prohibits release of rear steering lock and holds in front wheel mode 2) When rear steering is set to FREE, it is possible to switch steering mode, but after rear steering is set to LOCK, it prohibits release of rear steering lock and holds in front wheel mode	1) When rear steering is set to LOCK, front wheel mode is held and rear steering lock cannot be canceled. 2) When rear steering is set to FREE, it is possible to switch steering mode, but after rear steering is set to LOCK, it becomes as in 1).	EL-118
See error code for same nature of abnormality.	1) Holds normal steering mode, prohibits switching to reverse steering	1) When in normal steering mode, normal steering mode is held 2) When in reverse steering mode, switches to normal steering mode	EL-119
See error code for same nature of abnormality.	1) After switching to normal steering, it prohibits switching to reverse steering.	1) Nothing in particular (reverse steering mode)	EL-120
Voltage (between M03 (6) and chassis) • Right turn signal lever ON: 20 – 30 V intermittently • Turn signal indicator lever OFF: Max. 1 V	1) Does not take any particular action	1) Right turn signal lamp cannot be operated or right turn signal lamp remains actuated.	EL-121

023S02

023S02

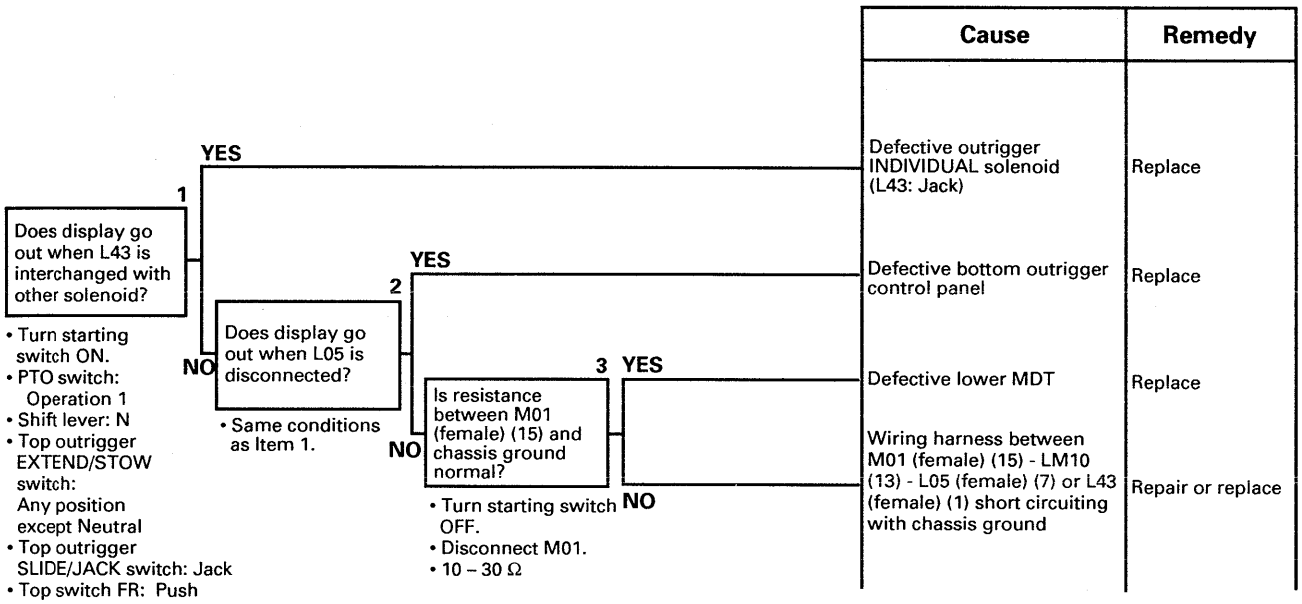


TKL00416

EL-25 MDTL error E43 (Outrigger jack FR short circuited with ground) is displayed

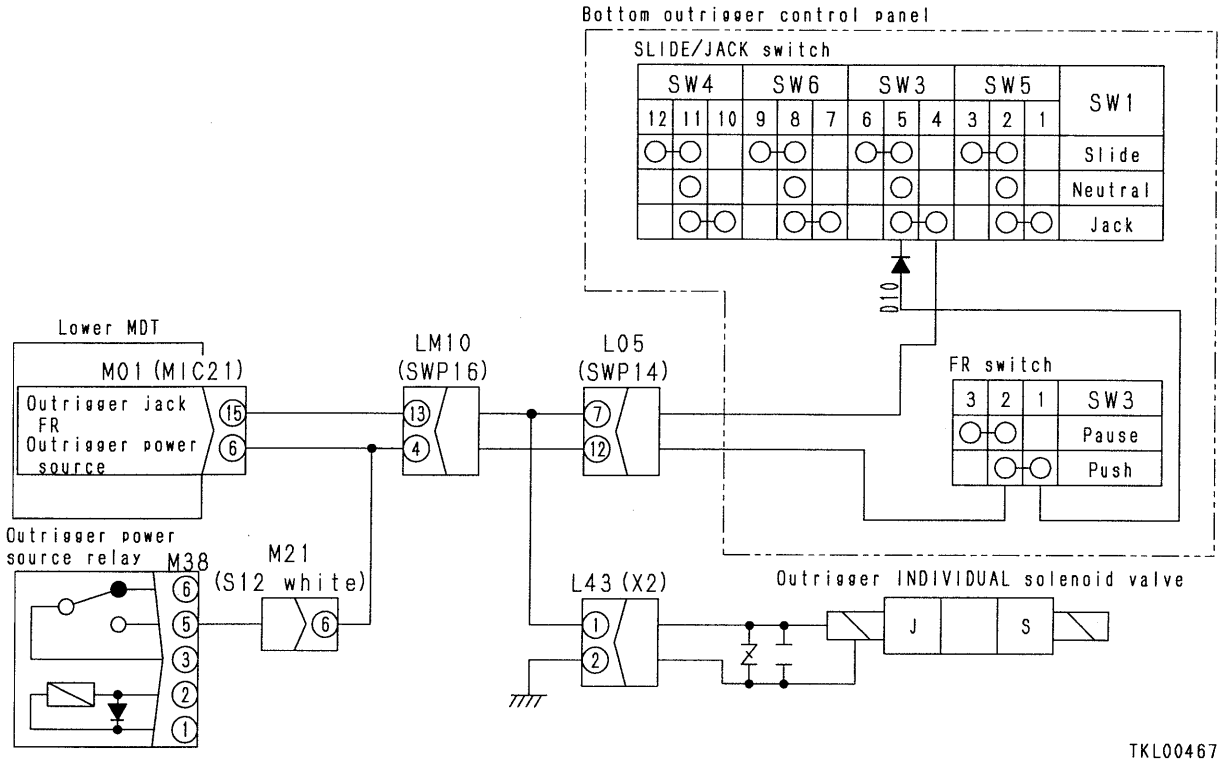
X-shaped outrigger specification

★ 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.



023S02

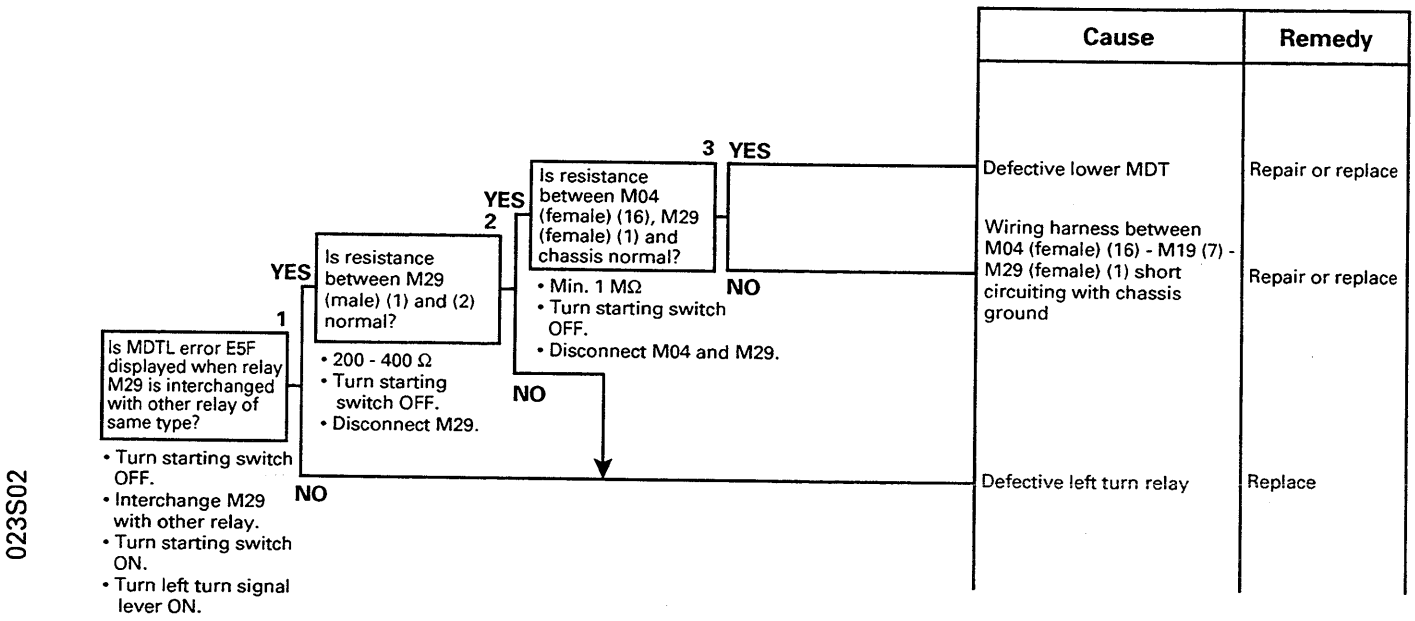
EL-25 Related electric circuit diagram (X-shaped outrigger)



TKL00467

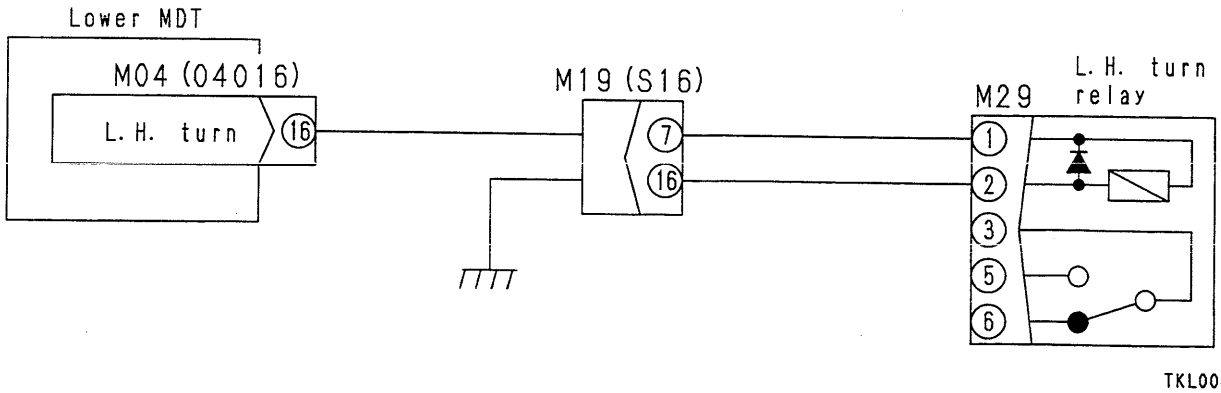
EL-48 MDTL error E5F (Left turn relay short circuited with ground) is displayed

★ Troubleshooting is carried out while the abnormality is being generated, so when the connector is disconnected and the T-adapter is inserted, or when the T-adapter is removed and the connector is connected again to its original position, if the error code is not displayed on the monitor, 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 to the next step.



023S02

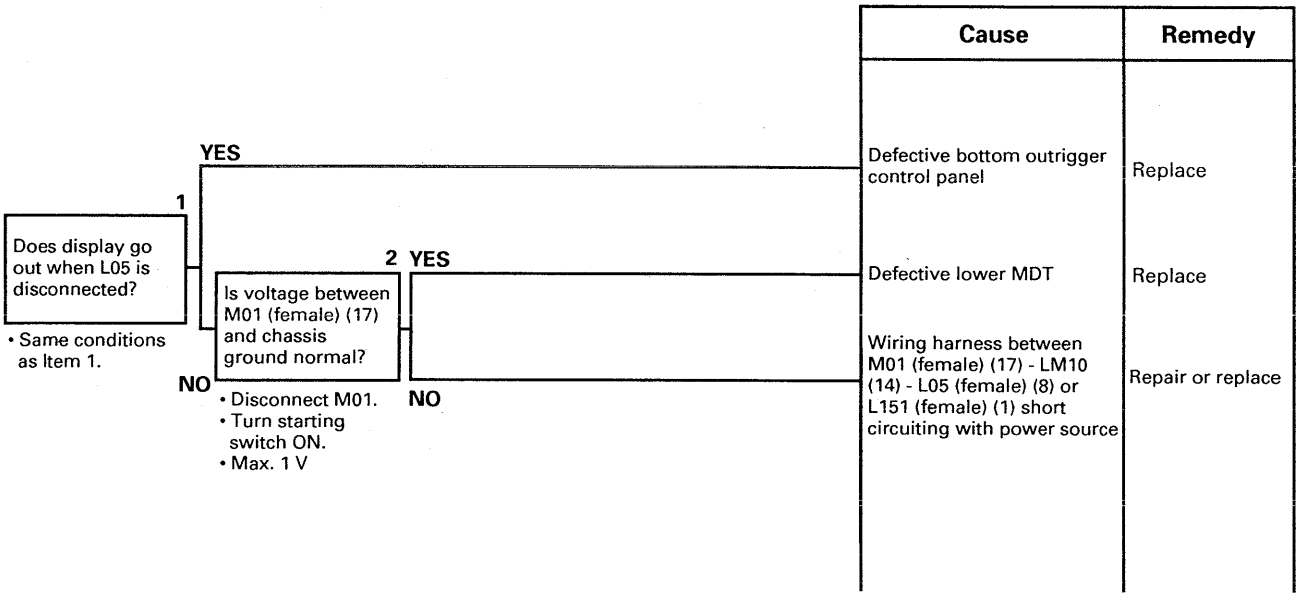
EL-48 Related electric circuit diagram



TKL00484

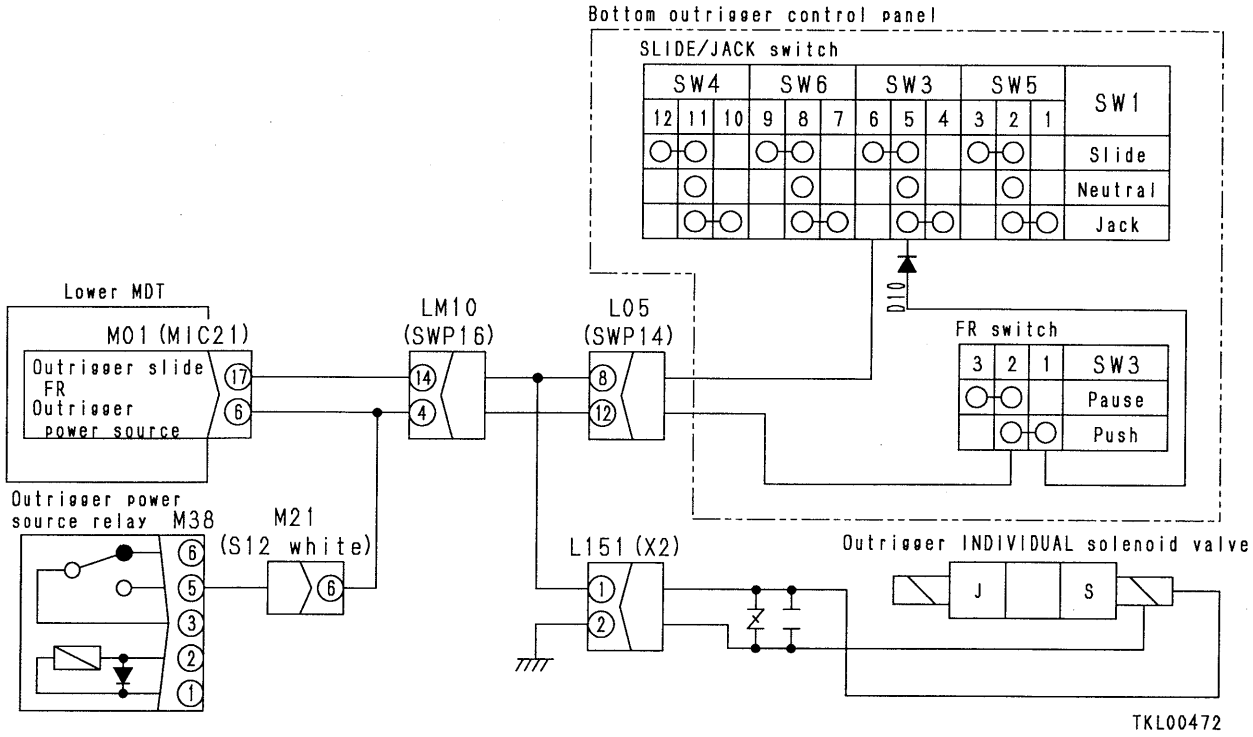
EL-64 MDTL error E87 (Outrigger slide FR short circuited with power source) is displayed

★ 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.



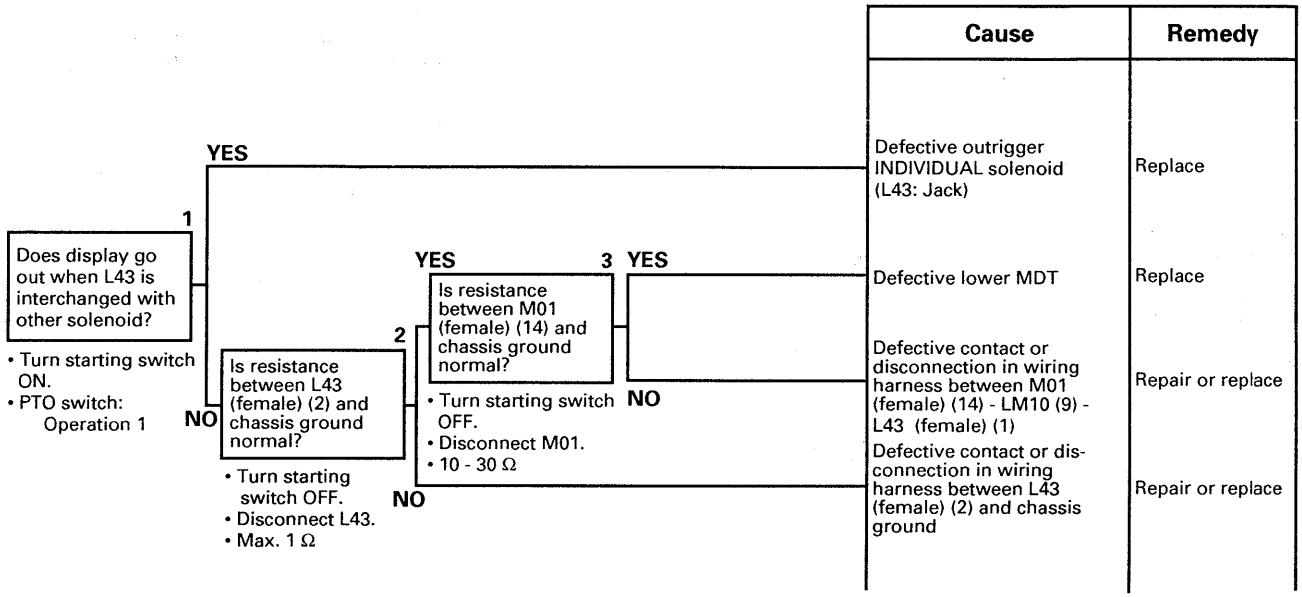
023S02

EL-64 Related electric circuit diagram



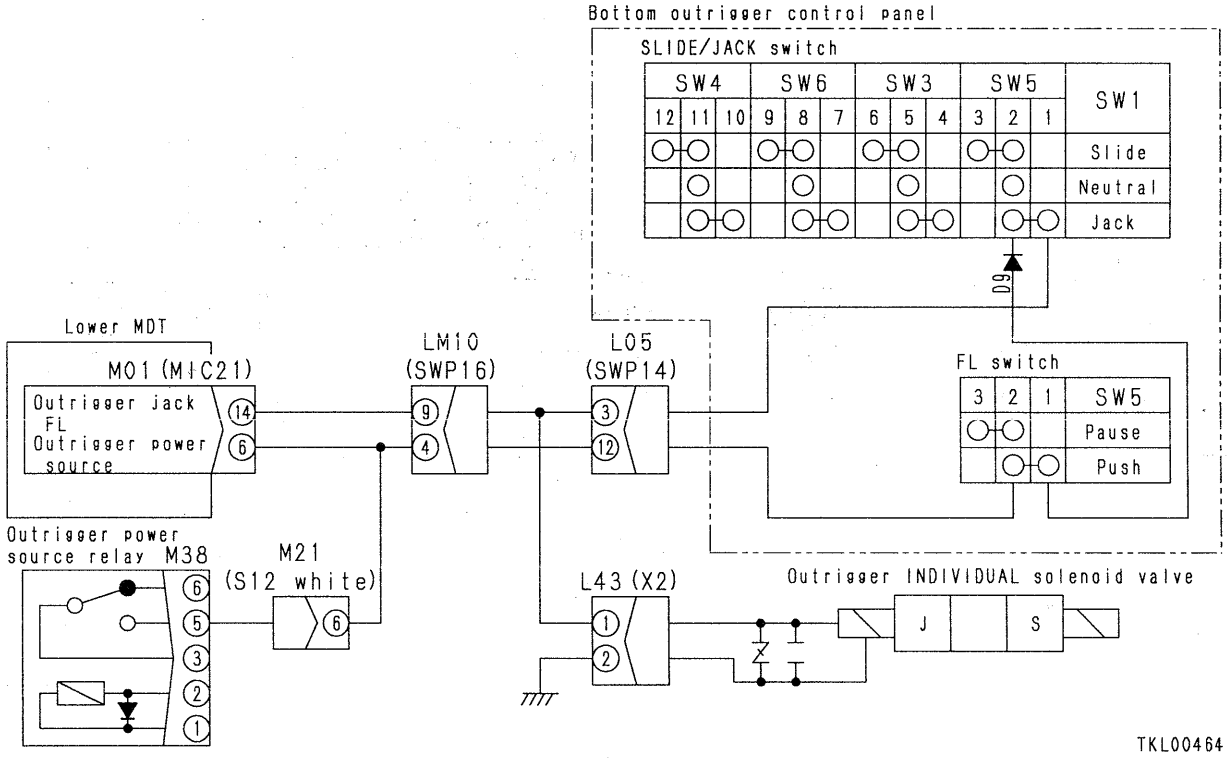
H-shaped outrigger specification

★ 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.



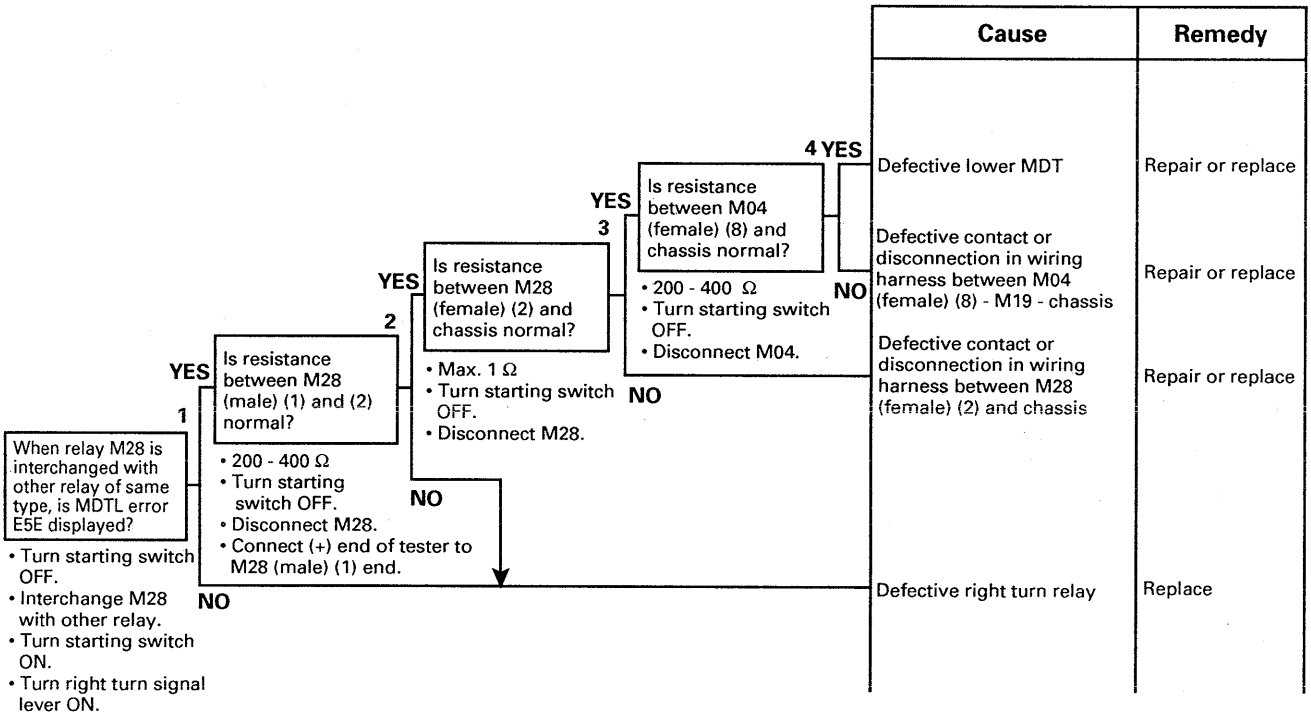
023S02

EL-85 Related electric circuit diagram (H-shaped outrigger)



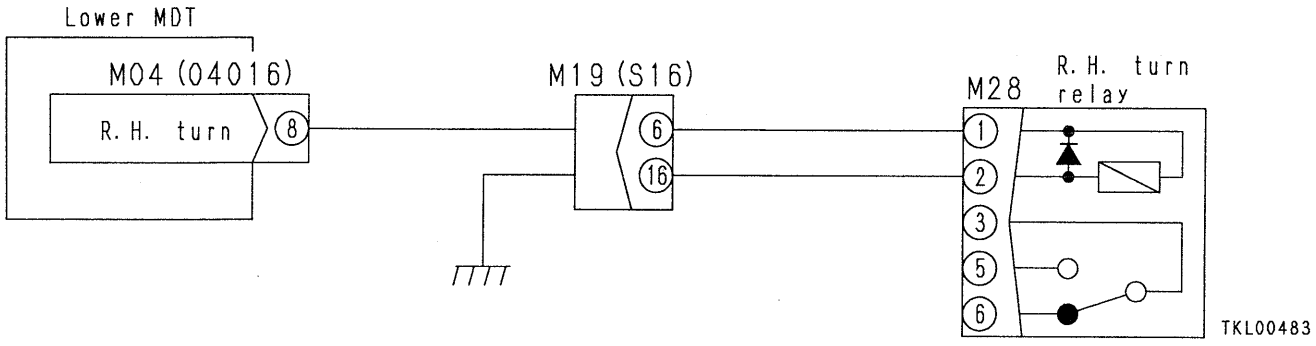
EL-102 MDTL error ECE (Disconnection in right turn relay) is displayed

★ Troubleshooting is carried out while the abnormality is being generated, so when the connector is disconnected and the T-adapter is inserted, or when the T-adapter is removed and the connector is connected again to its original position, if the error code is not displayed on the monitor, 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 to the next step.



023S02

EL-102 Related electric circuit diagram

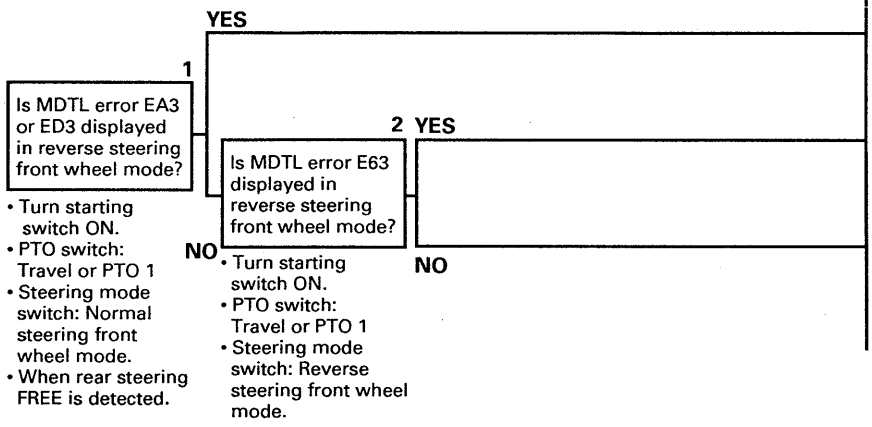


EL-119 MDTL error EF3 (Reverse steering failure 1, normal steering held) is displayed

★ Troubleshooting is carried out while the abnormality is being generated, so when the connector is disconnected and the T-adapter is inserted, or when the T-adapter is removed and the connector is connected again to its original position, if the error code is not displayed on the monitor, the system has been reset.

★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.

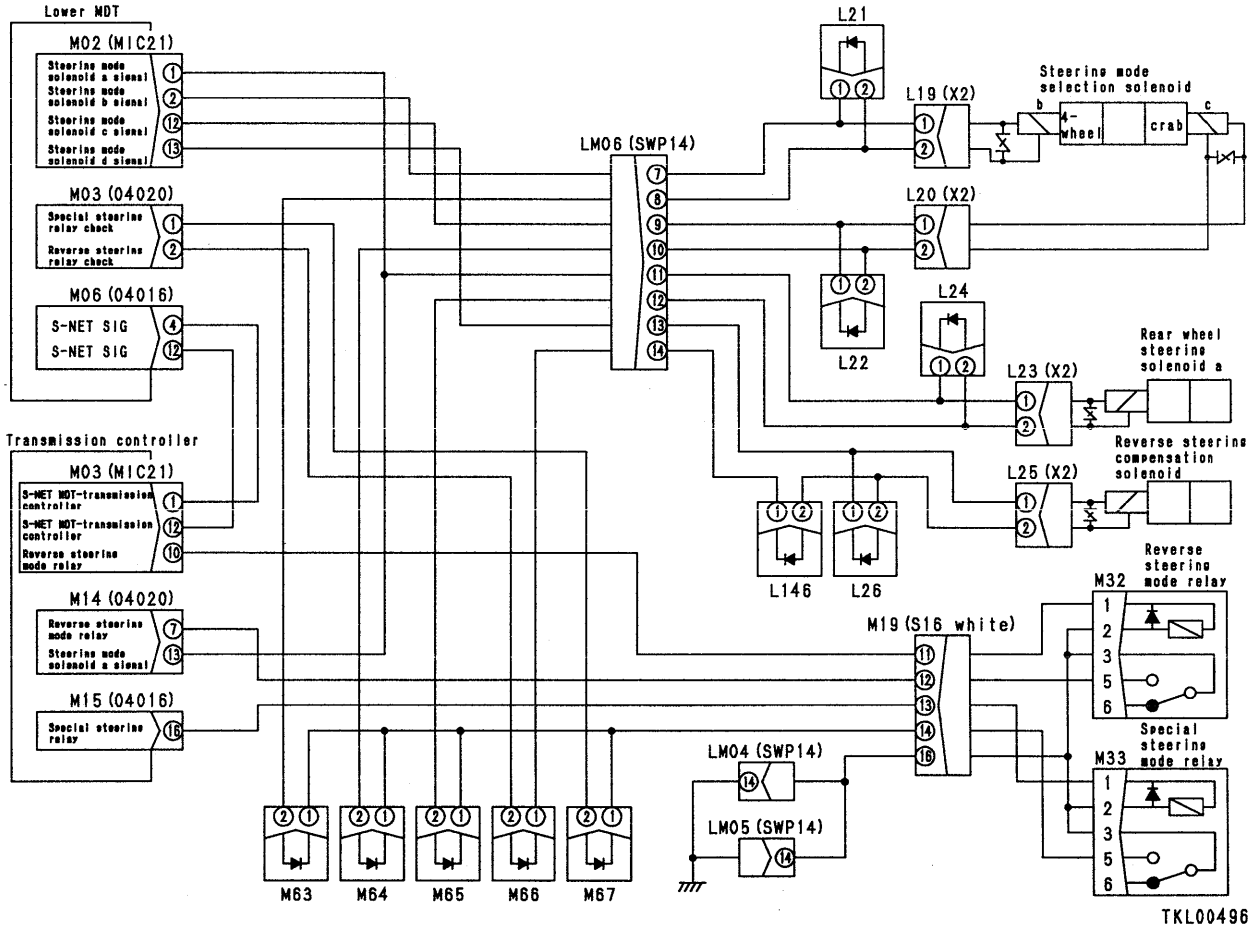
★ Always connect any disconnected connectors before going on to the next step.



Cause	Remedy
Go to troubleshooting for applicable error code	—
Go to troubleshooting for applicable error code	—
Go to troubleshooting for ATM error [E5C, E5D, E7B, E8B]	—

023S02

EL-119 Related electric circuit diagram



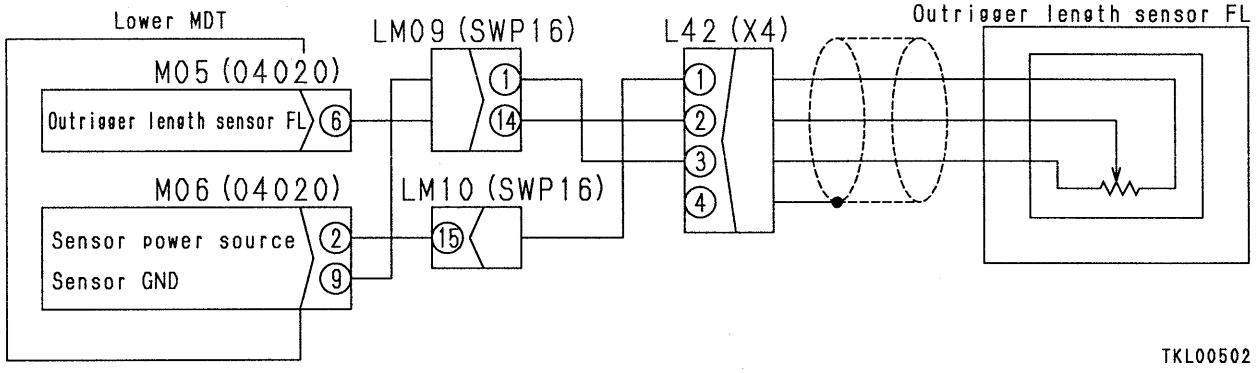
Action by controller when abnormality is detected							Problem that appears on machine when there is abnormality	PTO code	Working mode	Trouble-shooting code
Content	Buzzer	Red lamp	Motion cut	Error re-corded	Emer-gency stop display	Latch				
Output OFF	○	×	×	○	×	○	Work equipment does not move (except swing)	Working mode		EM-18
	○	×	×	○	×	×	Work equipment does not move (except swing)	Working mode		EM-43
	○	○	×	○	○	○	Does not carry out automatic stop	Working mode		EM-34
Output OFF	○	×	×	○	×	○	Automatic stop cancel prohibition impossible	Working mode		EM-21
	○	×	×	○	×	○	Automatic stop cancel prohibition impossible	Working mode		EM-46
	×	×	×	○	×	×	Automatic stop cancel impossible	Working mode		EM-37
Output OFF	○	×	×	○	×	○	No. 2 cylinder does not telescope	Working mode		EM-20
	○	×	×	○	×	×	No. 2 cylinder does not telescope	Working mode		EM-45

023S02

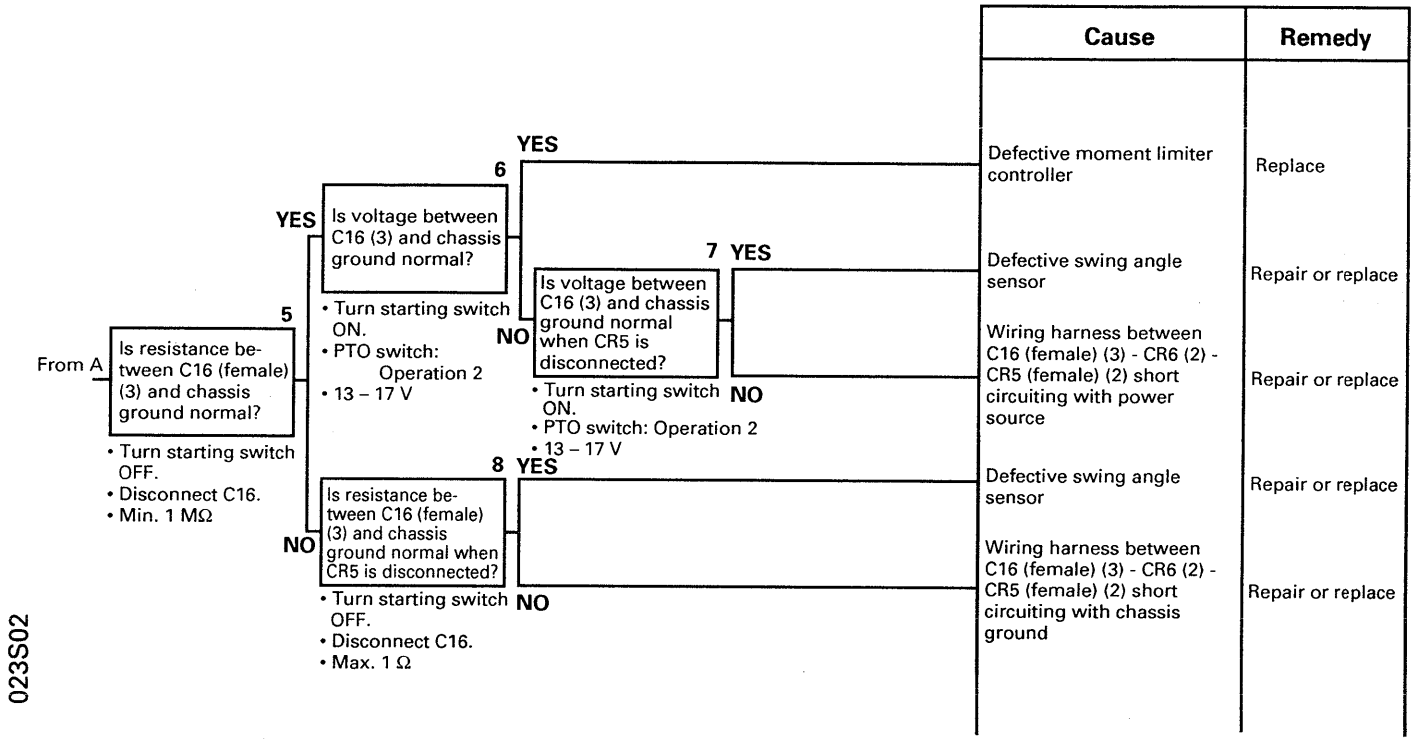
No.	Abnormal system	Error code	Nature of abnormality	Condition when abnormal	Condition when normal
107	Sensor input	OSS error E45	1) Defective hoist cylinder head pressure sensor 2) Defective contact or disconnection in wiring harness between C16 (female) (20) – CR6 (8) – R37 (female) (1) 3) Defective contact or disconnection in wiring harness between C16 (female) (2) – CR6 (10) – R37 (female) (3) 4) Defective contact or disconnection in wiring harness between C16 (female) (18) – CR6 (9) – R37 (female) (2) 5) Defective contact or disconnection in wiring harness between C12 (8),(18) and chassis 6) Wiring harness between C16 (female) (2) – CR6 (10) – R37 (female) (3) short circuiting with chassis ground 7) Wiring harness between C16 (female) (2) – CR6 (10) – R37 female) (3) short circuiting with power source 8) Defective moment limiter controller	Sensor 15V power source not short circuited with ground and input voltage within error detection range	Voltage (between C16 (2) and (20)) • When engine is started and boom hoist cylinder head pressure is detected: 0.7 – 5.3 V Starting switch at ON: Max. 1 V
108		OSS error E44	1) Defective hoist cylinder bottom pressure sensor 2) Defective contact or disconnection in wiring harness between C16 (female) (20) – CR6 (5) – R36 (female) (1) 3) Defective contact or disconnection in wiring harness between C16 (female) (12) – CR6 (7) – R36 (female) (3) 4) Defective contact or disconnection in wiring harness between C16 (female) (8) – CR6 (6) – R36 (female) (2) 5) Defective contact or disconnection in wiring harness between C12 (8),(18) and chassis 6) Wiring harness between C16 (female) (12) – CR6 (7) – R36 (female) (3) short circuiting with chassis ground 7) Wiring harness between C16 (female) (12) – CR6 (7) – R36 (female) (3) short circuiting with power source 8) Defective moment limiter controller	Sensor 15V power source not short circuited with ground and input voltage within error detection range	Voltage (between C16 (12) and (20)) • When engine is started and boom hoist cylinder bottom pressure is detected: 0.7 – 5.3 V Starting switch at ON: Max. 1 V
109		OSS error E48	1) Mistake in connection of R36 and R37 2) Defective moment limiter controller	Sensor 15V power source not short circuited with ground and no sensor error and result of calculation of axial force is negative	Sensor resistance value See STANDARD VALUE TABLE on page 20-47. Voltage (between C16 (3) and (20)) 0 – 10.5 V (see graph on page 20-52)
110		OSS error E46	1) Defective swing angle sensor 1 2) Defective contact or disconnection in wiring harness between C16 (female) (13) – CR6 (4) – CR5 (female) (4) or between C16 (female) (3) – CR6 (2) – CR5 (female) (2) 3) Wiring harness between C16 (female) (13) – CR6 (4) – CR5 (female) (4) or between C16 (female) (3) - CR6 (2) – CR5 (female) (2) short circuiting with chassis ground 4) Wiring harness between C16 (female) (13) – CR6 (4) – CR5 (female) (4) or between C16 (female) (3) - CR6 (2 – CR5 (female) (2) short circuiting with power source 5) Defective contact or disconnection in wiring harness between CR5 (female) (3) – CR6 (3) – C16 (female) (10)	Sensor 15V power source not short circuited with ground and abnormality in voltage related system	
111					
112		OSS error E43	1) Defective boom length sensor 2) Defective contact or disconnection in wiring harness between C16 (female) (1) – CR10 (6) – BR2 (3) – B14 (female) (1) 3) Defective contact or disconnection in wiring harness between C12 (8),(18) and chassis 4) Defective contact or disconnection in wiring harness between C16 (female) (10) – CR10 (8) – BR2 (5) – B14 (female) (3) 5) Defective contact or disconnection in wiring harness between C16 (female) (4) – CR10 (7) – BR2 (4) – B14 (female) (2) 6) Wiring harness between C16 (female) (4) – CR10 (7) – BR2 (4) - B14 (female) (2) short circuiting with chassis ground 7) Wiring harness between C16 (female) (4) – CR10 (7) – BR2 (4) - B14 (female) (2) short circuiting with power source 8) Defective moment limiter controller	Sensor 10V power source not short circuited with ground and input voltage within error detection range	Sensor resistance value See STANDARD VALUE TABLE on page 20-46. Voltage (between C16 (4) and (20)) See STANDARD VALUE TABLE on page 20-39

023S02

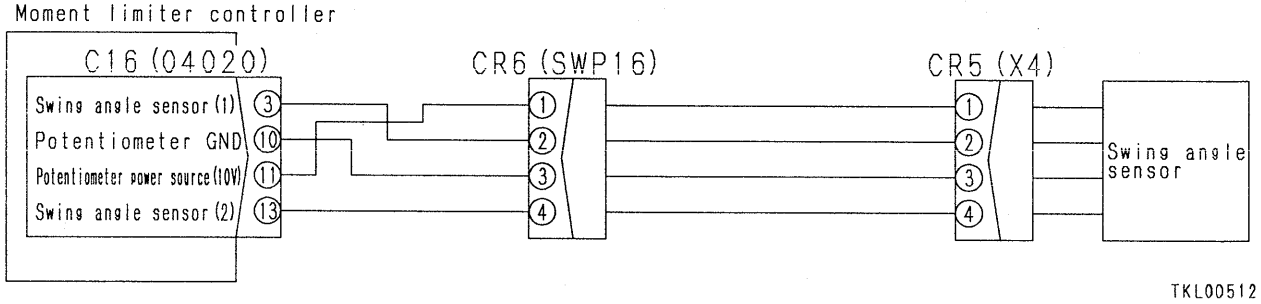
EM-6 Related electric circuit diagram



023S02

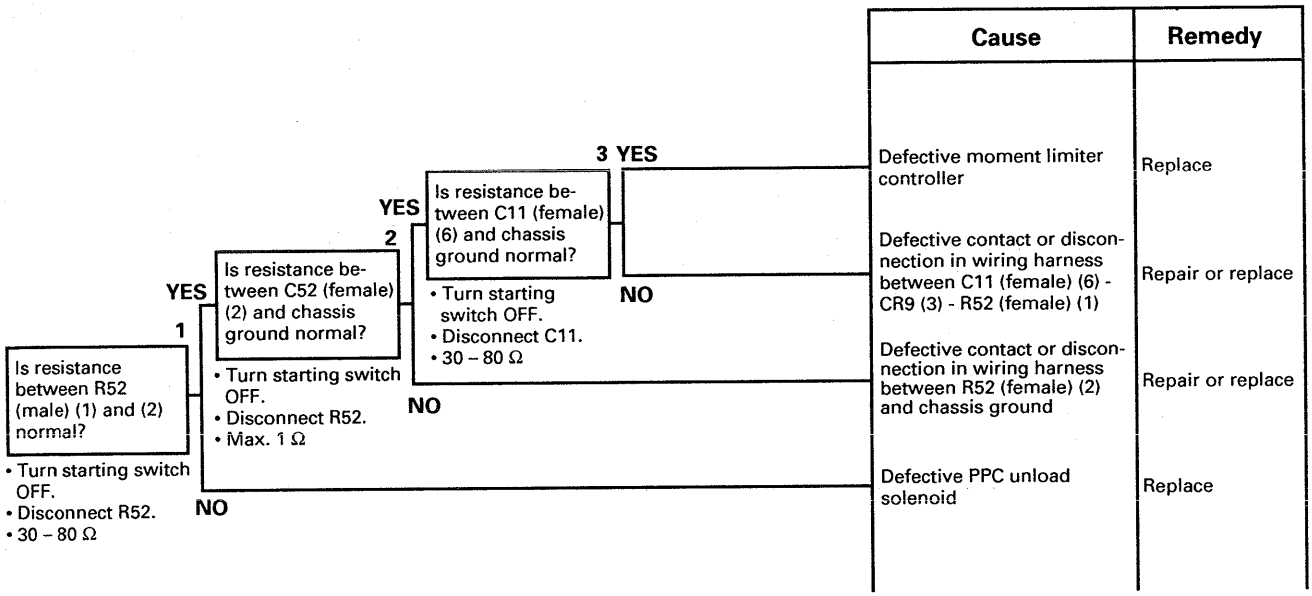


EM-16 Related electric circuit diagram



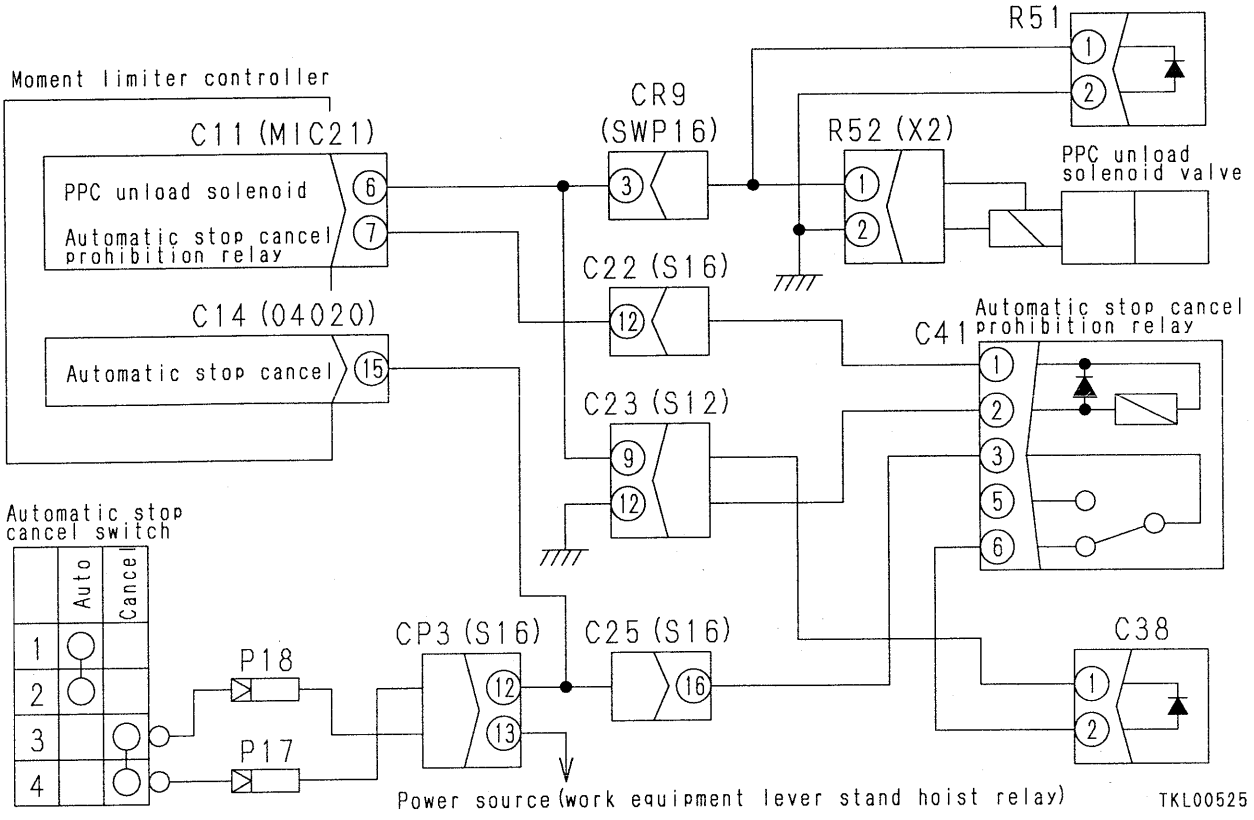
EM-44 OSS error E89 (Disconnection in PPC unload solenoid) is displayed

★ 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.

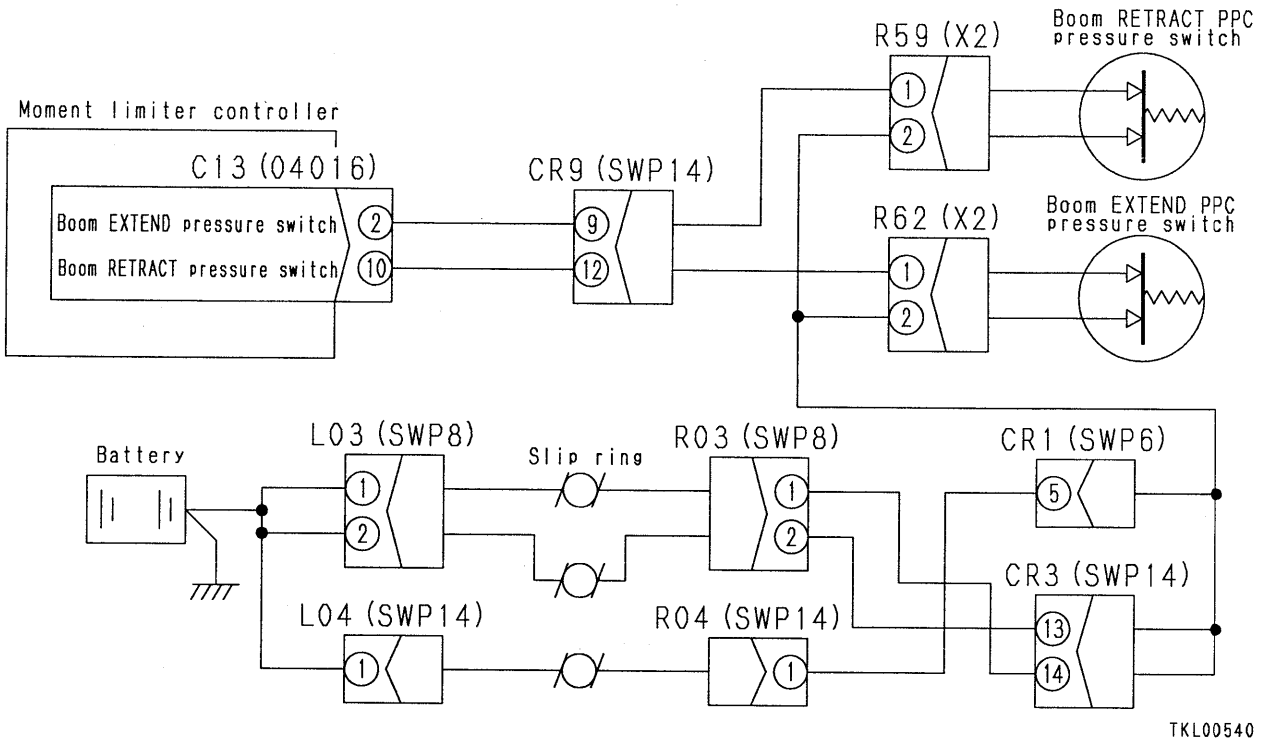


023S02

EM-44 Related electric circuit diagram



EM-62 Related electric circuit diagram

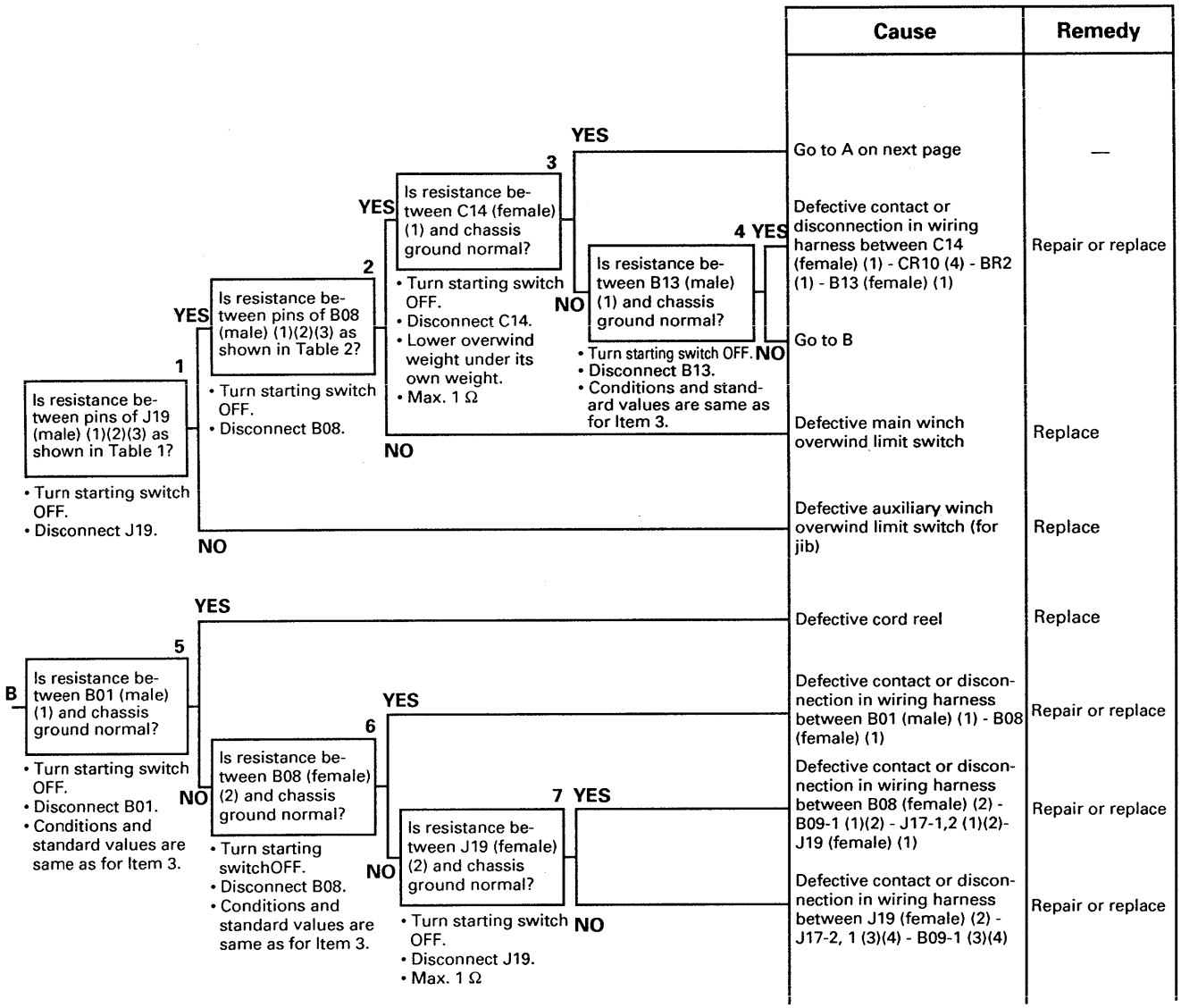


023S02

b) Jib specification machine (1st jib operations)

★ When no error code is displayed.
★ 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.

Disconnection



023S02

Table 1

J19 (male)	Auxiliary winch limit switch	Resistance value
Between (1) - (2)	Lower overwind weight under its own weight	Max. 1 Ω
Between (1) - (3)		Min. 1 MΩ
Between (1) - (2)	Lift up overwind weight by hand	Min. 1 MΩ
Between (1) - (3)		Max. 1 Ω

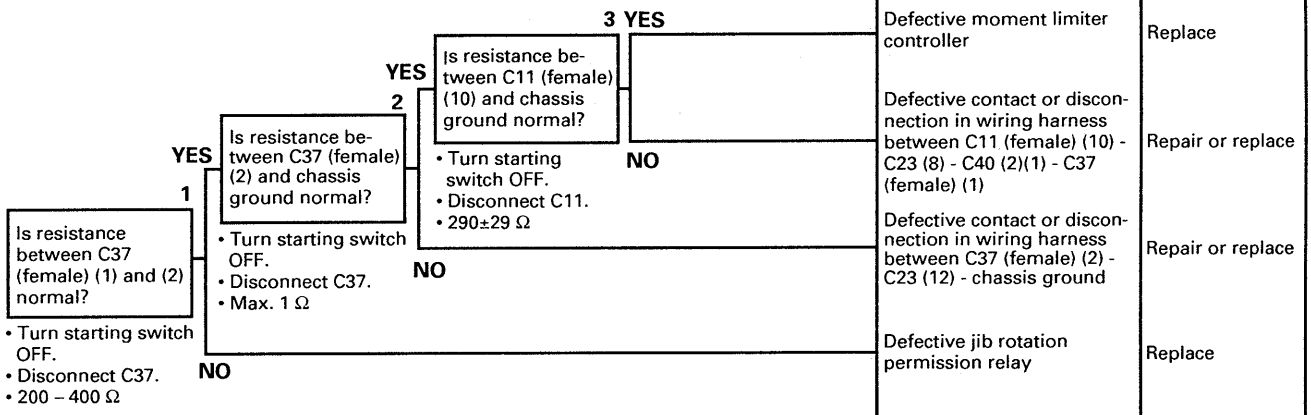
Table 2

B08 (male)	Main winch limit switch	Resistance value
Between (1) - (2)	Lower overwind weight under its own weight	Max. 1 Ω
Between (1) - (3)		Min. 1 MΩ
Between (1) - (2)	Lift up overwind weight by hand	Min. 1 MΩ
Between (1) - (3)		Max. 1 Ω

EM-113 Abnormality in jib rotation permission relay system

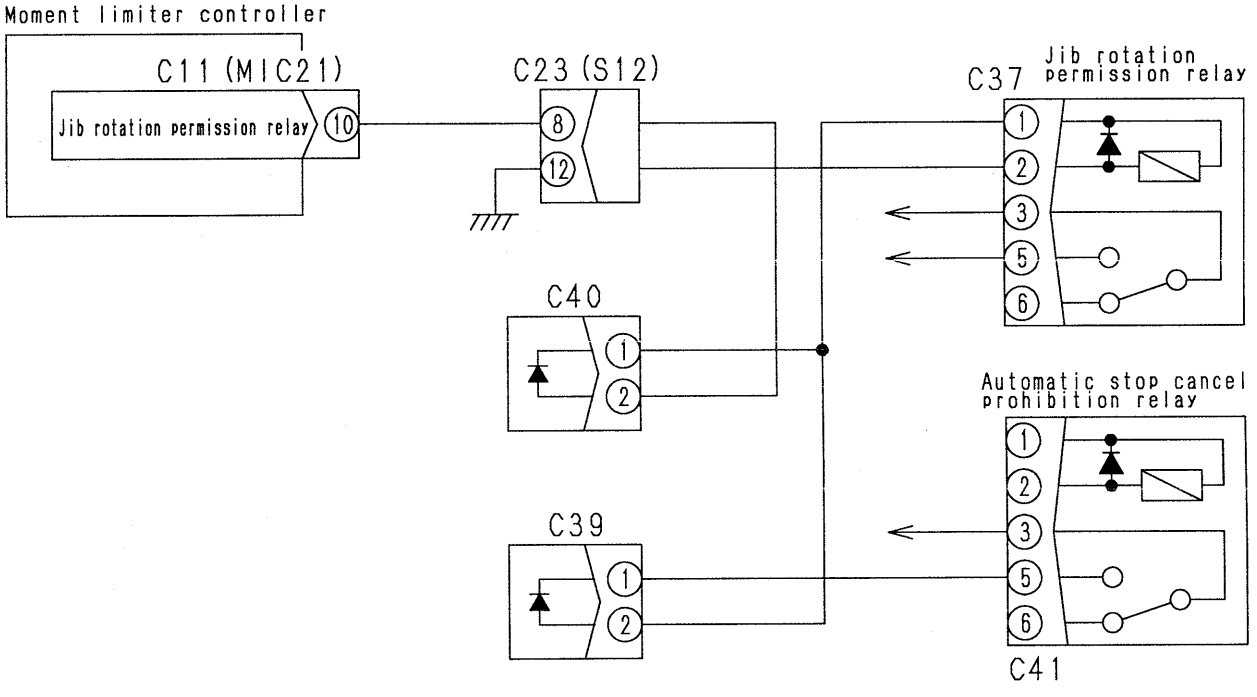
★ When no error code is displayed.
★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
★ Always connect any disconnected connectors before going on to the next step.

Disconnection



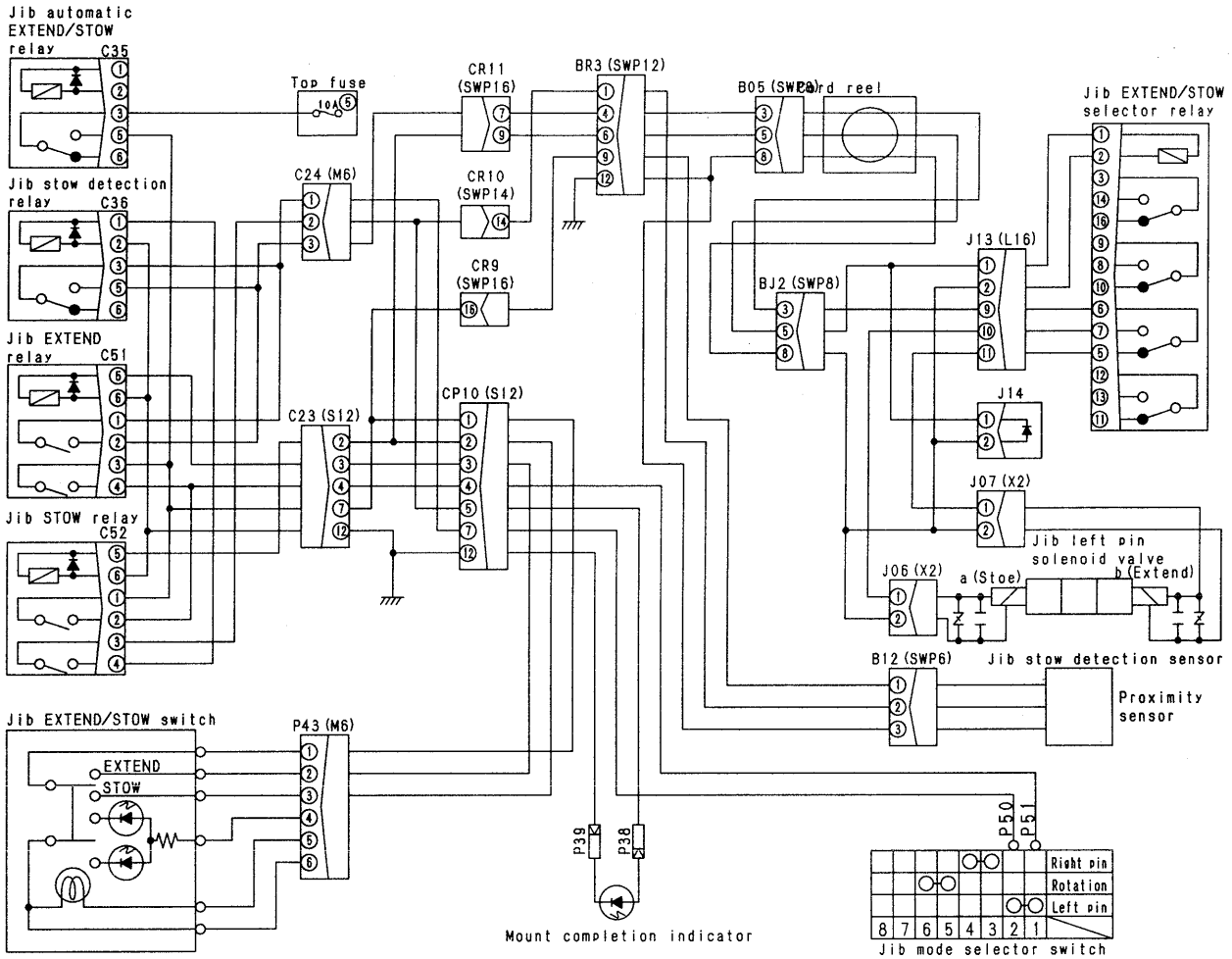
023S02

EM-113 Related electric circuit diagram



TKL00519

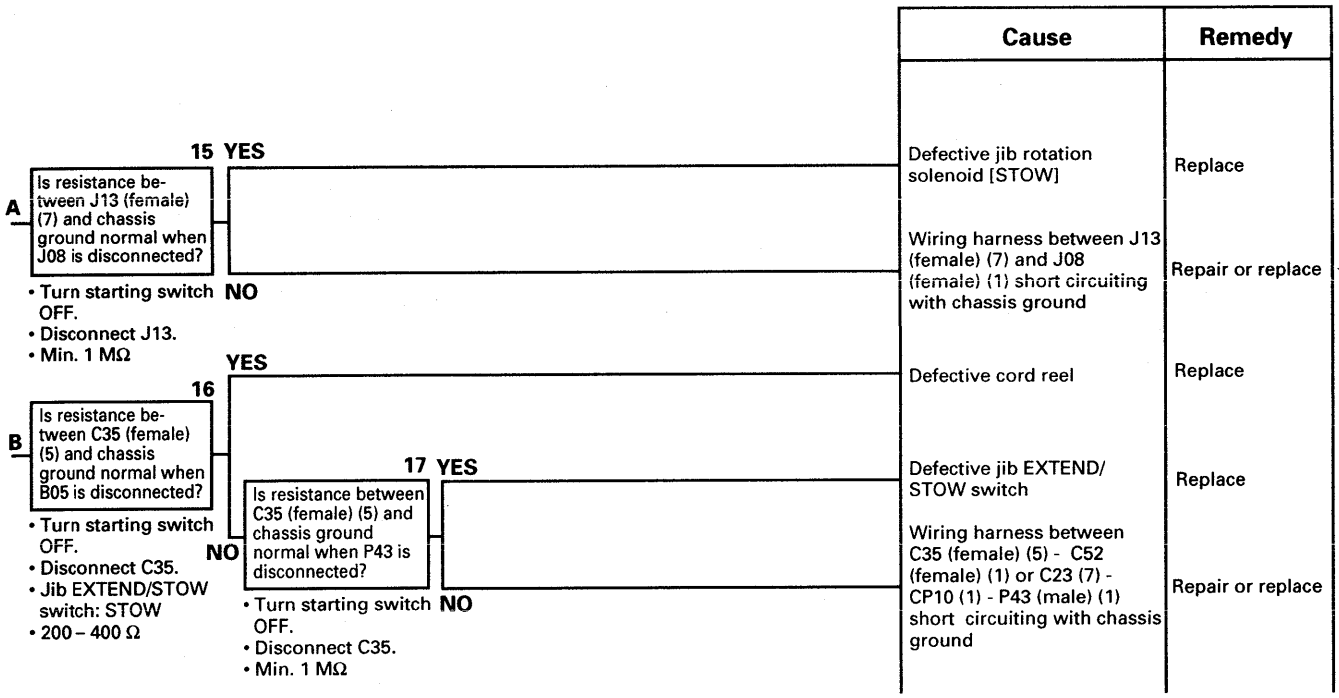
EM-116 Related electric circuit diagram



TKL00558

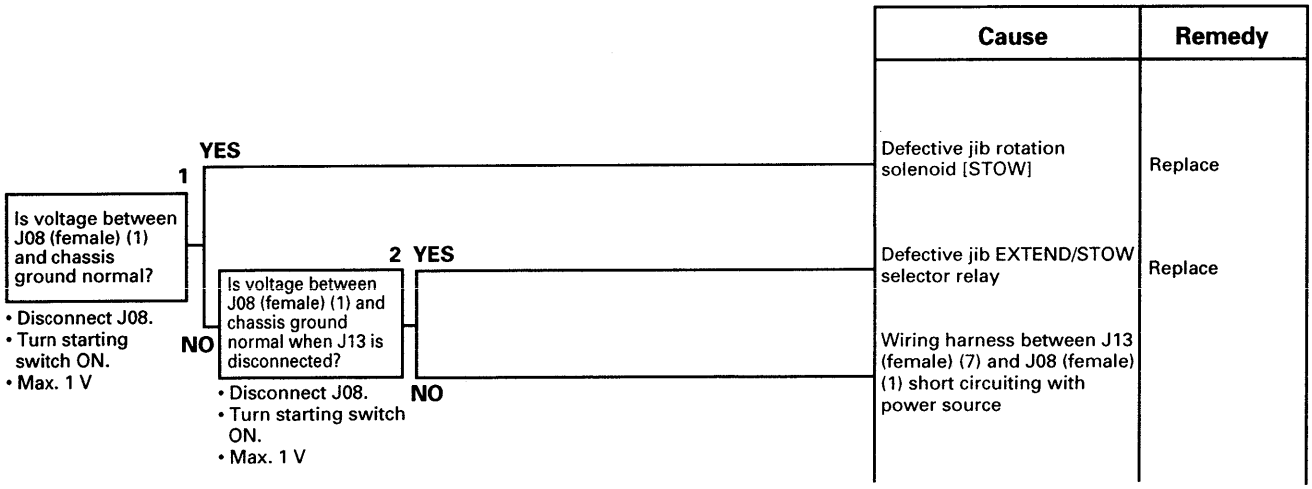
023S02

Short circuit with chassis ground (2/2)



023S02

Short circuit with power source



EM-124 Abnormality in swing FREE solenoid system

★ When no error code is displayed.
★ 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.

Disconnection

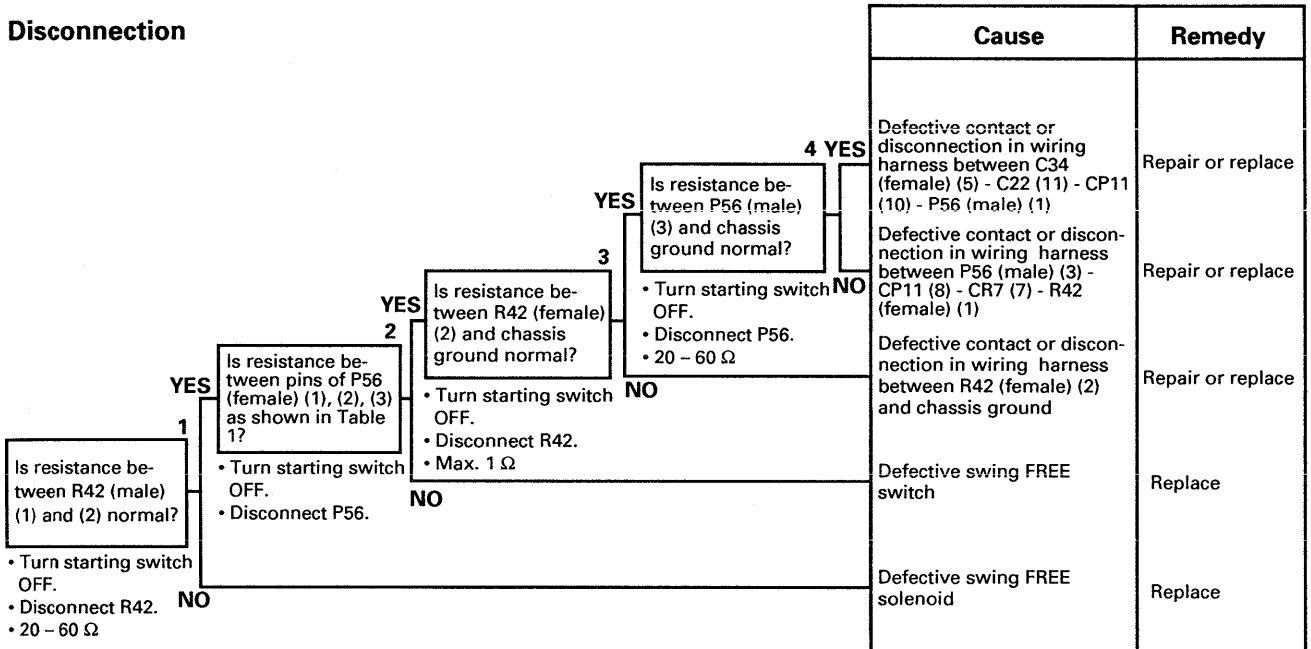


Table 1

P56 (female)	Swing FREE switch	Resistance value
Between (1) - (2)	LOCK	Max. 1 Ω
Between (1) - (3)		Min. 1 MΩ
Between (1) - (2)	FREE	Min. 1 MΩ
Between (1) - (3)		Max. 1 Ω

Short circuit with chassis ground

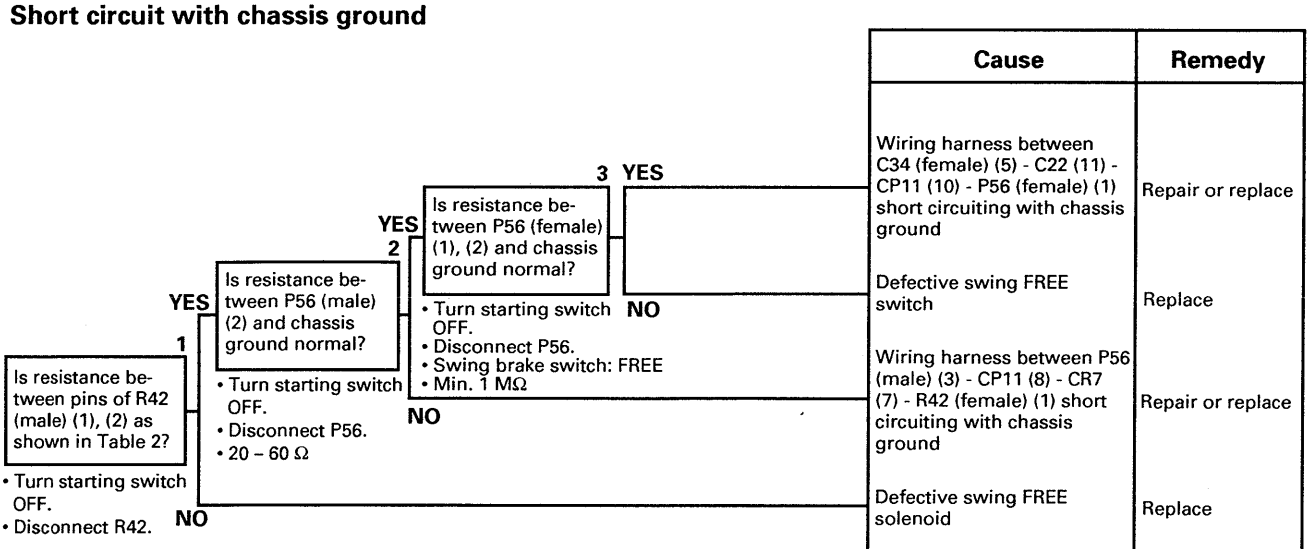


Table 2

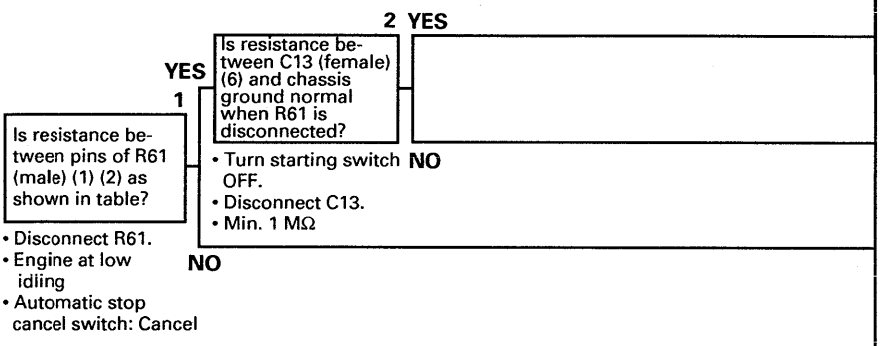
R42 (male)	Resistance value
Between (1) - (2)	20 – 60 Ω
Between (1) - chassis ground	Min. 1 MΩ

023S02

EM-133 Abnormality in main winch WIND IN PPC pressure switch system

★ When no error code is displayed.
★ 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.

Short circuit with chassis ground



Cause	Remedy
Defective moment limiter controller	Replace
Wiring harness between C13 (female) (6) - CR9 (11) - R61 (female) (1) short circuiting with chassis ground	Repair or replace
Defective main winch WIND IN PPC pressure switch	Replace

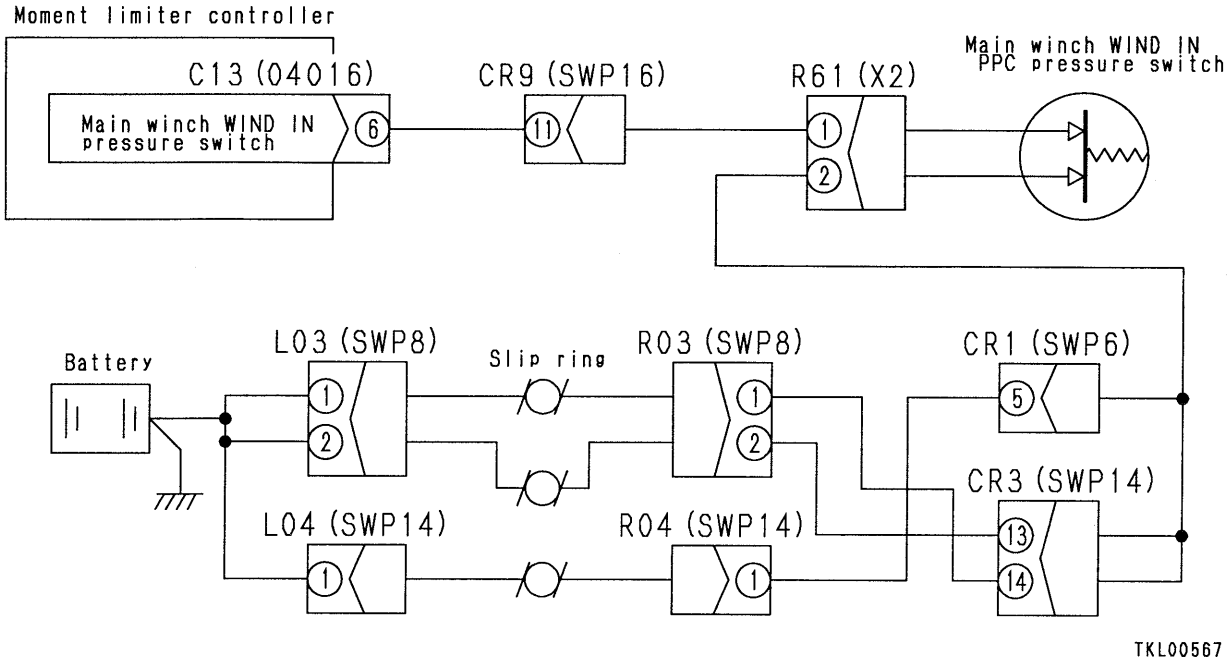
Table

R61 (male)	Main winch lever	Resistance value
Between (1) - (2)	At neutral	Max. 1 Ω
Between (1) - (2)	When winding in	Min. 1 MΩ
Between (1)(2) – chassis ground		Min. 1 MΩ

★ Operate the main winch in small movements.

023S02

EM-133 Related electric circuit diagram



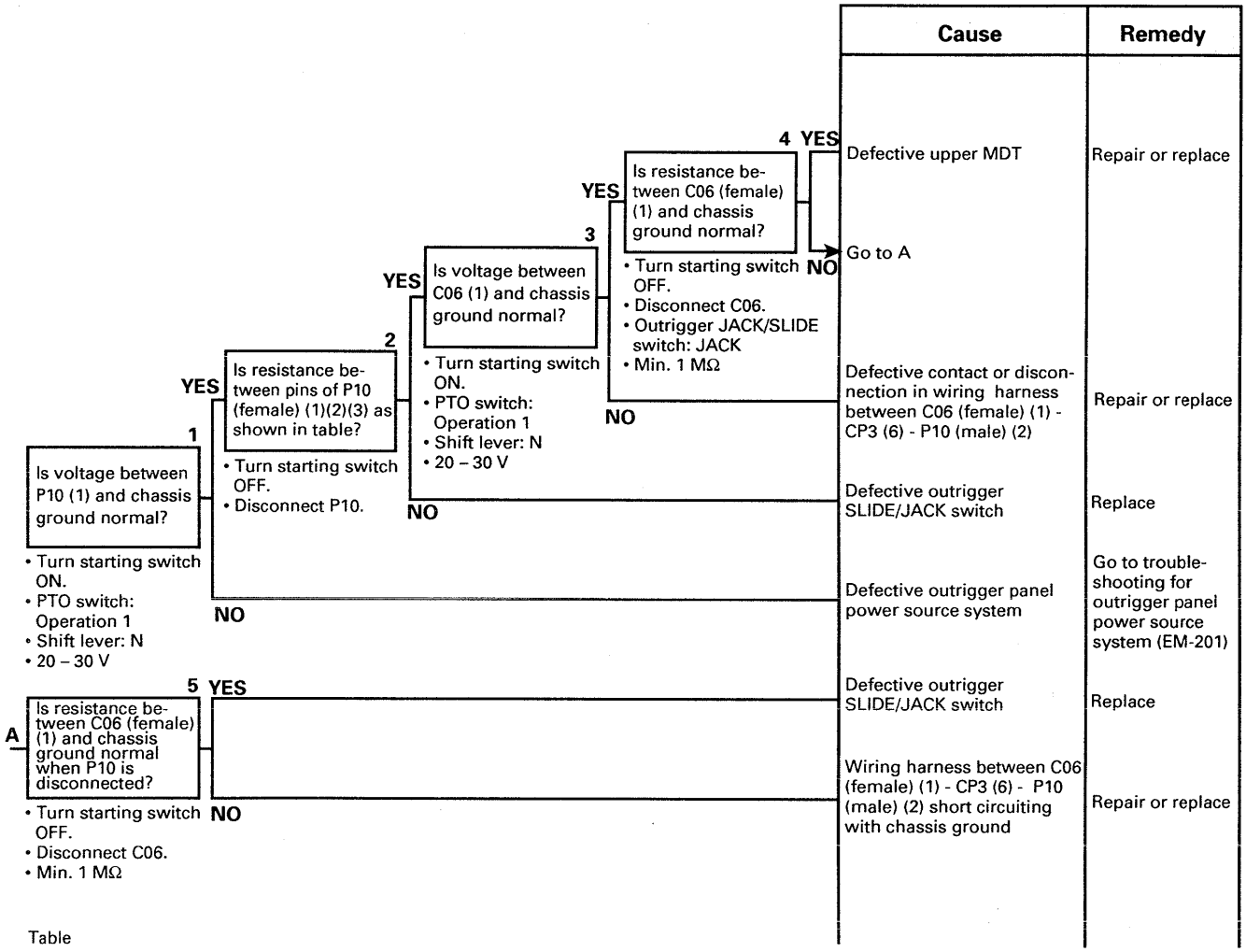
TKL00567

EM-207 Defective operation of top outrigger SLIDE/JACK switch (SLIDE) system (When the actuation conditions are OK, even if the top outrigger SLIDE/JACK switch is operated to the SLIDE position, the outriggers do not move, or the outriggers move even when the switch is not being operated.)

★ When no error code is displayed.
★ 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.

a) Does not work when operated (disconnection, short circuit with chassis ground)

023S02



Table

P10 (female)	Outrigger SLIDE/JACK switch	Resistance value
Between (1) - (2)	JACK	Min. 1 MΩ
Between (1) - (3)		Max. 1 Ω
Between (1) - (2)	Neutral	Min. 1 MΩ
Between (1) - (3)		Min. 1 MΩ
Between (1) - (2)	SLIDE	Max. 1 Ω
Between (1) - (3)		Min. 1 MΩ

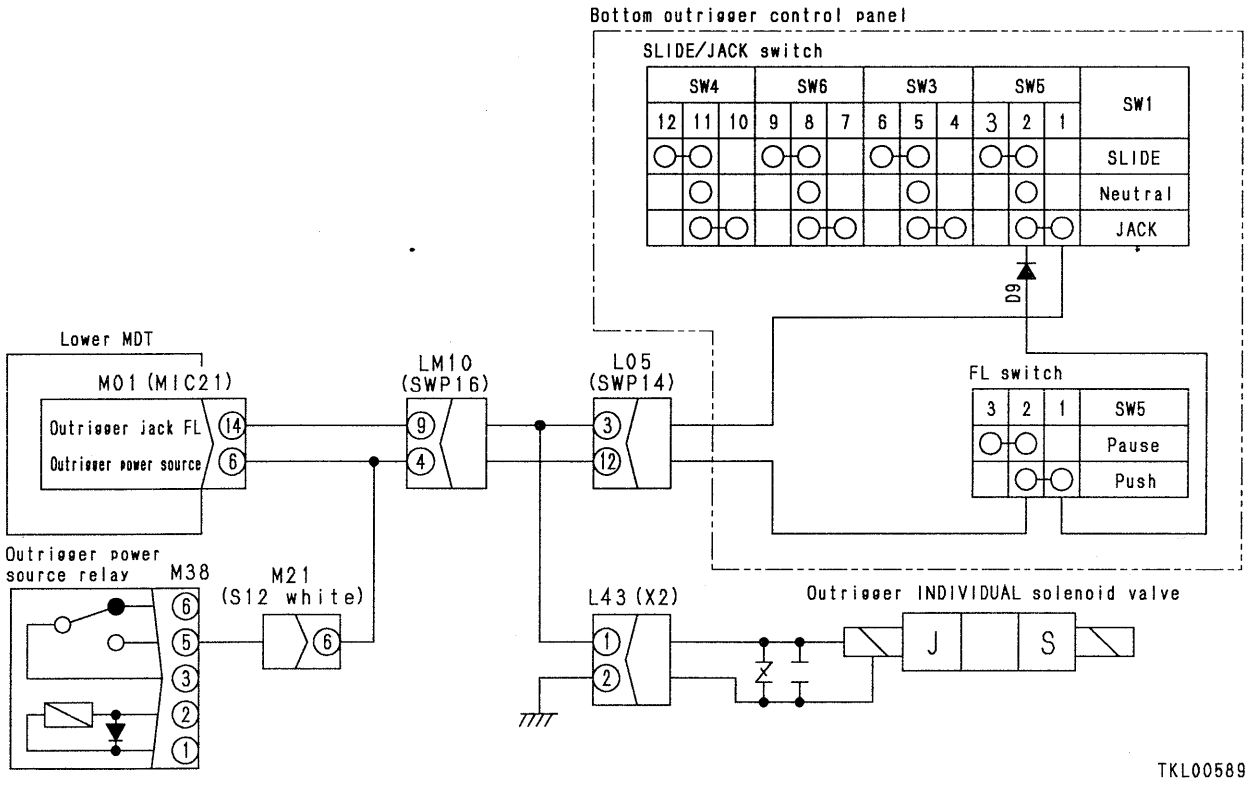
H-shaped outrigger specification

★ When no error code is displayed.
★ 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.

	Cause	Remedy
1 Is resistance between L05 (female) (7) and chassis ground normal? • Turn starting switch OFF. • Disconnect L05. • 20 – 30 V		
YES	Defective outrigger control panel	Replace
	Defective contact or disconnection in wiring harness between L05 (female) (7) and connecting point of LM10 (male) (9) and L43 (female) (1)	Repair or replace
NO		

023S02

EM-216 Related electric circuit diagram (H-shaped outrigger)



Displayed code	Abnormal system and detail of abnormality	Problem on machine	Trouble-shooting code
MDTL error EBB	Disconnection in rear steering FREE solenoid	Impossible to set rear steering to FREE	EL- 95
MDTL error EBC	Disconnection in service brake	Impossible to operate auxiliary brake	EL- 96
MDTL error EBD	Disconnection in exhaust brake	Impossible to operate exhaust brake	EL- 97
MDTL error EBF	Disconnection in preheating	Impossible to operate preheating	EL- 98
MDTL error ECA	Disconnection in head lamp Hi relay	Impossible to operate Hi beam	EL- 99
MDTL error ECB	Disconnection in head lamp Lo relay	Impossible to operate Lo beam	EL-100
MDTL error ECC	Disconnection in side lamp relay	Impossible to operate side lamp	EL-101
MDTL error ECE	Disconnection in right turn relay	Impossible to operate turn signal	EL-102
MDTL error ECF	Disconnection in left turn relay	Impossible to operate turn signal	EL-103
MDTL error ED0	Disconnection in steering mode solenoid a	Rear steering set to LOCK, travel with front 2-wheel steering	EL-104
MDTL error ED1	Disconnection in steering mode solenoid c	Rear steering set to LOCK, travel with front 2-wheel steering	EL-105
MDTL error ED2	Disconnection in steering mode solenoid b	Rear steering set to LOCK, travel with front 2-wheel steering	EL-106
MDTL error ED3	Disconnection in steering mode solenoid d	Rear steering set to LOCK, travel with front 2-wheel steering	EL-107
MDTL error ED4	Disconnection in pump merge solenoid	Lack of speed when outrigger ALL switch is operated	EL-108
MDTL error ED7	Disconnection in suspension lift	Impossible to use suspension lift	EL-109
MDTL error EE7	Outrigger control signal short circuited with power source	Immediately stops travel, impossible to operate steering, actuates emergency steering	EL-110
MDTL error EE8	Outrigger control signal short circuited with ground, disconnection	Takes no particular action, impossible to detect occurrence of secondary problem	EL-111
MDTL error EE9	Disconnection in fuel sensor	Fuel level unknown	EL-112
MDTL error EEB	Abnormality in rear steering LOCK limit switch/ FREE limit switch	Rear steering set to LOCK, travel with front 2-wheel steering	EL-113
MDTL error EEE	Failure of both speedometer sensors	No speedometer display, rear steering set to LOCK, travel with front 2-wheel steering	EL-114
MDTL error EEF	MDT speedometer sensor failure	Rear steering set to LOCK, travel with front 2-wheel steering	EL-115
MDTL error EF0	Special steering failure (emergency stop mode)	Immediately stops travel	EL-116
MDTL error EF1	Reverse steering failure (emergency stop mode)	Immediately stops travel	EL-117
MDTL error EF2	Special steering failure	Immediately stops travel, rear steering set to LOCK, travel with front 2-wheel steering	EL-118
MDTL error EF3	Reverse steering failure 1	Travels with normal steering, cannot set to reverse steering	EL-119
MDTL error EF4	Reverse steering failure 2	Immediately stops travel, rear steering set to LOCK, travel with normal steering	EL-120
MDTL error EFE	Abnormality in right turn relay	Abnormal actuation of turn signal, or impossible to actuate turn signal	EL-121
MDTL error EFF	Abnormality in left turn relay	Abnormal actuation of turn signal, or impossible to actuate turn signal	EL-122
(Moment limiter controller related)			
OSS error E00	Abnormality in panel communication	Impossible to change working mode	EM- 1
OSS error E01	Panel system error	Impossible to change working mode	EM- 2
OSS error E02	Abnormality in panel rotary switch	Impossible to change working mode	EM- 3
OSS error E10	Moment limiter system error	Action impossible, stops work	EM- 4
OSS error E20	Abnormality in S-NET (communication between MDTs)	Action impossible, stops work	EM- 5

023S02

Condition when normal (voltage, current, resistance)	Action by controller when abnormality is detected	Problem that appears on machine when there is abnormality	Trouble-shooting code
1) Resistance value in wiring harness between transmission controller M15 (7) – chassis ground: 200 – 400 Ω	R, F2 ECMV cut relay output: OFF	Travel possible (however, it is impossible to cut off circuit when R or F2 are short circuiting with power source)	ET-43
1) Resistance value in wiring harness between transmission controller M15 (8) - chassis ground: 200 – 400 Ω	Back-up lamp relay output: OFF	Back-up lamp does not light up when traveling in reverse	ET-44
1) Resistance value in wiring harness between transmission controller M15 (15) – chassis ground: 200 – 400 Ω	F1, F3 ECMV cut relay output: OFF	Travel possible (however, it is impossible to cut off circuit when F1 or F3 are short circuiting with power source)	ET-45
1) Resistance value in wiring harness between transmission controller M15 (16) – chassis ground: 200 – 400 Ω	Special steering relay output: OFF	Possible to travel in front wheel mode	ET-46
1) Voltage between transmission controller M13 (7), (6) and chassis ground at neutral: Max. 1 V	R, F2 ECMV output: OFF and cut relay ON	Cannot travel (impossible to travel even in emergency gear shift)	ET-47
1) Voltage between transmission controller M13 (5), (4) and chassis ground at neutral: Max. 1 V	F1, F3 ECMV output: OFF and cut relay ON	Cannot travel (impossible to travel even in emergency gear shift)	ET-48

023S02

ET-10 ATM error E32 (Abnormality in speed sensor 1) is displayed

⚠ Check carefully that there is no one in the surrounding area before starting troubleshooting.

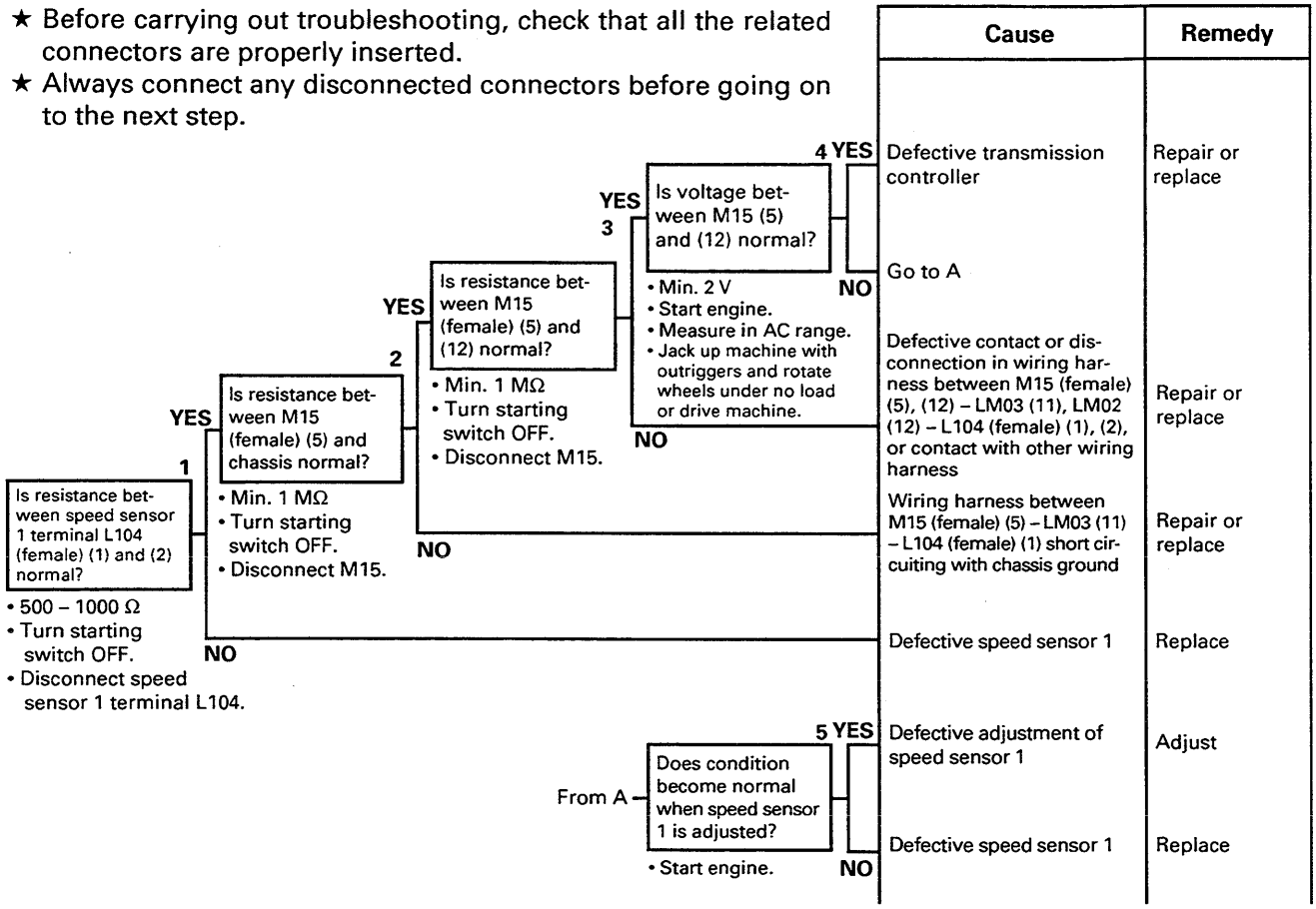
★ Troubleshooting is carried out while the abnormality is being generated, so when the connector is disconnected and the T-adapter is inserted, or when the T-adapter is removed and the connector is connected again to its original position, if the error code is not displayed on the monitor, the system has been reset.

★ For disconnection, see other error code (ATM error E12).

★ When there is no S-NET error.

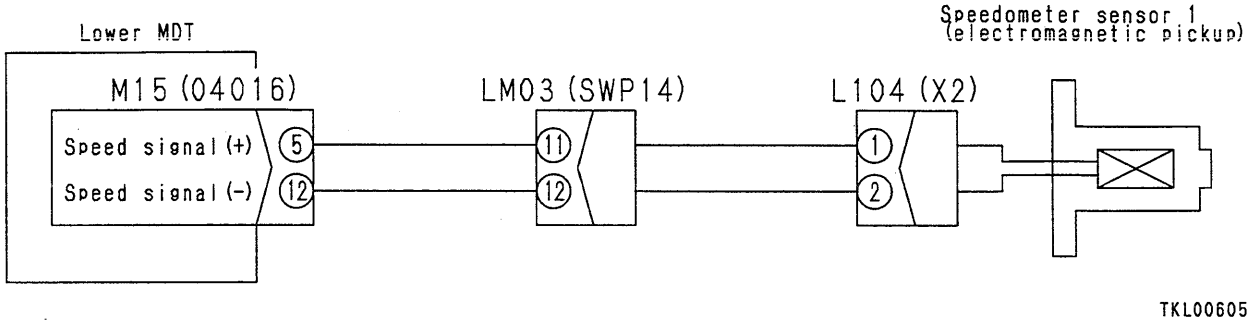
★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.

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



023S02

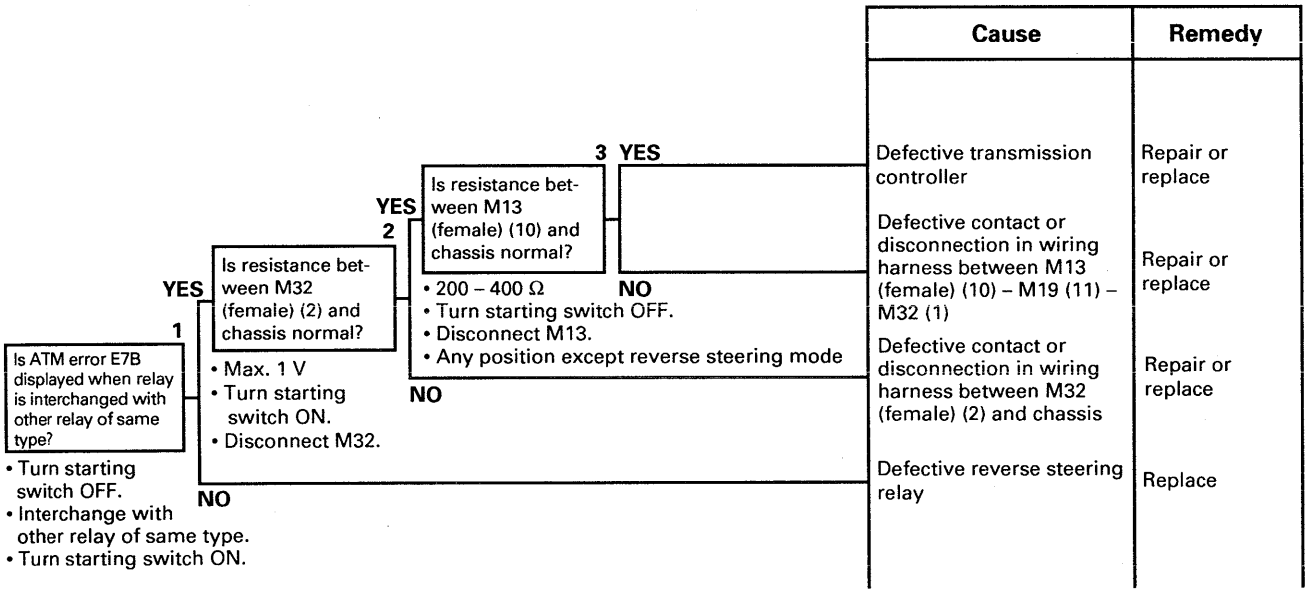
ET-10 Related electric circuit diagram



TKL00605

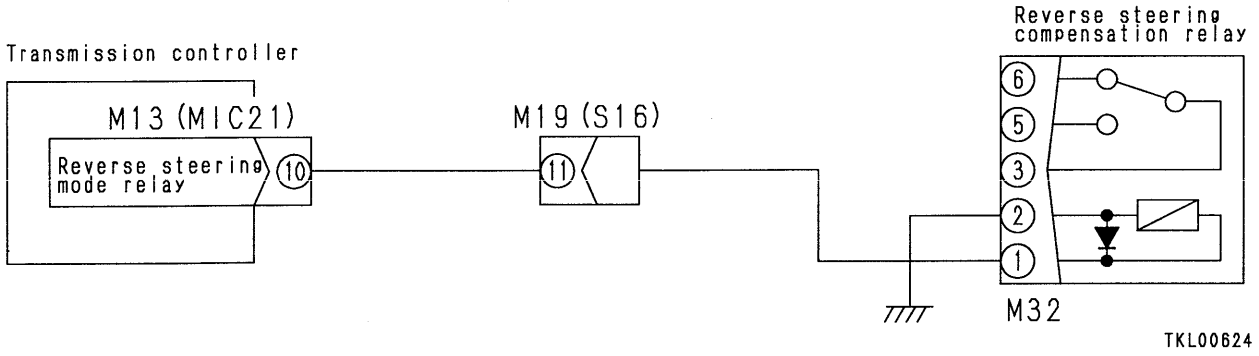
ET-30 ATM error E7B (Disconnection in reverse steering compensation relay system) is displayed

★ Troubleshooting is carried out while the abnormality is being generated, so when the connector is disconnected and the T-adapter is inserted, or when the T-adapter is removed and the connector is connected again to its original position, if the error code is not displayed on the monitor, 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 to the next step.



023S02

ET-30 Related electric circuit diagram



ET-49 ATM error E94 (Lock-up solenoid [ECMV] short circuited with power source) is displayed

★ Troubleshooting is carried out while the abnormality is being generated, so when the connector is disconnected and the T-adapter is inserted, or when the T-adapter is removed and the connector is connected again to its original position, if the error code is not displayed on the monitor, the system has been reset.
★ After the abnormality occurs, if the starting switch is turned OFF and then turned ON again, and the error code is not displayed on the monitor, 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 to the next step.

	Cause	Remedy
1 Is voltage between M13 (3), L92 (1) and chassis normal? • Max. 1 V • Disconnect M13 and L92. • Turn starting switch ON.		
YES	Defective transmission controller	Repair or replace
NO	Wiring harness between M13 (female) (3) – LM08 (4) – L92 (1) short circuiting with power source	Repair or replace

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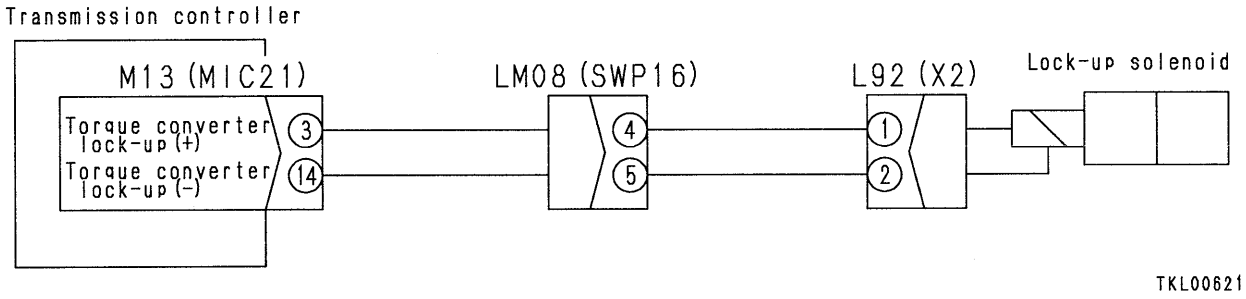
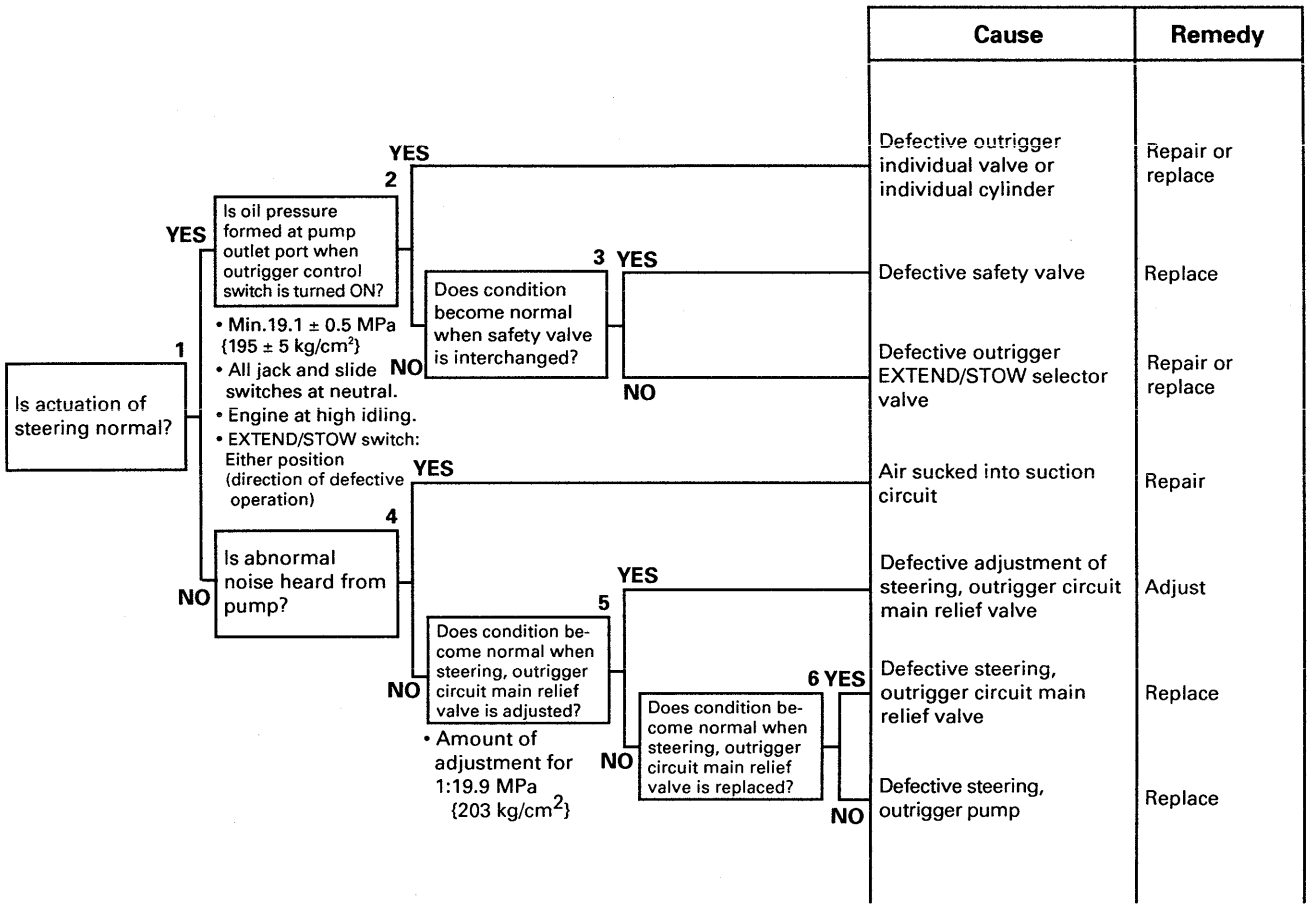
ET-49 Related electric circuit diagram



H-8 Outriggers cannot be extended or stowed

⚠ Check that there is no one in the surrounding area before starting troubleshooting.
★ When the operation of the PTO clutch is normal.
★ When the electric system is normal.
★ Carry out the operation with the PTO switch at Operation 1.



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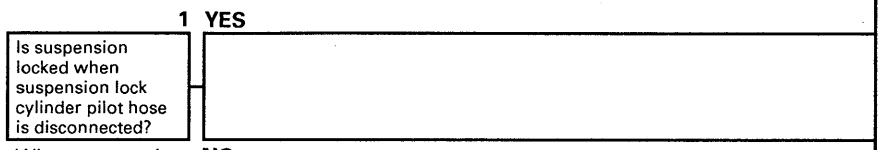
H-114 Suspension cannot be locked or cannot be set free

★ When the electric system is normal.
★ When the operation of the transmission is normal.

a) Suspension cannot be locked



Cause	Remedy
Defective suspension LOCK/FREE solenoid valve	Repair or replace
Defective suspension lock cylinder	Repair or replace

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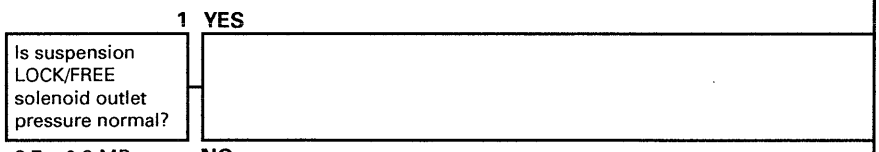
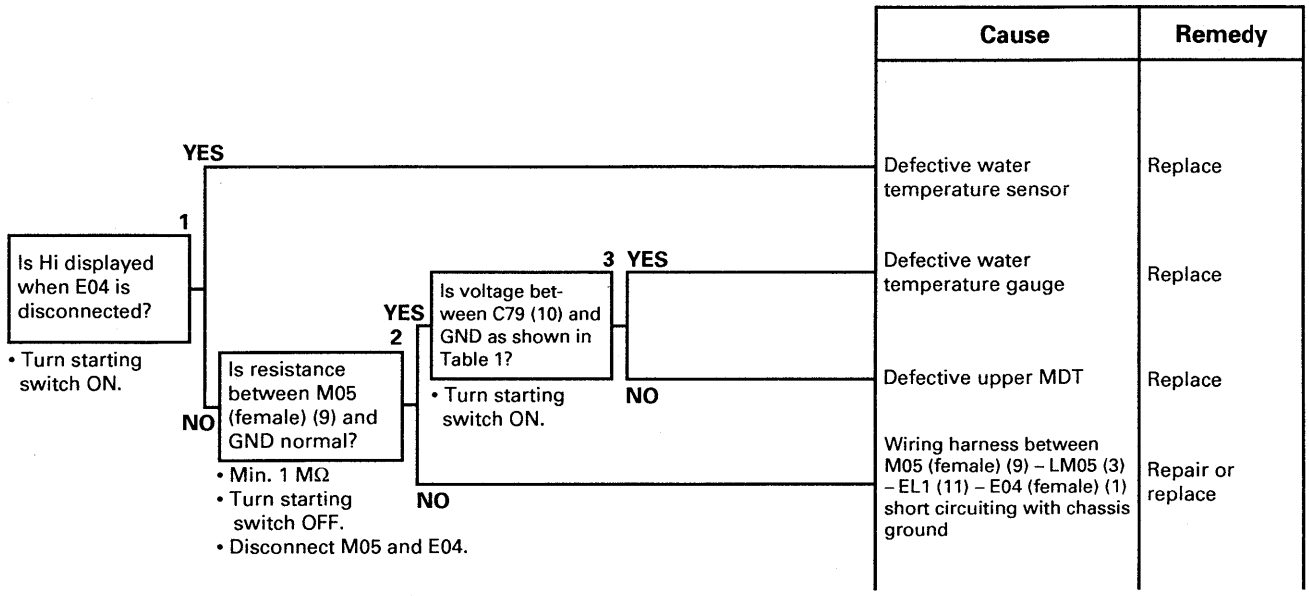
b) Suspension cannot be set free



Cause	Remedy
Defective suspension lock cylinder	Repair or replace
Defective suspension LOCK/FREE solenoid valve	Repair or replace

b) Engine water temperature gauge display stays at Hi level



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c) Engine water temperature gauge display does not match actual temperature

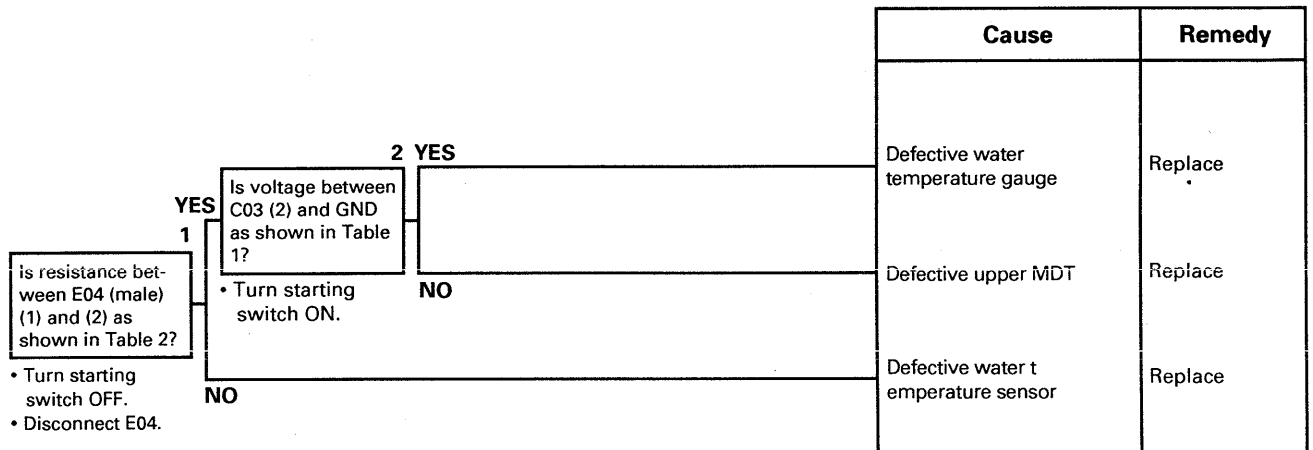
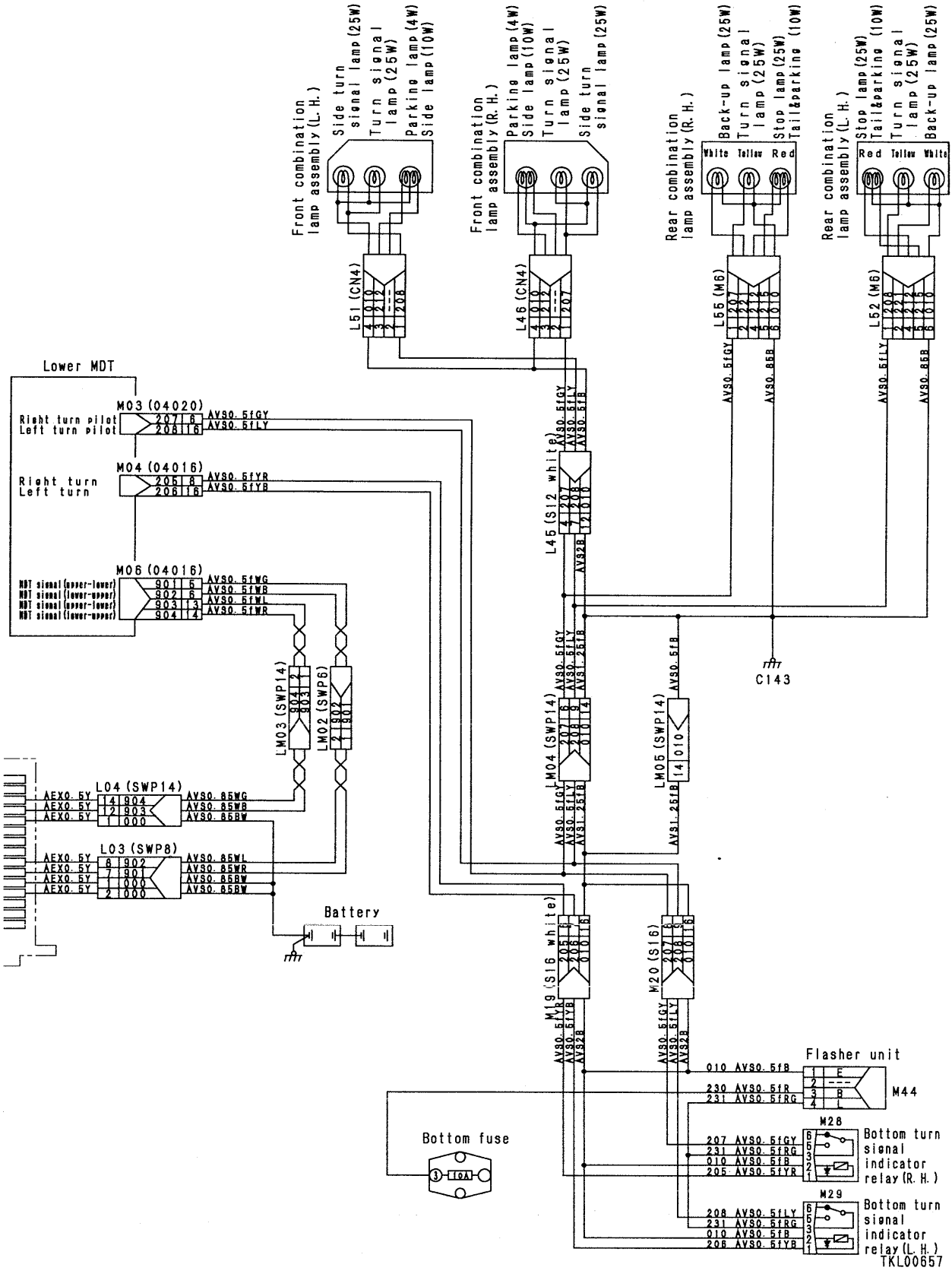


Table 1

Water temperature	Voltage (V)
100°C	0.9 – 1.7
50°C	2.5 – 5.5

Table 2

Water temperature	Resistance value (kΩ)
100°C	3.5 – 4.0
25°C	37 – 50


023S02
Front combination lamp assembly (L. H.)
Side turn signal lamp (25W)
Turn signal lamp (25W)
Parking lamp (4W)
Side lamp (10W)
Front combination lamp assembly (R. H.)
Parking lamp (4W)
Side lamp (10W)
Turn signal lamp (25W)
Side turn signal lamp (25W)
Rear combination lamp assembly (R. H.)
Back-up lamp (25W)
Turn signal lamp (25W)
Stop lamp (25W)
Tail&parking (10W)
Rear combination lamp assembly (L. H.)
Stop lamp (25W)
Tail&parking (10W)
Turn signal lamp (25W)
Back-up lamp (25W)
White Yellow Red
Red Yellow White
L51 (CN4)
L46 (CN4)
L55 (M6)
L52 (M6)
Lower MDT
M03 (04020)
Right turn pilot
Left turn pilot
M04 (04016)
Right turn
Left turn
M06 (04016)
MDT signal (upper-lower)
MDT signal (lower-upper)
MDT signal (upper-lower)
MDT signal (lower-upper)
L45 (S12 white)
C143
LM03 (SWP14)
LM02 (SWP6)
LM04 (SWP14)
LM05 (SWP14)
L04 (SWP14)
L03 (SWP8)
Battery
M19 (S16 white)
M20 (S16)
Flasher unit
M44
M28
Bottom turn signal indicator relay (R. H.)
M29
Bottom turn signal indicator relay (L. H.)
Bottom fuse
10A
TKL00657

E-6 Parking brake cannot be released or cannot be applied

★ When no error code is displayed.
★ Check that top fuse 26 is normal.
★ 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.

a) Parking brake cannot be released (disconnection)

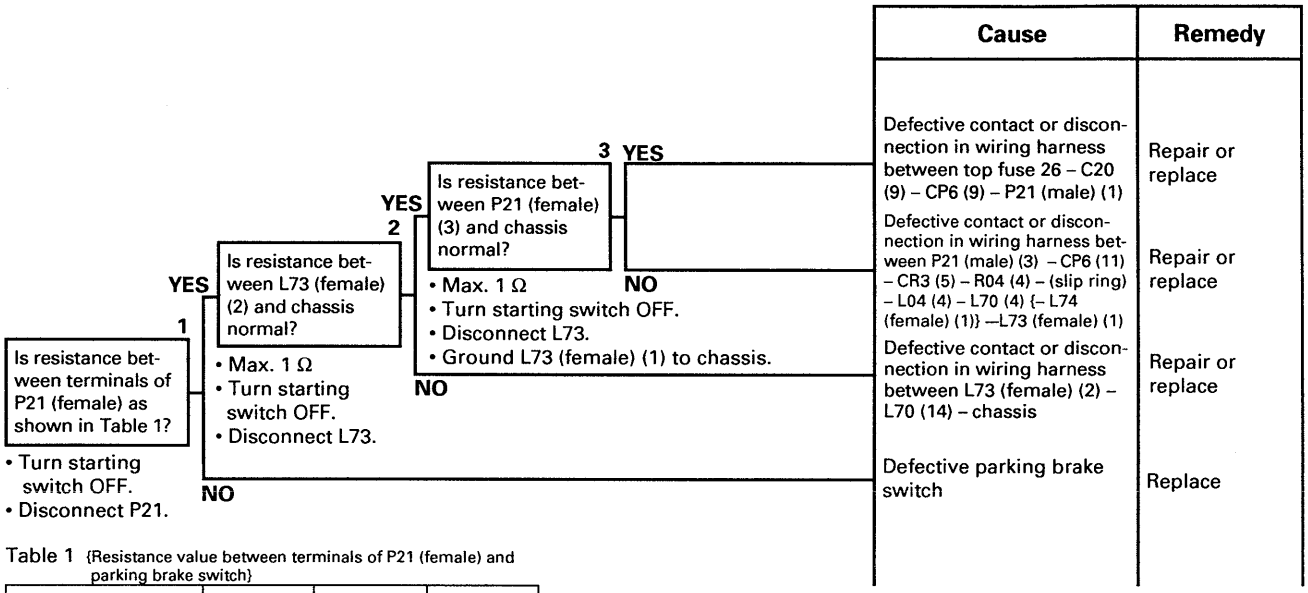


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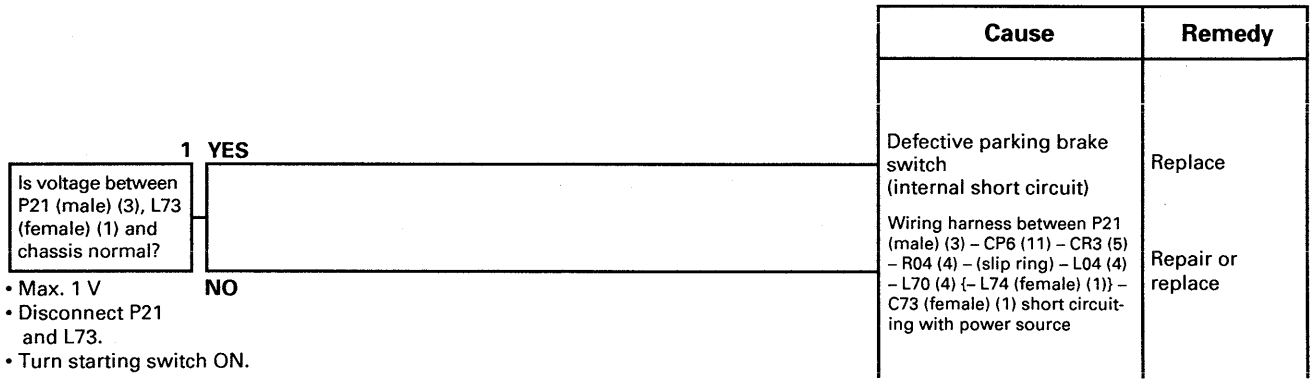
Table 1 {Resistance value between terminals of P21 (female) and parking brake switch}

P21 (female) terminal	Auxiliary	Parking	OFF
Between (1) – (2)	Max. 1 Ω	Min. 1 MΩ	Min. 1 MΩ
Between (1) – (3)	Min. 1 MΩ	Min. 1 MΩ	Max. 1 Ω
Between (2) – (3)	Min. 1 MΩ	Min. 1 MΩ	Min. 1 MΩ

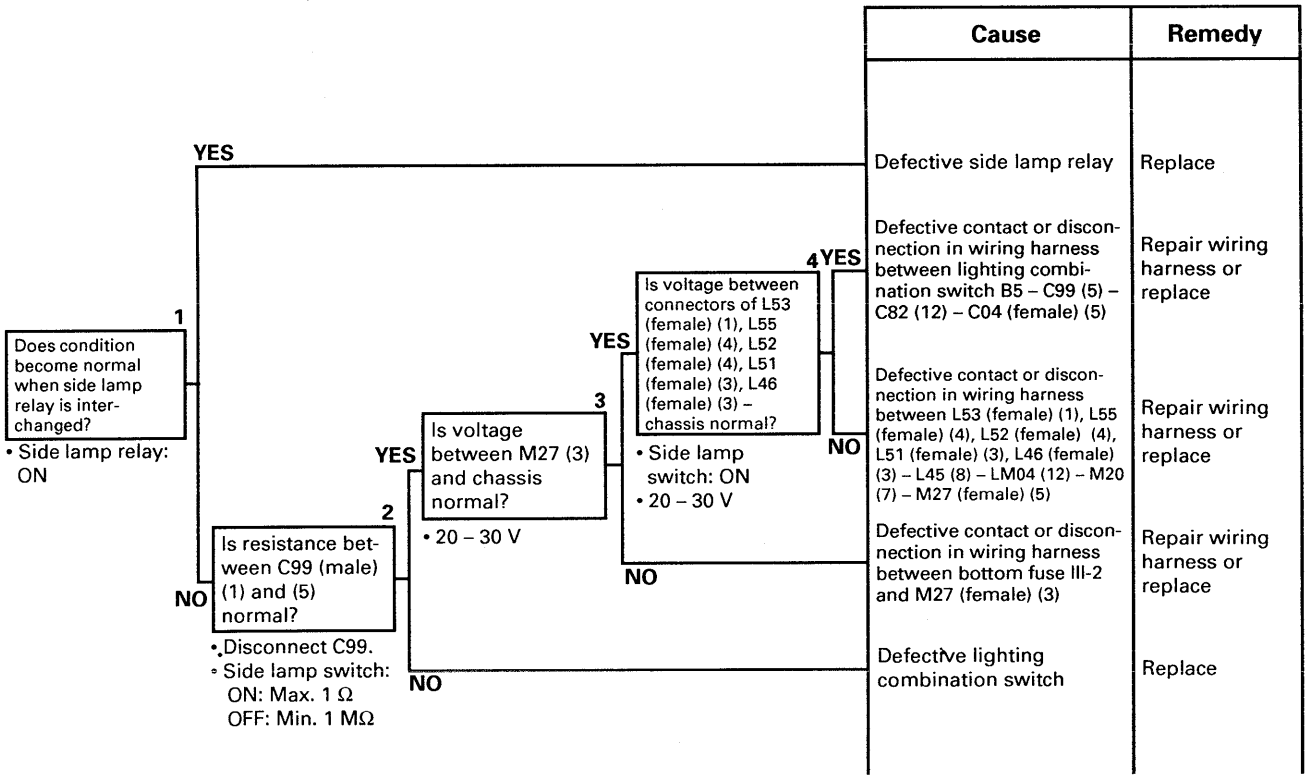
b) Parking brake cannot be applied (short circuit with power source)



E-19 Side lamp, tail lamp, license lamp do not light up or do not go out

a) Side lamp, tail lamp, license lamp do not light up (disconnection)

★ When no error code is displayed.
★ When none of 4 side lamps and license plate lamp light up (when each lamp bulb is normal).
★ When head lamp Lo beam is normal.
★ When turn signal lamp flashes.
★ 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.
★ Check that top fuse 17 is not blown.
(If the fuse is blown, check for a short circuit with the chassis ground between top fuse 17 – C20 (3) – C82 (9) – C99 (1) – lighting switch combination B1, and between lighting switch combination B5 – C99 (5) – C82 (9) – C04 (5).)
★ Check that bottom fuse III-2 is not blown.
(If the fuse is blown, check for a short circuit with the chassis ground between bottom fuse III-2 – M27 (3), and between M27 (5) – M20 (7) – LM04 (12) – L45 (8) – L46 (3) or L51 (3).)



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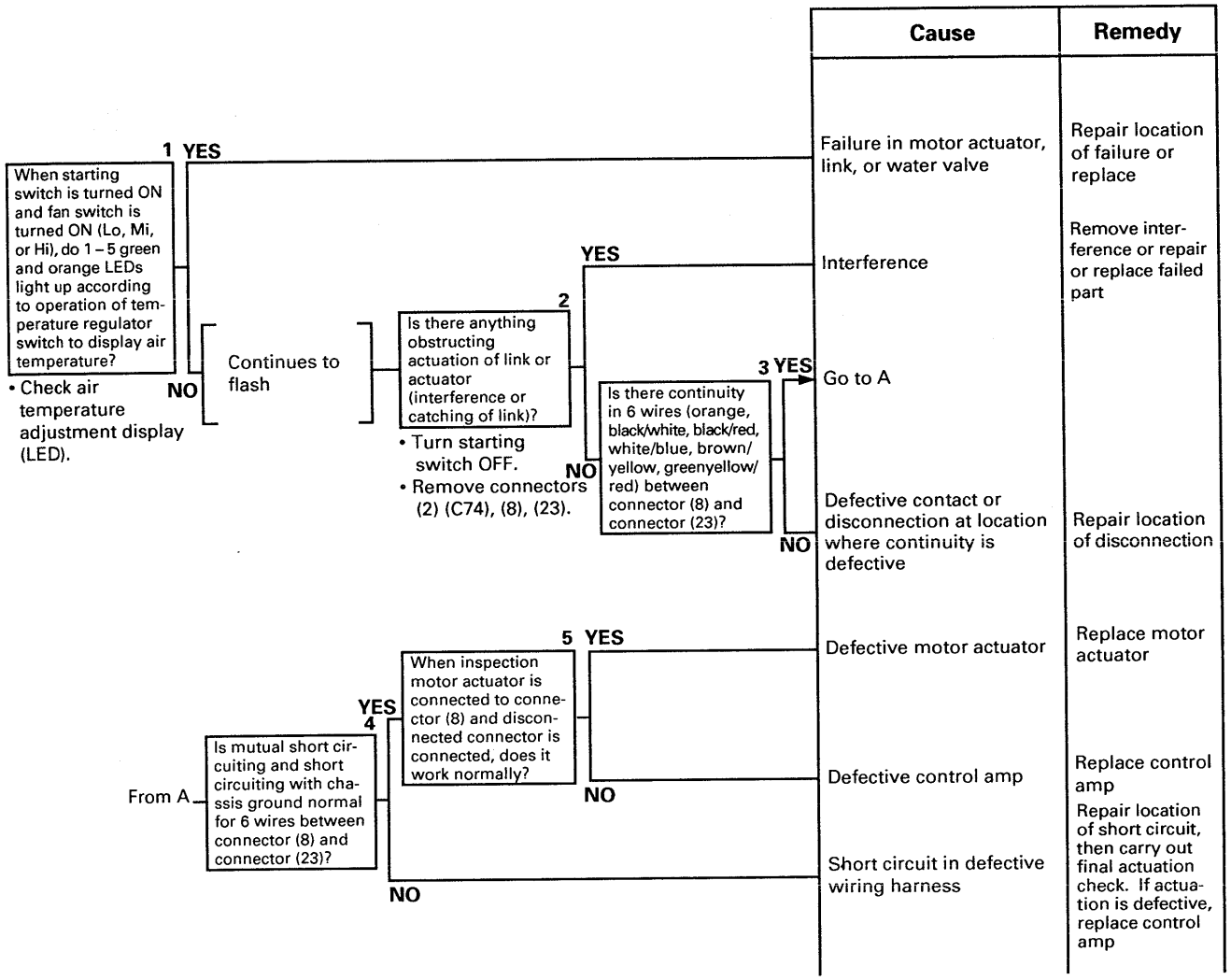
E-51 c) Defective heating (impossible to adjust air temperature)

Note: If any connectors are removed for inspection, connect them securely after completing repairs.
★ Check that top fuses 7, 17, and 20 are normal.
★ 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.



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Component	Symbol		Part No.	Part Name	Q'ty	New/remodel	Sketch	Nature of work, remarks	
Final drive	J		797T-423-1190	Push tool	1	N	O	Disassembly, assembly	Press fitting of wheel hub seal
Center swivel joint assembly	T	1	790-101-2501	Puller	1			Disassembly, assembly	Disconnection of shaft and rotor
			• 790-101-2510	• Plate	1				
			• 790-101-2620	• Leg	2				
			• 790-101-2570	• Plate	4				
			• 790-101-2560	• Nut	2				
			• 790-101-2660	• Adapter	2				
		2	797T-423-1180	Plate	1	N	O		
			01050-51035	Bolt	3				
		3	790-201-2640	Plate	1				
		4	790-201-2750	Push tool	1				
		5	790-101-2101	Puller (30 t)	1				
			790-101-1102	Pump	1				
Suspension lock cylinder assembly Steering cylinder assembly Outrigger slide assembly Jib rotation cylinder assembly Jib lock cylinder assembly	U	1	790-502-1003	Cylinder repair stand	1			Disassembly, assembly	Disassembly, assembly of hydraulic cylinder
			790-101-1102	Pump	1				
		2	790-302-1280	Socket (width across flats: 55)	1				Suspension lock cylinder — Removal, installation of nylon nut
			790-302-1480	Socket (width across flats: 41)	1	N			Steering cylinder — Removal, installation of nylon nut
			792-535-2340	Socket (width across flats: 36)	1				Outrigger slide cylinder, Jib rotation cylinder — Removal, installation of nylon nut
		3	790-201-1702	Push tool kit	1				
			• 790-101-5021	• Grip	1				
			• 01010-50816	• Bolt	1				
			• 790-201-1761	• Push tool	1				Suspension lock cylinder, Steering cylinder — Press fitting of coil bushing
			• 790-201-1751	• Push tool	1				Outrigger slide cylinder (X, H-shaped) — Press fitting of coil bushing
			• 790-201-1731	• Push tool	1				Jib rotation cylinder — Press fitting of coil bushing
			• 790-201-1711	• Push tool	1				Jib lock cylinder — Press fitting of coil bushing
		4	790-201-1500	• Push tool kit	1				
			• 790-101-5021	• Grip	1				
			• 01010-50816	• Bolt	1				
			• 790-201-1570	• Plate	1				Suspension lock cylinder, Steering cylinder — Press fitting of dust seal
			• 790-201-1560	• Plate	1				Outrigger slide cylinder (X, H-shaped) — Press fitting of dust seal
			• 790-201-1540	• Plate	1				Jib rotation cylinder — Press fitting of dust seal
			• 790-201-1520	• Plate	1				Jib lock cylinder — Press fitting of dust seal

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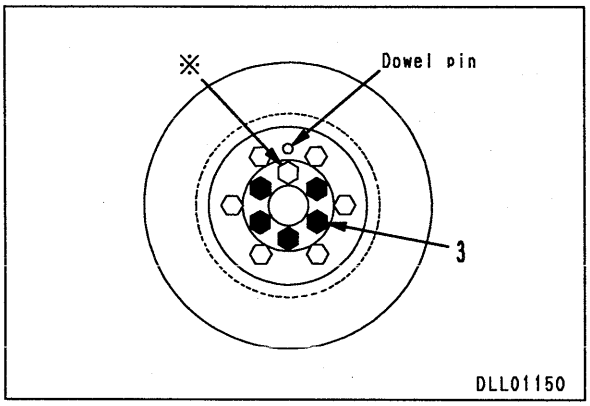
※ 2

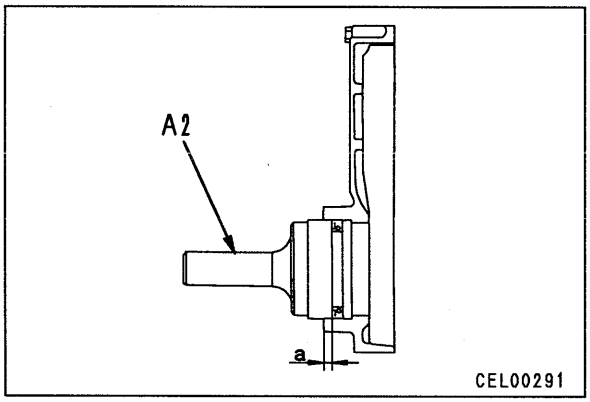
kgm Crankshaft pulley mounting bolt (3) :
276.85 ± 31.85 Nm {28.25 ± 3.25 kgm}
kgm Crankshaft pulley mounting bolt (※) :
176.4 ± 19.6 Nm {18 ± 2.0 kgm}



※ 3

★ Using tool **A2**, press fit the oil seal.
Oil seal press-fitting tolerance **a** : $^{+1}_{0}$ mm

Oil seal lip: Fill 50 – 80% of space at lip with heat- resistant long-life grease (G2-LI-S) (Kyodo Grease Martemp ET-130 or equivalent)



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INSTALLATION OF ENGINE ASSEMBLY

- Carry out installation in the reverse order to removal.

★ Replace the O-rings and gaskets with new parts. When using the parts again, check carefully that there is no damage, settling, cracks, or other deterioration.

※ 1

kgm Drive shaft mounting bolt :
110.25 ± 12.25 Nm {11.25 ± 1.25 kgm}
kgm Damper mounting bolt :
66.15 ± 7.65 Nm {6.75 ± 0.75 kgm}

※ 2

Engine mount bolt thread :
Thread tightener (LT-2)
kgm Engine mount bolt :
382 ± 39 Nm {39 ± 4.0 kgm}

- **Refilling with water**
  Add water to the specified level. Run the engine to circulate the water through the system. Then check the water level in the reserve tank again.

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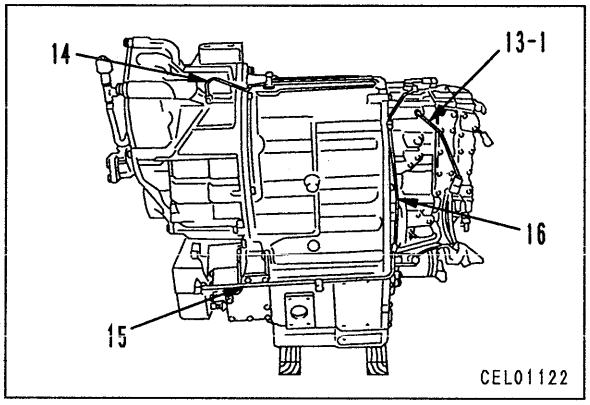
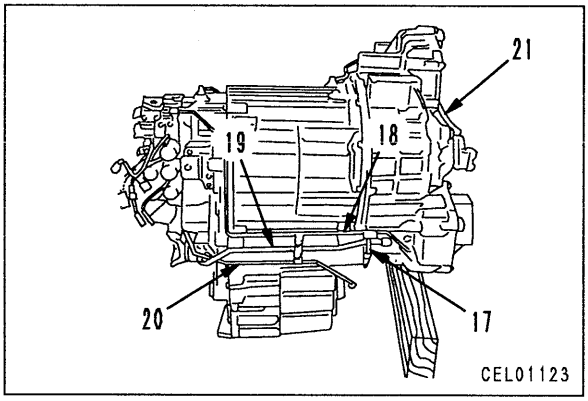
7. Oil temperature sensor
Remove oil temperature sensor (13-1).

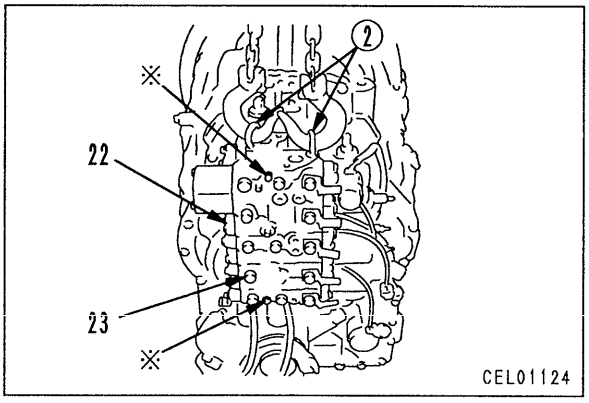
8. Piping
1) Remove lubrication tube (14).
2) Remove tubes (15) and (16).



3) Remove engine tube (17), then remove PTO tube (18).
4) Remove tube (19).
5) Remove Hi/Lo tube (20).
6) Remove breather hose (21).

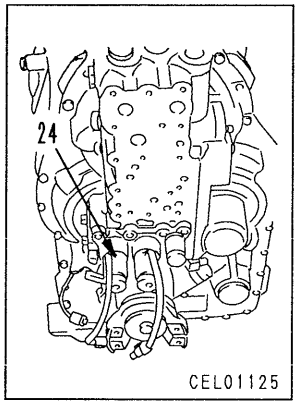


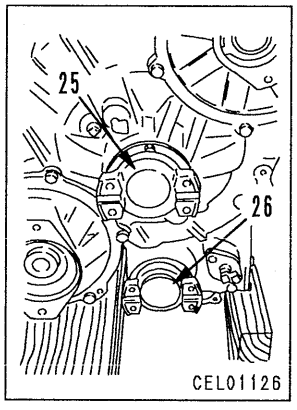
9. Transmission control valve assembly
Using eyebolts (2), sling transmission control valve assembly (22), then remove 13 mounting bolts (23), and lift off.
★ Do not remove the 2 bolts marked ※.



10. Hi/Lo and 2WD/4WD valve assembly
Remove Hi/Lo and 2WD/4WD valve assembly (24).

11. Couplings
Remove couplings (25) and (26).





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ASSEMBLY OF TRANSMISSION ASSEMBLY

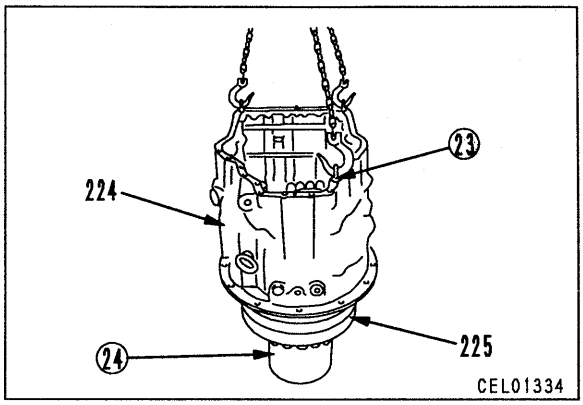
★ Clean all parts, and check for dirt or damage before assembling.

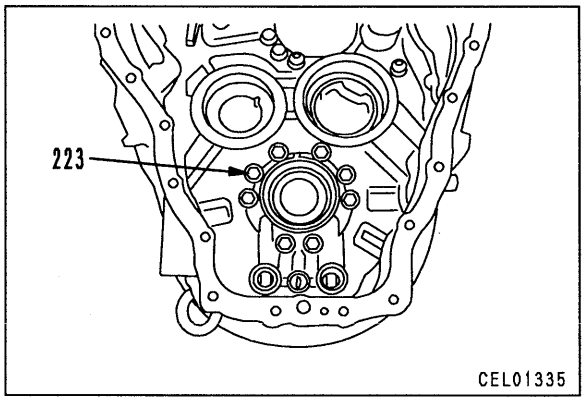
1. Middle case

1) Set torque converter assembly (225) to block ㉔.
2) Using eyebolts ㉓, set middle case (224) to torque converter assembly, then tighten mounting bolts (223).

Mounting bolt : **Thread tightener (LT-2)**

Mounting bolt : **110.25 ± 12.25 Nm {11.25 ± 1.25 kgm}**





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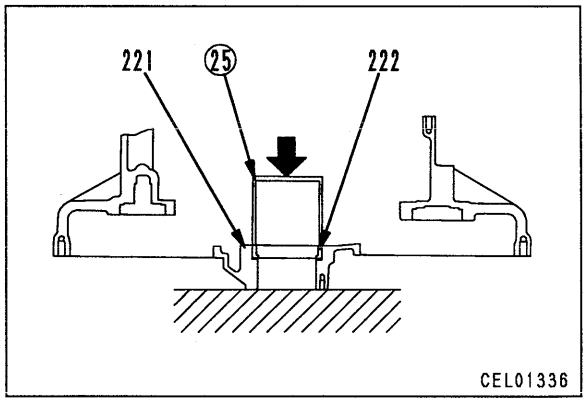
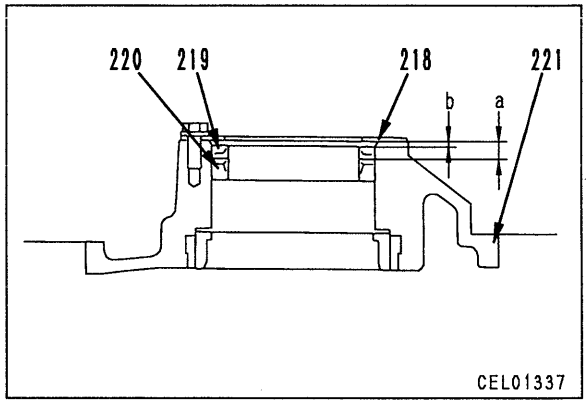
2. Rear case assembly

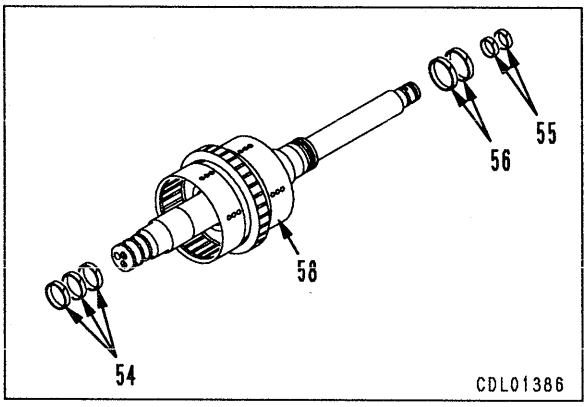
1) Assembly of rear case assembly
   i) Using push tool ㉕, press fit rear case outer race (222) to rear case (221).



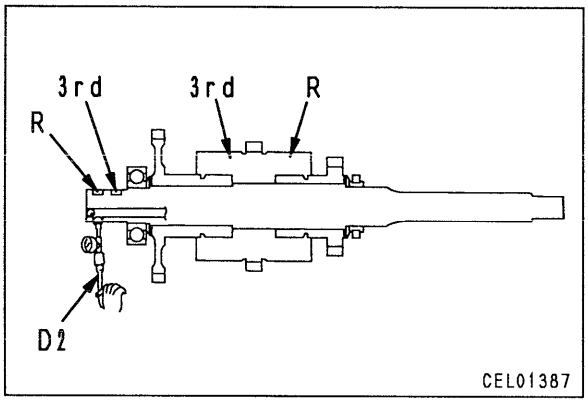
   ii) Using push tool, press fit oil seal (220) and dust seal (219) to rear case (221) to positions a and b.
   ★ Press-fitting dimension **a**: 11.0 ± 0.2 mm
   Press-fitting dimension **b**: 3.0 ± 0.2 mm
   Seal lip : **Grease (G2-LI)**
   iii) Install plate (218).



xxiii) Install seal rings (54), (55), and (56) to shaft.
★ Coat the outside circumference of the seal ring with grease (G2-LI) and take care not to install it off center.



2) Using tool **D2**, blow air in from oil hole of shaft and check that each clutch works.
★ If the gear is held in position when air is blown in, the clutch is working normally.
★ Air pressure: 0.5 – 0.6 MPa {5 – 6 kg/cm²}



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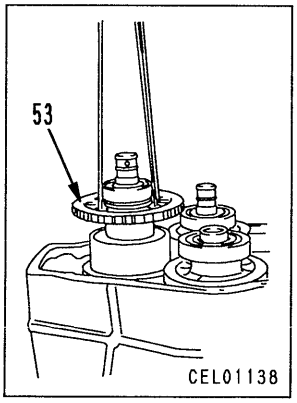
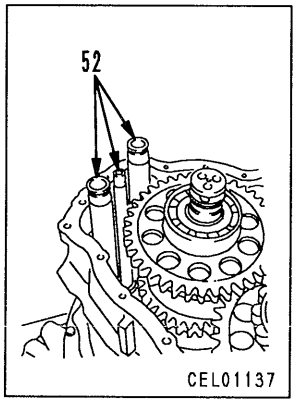
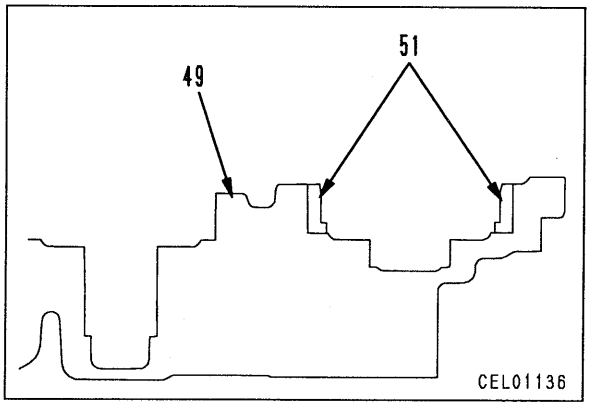
3) Raise 3rd and REVERSE clutch assembly (53) and install to middle case.
★ There is danger that the seal ring at the tip of the shaft may be damaged, so be careful not to interfere with the other gears, and remove slowly.



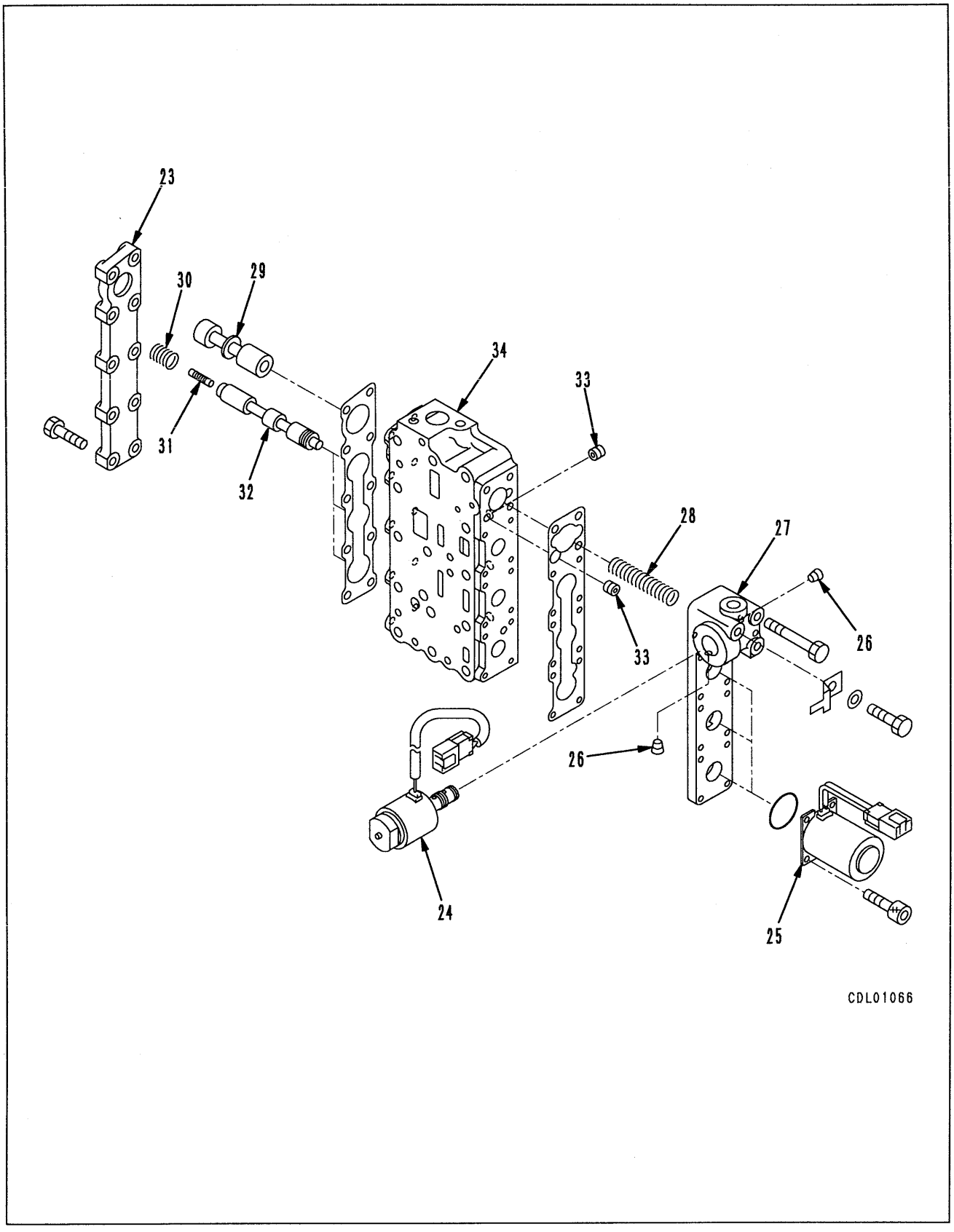


19. Tubes
Fit O-rings and install tubes (52).

20. Front cover
1) Install outer races (51) to front cover (49).



LOWER VALVE ASSEMBLY



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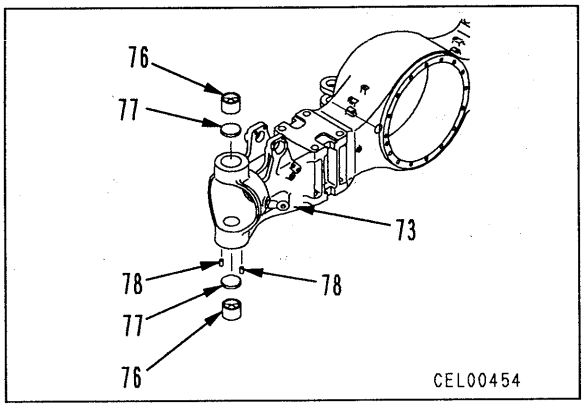
ASSEMBLY OF AXLE ASSEMBLY

1. Remove, bushing, thrust washer, seal

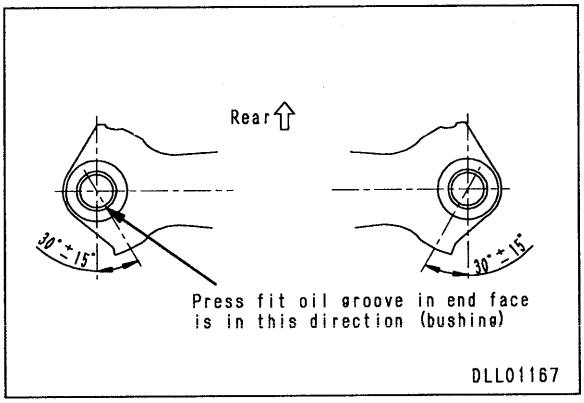
1) Assemble retainer (77), then using push tool, press fit bushing (76) to axle housing (73).
   - ★ Press fit the bushing so that the oil groove in the end face of the bushing is in the direction shown in the diagram on the right.
   - ★ Press fit the bushing to a point where it pushes the retainer in fully.

   Inside face of bushing: **Molybdenum disulphide lubricant (LM-G)**



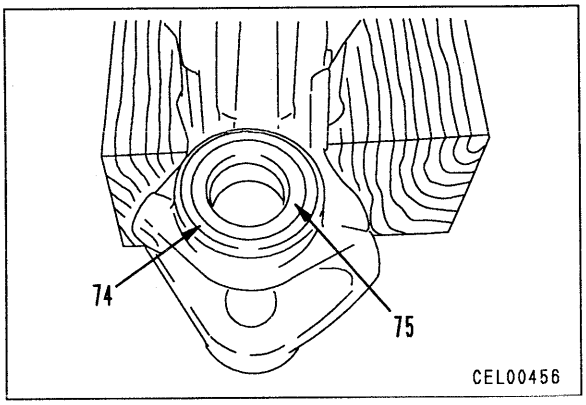
2) Knock pin (78) into axle housing.
   - ★ Set the large chamfered end at the housing end and knock the pin in completely.

   Pin (housing end) : **Thread tightener (LT-2)**



3) Install thrust washer (75) and seal (74).

   Thrust washer, seal: **Molybdenum disulphide lubricant (LM-G)**



2. Bushing, oil seal

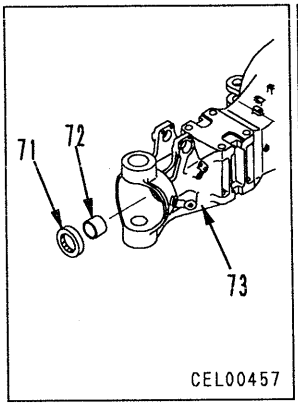
1) Using push tool, press fit bushing (72) to axle housing (73).
   - ★ Check that the vertical misalignment at the bushing press-fitting portion is less than 0.1 mm.

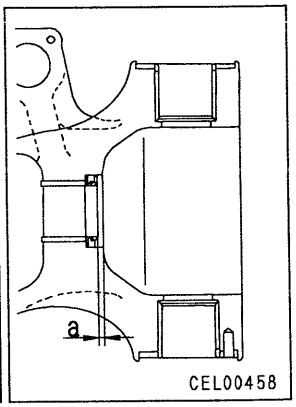
   Inside surface of bushing : **Oil (AX075)**

2) Using push tool, press fit oil seal (71) to axle housing (73) so that it is dimension a.
   - ★ Dimension **a** : 5.5 ± 0.2 mm

   Oil seal press-fitting portion : **Thread tightener (Seal end 242)**

   Lip of oil seal : **Grease (G2-LI)**





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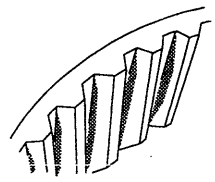
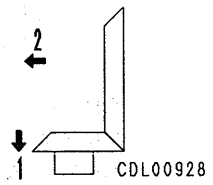
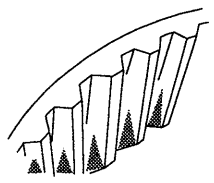
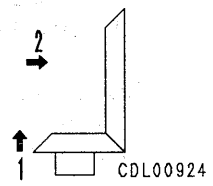
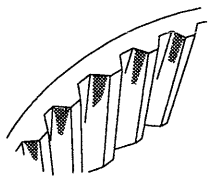
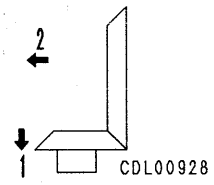
Tooth contact	Cause	Procedure for adjustment
 CEL00925	Bevel pinion is too close to bevel gear.	1. Increase shims at bevel pinion to move away from bevel gear. 2. Move bevel gear closer to bevel pinion and adjust backlash correctly.  CDL00928
 CEL00926	Bevel pinion is too close to bevel gear.	1. Reduce shims at bevel pinion to bring closer to bevel gear. 2. Move bevel gear further away from bevel pinion and adjust backlash correctly.  CDL00924
 CEL00927	Bevel gear is too far from bevel pinion.	1. Increase shims at bevel pinion to move away from bevel gear. 2. Move bevel gear closer to bevel pinion and adjust backlash correctly.  CDL00928

★ When adjusting the bevel gear, move shims from one position to the other. Always keep the same total shim thickness on the left and right.

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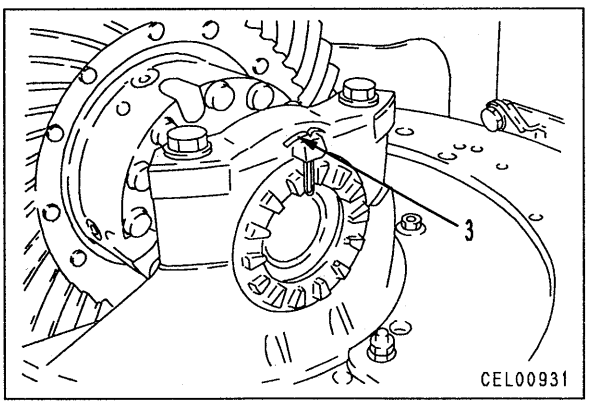
11. Cotter pin

Install cotter pins (3) for locking left and right adjustment rings.

★ Bend the cotter pin securely.

★ If the cotter pin does not match the hole in the cap, rotate the adjustment ring in the direction of tightening to align.



CEL00931

12. Adjustment bolt

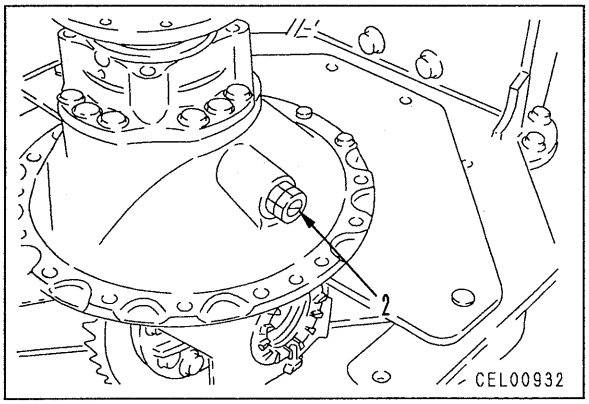
1) Screw in adjustment bolt (2) until it contacts rear face of bevel gear.

2) Turn back adjustment bolt 1/4 turns and tighten locknut.

★ This gives a clearance of 0.25 – 0.50 mm between the tip of the adjustment bolt and the bevel gear.

kgm Locknut :

220.5 ± 24.5 Nm (22.5 ± 2.5 kgm)



CEL00932

1. **Connector**
   Fit gasket and install connector (43) and joint bolt (42).
   ★ Tighten the joint bolt temporarily.
   (Install to the machine and tighten fully after bleeding the air from the system.)

   kgm Joint bolt (temporary tightening torque) :
   5.39 ± 1.47 Nm {0.55 ± 0.15 kgm}
   kgm Joint bolt (final tightening torque) :
   9.8 ± 1.96 Nm {1 ± 0.2 kgm}

2. **Connector**
   Fit O-ring and install connector (41), then install snap ring (40).

3. **Plug**
   Install plug (39) and cap (38).

   kgm Plug : **9.8 ± 2.94 Nm {1 ± 0.3 kgm}**

4. **Rod**
   1) Assemble rod (37).
   2) Install retainer (36).

   kgm Retainer :
   13.72 ± 5.88 Nm {1.4 ± 0.6 kgm}

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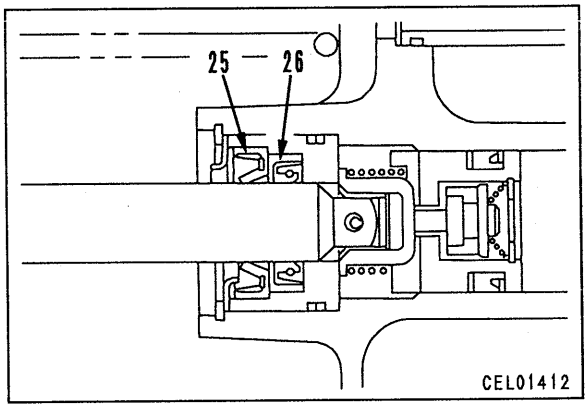
5. **Switch assembly**
   Install shim (35) and switch assembly (34).

   kgm Switch assembly :
   29.4 ± 4.9 Nm {3 ± 0.5 kgm}

6. **Pin**
   Install pin (32) to push rod (33).

7. **Piston assembly**
   1) Install back-up ring (31) and packing (30) to piston (22).
   2) Assemble valve seat (29) and spring (28), and install snap ring (27).
   3) Install seals (26) and (25) to retainer (21).
      ★ Install seals (26) and (25) facing in the direction shown in the diagram on the right.
      ★ Fill the lip of seal (25) with grease (silicon grease G40M).

      Seal (26) : **Oil (silicon oil)**



1. Install oil seal (15) and snap ring (14) to rotor (11).
   Oil seal : **Grease (G2-LI)**
2. Install 9 slipper seals (13) to rotor (11).
3. Install rotor (11) to shaft (12).
   Contact surface of rotor and shaft : **Grease (G2-LI)**
4. Fit O-ring and install shaft (4).
   Mounting bolt : **Thread tightener (Loctite 262 or equivalent)**
   kgm Mounting bolt : **66.15 ± 7.35 Nm {6.75 ± 0.75 kgm}**
5. Install oil seal (10), back-up ring (9), and O-ring (9) to spacer (8).
6. Fit O-ring and install spacer (8).
   Contact surface of shaft : **Grease (G2-LI)**
   kgm Mounting bolt : **66.15 ± 7.35 Nm {6.75 ± 0.75 kgm}**

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7. Install grommet (7) to rotor (3).
8. Install 7 seals (6) and 3 seals (5) to rotor (3).
9. Install rotor (3) to shaft (4).
   Contact surface of rotor and shaft : **Grease (G2-LI)**
10. Install cover (2).
    kgm Mounting bolt : **66.15 ± 7.35 Nm {6.75 ± 0.75 kgm}**
    Contact surface of shaft : **Grease (G2-LI)**
11. Install cover (11).
    kgm Mounting bolt : **66.15 ± 7.35 Nm {6.75 ± 0.75 kgm}**

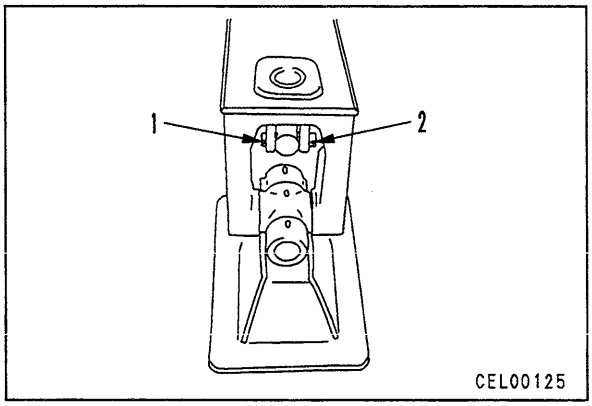
REMOVAL OF OUTRIGGER SLIDE CYLINDER ASSEMBLY (X-SHAPED)

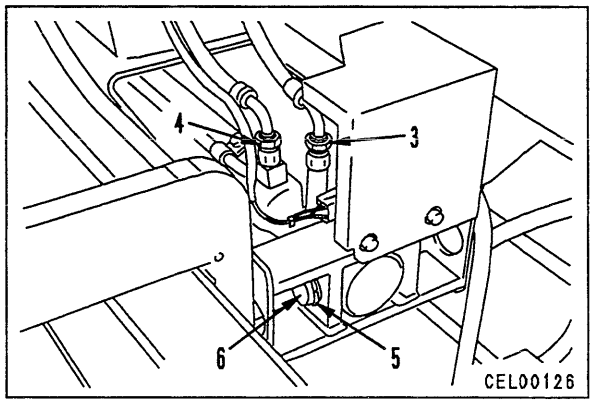
⚠ Set the parking brake switch to PARKING.

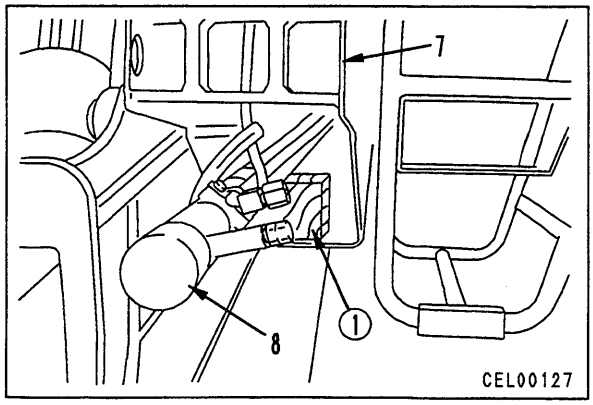
⚠ Extend the outrigger of the cylinder to be removed to a point approx. 100 mm before the end of its stroke, and put the outriggers lightly in contact with the ground.

1. Remove cotter pin (1) of cylinder head end, then remove pin (2). ※ 1
   - ★ When removing the pin, support the bottom of the cylinder at the head end on a block in order to prevent the cylinder from causing damage to the grease nipple.
   - ★ After removing, run the engine and retract the cylinder.
2. Disconnect hoses (3) and (4) from cylinder bottom end.
3. Remove cotter pin (5) from cylinder bottom end, then remove pin (6). ※ 2
4. Sling bottom end of cylinder.
   - ★ Set block (1) under cylinder inside outrigger (7). Choose block height to make cylinder horizontal.
5. Pass cylinder through inside of outrigger and pull out to outside.
   - ★ The cylinder head is stepped, so push down the bottom end and pass the head end through.
6. Sling outrigger slide cylinder assembly (8) again outside outrigger, then lift off.

kg Outrigger slide cylinder assembly : **55 kg**







INSTALLATION OF OUTRIGGER SLIDE CYLINDER ASSEMBLY (X-SHAPED)

- Carry out installation in the reverse order to removal.

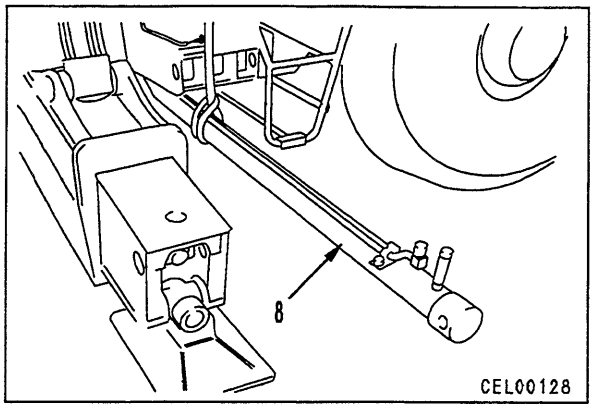
※ 1 ※ 2

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

Outrigger slide cylinder pin portion : **Grease (G2-LI)**

★ Bend the cotter pin securely.

- **Refilling with oil (hydraulic tank)**
  Run the engine to circulate the oil through the system. Then add oil to the specified level.
- **Bleeding air**
  Bleed the air from the cylinder.
  For details, see TESTING AND ADJUSTING, Bleeding air.



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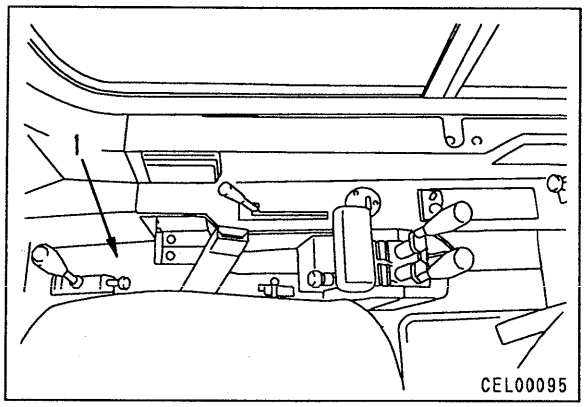
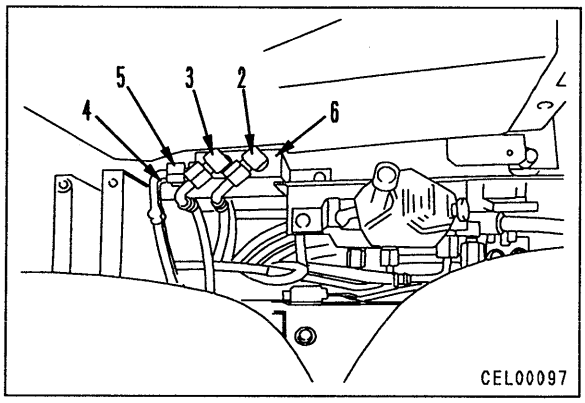
REMOVAL OF PEDAL CONTROL PPC VALVE ASSEMBLY

⚠ Set the parking brake switch to PARKING.

1. Remove cover (1).
2. Disconnect PPC hoses (2), (3), (4), and (5).
   ★ There is numbered tape stuck to the PPC hoses, so fit a tag with the same number to the PPC valve.
3. Remove pedal control PPC valve assembly (6).





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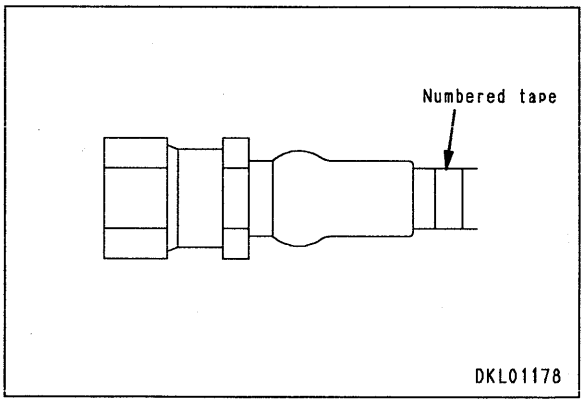
INSTALLATION OF PEDAL CONTROL PPC VALVE ASSEMBLY

- Carry out installation in the reverse order to removal.
- **Refilling with oil (hydraulic tank)**
  Run the engine to circulate the oil through the system. Then add oil to the specified level.



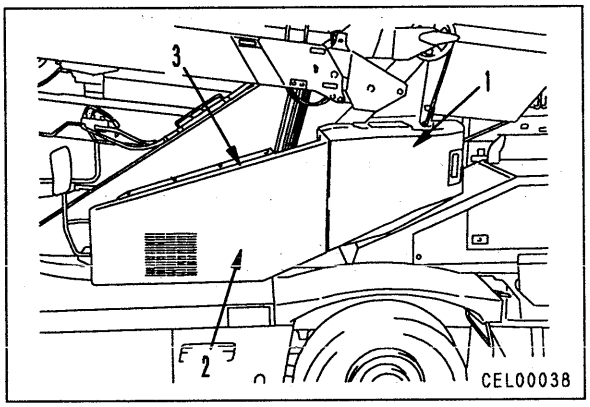
REMOVAL OF SWING CONTROL VALVE ASSEMBLY

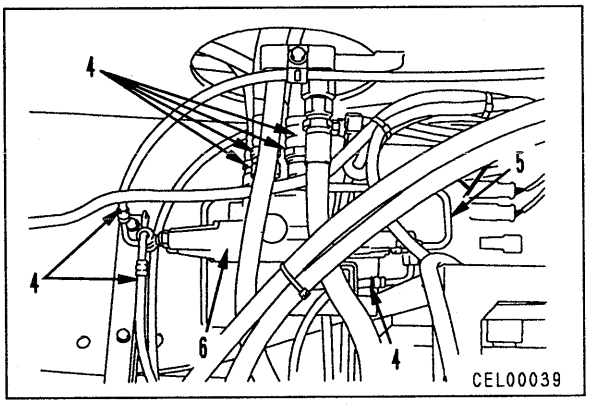
⚠ Set the parking brake switch to PARKING.

1. Remove covers (1), (2), and (3) at left side of revolving frame.
   ★ Disconnect wiring connectors (R15, R33, R34, R35) from inside the cover.

2. Disconnect 7 hoses (4) and tube (5).
   ★ After disconnecting the hoses, fit tags to distinguish them.

3. Remove swing valve (6).





INSTALLATION OF SWING CONTROL VALVE ASSEMBLY

- Carry out installation in the reverse order to removal.

- **Refilling with oil (hydraulic tank)**
  Run the engine to circulate the oil through the system. Then add oil to the specified level.

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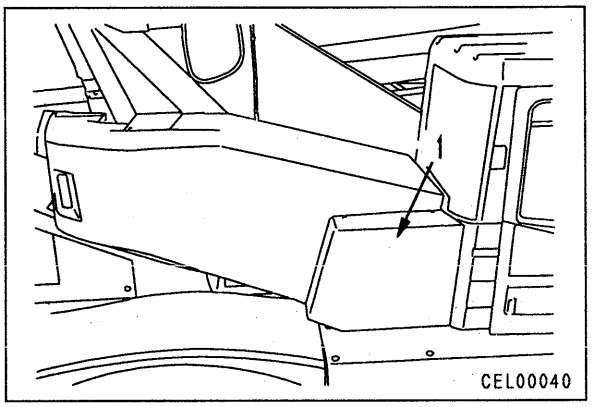
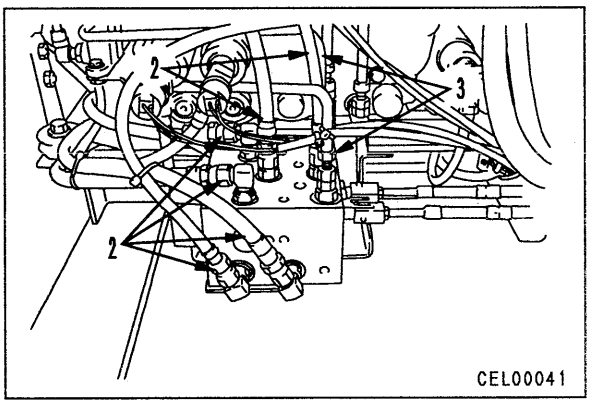
REMOVAL OF WINCH CLUTCH VALVE ASSEMBLY

⚠ Set the parking brake switch to PARKING.

⚠ Release the remaining pressure inside the accumulator.
For details, see TESTING AND ADJUSTING, Measuring and adjusting oil pressure.

1. Remove side cover (1) at right side of revolving frame.
2. Disconnect 6 hoses (2) and 2 tubes (3).
   ★ After disconnecting the hoses, fit tags to distinguish them.
3. Pull out pin of rod (4) and disconnect. ※ 1
4. Remove winch clutch valve assembly (5).





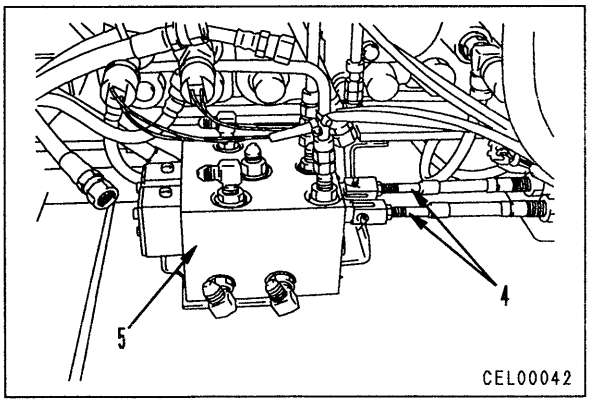
INSTALLATION OF WINCH CLUTCH VALVE ASSEMBLY

- Carry out installation in the reverse order to removal.

※ 1

★ Bend the cotter pin securely.

- **Refilling with oil (hydraulic tank)**
  Run the engine to circulate the oil through the system. Then add oil to the specified level.



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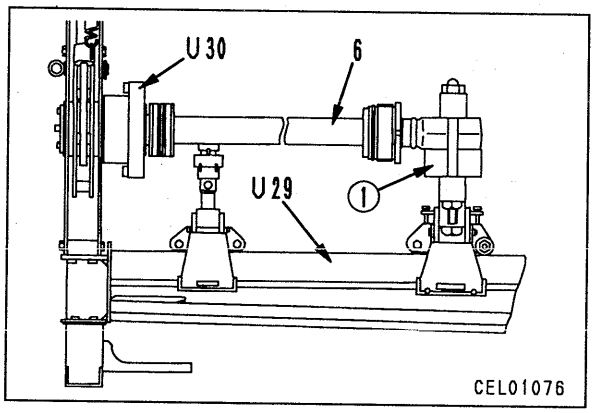
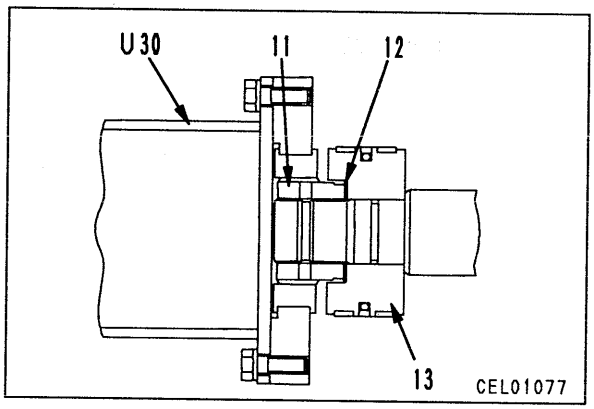
2) Put piston rod assembly (6) on block ①, and set to tool **U29**.



3) Using tool **U30**, remove nylon nut (11).

4) Remove shim (12).

5) Remove piston assembly (13).



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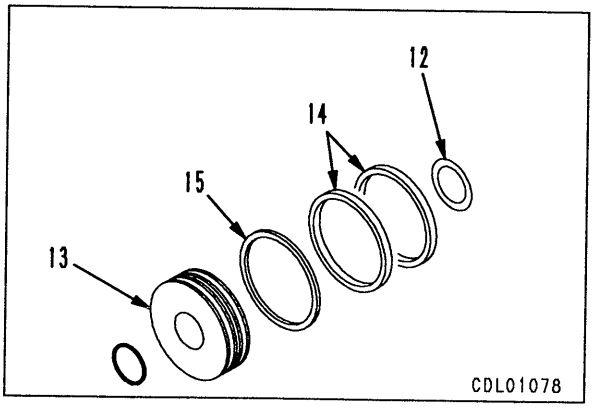
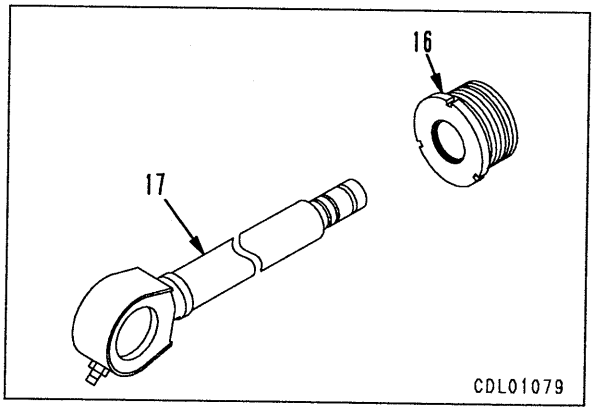
6) Disassemble piston assembly as follows.
   i) Remove wear ring (14).
   ii) Remove piston ring (15).
   ★ Put a screwdriver in contact with the piston ring, hit with a hammer to cut the ring, then remove the ring.



4. Cylinder head assembly

1) Remove cylinder head assembly (16) from piston rod (17).



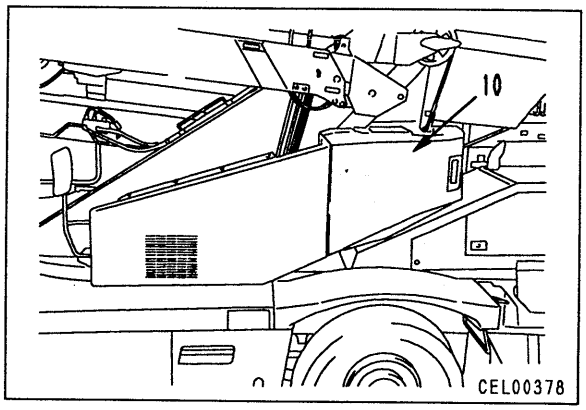
8. Remove cover (10) at rear left of revolving frame.
   ★ For the auxiliary winch motor, remove the cover at the rear right of the revolving frame.

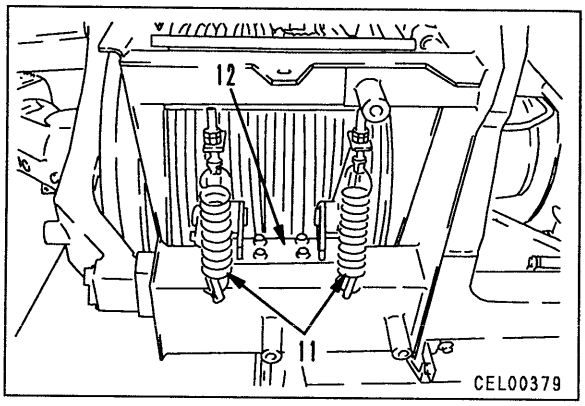
9. Raise boom and tilt jib (main winch only).

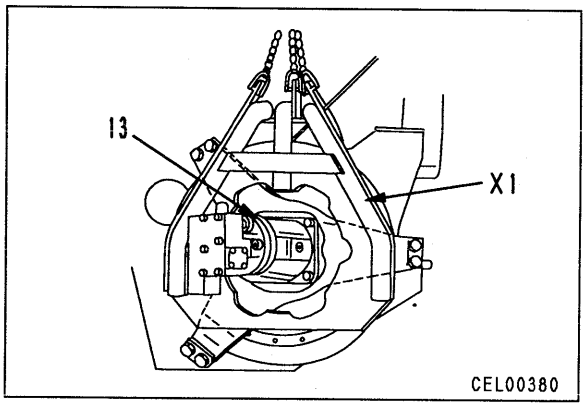
10. Remove springs (11) and drum roller (12).
    ★ Before disconnecting, measure the installed dimension of the spring. ※ 1

11. Remove winch brake caliper assembly. For details, see REMOVAL OF WINCH BRAKE CALIPER ASSEMBLY.

12. Using tool **X1**, keep winch assembly (13) horizontal and remove from revolving frame. ※ 2
    kg Main winch assembly : **600 kg**
    kg Auxiliary winch assembly : **470 kg**







INSTALLATION OF MAIN WINCH, AUXILIARY WINCH ASSEMBLY

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- Carry out installation in the reverse order to removal.

※ 1

kgm Spring mounting locknut :
110.25 ± 12.25 Nm {11.25 ± 1.25 kgm}

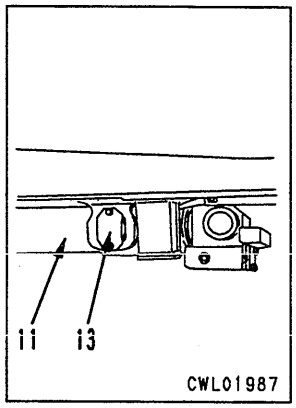
※ 2

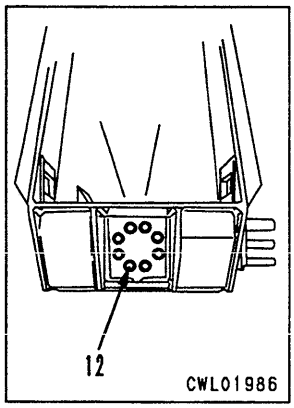
kgm Winch assembly mounting bolt :
548.8 ± 58.8 Nm {56 ± 6 kgm}

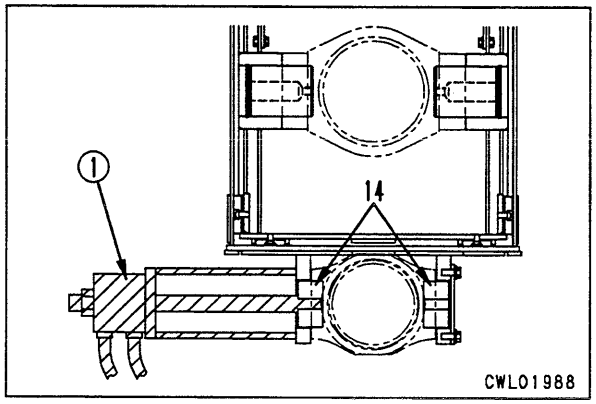
- **Refilling with oil (hydraulic tank)**
  Run the engine to circulate the oil through the system. Then add oil to the specified level.

- **Bleeding air**
  Bleed the air from the piping. For details, see TESTING AND ADJUSTING, Bleeding air.

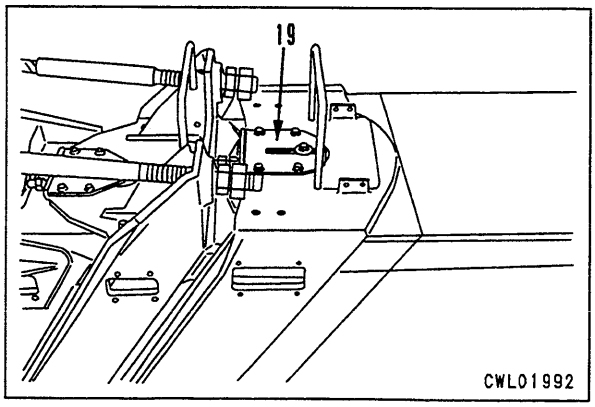
6. **No. 1 telescope cylinder assembly**
   1) Sling No. 1 telescope cylinder (11) at 2 places (front and rear).
   2) Remove mounting bolts (12) of cylinder bottom.
   3) Remove 2 covers (13), then using tool ①, remove 2 pins (14).
   4) Remove No. 1 telescope cylinder assembly (11) from 2nd boom assembly.



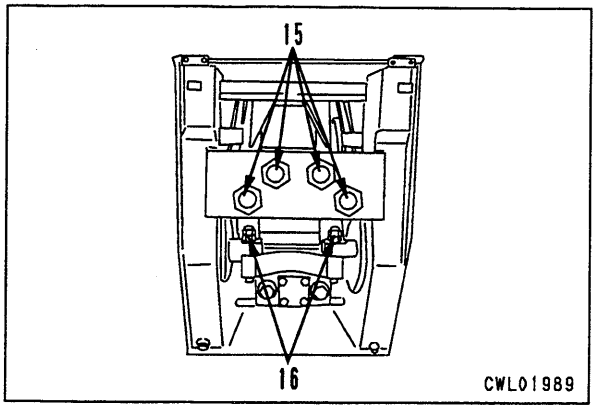




7. **3rd boom assembly**
   1) Remove 4th boom retraction sheave (19).



   2) Remove 4th boom extension rope mounting nuts (15) (4 places).
      ★ Before disconnecting the rope, check the mounting dimensions of the nuts.
   3) Remove mounting bolts and nuts (16) at No. 2 telescope cylinder head end.



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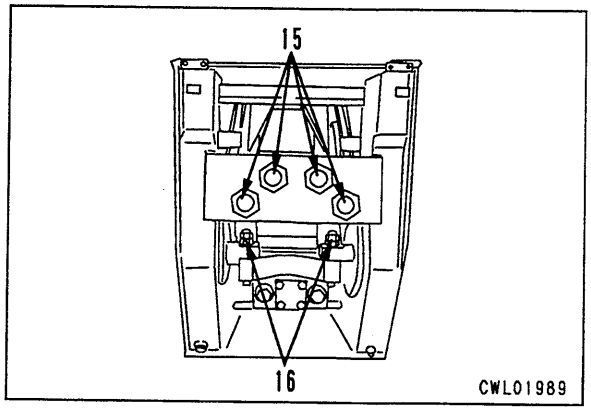
7) Install head mounting bolts (16) of No. 2 telescope cylinder.
★ Tighten the mounting bolts by hand to a point where the bolts contact, then tighten the locknut.

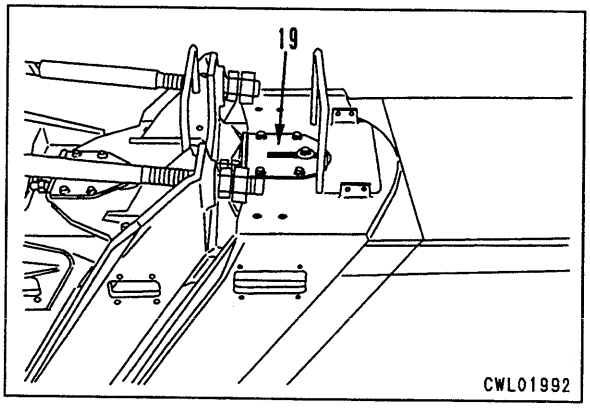
Mounting bolt : **Thread tightener (LT-2)**



8) Install 4th boom extension rope mounting nuts (15) at 4 places.
★ When installing, set the nuts to the mounting dimensions measured when disconnecting.

9) Install 4th boom retraction sheave (19).

Sheave pin portion: **Molybdenum disulphide lubricant (LM-G)**



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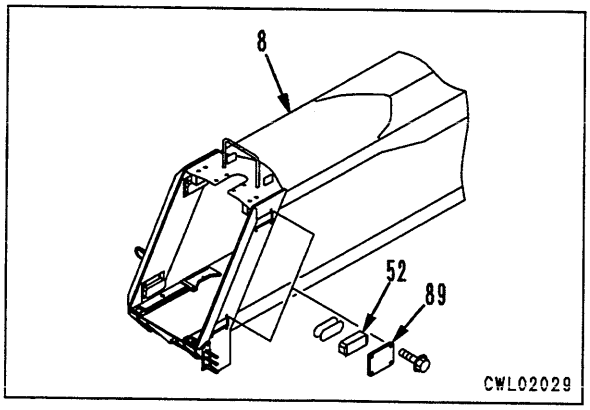
5. 2nd boom

1) Install 4 left and right pads (52) and 4 plates (89) to front of 2nd boom assembly (8).
★ For details of the shim adjustment, see Item 1 above.

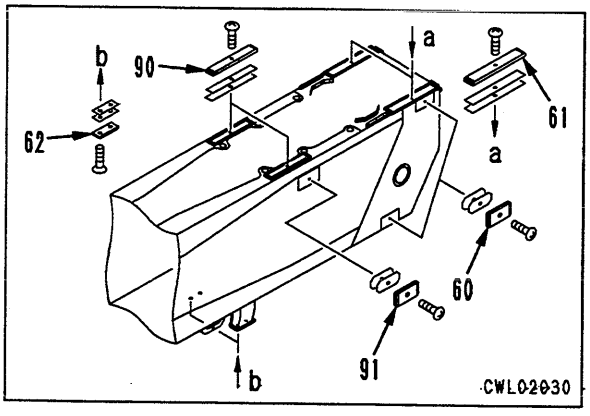
Mounting bolt : **59 – 74 Nm {6.0 – 7.5 kgm}**



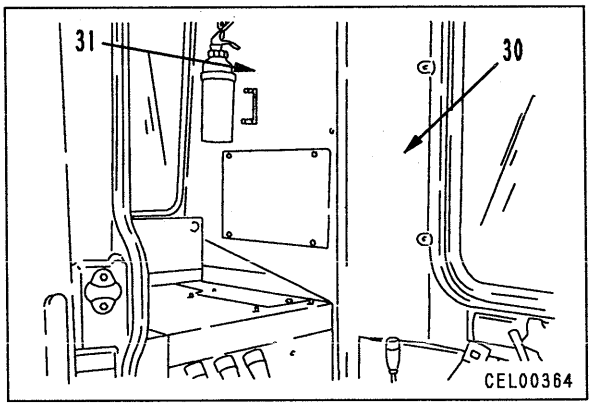
2) Install 4 left and right pallets (60) and 2 top pads (61) to rear of 2nd boom assembly (8), and 2 left and right pads (91), 2 top pads (90), and 2 bottom pads (62) to rear center.
★ For details of the shim adjustment, see Item 1 above.

Mounting bolt : **Thread tightener (LT-2)**

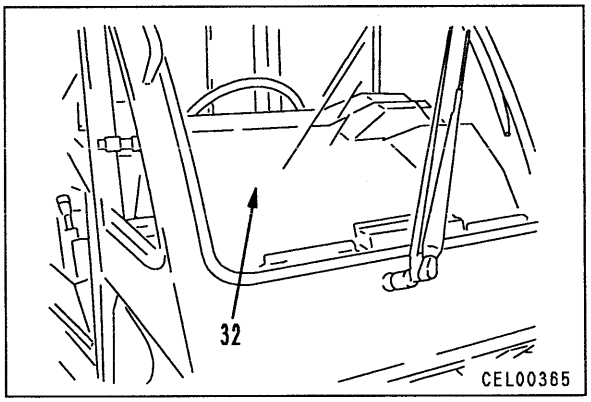
kgm Mounting bolt : **7.85 – 9.81 Nm {0.8 – 1.0 kgm}**



11. Remove covers (30) and (31) from rear left inside compartment.



12. Remove dashboard top cover (32).



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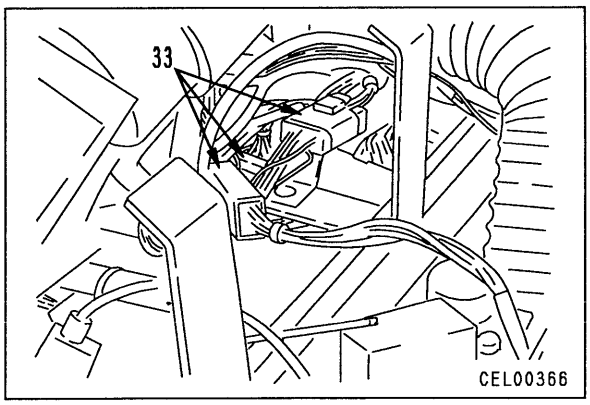
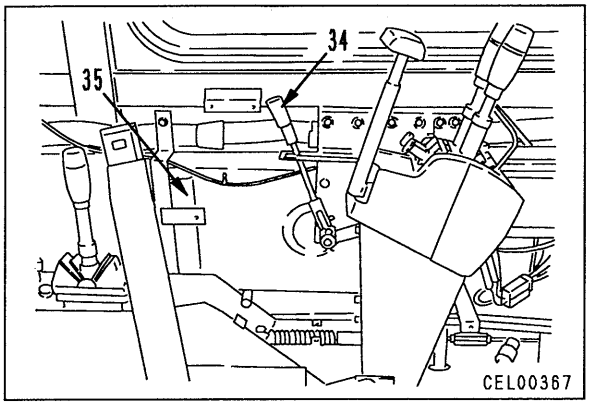
13. Disconnect wiring connectors (C81), (C82), and (C83) (33) from inside dashboard.



14. Remove swing lock lever (34) and air duct (35).

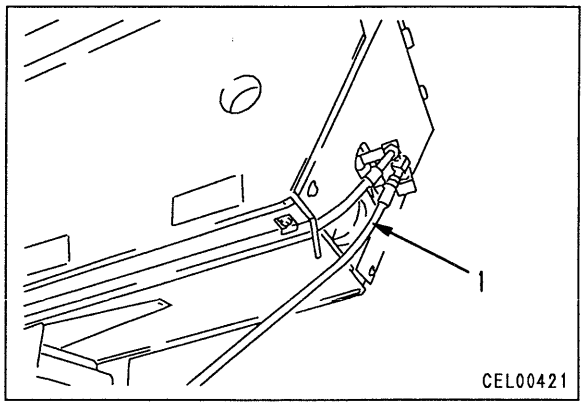


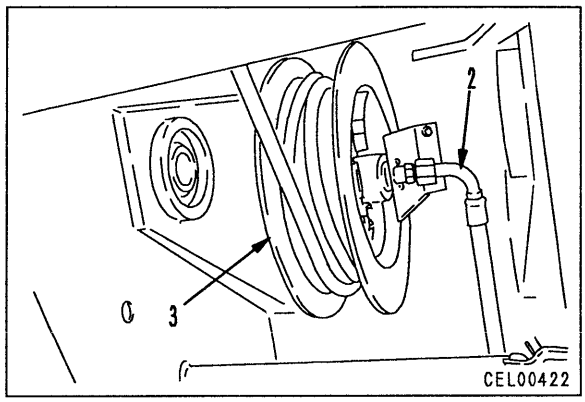
REMOVAL OF REAR HOSE REEL ASSEMBLY

⚠ Set the parking brake switch to PARKING.

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

1. Disconnect hose (1).
   ★ The disconnected hose is under the force of the spring, so tie a rope to the hose, then gradually loosen the rope and wind on to the rear hose reel.
2. Disconnect hose (2).
3. Remove rear hose reel assembly (3).





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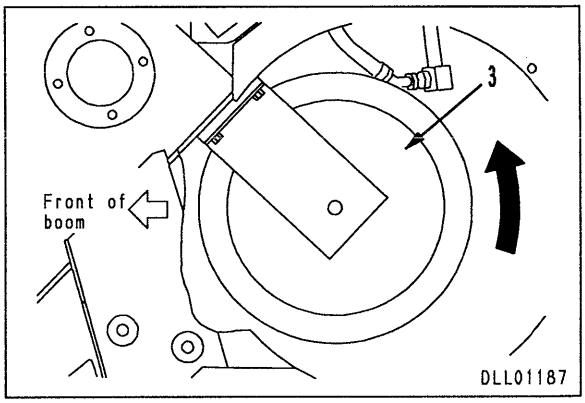
INSTALLATION OF REAR HOSE REEL ASSEMBLY

- Carry out installation in the reverse order to removal.

※ 1

★ Wind 3 or 4 turns in the direction shown in the diagram on the right, then install the hose.

- **Refilling with oil (hydraulic tank)**
  Run the engine to circulate the oil through the system. Then add oil to the specified level.



023S05

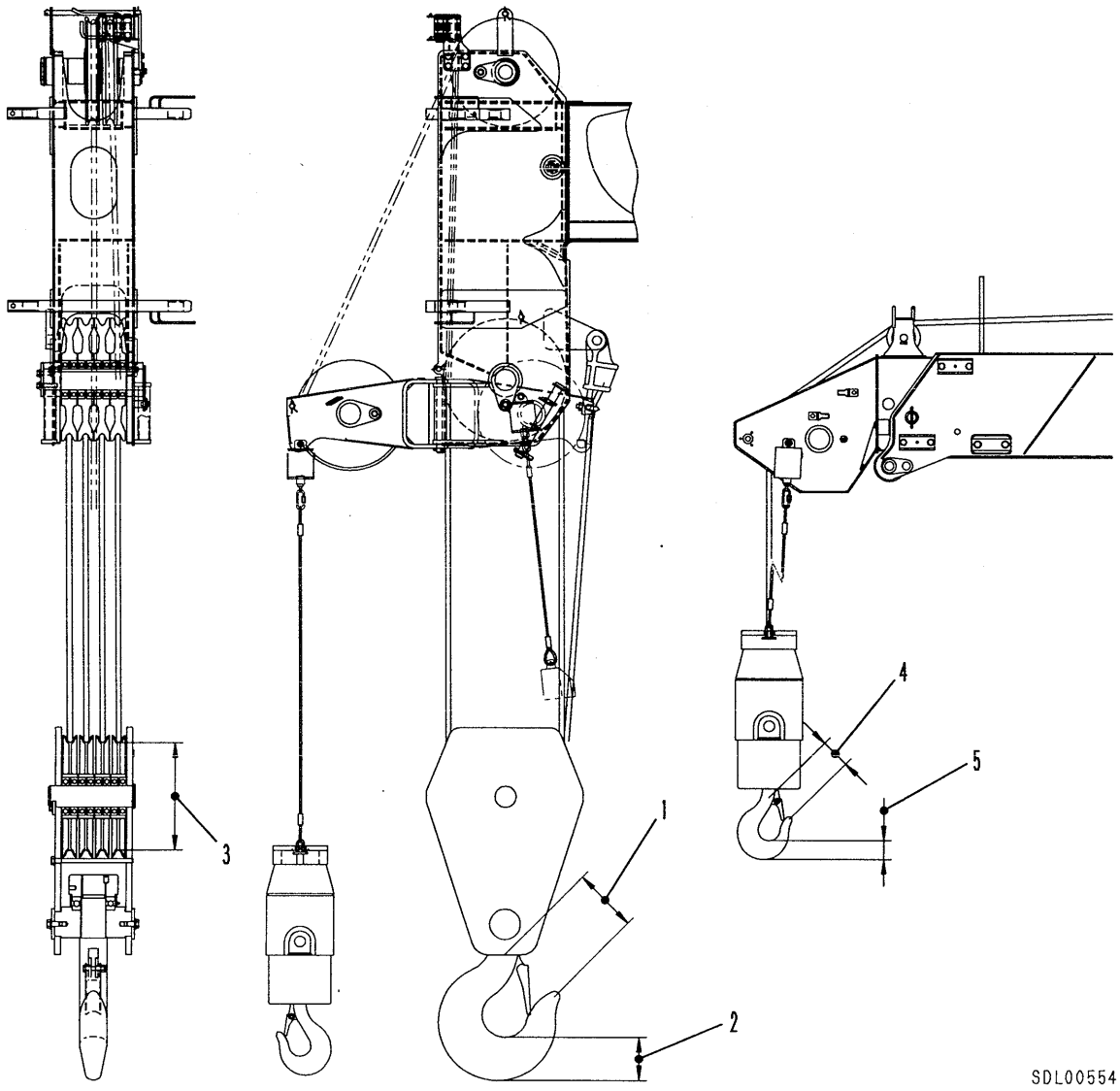
Unit: mm

No.	Check item	Criteria					Remedy
		Standard size	Tolerance		Standard clearance	Clearance limit	
			Shaft	Hole			
1	Clearance between king pin and bushing	62	0 −0.019	+0.151 +0.098	0.098 – 0.170	0.2	Replace
2	Clearance between U-joint (inside) and bushing	55	0 −0.019	+0.385 +0.231	0.231 – 1.404	0.4	
3	Clearance between U-joint (outside) and bushing	55	0 −0.019	+0.385 +0.231	0.231 – 0.404	0.4	
4	Clearance between tie rod pin and bushing	30	−0.020 −0.041	+0.117 +0.080	0.100 – 0.157	0.2	
		Standard size	Tolerance		Repair limit		
5	Thickness of king pin (top) thrust washer	5	0 −0.1		4.8		Replace. However, if end play of king pin in vertical direction is less than 0.25, it can be used again
6	Thickness of king pin (bottom) thrust washer	7	0 −0.1		6.8		
		Standard size			Repair limit		
7	End play of king pin in vertical direction	0.01 – 0.15			0.25		Adjust
8	Standard shim thickness for king pin	1.0					
9	Standard shim thickness for final drive hub	1.163					

HOOK

MAIN HOOK

AUXILIARY HOOK



023S05

Unit: mm

No.	Check item	Criteria		Remedy
		Standard size	Repair limit	
1	Opening of main hook	210.0	215.0	Replace
2	Wear of main hook	139.5	135.5	
3	Diameter of main hook sheave groove	352.0	348.0	
4	Opening of auxiliary hook	95.0	97.5	
5	Wear of auxiliary hook	60.0	58.2	

JIB

(MACHINES WITH POWER TILT)